

ANNUAL REPORT
OF THE
MINISTER OF MINES

FOR THE
YEAR ENDED 31ST DECEMBER

1929

BEING AN ACCOUNT OF
MINING OPERATIONS FOR GOLD, COAL, ETC.

IN THE
PROVINCE OF BRITISH COLUMBIA



JOFAN BILINSKI
EDMONTON, ALBERTA

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1930.

To His Honour ROBERT RANDOLPH BRUCE,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1929 is herewith respectfully submitted.

W. A. MCKENZIE,
Minister of Mines.

Minister of Mines' Office,
February 24th, 1930.

*To the Honourable W. A. McKenzie,
Minister of Mines.*

SIR,—I have the honour to submit herewith my Annual Report on the Mining Industry of the Province for the year ended December 31st, 1929.

The statistical tables give the total mineral production of the Province to date and show by Districts and Divisions the output of the various metals and minerals for the year 1929, and comparative figures for previous years.

The reports of the Resident Mining Engineers give much information about the progress of mining, development, and prospecting throughout the Province. The reports of the Inspectors of Mines cover fully the inspection of mines in British Columbia.

I have the honour to be,

Sir,

Your obedient servant,

JOHN D. GALLOWAY,

Provincial Mineralogist.

*Bureau of Mines, Victoria, B.C.,
February 24th, 1930.*



Pend d'Oreille River. Proposed Location of Hydro-electric Plant.

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STATISTICAL REVIEW OF THE MINERAL INDUSTRY OF BRITISH COLUMBIA IN 1929.

BY JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST.

GENERAL SUMMARY.

The steady progress that has characterized mining in the Province in recent years was again shown in 1929. An increased gross value of production was coupled with much development, and exploration and prospecting were vigorously carried on in widespread areas.

The gross value of the mineral production of British Columbia in 1929 was \$68,245,443, a new high record in the history of mining in the Province. This figure is \$2,872,860 greater than the value of the output in 1928, or 4.4 per cent., and 1.6 per cent. higher than the previous record production in 1926.

The final figure of mineral production value is somewhat lower than the estimate made in Bulletin No. 2, 1929, issued in December. The estimate was considerably high in zinc and coal; towards the end of the year the low price of zinc caused the storage of large quantities of zinc concentrates and coal production for several reasons declined materially as compared with the figures estimated. Structural materials and miscellaneous metals and minerals showed slight gains in the final figures as compared with the estimate.

Until the last two months of the year, metal and mineral production was at a slightly higher rate, in the aggregate, than in 1928, but curtailment in November and December resulted in decreased yearly outputs in some of the products of the industry. The explanation of the higher valuation is largely due to the much higher price of copper metal during 1929 and also a slightly higher average price of lead.

The tonnage of metalliferous ore mined in the Province during the year was 6,977,681 tons, as compared with 6,241,310 tons in 1928, an increase of 11.8 per cent. This increase was almost entirely due to larger tonnages mined at the *Sullivan* and *Britannia*. Slightly lower-grade ore was handled at these properties, so that the metal production from them was approximately the same as in 1928. The average gross value of the ore mined in the Province in 1929 was approximately \$7.35 a ton, as compared with \$7.75 a ton in 1928.

For the purpose of the statistical tables in this Annual Report, the mineral production of British Columbia is divided into four classes—metal-mining, coal-mining, structural materials, and miscellaneous metals and minerals. Of these, the first class is by far the most important, with a production for 1929 valued at \$51,293,570 (including placer gold). This is followed by coal, with an output valued at \$11,256,260, and structural materials and miscellaneous metals and minerals, totalling together \$5,695,613.

As compared with 1928, the production figures show increased valuations for copper, lead, structural materials, and miscellaneous metals and minerals, and decreases in all others.

By value, the various products of the mineral industry produced in 1929 are ranked in the following order: Copper, lead, coal, zinc, silver, structural materials, gold, miscellaneous metals and minerals.

The quantity of copper produced was 101,483,857 lb., which is a new high record and the first time that the output has been in excess of 100,000,000 lb.; the valuation at \$18,375,682 is also a record figure.

The output of lead in 1929 was \$302,346,268 lb., or only slightly less than in 1928. Owing to a higher market price for lead, the value was more than a million dollars greater than in the preceding year.

The coal production for the year is valued at \$11,256,260, as compared with \$12,633,150 in 1928, a decrease of \$1,376,890, or 10.9 per cent. The decrease was general in all districts in the Province. The decline in coal-output does not indicate a lessened fuel-consumption in the Province, but shows the further inroads being made in the Provincial coal industry by imported fuel-oil and imported coal, the latter particularly from Alberta.

The output of zinc in 1929 was 172,096,841 lb., valued at \$9,268,792, which compares with 181,763,147 lb., valued at \$9,984,613, in 1928. It was expected that a record output of zinc would be made in 1929, but curtailment of mining operations at some properties and the storage of zinc concentrates by others in the last two months of the year reduced the estimated figure con-

siderably. There are large reserves of zinc ore in the Province, but a decided improvement in the price of zinc metal will be required to stimulate increased production.

The production of lode gold in 1929 amounted to \$3,004,419, as compared with \$3,888,097 in 1928, a decrease of 22.7 per cent. The decrease was mainly caused by a lower production from the *Premier*.

Placer-gold output also decreased, the value being recorded at \$118,711, as compared with \$143,208 in 1928—a decline of 17.1 per cent.

Structural materials produced in 1929 were valued at \$3,921,768, an increase as compared with 1928 of \$513,082, or 15 per cent. This shows clearly that building activity continued to increase throughout the Province. The larger part of the output of structural materials is made in the Western District (Southern Coast) and the principal market is in the Coast cities.

The output of miscellaneous metals and minerals continued to show in 1929 the rapid growth that has characterized this branch of the industry in recent years. A value of \$1,773,845 was recorded for 1929, as compared with \$905,354 in 1928 and \$459,514 in 1927. The output has therefore been approximately doubled in each of the last two years. Continued expansion of this branch of the industry may be expected, as there are many deposits of such materials that will gradually be utilized in Provincial industries.

From the foregoing brief summary it is evident that mineral production in 1929 was quite satisfactory. Decreases in some of the products were more than offset by increases in others. The marked decline in the prices of silver, lead, and zinc which marked the end of 1929 and the early months of 1930 had but little effect on the production for 1929. The principal producer of these metals in British Columbia is the *Sullivan* and it is not likely that low prices will cause any marked decline in output from this mine in 1930.

The outlook for 1930 is that probable declines in the production of silver, zinc, and coal will be compensated by larger outputs of other metals and minerals—at least in part. With present conditions, however, it is not to be expected that 1930 will set a new record for production, but an output close to that of recent years should easily be attained.

METAL PRICES.

The important metals mined in British Columbia which are affected by fluctuations in market price are copper, lead, zinc, and silver. During 1929 the average prices for copper and lead were higher than in 1928, but these increases were offset by lower average prices for silver and zinc. The following table shows comparative average yearly prices for these four metals for the years 1927, 1928, and 1929:—

AVERAGE METAL-MARKET PRICES FOR 1927, 1928, AND 1929.

Year.	Silver (New York).	Copper (New York).	LEAD.		ZINC.	
			London.	New York.	London.	St. Louis.
	Cents per Oz.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.
1927.....	* 56.370	* 12.92	* 5.256	6.755	* 6.1946	6.242
1928.....	* 58.1760	* 14.570	* 4.5754	6.305	* 5.4932	6.027
1929.....	* 52.993	* 18.107	* 5.0504	6.833	* 5.3853	6.512

* Prices used in compiling total metal valuations in 1927, 1928, and 1929 Annual Reports.

The above table shows that in 1929, as compared with 1927, there were increases in the average prices of copper and lead of 24.2 and 10.4 per cent. respectively, and for silver and zinc, decreases of 8.9 and 2 per cent.

The price of silver has trended almost steadily downward in recent years and the future outlook is not encouraging. The lessened world demand for silver as currency and the relatively limited use of it in the arts has resulted in a tremendous overproduction of the white metal. Much of the world output of silver is a by-product from the mining of other metals and this production is made almost without regard to the price of silver. Unless important new uses are found for silver, an increased price can hardly be expected.

The effect of the lowered price of silver, in conjunction with low prices for lead and zinc, has been to close down a number of small mines which were producing silver-lead and silver-zinc

concentrates. It is improbable that these mines will resume operations until prices obtainable for the concentrates are considerably higher, either by increased metal prices, more favourable treatment rates, or a combination of both.

Productive copper-mining was speeded up in 1929 because of the increased price of copper. A considerably higher tonnage of copper ore has been treated, but the grade of ore has been somewhat lower, and as a result the output of copper is only slightly higher than in 1928. However, with an 18-cent price for copper, the two large copper companies have made considerably higher profits. Development of copper properties has also been accelerated this year and, owing to this, increased production may be anticipated in the future.

Expert opinion is by no means unanimous regarding the trend of copper-metal prices in the next year or two. The price has been stabilized at 18 cents by the Copper Export Association, and by balancing supply and demand this association expects to keep the price stabilized. That price may, however, not be 18 cents, but at least it is not at all likely to return to the relatively unprofitable levels of recent years. It seems likely that the price of copper metal will probably be maintained at a level profitable to copper-mining in British Columbia.

In the last two months of the year lead and zinc prices declined materially. The bulk of the lead and zinc production of the Province comes from the *Sullivan* mine—95 per cent. of the lead and 92 per cent. of the zinc output. This mine could continue to produce lead and zinc profitably when low prices would shut down most of the other lead-zinc mines in the world. The ore from this mine is milled and smelted and the metals refined and marketed by the owning company—the Consolidated Mining and Smelting Company of Canada, Limited—so that the company gets all the available profit in producing this lead and zinc. Costs in relation to selling-price are not likely, therefore, to influence the Consolidated Company in curtailing production from the *Sullivan*. However, the Consolidated is now an important factor in the world marketing of lead and zinc and world conditions may be such in the next six months as to warrant some curtailment. Actually the company is in shape to make a considerably larger production just as soon as more hydro-electric energy is made available, plans for which are being pushed ahead as fast as possible. The zinc-refinery of the company now has a capacity of 400 tons of zinc a day.

Summing up, it may be said that while some curtailment of production will take place with the small mines in 1930, due to low metal prices, it is expected that the large producers will maintain normal outputs and that the quantities of silver, copper, lead, and zinc produced may equal those of 1929.

DEVELOPMENT AND PROSPECTING.

During 1929 there was a steady continuation of the intensive development and exploration that has been a feature of the mining industry of the Province during the last three years. As usual, the Consolidated Company has been the most active in optioning and developing properties, but the *Britannia*, *Granby*, and *Premier* Companies have also carried on much scouting and development. This has been largely augmented by numerous small companies and individuals.

Most of the large operating companies maintained or increased ore reserves notwithstanding large tonnages mined. More ore was developed at the *Premier* than in 1928, but hardly enough to equal the tonnage mined. At the *Sullivan*, *Copper Mountain*, *Britannia*, *Monarch*, and smaller properties development was quite satisfactory.

At a number of properties not yet producing, development during the year has brought them much nearer the shipping stage. Of these, the most important are the *Coast Copper Company*, the *Ferguson*, *Tulsequah Chief*, *Manville*, *Big Missouri*, *B.C. Silver*, *Toric*, *Emerald*, *Mammoth*, and *Reeves-McDonald*.

While the closing months of 1929 brought a slowing-up of production owing to low metal prices, this condition had but little effect on development and exploration. Owing to financial conditions work was also discontinued on certain properties, but in the aggregate much useful and satisfactory development was accomplished in 1929.

Reports would indicate that more prospectors were in the field than in the previous years. Some of the larger mining companies, notably the Consolidated, placed prospecting parties in various parts of the Province. As an aid to prospecting, hydroplanes were used in places in Northern and Central British Columbia.

An important new discovery during the year was the *Manville* property in the Taku River area, which was shortly after acquired by the Alaska Juneau Company and intensive development commenced. A number of new discoveries have been reported from various districts, which will be investigated in 1930.

Plenty of capital would now seem to be available for British Columbia mining. The large mining companies in the Province all have substantial surpluses which they are using to acquire and develop mineral properties. Many small companies have been formed in British Columbia, which in part get their capital locally and in part from various sources outside the Province. Large mining companies from many parts of the world have had scouting engineers looking for promising mineral properties in British Columbia during 1929.

During the last five years good progress has been made in trying out hundreds of prospects in the Province; many of these of course will never make mines, but a fair measure of success is being attained. The result is that prospectors, small mining syndicates, and small companies can feel assured that, once a promising prospect is shown up, abundance of capital is available to carry it forward to the production stage.

METALLURGICAL FEATURES OF THE YEAR.

As has been customary in recent years, the most important metallurgical events of the year have been those related to the continued expansion of the Consolidated Mining and Smelting Company of Canada, Limited, at the Trail plant. The following excerpts from the annual report of this company indicate the scope of this expansion:—

"Construction-work completed during the year included the 35-ton contact acid plant, the enlargement of the Zinc Plant Electrolytic Department and the Casting Department from 300 to 400 tons daily capacity; the electric steel furnace addition to the foundry; the addition to the cadmium plant; a forty-room staff house at Tadanac, and an additional capacity of 3,000 gallons per minute to the Columbia River pumping-station, besides the items mentioned in the report of the vice-president in charge of mines. Modern fire-trucks have been installed both at Kimberley and Tadanac.

"The principal construction-work under way but still to be completed at the end of the year includes the finishing of the *Sullivan* mill extension, which is about 80 per cent. completed; the slag-fuming plant for the recovery of zinc and lead fume from zinc rejects and lead-furnace slags, which is about 60 per cent. completed; and the leaching plant for these fumes, about 70 per cent. completed.

"Work has been commenced on the first unit of the fertilizer plant. Water-mains, road and railway connections have been constructed. The shops, offices, chemical laboratories, etc., are nearing completion. The plans for most of the plant are out and a considerable part of the machinery has been ordered.

"*The Sullivan Mine.*—The tonnage mined increased from 1,502,348 to 1,778,000 tons. The cost of the ore delivered to the mill was slightly higher than in 1928, largely due to extra development-work being carried on. The reduction in milling costs was sufficient to offset most of this increase.

"There is a large quantity of ore in the *Sullivan* deposit which at first was considered too low grade to mine. Improvements in operating costs and metallurgical recoveries now allow this ore to be worked at a profit. Consequently, the capacity of the concentrator has been increased in order to allow the low-grade ore to be utilized without decreasing the metal-output of the mine. Some of this increased capacity was in use during 1929 and on this account the average grade of the ore mined in 1929 was lower than that mined in 1928. There will be further increase of capacity in 1930, when the average grade will be lower still on account of further dilution with this low-grade ore.

"All the remaining mine dumps, some 87,000 tons, were recovered and milled during the year.

"*The Kimberley Concentrator.*—This plant has been run at over normal capacity during most of the year and recoveries have suffered somewhat from this cause as well as from the lower grade of the ore. A very satisfactory reduction was made in the cost per ton milled and the grade of the zinc concentrates was materially increased.

"*The Research Department.*—While employed on almost innumerable problems, gave much more attention to fertilizer tests on the Canadian Prairies than before, with gratifying results, considering the unfavourable season. This work will be much extended in 1930, when sixty

combination seed and fertilizer drills will be spread over Manitoba, Saskatchewan, and Alberta to test various fertilizers on various crops and soils.

"*Power.*—Hand in hand with the expansion in your operations, the West Kootenay Power and Light Company, Limited, continues to increase the development of hydro-electric energy. No. 3 unit (capacity 25,000 horse-power) of the South Slocan plant was completed in the spring of last year and immediately went into satisfactory operation.

"An application has been made to the International Joint Commission to permit the storage of flood-water in Kootenay lake, to be used to maintain the minimum flow of water required to run the power plants on the Kootenay river to full capacity during the winter months. The Commission has ordered an investigation to determine the effect of this storage on lands in the State of Idaho, reserving judgment in the meantime.

"Investigation of the proposed power-site on the Pend d'Orelle river about 7 miles from its mouth disclosed unsatisfactory physical conditions. Upon further examination of the river a site has been found about 1 mile from its mouth which appears to be satisfactory.

"Confirmatory exploration is being proceeded with, and, if favourable, development will be actively prosecuted. Ultimately over 300,000 horse-power may be generated.

"A considerable part of this power will be required by your fertilizer plants. Your directors are confident that a profitable use of the remainder will be found in good time through the output of further products, which will add materially to employment and the production of wealth in the Southern Interior of British Columbia.

"The right to develop hydro-electrical energy on the Adams river, a tributary of the Thompson river, has been secured. Work is being proceeded with at an estimated cost of \$2,662,000. The development will give a maximum of 30,000 horse-power. The actual output will vary according as the storage is drawn upon. This power will be available to supply any needed electrical energy during the low-water period of the Kootenay river.

"The right to investigate the power available on the Kokish river, which flows into the sea not far from Alert Bay, on the east coast of Vancouver island, has been secured. If found satisfactory this power can be used to supply electrical energy to your Coast Copper property, and the Kinman property on Nimpkish lake, as well as to the proposed copper smelter and refinery."

Production was speeded up at the *Britannia* during the year, so that now the daily tonnage handled is about 6,000 tons, and some days more than this is put through the mill.

An important event of the year was the construction of a 300-ton flotation-mill at the *Monarch* at Field. This property is now well developed and equipped and should be an important producer in the future.

Construction was proceeded with during the year on the *Mammoth* mill at Silverton, and it is expected this will be ready to go into production in 1930.

The *Union* gold-silver property in the Grand Forks Division is being equipped with a 100-ton concentrator, which will go into production in 1930.

Construction of a small flotation concentrator was completed at the *Silver Cup* near Hazelton and production commenced.

A 30-ton cyanide plant was constructed and production commenced at the *Reno*, Nelson Mining Division.

The new concentrator and hydro-electric power plant at the *Cork-Province*, Ainsworth Mining Division, was completed during the year and production commenced. Late in the fall this plant was closed down.

A 100-ton flotation-mill was completed at the *Planet*, Nicola Mining Division, and production commenced.

PROFITS OF MINING COMPANIES.

The following table shows the dividends declared by companies engaged in the mineral industry in the Province during 1928 and 1929:—

Company.	1928.	1929.
The Consolidated Mining and Smelting Co. of Canada, Ltd.	\$6,366,594	\$6,373,750
Premier Gold Mining Co., Ltd.	1,300,000	1,208,250
<i>Carried forward</i>	\$7,666,594	\$7,582,000

Company	1928.	1929.
<i>Brought forward</i>	\$7,666,594	\$7,582,000
Howe Sound Co.*	1,984,152	2,480,190
Duthie Mines, Ltd.	50,000	.....
Granby Consolidated M.S. & P. Co., Ltd.	1,344,515	3,150,005
Bell	55,714	46,539
Crow's Nest Pass Coal Co., Ltd.	372,696	372,699
Others	83,017	111,875
Totals	\$11,556,688	\$13,743,308

The amount of \$13,743,308 shown above as distributed in 1929 by no means represents the total net profits earned during that year. In nearly all cases substantial sums are set aside from profits to the credit of surplus and reserve accounts. Profits accruing to private companies and individual mining enterprises as a rule are not given publicity as dividends, as is the case with the large companies, so that no record of these profits, which in the aggregate are considerable, is available.

The following table shows strikingly the growth of dividends in recent years:—

Year.	Dividend.	Year.	Dividend.
1923	\$2,809,295	1927	\$10,800,838
1924	2,896,174	1928	11,556,688
1925	6,319,808	1929	13,743,308
1926	9,747,270		

MINERAL PRODUCTION OF BRITISH COLUMBIA.

METHOD OF COMPUTING PRODUCTION.

The total mineral production of the Province consists of the outputs of metals, coal, structural materials, and miscellaneous minerals, valued at standard recognized prices.

In the Annual Report for 1925 some changes were made in the methods used in previous years in computing and valuing the products of the industry; but in order to facilitate comparisons with former years the same general style of tables was adhered to. The methods used in 1925 have been followed in subsequent Annual Reports.

The following notes explain the methods used:—

(1.) From the certified returns of lode mines of ore and concentrate shipments made during the full calendar year by the producers the net recovered metal contents have been determined by deducting from the "assay value content" necessary corrections for smelting and refining losses.

In making comparisons of production figures with previous years, it should be remembered that prior to 1925 in the Annual Reports the total metal production, with the exception of copper, was determined by taking the assay value content of all ores shipped; deductions for slag losses were made by taking varying percentages off the metal prices.

(2.) Gold-placer returns are received from the operators in dollars and the dollar value converted to ounces of placer gold at \$17 an ounce, which is believed to represent the average value of placer gold throughout the Province.

(3.) The prices used in valuing the different metals are: For gold, the world standard price of \$20.6718 an ounce; for silver, the average New York metal-market price for the year; for lead, the average London metal-market price for the year; for zinc, the average London metal-market price for the year; and for copper, the average New York metal-market price for the year. The silver and copper outputs of the Province are bought and sold on the basis of the New York metal-market prices of these metals and for this reason they are used. The bulk of the lead and zinc production of the Province is sold on the basis of the London prices of these metals and they are therefore used. The New York and Montreal lead- and zinc-market prices differ materially from the London prices of these metals and are not properly applicable to valuing the British Columbia production.

* The Howe Sound Company is the holding company for the *Britannia* mine in British Columbia and the *El Potosi* and *Calera* mines in Mexico. Dividends paid by this company are therefore derived from the profits on operation of all three mines, so that only part of the dividends paid, as shown, can be credited to the *Britannia* mine.

(4.) In 1926 a change was made in computing coal and coke statistics. The practice in former years has been to list coal and coke production (in part) as primary mineral production. Only the coke made in bee-hive ovens was so credited; that made in by-product ovens was not listed as coke, but the coal used in making this coke was credited as coal production. The result was that the coke-production figures were incomplete.

Starting with the 1926 Annual Report, the standard practice of the Bureau of Statistics, Ottawa, has been adopted. This consists of crediting all coal produced, including that used in making coke, as primary mineral production. Coke-making is considered a manufacturing industry. As it is, however, of interest to the mineral industry, a table included in the Report shows the total coke produced in the Province, together with by-products, and the values given by the producers. This valuation of coke is not, of course, included in the total gross value of mineral production of the Province.

(5.) Structural materials are valued at the prices given by the producers.

(6.) Miscellaneous minerals are valued at the market or the prices given by the producers.

STATISTICAL TABLES.

TABLE I.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1929.

Gold, placer	\$78,436,714
Gold, lode	137,544,435
Silver	98,127,777
Copper	254,133,003
Lead	151,081,842
Zinc	78,762,097
Coal and coke	320,858,038
Structural materials	58,446,263
Miscellaneous minerals, etc.	5,065,683
Total	\$1,182,455,854

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1929 (INCLUSIVE).

1852 to 1895 (inclusive).....	\$94,547,241	1914	\$28,388,825
1896	7,507,956	1915	29,447,508
1897	10,455,268	1916	42,290,462
1898	10,906,861	1917	37,010,392
1899	12,393,131	1918	41,782,474
1900	16,344,751	1919	33,296,313
1901	20,086,780	1920	35,543,084
1902	17,486,550	1921	28,066,641
1903	17,495,954	1922	35,158,843
1904	18,977,359	1923	41,304,320
1905	22,461,325	1924	48,704,604
1906	24,980,546	1925	61,492,242
1907	25,882,560	1926	67,188,842
1908	23,851,277	1927	60,729,358
1909	24,443,025	1928	65,372,583
1910	26,377,066	1929	68,245,443
1911	23,499,072		
1912	32,440,800	Total	\$1,182,455,854
1913	30,296,398		

TABLE III.—QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1927, 1928, AND 1929.

Description.	1927.		1928.		1929.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer	oz. 9,191	\$156,247	8,424	\$143,208	6,983	\$118,711
Gold, lode	oz. 178,001	3,679,601	188,087	3,888,097	145,339	3,004,419
Silver	oz. 10,470,185	5,902,043	10,627,167	6,182,461	9,918,800	5,256,270
Copper	lb. 89,202,871	11,525,011	97,908,316	14,265,242	101,483,857	18,375,682
Lead	lb. 282,996,423	14,874,292	305,140,792	13,961,412	302,346,268	15,269,696
Zinc	lb. 145,225,443	8,996,135	181,763,147	9,984,613	172,096,841	9,268,792
Coal	tons, 2,240 lb. 2,453,827	12,269,135	2,526,702	12,633,510	2,251,252	11,256,260
Structural materials		2,867,380		3,408,686		3,921,768
Miscellaneous metals and minerals		459,514		905,354		1,773,845
Totals		\$60,729,358		\$65,372,583		\$68,245,443

TABLE IV.—OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

Names.	DIVISIONS.			DISTRICTS.		
	1927.	1928.	1929.	1927.	1928.	1929.
North-western District (No. 1).....				\$9,838,083	\$9,684,465	\$10,399,015
Atlin, Stikine, and Liard.....	\$93,098	\$64,197	\$53,612			
Nass River.....	4,943,233	5,307,358	6,901,925			
Portland Canal.....	4,753,782	4,255,393	3,391,066			
Skeena, Queen Charlotte, and Bella Coola.....	47,950	37,517	52,412			
North-eastern District (No. 2).....				263,809	391,783	315,013
Cariboo and Quesnel.....	105,515	80,914	88,659			
Omineca and Peace River.....	158,294	310,869	226,354			
Central District (No. 3).....				658,927	697,101	727,089
Nicola and Vernon.....	224,209	254,056	298,639			
Yale, Ashcroft, and Kamloops.....	297,244	275,365	292,046			
Lillooet and Clinton.....	137,474	167,680	136,354			
Southern District (No. 4).....				4,002,908	4,866,414	6,166,711
Grand Forks, Greenwood, and Osoyoos.....	699,808	540,573	872,978			
Similkameen.....	3,303,100	4,325,841	5,293,733			
Eastern District (No. 5).....				31,762,546	33,416,442	33,119,358
Fort Steele.....	29,905,168	31,269,770	31,596,722			
Windermere and Golden.....	10,038	62,995	27,056			
Ainsworth.....	521,931	357,169	337,318			
Slocan and Slocan City.....	740,413	1,408,053	1,029,734			
Nelson and Arrow Lake.....	370,246	99,661	102,392			
Trail Creek.....	208,938	202,460	5,475			
Revelstoke, Trout Lake, and Lardeau.....	5,812	16,334	20,661			
Western District (No. 6).....				14,203,085	16,316,378	17,518,237
Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria (Vancouver Island).....	8,522,116	8,570,425	7,867,402			
Vancouver and New Westmin- ster (Mainland).....	5,680,969	7,745,953	9,650,795			
Totals.....	\$60,729,358	\$65,372,583	\$68,245,443	\$60,729,358	\$65,372,583	\$68,245,443

TABLE V.—YIELD OF PLACER GOLD TO DATE.

1858	\$705,000	1876	\$1,786,648	1894	\$405,516	1912	\$555,500
1859	1,615,070	1877	1,608,182	1895	481,683	1913	510,000
1860	2,228,543	1878	1,275,204	1896	544,026	1914	565,000
1861	2,666,118	1879	1,290,058	1897	513,520	1915	770,000
1862	2,656,903	1880	1,013,827	1898	643,346	1916	580,500
1863	3,913,563	1881	1,046,737	1899	1,344,900	1917	496,000
1864	3,735,850	1882	954,085	1900	1,278,724	1918	320,000
1865	3,491,205	1883	794,252	1901	970,100	1919	286,500
1866	2,662,106	1884	736,165	1902	1,073,140	1920	221,600
1867	2,480,868	1885	713,738	1903	1,060,420	1921	233,200
1868	3,372,972	1886	903,651	1904	1,115,300	1922	364,800
1869	1,774,978	1887	693,709	1905	969,300	1923	420,000
1870	1,336,956	1888	616,731	1906	948,400	1924	420,750
1871	1,799,440	1889	588,923	1907	828,000	1925	280,092
1872	1,610,972	1890	490,435	1908	647,000	1926	355,503
1873	1,305,749	1891	429,811	1909	477,000	1927	156,247
1874	1,844,613	1892	399,526	1910	540,000	1928	143,208
1875	2,474,004	1893	356,131	1911	426,000	1929	118,711
Total.....							\$78,436,714

TABLE VI.—PRODUCTION OF LOBE MINES.

Year.	GOLD.		SILVER.		COPPER.		LEAD.		ZINC.		Total Value.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		\$		\$		\$		\$		\$	\$
1887.....			17,690	17,331			204,800	9,216			26,547
1888.....			79,780	75,000			674,500	29,813			104,813
1889.....			53,192	47,873			165,100	6,498			54,371
1890.....			70,427	73,948							73,948
1891.....			4,500	4,000							4,000
1892.....			77,160	66,935			808,420	33,064			99,999
1893.....	1,170	23,404	227,000	193,000			2,135,023	78,996			297,400
1894.....	6,252	125,014	746,379	470,219	324,680	16,234	5,662,523	169,375			781,342
1895.....	39,264	785,271	1,496,522	977,229	952,840	47,642	16,475,464	532,253			2,342,397
1896.....	62,259	1,244,180	3,135,343	2,100,689	3,818,556	190,926	24,199,977	721,384			4,257,179
1897.....	106,141	2,122,320	5,472,971	3,272,836	5,325,180	266,258	38,841,135	1,390,517			7,052,431
1898.....	110,061	2,201,217	4,292,401	2,375,841	7,271,678	874,781	31,693,559	1,077,581			6,529,420
1899.....	138,315	2,857,573	2,939,413	1,663,708	7,722,591	1,351,453	21,862,436	878,870			6,751,604
1900.....	167,153	3,453,381	3,958,175	2,309,200	9,997,080	1,615,289	63,338,621	2,691,887			10,069,757
1901.....	210,354	4,348,603	5,151,333	2,884,745	27,603,746	4,446,963	51,532,906	2,002,733			13,683,044
1902.....	236,491	4,888,269	3,917,917	1,941,328	29,636,057	3,446,673	22,536,381	824,832			11,101,102
1903.....	232,831	4,812,616	2,996,204	1,521,472	34,359,921	4,547,535	18,089,283	689,744			11,571,367
1904.....	222,042	4,589,608	3,222,481	1,719,516	35,710,128	4,578,037	36,646,244	1,421,874			12,309,035
1905.....	238,660	4,933,192	3,439,417	1,971,818	37,692,251	5,876,222	56,530,722	2,399,022			15,180,164
1906.....	224,027	4,630,639	2,990,262	1,897,320	42,990,488	8,288,565	52,408,217	2,667,578			17,484,102
1907.....	196,179	4,055,020	2,745,448	1,703,825	40,832,720	8,166,544	47,738,703	2,291,458			16,216,847
1908.....	255,582	5,282,880	2,631,389	1,321,483	47,274,614	6,240,249	43,195,733	1,632,799			14,477,411
1909.....	238,224	4,924,090	2,532,742	1,239,270	45,597,245	5,918,522	44,396,346	1,709,259	8,500,000	400,000	14,191,141
1910.....	267,701	5,533,380	2,450,241	1,245,016	38,243,934	4,871,512	34,658,746	1,386,350	4,184,192	192,473	13,228,731
1911.....	228,617	4,725,513	1,892,364	958,293	36,927,656	4,571,644	26,872,397	1,069,521	2,634,544	129,092	11,454,063
1912.....	257,496	5,322,442	3,132,108	1,810,045	51,456,537	8,408,513	44,871,454	1,805,627	5,358,280	316,139	17,662,766
1913.....	272,254	5,627,490	3,465,856	1,968,606	46,460,305	7,094,489	55,364,677	2,175,832	6,758,768	324,421	17,190,838
1914.....	247,170	5,109,004	3,602,180	1,876,736	45,009,699	6,121,319	50,625,048	1,771,877	7,866,467	346,125	15,225,061
1915.....	250,021	5,167,934	3,366,506	1,588,991	56,918,405	9,835,500	46,503,590	1,939,200	12,982,440	1,460,524	19,992,149
1916.....	221,932	4,587,334	3,301,923	2,059,739	65,379,364	17,734,494	48,727,516	3,007,462	37,168,980	4,943,985	31,483,014
1917.....	114,523	2,367,190	2,929,216	2,265,749	59,007,565	16,038,256	37,307,465	2,951,020	41,848,513	3,166,259	26,788,474
1918.....	164,674	3,403,812	3,498,172	3,215,870	61,483,754	15,143,449	43,899,661	2,928,107	41,772,918	2,899,040	27,590,278
1919.....	152,426	3,150,645	3,403,119	3,592,673	42,459,339	7,939,896	29,475,968	1,526,853	56,737,651	3,540,429	19,750,498
1920.....	120,048	2,481,392	3,377,849	3,235,980	44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,979	19,444,365
1921.....	135,663	2,804,154	2,673,389	1,591,201	39,036,993	4,879,624	41,402,288	1,693,354	49,419,372	1,952,065	12,920,398
1922.....	197,856	4,089,684	7,101,311	4,554,781	32,359,896	4,329,754	67,447,985	3,480,316	57,146,548	2,777,322	19,231,857
1923.....	179,245	3,704,994	6,032,986	3,718,129	57,720,290	8,323,266	96,663,152	6,321,770	58,343,462	3,278,903	25,347,062
1924.....	247,716	5,120,535	8,341,768	5,292,184	64,845,393	8,442,870	170,384,481	12,415,917	79,130,970	4,266,741	35,538,247
1925.....	209,719	4,335,269	7,054,844	5,286,818	72,306,432	10,153,269	237,899,199	18,670,329	98,257,099	7,754,450	46,200,135
1926.....	201,427	4,163,859	10,748,556	6,675,606	89,339,768	12,324,421	263,023,937	17,757,535	142,876,947	10,586,610	51,508,031
1927.....	178,001	3,679,601	10,470,185	5,902,043	89,202,871	11,525,011	282,996,423	14,874,292	145,225,443	8,996,135	44,977,082
1928.....	188,087	3,888,097	10,627,167	6,182,461	97,908,316	14,265,242	305,140,792	13,961,412	181,763,147	9,984,613	48,281,825
1929.....	145,012	3,004,419	9,918,800	5,256,270	101,483,857	18,375,682	302,346,268	15,269,696	172,096,841	9,268,792	51,174,859
Totals.....	6,664,742	137,544,435	160,186,686	98,127,777	1,569,546,825	254,133,003	2,804,212,339	151,081,842	1,259,280,848	78,762,097	719,649,154

MINERAL PRODUCTION.

TABLE VII.—PRODUCTION IN DETAIL OF THE

DISTRICTS AND DIVISIONS.	YEAR.	TONS.	GOLD—PLACER		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
				\$		\$		\$
North-western District (No. 1)								
Atlin.....	1928	400	5,174	53,958	195	3,990	133	78
	1929		2,408	40,936				
Stikine.....	1928		29	493				
	1929		38	646				
Liard.....	1928		334	5,678				
	1929		340	5,780				
Nass River.....	1928	1,425,802			5,100	105,426	273,068	158,890
	1929	1,722,555			4,671	96,558	285,394	151,239
Portland Canal.....	1928	278,375			130,804	2,693,618	2,369,176	1,378,292
	1929	268,591			96,676	1,998,467	2,373,872	1,258,039
Skeena.....	1928	190	30	510	139	2,874	1,166	678
	1929	72	18	306	69	1,426	328	174
Queen Charlotte.....	1928							
	1929		9	153				
Bella Coola.....	1928							
	1929							
North-eastern District (No. 2)								
Cariboo.....	1928		2,287	38,879				
	1929		2,495	42,415				
Quesnel.....	1928		1,649	28,033				
	1929		1,201	20,417				
Omineca.....	1928	15,332	235	3,995	477	9,860	343,653	190,024
	1929	16,758	120	2,040	226	4,672	261,351	138,498
Peace River.....	1928		200	3,400				
	1929		120	2,040				
Central District (No. 3)								
Nicola.....	1928	73			1	21	1,595	928
	1929	7,005			794	16,413	41,945	22,223
Vernon.....	1928	36			2	41		
	1929							
Yale.....	1928		20	340				
	1929	21	20	340	1	21	1,038	550
Ashcroft.....	1928							
	1929							
Kamloops.....	1928	5,000	15	255	157	3,246	320	186
	1929	367			128	2,648	356	189
Lillooet.....	1928	14,360			7,730	159,793	1,400	814
	1929	13,260			5,061	104,620	670	355
Clinton.....	1928		186	3,162				
	1929		109	1,853				
Southern District (No. 4)								
Grand Forks.....	1928	15					1,059	616
	1929							
Greenwood.....	1928	2,711			134	2,770	386,957	223,116
	1929	2,494			141	2,915	444,429	235,516
Osoyoos.....	1928	45,437			11,843	244,816	3,148	1,831
	1929	71,565			14,217	293,891	226	120
Similkameen.....	1928	889,020	242	4,114	5,265	108,837	150,757	87,705
	1929	927,992	75	1,275	5,624	122,460	167,040	88,520
Eastern District (No. 5)								
Fort Steele.....	1928	1,792,633	23	391	731	15,111	5,595,565	3,255,276
	1929	1,913,075	27	459	227	4,692	5,055,996	2,679,324
Windermere.....	1928	7,647			3	62	19,023	11,067
	1929	909			2	41	2,663	1,411
Golden.....	1928							
	1929	1,731	3	51			1,466	777
Ainsworth.....	1928	30,033			148	3,059	102,654	59,720
	1929	31,959			96	1,984	92,323	48,925
Slocan.....	1928	90,610			383	7,917	1,117,993	650,404
	1929	61,471			156	3,225	658,294	507,829
Slocan City.....	1928	623			41	848	13,906	8,090
	1929	55					3,252	1,723
Nelson.....	1928	14,983			2,712	56,062	43,357	25,223
	1929	16,283			2,465	50,956	26,868	14,238
Arrow Lake.....	1928							
	1929							
Trail Creek.....	1928	13,941			7,424	153,467	7,435	4,325
	1929	110			164	3,394	393	208
Revelstoke.....	1928	44			1	21	1,808	1,052
	1929	30					466	247
Trout Lake.....	1928	54			7	145	633	368
	1929							
Lardeau.....	1928	11			15	310	5	3
	1929	13			2	41	529	280
Western District (No. 6)								
Nanaimo.....	1928	47					128	74
	1929	274			25	517	216	114
Alberni.....	1928							
	1929	186			4	83	41	22
Clayoquot.....	1928							
	1929							
Quatsino.....	1928							
	1929							
Victoria.....	1928							
	1929							
New Westminster.....	1928							
	1929							
Vancouver.....	1928	1,613,931			15,277	315,803	192,228	111,831
	1929	1,620,905			14,290	295,400	199,544	105,744
Totals.....	1928	6,241,310	8,424	143,208	188,087	3,888,097	10,627,167	6,182,461
	1929	6,977,681	6,983	118,711	145,339	3,004,419	8,918,800	5,256,270

MINERAL PRODUCTION.

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METALLIFEROUS MINES FOR 1928 AND 1929.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS.		TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1928.	1929.	1929.
	\$		\$		\$	\$	\$	\$
						58,026	40,936	10,345,589
						493	646	
						5,678	5,780	
24,605,833	5,042,070	21,911	1,002			5,307,358	6,901,925	
26,746,057	6,653,609	10,230	519					
317,493	46,259	2,933,599	134,224			4,252,393	3,391,066	
130,167	23,566	2,197,666	110,991					
48,012	6,995	2,309	106			11,163	5,983	
17,548	3,177						153	
								278,584
						38,879	42,415	
						28,083	20,417	
52	8	868,695	39,746	788,253	43,300	296,833	213,712	
5,760	1,043	820,938	41,460	482,731	25,999			
						3,400	2,040	177,661
		4,131	189	3,770	207	1,345	61,287	
		448,400	22,646					
614	89	1,583	72			202		
		2,243	113			340	1,024	
202,832	29,560					33,247	5,552	
31,574	5,717					160,607	104,975	
						3,162	1,853	4,845,049
		5,206	238			854		
5,000	729	175,898	8,048	6,366	350	237,013	253,964	
		187,390	9,464	112,681	6,069			
528	77	1,645	76			246,800	294,016	
		100	5					
21,384,228	3,115,632					3,316,338	4,297,069	27,588,748
22,539,798	4,081,281	52,640	2,659	16,229	874			
83	12	292,757,130	13,994,810	167,842,300	9,219,913	25,885,513	26,131,862	
		290,544,455	14,673,657	162,904,553	8,773,730			
200	29	369,982	16,028	557,593	30,630	58,716	4,290	
		56,184	2,838					
		397,876	20,084				20,922	
		1,350,894	61,809	3,662,363	201,181	325,769	328,297	
		1,172,475	59,215	4,050,901	218,173			
		5,440,581	248,928	8,735,009	479,831	1,387,080	1,027,074	
		5,407,036	273,077	4,510,302	242,943			
		48,392	2,214	142,370	7,821	18,973	2,660	
190	28	7,359	372	10,492	565	88,841	68,397	
		160,974	7,865	2,967	163			
		63,416	3,203					
292,850	42,668					200,460	3,825	
		1,914	97	2,367	129			
		44,208	2,023			3,096	792	
683	124	4,159	210	3,926	211			
		11,703	536	22,156	1,217	2,266		
		4,143	209	1,839	99	318	629	8,057,909
4,348	633					707	2,709	
11,475	2,078						2,401	
12,680	2,296							
41,046,003	5,980,403	941,951	43,098			6,451,135	8,052,799	
41,985,115	7,602,788	967,594	46,867					
97,908,316	14,265,242	305,140,792	13,961,412	181,763,147	9,984,613	48,425,033		
101,483,857	18,375,682	302,346,263	15,269,696	172,096,841	9,268,792		51,293,570	51,293,570

TABLE VIII.—COAL PRODUCTION PER YEAR TO DATE.*

Year.	Tons (2,240 lb.)	Value.	Year.	Tons (2,240 lb.)	Value.
1836-1885.....	3,029,011	\$9,468,557	1909.....	2,006,476	\$7,022,666
1886.....	328,636	979,908	1910.....	2,800,046	9,800,161
1887.....	413,360	1,240,080	1911.....	2,193,062	7,675,717
1888.....	489,301	1,467,903	1912.....	2,628,804	9,200,814
1889.....	579,830	1,739,490	1913.....	2,137,483	7,481,190
1890.....	678,140	2,034,420	1914.....	1,810,967	6,338,386
1891.....	1,029,097	3,087,291	1915.....	1,611,129	5,638,952
1892.....	826,335	2,479,005	1916.....	2,084,093	7,294,325
1893.....	978,294	2,934,882	1917.....	2,149,975	7,324,913
1894.....	1,012,953	3,038,859	1918.....	2,302,245	11,511,225
1895.....	939,654	2,818,962	1919.....	2,267,541	11,337,705
1896.....	896,222	2,688,666	1920.....	2,595,125	12,975,628
1897.....	882,854	2,648,562	1921.....	2,483,995	12,419,975
1898.....	1,135,865	3,407,595	1922.....	2,511,843	12,559,216
1899.....	1,306,324	3,918,972	1923.....	2,453,223	12,266,115
1900.....	1,439,595	4,318,785	1924.....	1,939,526	9,697,630
1901.....	1,460,331	4,380,993	1925.....	2,328,522	11,642,610
1902.....	1,397,394	4,192,182	1926.....	2,330,036	11,650,180
1903.....	1,168,194	3,504,582	1927.....	2,453,827	12,269,135
1904.....	1,253,628	3,760,884	1928.....	2,526,702	12,633,510
1905.....	1,884,312	4,152,936	1929.....	2,251,252	11,256,200
1906.....	1,517,303	4,551,909			
1907.....	1,800,067	6,300,235			
1908.....	1,677,849	5,872,472			
			Totals.....	75,488,421	\$295,184,438

* For all years to 1925 (inclusive) figures are net coal production and do not include coal made into coke; subsequent figures are entire coal production, including coal made into coke.

TABLE IX.—COKE PRODUCTION FROM BEE-HIVE OVENS IN BRITISH COLUMBIA FROM 1895 TO 1925.

Year.	Tons (2,240 lb.)	Value.	Year.	Tons (2,240 lb.)	Value.
1895-97.....	19,396	\$96,980	1913.....	286,045	\$1,716,270
1898 (estimated).....	35,000	175,000	1914.....	234,577	1,407,462
1899.....	34,251	171,255	1915.....	245,871	1,475,226
1900.....	85,149	425,745	1916.....	267,725	1,606,350
1901.....	127,081	635,405	1917.....	159,905	959,430
1902.....	128,015	640,075	1918.....	188,967	1,322,769
1903.....	165,543	827,715	1919.....	91,138	637,966
1904.....	238,428	1,192,140	1920.....	67,792	474,544
1905.....	271,785	1,358,925	1921.....	59,434	416,038
1906.....	199,227	996,135	1922.....	45,835	320,845
1907.....	222,913	1,337,478	1923.....	58,919	412,433
1908.....	247,399	1,484,394	1924.....	30,615	214,305
1909.....	258,703	1,552,218	1925.....	75,185	526,295
1910.....	218,029	1,308,174			
1911.....	66,005	396,030			
1912.....	264,333	1,585,998			
			Totals.....	4,393,255	\$25,673,600

TABLE X.—COKE AND BY-PRODUCTS PRODUCTION OF BRITISH COLUMBIA, 1928 AND 1929.

Description.	1928.		1929.	
	Quantity.	Value.	Quantity.	Value.
Coal used in making coke, long tons.....	187,685	\$940,668	215,501	\$1,048,691
Coke made in bee-hive ovens, long tons.....	61,370	429,590	67,280	574,279
Coke made in by-product ovens, long tons.....	28,680	263,781	29,738	303,867
Coke made in gas plants, long tons.....	37,242	187,882	22,891	117,305
Total coke made, long tons.....	127,292	\$881,253	119,909	\$1,000,451
Gas produced.....		1,313,407		1,461,445
Tar produced.....		45,313		61,084
Other by-products.....		14,036		39,202
Total production value of coke industry.....		\$2,254,009		\$2,562,182

TABLE XI.—PRODUCTION IN DETAIL OF STRUCTURAL MATERIALS, 1929.

District and Division.	Cement.	Lime and Lime-stone.	Building-stone.	Riprap and Crushed Rock.	Sands and Gravel.	Pottery and Tile.	Clay.	Fire-brick.	Face and Front Brick.	Red Brick.	Totals for Divisions.	Totals for Districts.
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
North-western District (No. 1).....												53,426
Atlin, Liard, and Stikine.....				4,100	2,150						6,250	
Nass River.....												
Portland Canal.....												
Skeena and Queen Charlotte.....				6,490	8,620						15,110	
Bella Coola.....		29,404			2,662						32,066	
North-eastern District (No. 2).....												23,654
Cariboo and Quesnel.....					17,430		1,397	1,750			20,577	
Omineca and Peace River.....					1,867					1,210	3,077	
Central District (No. 3).....												88,582
Nicola and Vernon.....			7,200		8,135					3,277	18,612	
Yale, Ashcroft, and Kamloops.....				19,042	29,062						48,104	
Lillooet and Clinton.....					21,866						21,866	
Southern District (No. 4).....												26,293
Grand Forks and Greenwood.....					2,137					\$15,000	17,137	
Osoyoos.....		2,831			3,750						6,581	
Similkameen.....					2,375						2,375	
Eastern District (No. 5).....												107,022
Fort Steele.....				1,130	40,172						41,302	
Windermere and Golden.....				1,350	494						1,844	
Ainsworth.....			5,282		3,709						8,991	
Slocan and Slocan City.....												
Nelson.....			14,455	560	18,980						33,995	
Trail Creek.....				150	1,500						1,650	
Revelstoke.....			75	7,335	11,830						19,240	
Western District (No. 6).....												3,622,791
Nanaimo.....		443,066	24,643	1,073	7,209					87,551	513,542	
Victoria and Quatsino.....	1,487,223	71,879		9,145	66,352					104,866	1,739,465	
Vancouver.....			55,800	146,937	309,637	43,164					555,538	
New Westminster.....				113,002	28,562	279,181	14,924	215,599	107,763	55,215	814,246	
Totals.....	1,487,223	547,180	*107,455	†310,314	1588,699	322,345	16,321	*217,349	107,763	217,119	3,921,768	3,921,768

* Includes \$75 received too late to be included in 1928 production.
 † Includes \$43,668 received too late to be included in 1928 production.
 ‡ Includes \$139,339 received too late to be included in 1928 production.
 § Estimated.

TABLE XII.—PRODUCTION IN DETAIL OF MISCELLANEOUS METALS AND MINERALS, 1929.

District and Division.	Arsenic.	Bismuth.	Cadmium.	Chromite.	Diatomite.	Fluorspar.	Flux (Lime and Quartz).	Gypsum.	Gypsum.	Iron Ore.	Manganese.	Palladium.	Phosphate.	Platinum.	Soda.	Sulphur Content of Pyrites and Sulphuric Acid manufactured.	Talc.	Divisions.	Districts.
	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢
North-western District (No. 1)																			
Atlin, Liard, and Stikine																			
Nass River																			
Portland Canal																			
Skeena and Queen Charlotte																			
Bella Coola																			5,250
North-eastern District (No. 2)																		5,250	
Cariboo and Quesnel					5,250														
Omineca and Peace River																			242,026
Central District (No. 3)																			
Nicola and Vernon																			
Yale, Ashcroft, and Kamloops								234,366										234,366	
Lillooet and Clinton				900					1,176						4,864		720	7,660	302,979
Southern District (No. 4)																			
Grand Forks and Greenwood						267,000	16,293											283,293	
Osoyoos	16,433						1,554											17,987	
Similkameen														1,699				1,699	990,058
Eastern District (No. 5)																			
Fort Steele		283,701	675,294							8,272		6,836	4,580	1,129		10,216		990,028	
Windermere and Golden																			
Ainsworth											30							30	
Slocan and Slocan City																			
Nelson																			
Trail Creek																			
Revelstoke																			233,532
Western District (No. 6)																			
Nanaimo							5,320											5,320	
Victoria and Quatsino																			
Vancouver										2,000						226,212		228,212	
New Westminster																			
Totals	16,433	283,701	675,294	900	5,250	267,000	23,167	1,176	242,638	2,000	30	6,836	4,580	2,828	4,864	236,428	720	1,773,845	1,773,845

TABLE XIII.

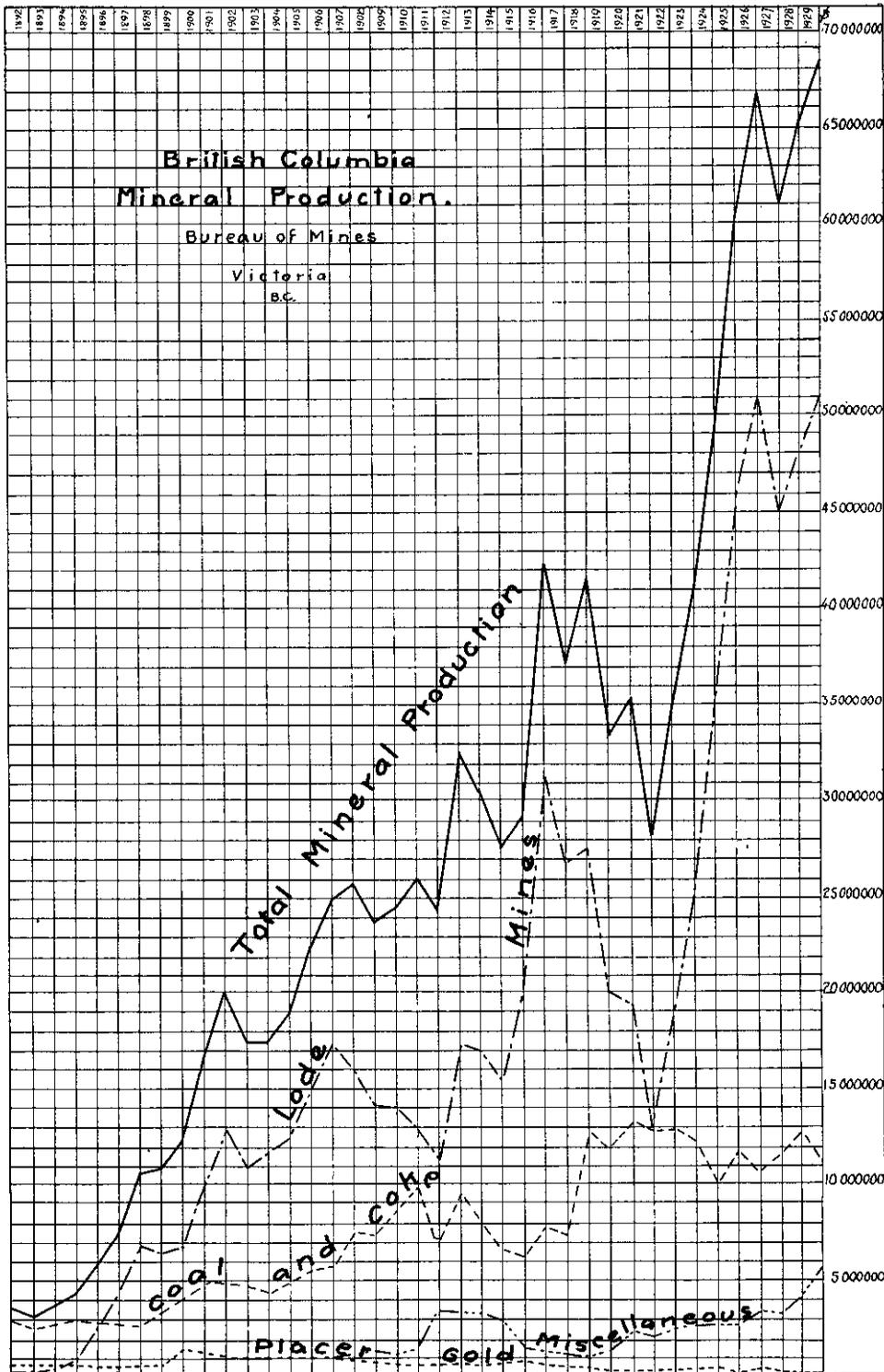


TABLE XIV.

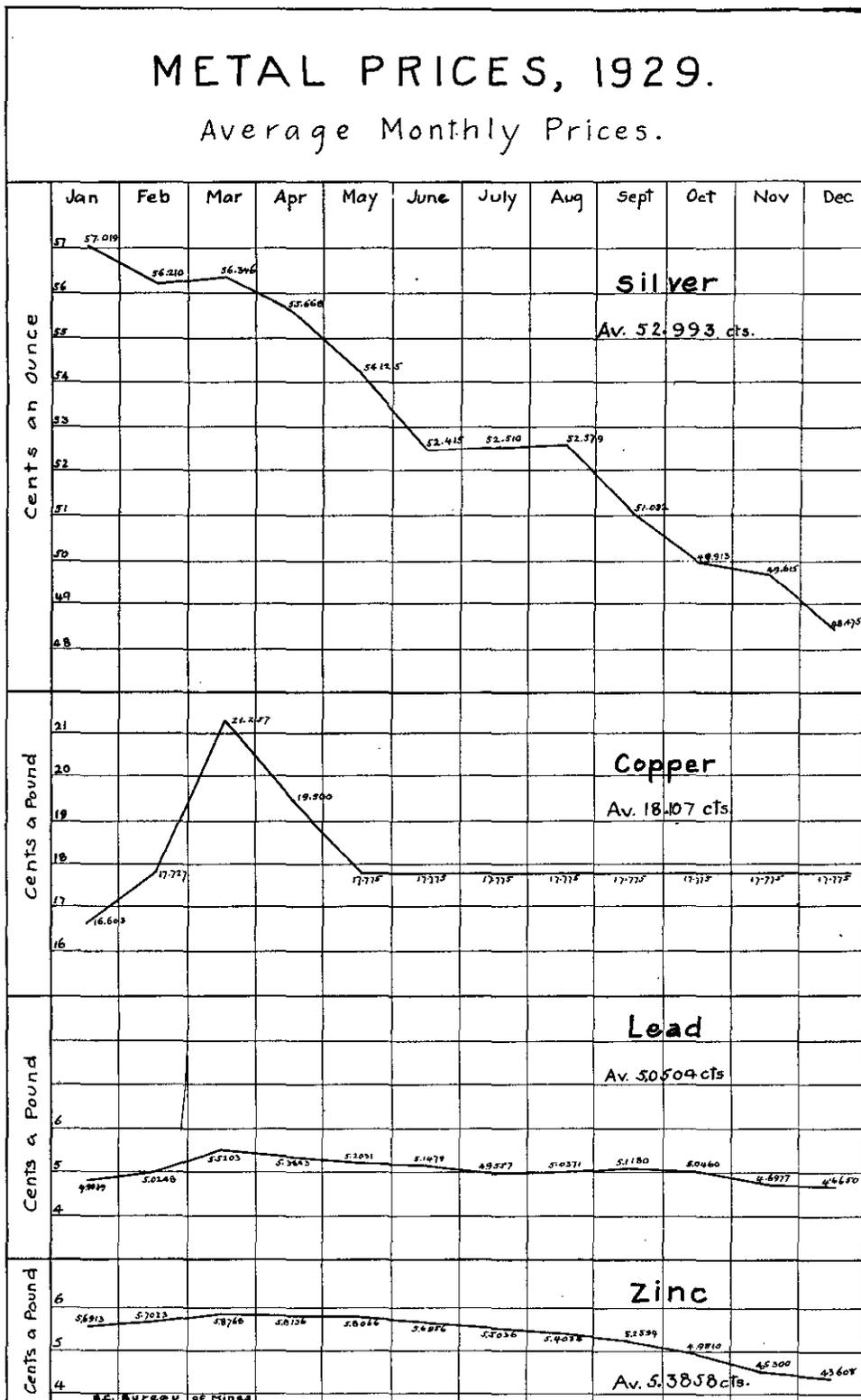


TABLE XV.

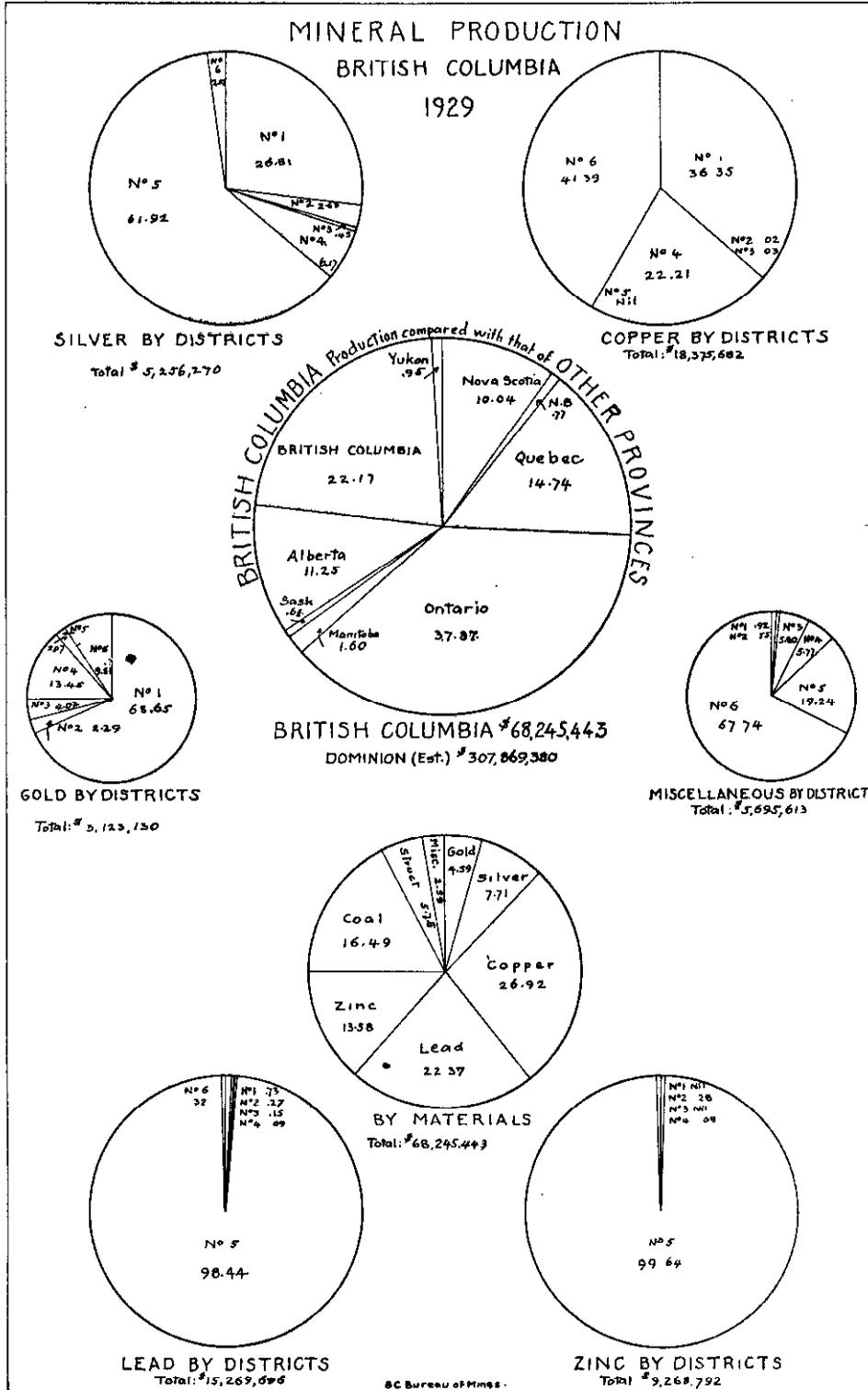


TABLE XVI.—MEN EMPLOYED IN THE MINERAL INDUSTRY OF BRITISH COLUMBIA, 1929.

District.	Placer-mining.	LODE-MINING.			In Concentrators.	In Smelters.	COAL-MINING.			STRUCTURAL MATERIALS.		Miscellaneous Minerals.	Total.
		Under.	Above.	Total.			Under.	Above.	Total.	Quarries.	Plants.		
No. 1.....	120	637	393	1,030	90	515	.....	.....	.....	16	.....	.....	1,780
No. 2.....	110	115	146	261	10	.....	6	2	8	5	3	4	406
No. 3.....	40	109	125	234	24	.....	93	40	133	24	2	83	540
No. 4.....	29	401	291	692	156	.....	427	210	637	4	15	35	1,568
No. 5.....	37	1,042	765	1,807	466	2,433	1,116	387	1,503	20	3	54	6,323
No. 6.....	5	622	332	954	211	.....	2,033	714	2,747	423	516	92	4,948
Totals....	341	2,926	2,052	4,978	966	2,948	3,875	1,353	5,028	492	544	268	15,565

TABLE XVII.—TONNAGE, NUMBER OF MINES, AND NET VALUE OF LODE MINERALS.

District.	Tonnage.	No. of Shipping Mines, 1929.	No. of Mines shipping over 100 Tons.	Net Value of Lode Minerals produced.
No. 1.....	1,991,218	15	7	\$6,873,395
No. 2.....	16,758	5	2	158,027
No. 3.....	20,653	6	3	139,199
No. 4.....	1,002,051	16	7	3,921,056
No. 5.....	2,025,636	53	26	17,103,975
No. 6.....	1,921,365	6	3	6,518,235
Totals.....	6,977,681	106	48	\$34,713,887

SUMMARY OF STATISTICAL TABLES.

In compiling the Statistical Tables for the 1929 Annual Report the same general arrangement has been followed as in previous years, and the order of the tables is the same as in the 1928 Annual Report.

Referring to the preceding Statistical Tables showing the mineral production of the Province, the following is a summary of their contents:—

Table I. shows the total gross value of each mineral product mined in the Province up to the end of 1929, aggregating \$1,182,455,854. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of \$320,858,038; followed next in importance by copper at \$254,133,003, and next in order is lead at \$151,081,842, with lode gold in fourth place at \$137,544,435.

Table II. shows the value of the total production of the mines of the Province from 1852 to 1895 (included in one total) and for each year from 1896 to 1929. The value of the total mineral production of the Province up to the end of 1929 was \$1,182,455,854.

Table III. gives the quantities in the customary units of measure and the values of the various metals or minerals which go to make up the total of the mineral production of the Province for 1929, and also, for the purpose of comparison, similar data for the two preceding years.

Table IV. shows the proportions of the total mineral productions made in each of the various districts into which the Province is divided.

It will be noted that again this year the Eastern District has the honour of first place on the list, followed, in order of importance, by the Western, North-western, Southern, Central, and North-eastern Districts. The Western and Eastern Districts owe a considerable proportion of their output to the coal-mines situated within their limits, whereas in the other districts the production is chiefly from metal-mining.

The Western District also derives a fair proportion of its production from structural materials, due to the larger cities therein; this year this amounted to \$3,622,791, as shown in Table XI.

Table V. shows the statistical record of the placer mines of the Province from 1858 to 1929, and shows a total production of \$78,436,714. The value of the output for 1929 was \$118,711, a decrease, as compared with the previous year, of \$24,497.

Table VI. relates entirely to the lode mines of the Province, and shows the quantities and values of the various metals produced each year since the beginning, in 1887, of such mining in the Province. The gross value of the product of these mines to date is \$719,649,154; this figure includes the zinc production of 1909 and all subsequent years.

Table VII. gives the details of production of metalliferous mines of the Province for the years 1928 and 1929 and the divisions and districts in which such productions were made, showing the tonnage of ore mined in each division, with its metallic contents and the market value of the contained metals recovered in treatment.

The total tonnage of ore mined in the Province during the year 1929 was 6,977,681 tons, having a gross value of \$51,174,859, and, with the placer gold, a total value of \$51,293,570.

Table VIII. contains the statistics of production of the coal-mines of the Province. The total amount of coal produced to the end of 1929 was 75,488,421 tons (2,240 lb.), worth \$295,184,438. Of this, 2,251,252 tons was produced in 1929, valued at \$11,256,260. In these figures of coal production up to and including 1925 the coal used in making coke is not included, as such coal is accounted for in the figures of output of coke, but the figures since then include coal made into coke.

More detailed statistics as to the coal production of the Province are given in the reports of the Inspection Branch.

Table IX. shows the production of coke from bee-hive ovens in the Province up to the end of 1925.

Table X., commenced in 1926, shows complete statistics of the coke industry of the Province. Commencing with 1926, coke is not considered a primary mineral production as the coal used in making coke is included and valued in the coal production total. The statistics of the coke industry for the current year are, however, given in this table, as they are believed to be of interest to the mineral industry.

Table XI. shows in detail the production of structural materials. The production in 1929 was valued at \$3,921,768, as compared with \$3,408,686 in 1928. Rock used as flux by smelters does not appear in this table, but will be found in Table XII., "Miscellaneous Metals and Minerals."

Table XII. shows the production of "Miscellaneous Metals and Minerals" by divisions and districts. This branch of the industry is steadily expanding. In 1929 the production value was \$1,773,845, as compared with \$905,354 in 1928, or an increase of 96 per cent.

Table XIII. presents in graphic form the facts shown in figures in the tables, and demonstrates to the eye the growth of mining in the Province, and also the fluctuations to which it has been subject.

The curve of lode production shows on the average a steady growth, but some marked interruptions have occurred; it is satisfactory that a substantial increase in production has occurred in the last ten years. The total mineral production also shows a progressive increase, with, however, some large fluctuations.

Table XIV. shows graphically the metal prices for 1929.

Table XV. shows graphically the Dominion mineral production (preliminary estimates for all Provinces except British Columbia) in 1929 by Provinces, and the outputs by minerals and districts of the British Columbia production.

Table XVI. shows the total number of men employed in the mineral industry of the Province. The figures are probably incomplete with regard to a number of very small operators and leasers working intermittently, but the totals for the different branches indicate very closely the actual men employed.

Table XVII. shows the tonnages of ore and number of shipping mines for each district. A column in this table shows the net value of lode-minerals produced by districts; 1926 was the first year that statistics were collected from which to compile such figures. The net value is the amount given by the mine-owner as being the money value received for his ore; it is the gross value less deductions for transportation, smelting, refining, and marketing charges on the contained metals.

The total net value of \$34,713,887 is believed to be approximately correct, although the statistics obtained were not as complete as desired. In many instances small operators and leasers did not give a return of net value, and in all these cases the value was estimated.

REVIEW BY METALS AND MINERALS.

GOLD.

The production of placer gold in 1929 was \$118,711, as compared with **Placer Gold.** \$143,208 in 1928, a decrease of \$24,497. For some years the placer-output has been steadily dwindling until now it is a very unimportant item from the view-point of production. Although production has become almost negligible, it should not be concluded that there is no interest in the industry. Actually in the last five years much placer-mining has been carried on, but unfortunately without as yet very tangible production results. Much of this work has consisted of testing placer-ground, and in many instances the testing is not conclusive or completed. In a number of placer-fields of the Province plants for hydraulicking are being constructed, and some of these may be expected to be productive in the future. Much desultory small-scale work has been carried on, partly to recover gold and partly to prove up deposits of placer-gravels.

The principal output of placer gold in the Province is still made in Cariboo, Quesnel, and Atlin Mining Divisions, 87 per cent. of the total coming from these Divisions.

The value of lode gold produced in 1929 was \$3,004,419, as compared with **Lode Gold.** \$3,888,097 in 1928, a decrease of 22.7 per cent. Of this output the *Premier* contributed about 66 per cent. of the Provincial total, or about the same ratio as in recent years. The *Nickel Plate*, *Pioneer*, and *Reno* are other straight gold-mines that contribute to the output, and the remainder is mainly a by-product from the treatment of copper and silver-lead ores.

The big decrease in output this year was due to a smaller production from the *Premier*, owing to lower-grade ore being mined, and the practical cessation of mining in the Rossland camp.

Development of several gold properties was carried on during the year and it is expected that eventually some of these will become producers. It is probable that the yearly gold-output from the *Premier* will gradually decline, but the advent of other gold-producers should keep the yearly figure between three and four million dollars.

The following table shows the gold production by Mining Divisions for the years 1928 and 1929:—

Mining Divisions.	1928. Oz.	1929. Oz.
Portland Canal	130,304	96,676
Vancouver	15,277	14,290
Osoyoos	11,843	14,217
Lillooet	7,730	5,061
Trail Creek	7,424	164
Similkameen	5,265	5,924
Nass River	5,100	4,671
Nelson	2,712	2,465
All others	2,432	1,871
Totals	188,807	145,339

SILVER.

The quantity of silver produced in 1929 was 9,918,800 oz., worth \$5,256,270, a decrease from the production in 1928 in quantity of 708,367 oz., or 6.66 per cent., and in value of \$926,191. The Fort Steele and Portland Canal Divisions together produced 7,429,963 oz., or 75 per cent. of the total output.

The decline in production was due to decreased outputs from Fort Steele and Slocan Divisions, partly offset by small increases in Nass River, Portland Canal, Greenwood, Similkameen, and Vancouver Divisions.

The average market price of silver for the year was 52.993 cents an ounce, as compared with 58.176 cents in 1928. The year closed with the price at 46.75 cents an ounce.

MINERAL PRODUCTION.

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The following table shows the silver production by Mining Divisions for the years 1928 and 1929:—

Mining Divisions.	1928. Oz.	1929. Oz.
Fort Steele	5,595,565	5,055,996
Portland Canal	2,369,176	2,373,972
Slocan	1,117,993	958,204
Greenwood	386,957	444,429
Nass River	273,068	285,304
Omineca	343,653	261,351
Vancouver	192,228	199,544
Ainsworth	102,654	92,323
Similkameen	150,757	167,040
Nelson	43,357	26,868
All others	51,759	53,589
Totals	10,627,167	9,918,800

COPPER.

The amount of copper produced in 1929 was 101,483,837 lb., which is an increase, as compared with 1928, of 3,575,541 lb., or 3.65 per cent. This is the greatest production of copper ever recorded in the Province.

Owing to the much higher market price of copper—18.107 cents a pound average, as compared with 14.57 cents in 1928—the copper production in 1929 established a new high record for valuation; the figure of \$18,650,210 compares with the previous record of \$17,784,494 in 1916, when the average price of copper was 27.202 cents a pound.

The three important copper-mines of the Province—*Britannia*, *Hidden Creek*, and *Copper Mountain*—produced about 99 per cent. of the total output. All three treated larger tonnages than in any preceding year. The *Britannia* is now producing at the rate of 6,000 tons a day and has taken first place as the leading copper-producer of the Province.

With an increased price for copper, the demand for copper prospects in British Columbia has been stimulated and much development was carried on in 1929. It is not expected that there will be any large increase in copper-output in 1930, but development plans now under way should cause a higher production within two or three years.

The following table shows the production of copper by Mining Divisions for the years 1928 and 1929:—

Mining Divisions.	1928. Lb.	1929. Lb.
Nass River	34,605,833	36,746,057
Vancouver	41,046,003	41,988,115
Similkameen	21,384,228	22,539,798
Trail Creek	292,850	.....
Portland Canal	317,493	130,167
Skeena	48,012	17,548
All others	213,897	62,172
Totals	97,908,316	101,483,857

LEAD.

The amount of lead produced in 1929 was 302,346,268 lb., valued at \$15,269,696. This represents, as compared with the previous year, a decrease in quantity of 2,794,524 lb., but, owing to a higher average market price for the metal, an increase in value of \$1,308,284.

This enormous production of lead comes largely from the *Sullivan* mine of the Consolidated Mining and Smelting Company of Canada. This mine has regularly increased its lead production every year since 1919 and is now equipped to mine and mill at the rate of 5,000 tons a day.

The lead-output by Mining Divisions shows but little change from the figures for 1928. A larger output may be expected in 1930 owing to the operation of the *Monarch*.

The average London market price of lead in 1929 was 5.0504 cents a pound, as compared with 4.5754 cents in 1928, an increase of 10.4 per cent.

The following table shows the production of lead, according to Mining Divisions, for the years 1928 and 1929:—

Mining Divisions.	1928. Lb.	1929. Lb.
Fort Steele	292,757,130	290,544,455
Slocan	5,440,581	5,407,036
Ainsworth	1,350,894	1,172,475
Windermere	360,982	56,184
Portland Canal	2,933,599	2,197,666
Nelson	160,794	63,416
Greenwood	175,898	187,390
Omineca	868,695	820,938
All others	1,083,039	1,896,708
Totals	305,140,792	302,346,268

The Fort Steele Division continues to head the list, with 95.3 per cent. of the total output of the Province for the year.

Zinc.

The production of zinc in 1929 was 172,096,841 lb., valued at \$9,268,792. Compared with the 1928 output, this is a decrease in quantity of 9,666,306 lb., or 5.3 per cent., and a decrease in value of \$715,821.

Similarly, as with lead, the bulk of the Provincial zinc production is made by the *Sullivan* mine. A larger output of zinc was expected in 1929, but owing to poor market conditions a large quantity of zinc concentrates was stored in the last months of the year.

The average London price of zinc for the year was 5.3858 cents a pound, as compared with 5.4932 cents in 1928, a decline of 2 per cent.

The following table shows the production of zinc by Mining Divisions for the years 1928 and 1929:—

Mining Divisions.	1928. Lb.	1929. Lb.
Fort Steele	167,842,300	162,904,853
Slocan	8,735,009	4,510,802
Ainsworth	3,662,363	4,050,901
Omineca	788,253	482,731
Windermere	557,593	.....
All others	177,629	147,554
Totals	181,763,147	172,096,841

COAL.

The production of coal in 1929 was 2,251,252 long tons, which shows a decrease, as compared with 1928, of 275,450 tons.

Summarizing the Provincial production of coal, the following table shows the output:—

	1926.	1927.	1928.	1929.
Vancouver Island mines	1,293,175	1,331,325	1,277,533	1,120,805
Nicola-Princeton mines	187,153	213,292	245,978	242,236
Crowsnest mines	848,448	907,519	1,001,523	886,706
Northern District	1,260	1,691	1,668	1,505
Total quantity of coal mined	2,330,036	2,453,827	2,526,702	2,251,252

The greater part of the Provincial coal production is still being mined by three companies—the Crow's Nest Pass Coal Company, of East Kootenay; the Canadian Collieries (Dunsmuir), Limited; and the Western Fuel Corporation, of Vancouver island, which mined, collectively, 73 per cent. of the output.

Of the other collieries: In the Coast District, on Vancouver island, the Granby Company, from its colliery near Cassidy, produced 170,767 tons; the Fiddick mine, 2,998 tons; the Little Ash mine, 5,464 tons; the Richardson mine, 766 tons; the Lantzville Colliery, 4,420 tons;

and the Biggs' mine, 440 tons. In the Nicola Valley section of the district the Middlesboro Colliery Company mined 43,373 tons; the Coalmont Collieries, Limited, 149,750 tons; the Tulameen Valley Coal Company, Limited, produced 37,435 tons; the Normandale Colliery, 185 tons; the Pleasant Valley Coal Company, 3,445 tons; the Ashington Coal Company, 22 tons; the Canadian Coal and Briquetting Company, 200 tons; the Blue Flame Colliery (formerly Lynden), 6,360 tons; the Gem Domestic Coal Company, 538 tons; and the Black Coal mine, 928 tons.

In the Northern District the Telkwa Collieries, Limited, shipped 1,505 tons. This property, for convenience, is included in the Coast District figures.

In the East Kootenay District, in addition to the Crow's Nest Pass Coal Company, which produced 718,447 tons, the Corbin Coals, Limited, produced 168,259 tons.

The collieries of the Coast District, including the Nicola-Princeton and Telkwa fields, are to be credited for 1929 with about 60 per cent. of the total coal-output.

The output of the collieries of the Province for 1929 was, as already stated, 2,251,252 tons, which includes 16,398 tons of coal added to stock.

Of this amount, there was sold for consumption in Canada, 1,550,245 tons; sold for consumption in the United States, 321,919 tons; sold in other countries, 562 tons; making the total coal sales for the year 1,872,726 tons of 2,240 lb.

In addition to the coal sold, there was used by the Crow's Nest Pass Coal Company in the manufacture of coke, 103,109 tons; used under companies' boilers, etc., 144,754 tons; while 114,265 tons was lost in washing and screening.

The following table indicates the markets in which the coal-output of the Province was sold:—

Coal.	Coast District.	Crowsnest Pass District.	Total for Province.
Sold for consumption in Canada.....tons, 2,240 lb.	1,075,638	474,607	1,550,245
Sold for export to United States.....	90,264	231,655	321,919
Sold for export to other countries.....	.....	562	562
Total coal sales.....	1,165,902	706,824	1,872,726

COLLIERIES OF COAST DISTRICT.

The collieries of the Coast District, which includes those on Vancouver island and in the Nicola-Princeton fields and one small colliery in the Northern District, mined 1,364,546 tons of coal in 1929, of which 3,617 tons was added to stock, making 1,360,929 tons distributed from these collieries in 1929. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	1,075,638	
Sold as coal in United States	90,264	
Sold as coal in other countries .....	.....
Total sold as coal		1,165,902
Used under companies' boilers, etc.		104,801
Lost in washing, etc.		90,226
		1,360,929
Plus coal added to stock		3,617
Gross output		1,364,546

The total coal sales of the Coast collieries for 1929 show, as compared with the sales of the previous year, a decrease of 119,209 tons, equivalent to about 9.2 per cent.

The coal sold in Canada by the collieries of the Coast District in 1929 shows a decrease of 117,051 tons, or about 9.8 per cent. less than the preceding year; the amount exported to the United States was 2,158 tons less than the preceding year, a decrease of about 2.2 per cent.

On Vancouver island eight companies produced coal in 1929, the combined output being 1,120,805 tons.

In the Nicola and Princeton coalfields of the Coast District ten companies made a combined output of 242,236 tons.

The Telkwa Collieries produced 1,505 tons.

EAST KOOTENAY COALFIELD.

There were only two companies operating in this district in 1929—the Crow's Nest Pass Coal Company, operating two separate collieries, which together mined 718,447 tons; and the Corbin Coals, Limited, which mined 168,259 tons; making an output for the district for 1929 of 886,706 tons of coal.

The amount of coal actually distributed was 873,925 tons, which, together with 12,781 tons added to stock, makes the total production 886,706 tons.

The following table shows the distribution made of the coal of this district:—

	Tons.	Tons.
Sold as coal in Canada	474,607	
Sold as coal in United States	231,655	
Sold as coal in other countries	562	
	<hr/>	
Total sold as coal		706,824
Used by Crow's Nest Pass Coal Co. in making coke		103,109
Used by the companies under boilers, etc.		39,953
Lost in washing		24,039
		<hr/>
		873,925
Plus coal added to stock		12,781
		<hr/>
Gross output		886,706

STRUCTURAL MATERIALS.

The output of structural materials in 1929 was valued at \$3,921,768, an increase of \$513,082, or 15 per cent., as compared with 1928.

Building construction in Vancouver, where the bulk of the structural materials is marketed, was active, and, in general, production in this branch of the industry varies with the demand very closely. It will, therefore, continue to increase with the growth of population. The raw materials are to be found in many parts of the Province ready for use when required.

Approximately 92 per cent. of the total production of structural materials comes from the Coast District and the larger part of this is marketed in the Coast cities.

Increases occurred particularly in the outputs of stone, crushed rock, and various kinds of bricks and tile.

The Portland-cement production was also the same as in 1928. Building-stone is quarried in Vancouver and Nelson Divisions and marble in Ainsworth Division. High-grade pulp stones are obtained in Nanaimo Division.

The principal production of limestone is from Texada Island, in Nanaimo Division, but some is also quarried in Victoria, Bella Coola, and Osoyoos Divisions.

Crushed rock and sand and gravel are obtained where needed in various parts of the Province. The principal output is from the Coast District, where there are a number of well-equipped plants for producing the various sizes and qualities required in construction-work.

A considerable increase occurred in the outputs of different types of bricks. This indicates more building activity. The principal producer of firebrick is the Clayburn Company, with plants at Clayburn and Kilgard.

MISCELLANEOUS METALS AND MINERALS.

The production of miscellaneous metals and minerals in 1929 was valued at \$1,773,845, an increase, as compared with 1928, of \$868,491, or 96 per cent. A total of seventeen different products are listed in Table XII., which shows in some detail the output by divisions and districts.

The largest output was cadmium, valued at \$675,294. This metal occurs in small quantities in the zinc concentrates from the *Sullivan* and other mines and is recovered as a by-product at the Trail plant of the Consolidated Mining and Smelting Company.

Bismuth is another metal occurring in small quantities in the ores and concentrates received at the Trail plant, which is now recovered as a by-product. The output for 1929 was valued at \$283,701. Fluorspar, gypsum, and pyrite were the next most important products in the Miscellaneous class, each with outputs valued at over \$200,000.

The arsenic production is made by the *Nickel Plate* mine at Hedley. The palladium and some of the platinum is obtained as a by-product of metal-refining at the Trail plant; the remainder of the platinum is obtained from placer operations on the Tulameen river.

There are numerous deposits of non-metallic minerals in the Province which may be utilized in the future in connection with expanding manufacturing activities of the Province. The Consolidated Company has acquired deposits of chromite, molybdenite, and other minerals and is now carrying on research-work to utilize the contained metals.

DEPARTMENT OF MINES.

VICTORIA, B.C.

HON. W. A. MCKENZIE	- - - - -	<i>Minister of Mines.</i>
ROBERT DUNN	- - - - -	<i>Deputy Minister.</i>
JOHN D. GALLOWAY	- - - - -	<i>Provincial Mineralogist.</i>
D. E. WHITTAKER	- - - - -	<i>Provincial Analyst and Assayer.</i>
JAMES DICKSON	- - - - -	<i>Chief Inspector of Mines.</i>

GEO. O'BRIEN, *District Inspector*, Nanaimo.T. R. JACKSON, *District Inspector*, Nanaimo.ROBERT STRACHAN, *District Inspector*, Fernie.JOHN MACDONALD, *District Inspector*, Fernie.JOHN G. BIGGS, *District Inspector*, Merritt.THOS. J. SHENTON, *Dist. Inspector*, Prince Rupert.H. H. JOHNSTONE, *Inspector*, Nelson.JAS. STRANG, *Inspector and Examiner*, Victoria.H. E. MIARD, *Inspector and Examiner*, Fernie.*Resident Mining Engineers.*

J. T. MANDY, No. 1 District, Prince Rupert.

DOUGLAS LAY, No. 2 District, Hazelton.

H. G. NICHOLS, No. 3 District, Kamloops.

P. B. FREELAND, No. 4 District, Grand Forks.

B. T. O'GRADY, No. 5 District, Revelstoke.

GEO. A. CLOTHIER, No. 6 District, Nanaimo.

DEPARTMENT OF MINES.

Mining in British Columbia is administered for the Government by the Department of Mines through the Deputy Minister of Mines and under the direction of the Honourable the Minister of Mines. The Department has charge of all Government offices in connection with the mining industry and, except as may be otherwise provided by Statute, the administration of the laws with respect to all kinds of mining. The technical branch of the Department is the Bureau of Mines, under the supervision of the Provincial Mineralogist, to whom inquiries of a technical nature regarding the mineral industry of the Province should be addressed.

Under the "Mineral Act" the Province is divided into forty-two Mining Divisions. Over each of these Divisions there is a Mining Recorder and over groups of Divisions of varying sizes there are Gold Commissioners. Of Mining Recorders, inclusive of Sub-Mining Recorders, there are 121, and of Gold Commissioners, 25. These figures give an insight into the extensive provision which has been made to assure prospectors and mining men generally that, wherever they may find themselves within British Columbia's 370,000 square miles of territory, they at all times will be within reasonable reach of a Mining Recorder, or a Deputy Mining Recorder, or a Gold Commissioner ready to extend to them all the privileges to which they are entitled, as free miners, under the "Mineral," "Placer," or other Mining Acts.

A sketch of the respective duties of the above-enumerated officers may be of interest. The Gold Commissioner in many cases also is Government Agent and in the latter capacity may represent every department of public service. Under the mining laws he has all the powers of a Mining Recorder and sometimes discharges the duties of both offices. One of his responsible duties is the issuing of certificates of improvement in respect of mineral claims for which Crown grants are sought; another is the consideration and the granting or otherwise of placer-mining leases; and in addition he has quasi-judicial authority in regard to questions which arise from time to time under both the "Mineral Act" and the "Placer-mining Act." A Gold Commissioner may have one or more Mining Divisions under his supervision.

As to Mining Recorders and Sub-Mining Recorders, the Acts clearly explain their duties. They are the officials first looked for on the discovery and location of placer-ground or mineral claims. They must see that all records are properly made and that the order of priority is carefully observed in respect of the same. They issue Free Miners' Certificates and must see that a proper return of the same is made to the Department.

It is this comprehensive system of administration which, broadly speaking, constitutes the Department of Mines, headquarters of which, under the Honourable the Minister of Mines, are in

Victoria. From the head office the activities of the officers in the different parts of the Province are directed and co-ordinated. Care must be given the application of the mining laws to divergent problems in order that, while justice is accorded in all cases, in none are the vital principles underlying the Statute departed from. This is one of the most important of the duties of the Department functioning under the direct supervision of the Minister.

There also is the duty of administering the "Mines Development Act," under the terms of which the sum of \$1,289,000 was expended in the construction and the maintenance of mine roads, trails, and bridges from May 31st, 1916, to date. As a result, mines, found upon inspection by Government Mining Engineers to merit assistance, have benefited by the building of 440 miles of road and 1,404 miles of trail and the maintenance of 2,239 miles of road and 7,606 miles of trail. This means that a grand total of 11,689 miles of road and trails have been opened and kept open in order that the development of mining might be facilitated. This, then, is another phase of the work of the Department, which maintains its touch with the field through six Resident Mining Engineers appointed under the "Mineral Survey and Development Act."

All who are interested in mining in British Columbia should make themselves acquainted with the "Mineral Survey and Development Act." It is interesting not only because of the appointment of Resident Mining Engineers over six Mineral Survey Districts, who are required to apply themselves constantly to the making of a survey of the mineral resources of their respective districts, to prepare a report each year dealing with their activities and observations, and to extend every possible assistance to mining men and prospectors. There are other features; perhaps the most important, in view of recent increased public financial support of mining enterprises, being contained in sections 15 and 16 of the Act. Briefly these sections make it necessary for a mining company to forward a copy of its prospectus to the Provincial Mineralogist and to the Resident Mining Engineer of the district in which its mining property is situated. The Engineer's duty is to compare statements contained in the prospectus with the conditions as he knows them to exist on the ground. If he finds misstatements or discrepancies calculated to mislead an investor, the Minister is notified. He makes further investigation. The company may be communicated with and asked to withdraw the statements complained of; or, if the case is one that seems to demand more extreme measures, the Minister may authorize the public advertisement of the facts through the Provincial Gazette and the public press.

The foregoing will serve to convey a general idea of the activities of the administrative headquarters of the Department in Victoria and those branch offices situated in the large centres of population as well as in the most remote parts of the Province over which jurisdiction is exercised.

If you want information as to the mining laws of the Province, apply to the Department. If you are contemplating investment in the stock of a British Columbia mining company, do not fail to get the last Annual Report of the Minister of Mines. References to practically every mine or mining prospect in British Columbia are contained in these Annual Reports. If no such references were made last year, the desired information may have been given in the Annual Report of some previous year. It is possible that the slight trouble of asking for a search will be well rewarded. The Department is prepared to render this service on application.

Communications from anywhere in Canada, the United States, or South America, seeking either copies of Annual Reports or mining maps, or any other information concerning mining in the Province, will have immediate attention if directed to:—

HON. W. A. MCKENZIE,
Minister of Mines,
Victoria, B.C.,
Canada.

Applications for information, as above set out, from Great Britain, or any other European country, will receive prompt attention by being referred to the Agent-General for British Columbia, British Columbia House, 1 and 3 Regent Street, London, S.W. 1, England.

INSPECTION BRANCH.

The Inspection Branch of the Department of Mines consists of a Chief Inspector, seven District Inspectors, two examiners, who are also Acting-Inspectors, and four Instructors in Mine-rescue Work.

The Inspectors have jurisdiction over both coal and metalliferous mines within the boundaries of their respective districts. Every part of all operating coal-mines are inspected at least once every month, and metalliferous mines as often as time will permit, generally once in every sixty days, to see that general conditions are good for the safety and health of the workmen employed, and that the Coal and Metalliferous Mines Regulation Acts are complied with.

The Mine-rescue Stations are under the jurisdiction of the Inspection Branch. Five are maintained at the principal mining centres for the purpose of supplementing, in case of need, the colliery installations of mine-rescue apparatus, and also for the purpose of training the holders of certificates in the use of mine-rescue apparatus. In cases of emergency these stations are available for the use of any trained corps of mine rescuers, duly qualified medical practitioners, or corps trained in the work of first aid to the injured, subject to the order of an Inspector. All certificated officials who are physically fit, and not less than 3 per cent., or such number as the Chief Inspector may deem sufficient, of the workmen at each colliery must be trained in the use of mine-rescue apparatus.

The examining boards for granting certificates of competency to coal-mine officials and coal-miners are under the jurisdiction of the Inspection Branch. The Chief Inspector and the two examiners form the board for coal-mine officials for the whole of the Province, and the two examiners and the District Inspector form the board for granting certificates to coal-miners within their respective districts.

A District Inspector may grant a provisional certificate to a coal-miner between examinations for a period not exceeding sixty days.

Blasting certificates of competency to miners at metalliferous mines are granted by the Inspector of Mines.

A section of the Annual Report of the Minister of Mines contains the reports of the officials of the Inspection Branch.

GOLD COMMISSIONERS AND MINING RECORDERS.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin.....	Atlin.....	W. W. Wright.....	W. W. Wright.....	J. G. Garrett.
Sub-office.....	Telegraph Creek.....			H. W. Dodd.
Sub-office.....	Haines (U.S.).....		(Com. for taking Affidavits)	B. A. Barnett.
Sub-office.....	Tulsequah.....			C. G. Barber.
Sub-office.....	Juneau (U.S.).....		(Com. for taking Affidavits)	Harold E. Brown.
Stikine.....	Telegraph Creek.....	H. W. Dodd.....	H. W. Dodd.....	
Sub-office.....	Boundary.....			W. R. Overend.
Liard.....	Telegraph Creek.....	H. W. Dodd.....	H. W. Dodd.....	
Sub-office.....	Porter.....			Chas. H. Smith.
Sub-office.....	McDame Creek.....			Mike Larsen.
Sub-office.....	Fort St. John.....			F. W. Beatton.
Skeena.....	Prince Rupert.....	C. L. Monroe.....	C. L. Monroe.....	
Sub-office.....	Kitimat.....			C. M. Carlson.
Sub-office.....	Copper City.....			L. G. Skinner.
Sub-office.....	Terrace.....			O. T. Sundal.
Sub-office.....	Rosswood.....			Mrs. C. Warner.
Sub-office.....	Stewart (Portland Canal)			J. P. Scarlett.
Sub-office.....	Kimsquit.....			Percy Gadsden.
Nass River.....	Anyox.....	C. L. Monroe.....	H. B. Campbell.....	
Sub-office.....	Alice Arm.....			Mrs. L. Cummings.
Portland Canal.....	Stewart.....	C. L. Monroe (at Prince Rupert)	J. P. Scarlett.....	
Bella Coola.....	Prince Rupert.....	C. L. Monroe.....	C. L. Monroe.....	
Sub-office.....	Bella Coola.....			C. A. Brynildsen.
Sub-office.....	Bella Bella.....			
Sub-office.....	Ocean Falls.....			Geo. H. Hill.
Sub-office.....	Kimsquit.....			Percy Gadsden.
Queen Charlotte.....	Queen Charlotte.....	C. L. Monroe.....	G. A. C. Roberts, M.D.	Mrs. G. A. C. Roberts.
Sub-office.....	Jedway.....			Isaac Thompson.
Sub-office.....	Masset.....			J. C. S. Dunn, M.D.
Sub-office.....	Lockeport.....			Jas. S. Edkins.

GOLD COMMISSIONERS AND MINING RECORDERS—Continued.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Omineca.....	Smithers.....	Stephen H. Hoskins.....	Jas. E. Kirby.....	
Sub-office.....	Fort Grahame.....			F. W. Rogers.
Sub-office.....	Bella Coola.....			C. A. Brynildsen.
Sub-office.....	Finlay Forks.....			
Sub-office.....	Fort St. James.....			Alex. C. Murray.
Sub-office.....	Manson Creek.....			W. B. Steele.
Sub-office.....	Felkwa.....			T. J. Thorp.
Sub-office.....	Prince George.....			Geo. Milburn.
Sub-office.....	Hudson Hope.....			F. F. Monteith.
Sub-office.....	Kimsquit.....			Percy Gadsden.
Sub-office.....	Fort St. John.....			F. W. Beaton.
Sub-office.....	Copper City.....			L. G. Skinner.
Sub-office.....	Terrace.....			O. T. Sundal.
Sub-office.....	Fort Fraser.....			J. D. Moore.
Sub-office.....	Pacific.....			T. H. McCubbin.
Sub-office.....	Hazelton.....			W. J. Sanders.
Sub-office.....	Burns Lake.....			S. Godwin.
Sub-office.....	Usk.....			Jas. L. Bethurem.
Sub-office.....	Takla Landing.....			Mrs. Wilhemina Alken.
Peace River.....	Fort St. John.....	S. H. Hoskins (at Smithers)	F. W. Beaton.....	
Sub-office.....	Prince George.....			G. Milburn.
Sub-office.....	Finlay Forks.....			
Sub-office.....	Hudson Hope.....			F. F. Monteith.
Sub-office.....	Pouce Coupe.....			M. S. Morrell.
Carlboo.....	Barkerville.....	R. F. Ure.....	R. F. Ure.....	Mrs. R. F. Ure.
Sub-office.....	Quesnel.....			F. C. Lunn.
Sub-office.....	Prince George.....			Geo. Milburn.
Sub-office.....	McBride.....			I. McGilnchy.
Quesnel.....	Williams Lake.....	L. C. Maclure.....	L. C. Maclure.....	
Sub-office.....	Quesnel.....			E. C. Lunn.
Sub-office.....	Likely.....			A. B. Campbell.
Sub-office.....	Barkerville.....			R. F. Ure.
Clinton.....	Clinton.....	R. J. A. Dorrell.....	R. J. A. Dorrell.....	
Sub-office.....	Williams Lake.....			L. C. Maclure.
Sub-office.....	S. Fork, Bridge River.....			W. Haymore.
Lillooet.....	Lillooet.....	L. J. Price.....	L. J. Price.....	
Sub-office.....	S. Fork, Bridge River.....			R. W. Melton.
Kamloops.....	Kamloops.....	E. Fisher.....	E. Fisher.....	
Sub-office.....	Chu Chua.....			George Fennell.
Sub-office.....	Vavenby.....			I. Finley.
Ashcroft.....	Ashcroft.....	E. Fisher (at Kam.)..	W. C. Adams.....	F. H. C. Wilson.
Sub-office.....	Lytton.....			A. Dryden.
Nicola.....	Merritt.....	E. Fisher (at Kam.)..	R. G. Cowper.....	
Yale.....	Yale.....	E. Fisher (at Kam.)..		
Sub-office.....	Hope.....		C. A. W. Lethbridge..	Ian MacRae.
Similkameen.....	Princeton.....	L. A. Dodd.....	L. A. Dodd.....	
Sub-office.....	Hedley.....			R. E. Baxter.
Vernon.....	Vernon.....	R. M. McGusty.....	R. M. McGusty.....	J. G. Simms.
Greenwood.....	Greenwood.....	S. B. Hamilton.....	S. B. Hamilton.....	
Sub-office.....	Rock Creek.....			S. A. H. Brew.
Sub-office.....	Beaverdell.....			T. W. Clarke.
Grand Forks.....	Grand Forks.....	Chas. Mudge.....	Chas. Mudge.....	
Osoyoos.....	Penticton.....	W. R. Dewdney.....	W. R. Dewdney.....	
Sub-office.....	Keremeos.....			L. S. Coleman.
Sub-office.....	Hedley.....			R. E. Baxter.
Sub-office.....	Oliver.....			Edward B. Rossiter.
Golden.....	Golden.....	G. E. Sanborn.....	G. E. Sanborn.....	I. C. Moore.
Windermere.....	Wilmer.....	G. E. Sanborn (at Golden)	E. M. Sandilands.....	
Fort Steele.....	Cranbrook.....	N. A. Wallinger.....	J. E. Kennedy.....	N. A. Wallinger.
Sub-office.....	Fernie.....			J. R. Nolan.
Ainsworth.....	Kaslo.....	Ronald Hewat.....	A. McQueen.....	A. W. Anderson.
Sub-office.....	Howser.....			J. F. Thompson.

GOLD COMMISSIONERS AND MINING RECORDERS—Continued.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Ainsworth—Continued.				
Sub-office.....	Trout Lake.....			Roy V. Jacobson.
Sub-office.....	Poplar.....			Arthur G. Johnston.
Slocan.....	New Denver.....	Ronald Hewat (at Kaslo)	Angus McInnes.....	
Sub-office.....	Sandon.....			W. J. Parham.
Slocan City.....	Slocan.....	Ronald Hewat.....	T. McNeish.....	
Trout Lake.....	Trout Lake.....	Ronald Hewat.....	Roy V. Jacobson.....	
Nelson.....	Nelson.....	J. Cartmel.....	J. Cartmel.....	
Sub-office.....	Creston.....			H. W. McLaren.
Sub-office.....	Ymir.....			Wm. Clark.
Sub-office.....	Salmo.....			M. C. Donaldson.
Arrow Lake.....	Nakusp.....	J. Cartmel (at Nelson)	Walter Scott.....	
Revelstoke.....	Revelstoke.....	Wynfield Maxwell.....	C. J. Aman.....	
Lardeau.....	Beaton.....	Wynfield Maxwell (at Revelstoke)	H. J. Gunterman.....	Mrs. H. J. Gunterman.
Trail Creek.....	Rossland.....	W. H. Reid.....	W. H. Reid.....	
Nanaimo.....	Nanaimo.....	W. H. Boothroyd.....	W. H. Boothroyd.....	
Sub-office.....	Ladysmith.....			J. A. Knight.
Sub-office.....	Alert Bay.....			Ernest H. Robinson.
Sub-office.....	Vananda.....			Leonard Raper.
Sub-office.....	Granite Bay.....			Henry Twidle.
Alberni.....	Alberni.....	A. G. Freeze.....	A. G. Freeze.....	
Clayoquot.....	Clayoquot.....	A. G. Freeze (at Alberni)	W. T. Dawley.....	
Quatsino.....	Quatsino.....	A. G. Freeze (at Alberni)	Ed. Evensen.....	
Victoria.....	Victoria.....	R. J. Steenson.....	R. J. Steenson.....	
New Westminster.....	New Westminster.....	F. C. Campbell.....	A. B. Gray.....	
Sub-office.....	Harrison Lake.....			L. A. Agassiz.
Sub-office.....	Chilliwack.....			Chas. J. Whittaker.
Vancouver.....	Vancouver.....	John Mahony.....	A. P. Grant.....	

GOLD COMMISSIONERS' AND MINING RECORDERS' OFFICE STATISTICS.

Districts and Divisions.	FREE MINERS' CERTIFICATES.			LODE-MINING.						PLACER-MINING.					REVENUE.		TOTAL.	
	Individual.	Company.	Special.	Mineral Claims recorded.	Certificates of Work.	Bills of Sale, etc.	Certificates of Improvements.	Leases of Re-vented Crown-granted Mineral Claims.	Placer Claims recorded.	Placer Leases granted (Bench, Creek and Dredging).	Certificates of Work, Placer Claims and Leases.	Bills of Sale.	Free Miners' Certificates.	General.	Mining Divisions.	Districts.		
<i>North-western District (No. 1)</i>																	<i>\$49,958.04</i>	
Atlin.....	352	6	1	301	110	29	3		2	21	200	35	\$2,205.25	\$9,485.69	\$11,690.94			
Stikine and Liard.....	212	3	1	112	18				12	2		30	1,186.23	5,408.80	6,593.05			
Nass River.....	181	4		218	499	74		5					1,274.75	2,448.45	3,723.20			
Portland Canal.....	452	19	1	933	1,534	271	208	14				2	4,139.23	15,460.50	19,599.73			
Skeena.....	710	1	2	218	156	57		9	1	14	3		3,124.25	4,137.50	7,261.75			
Queen Charlotte.....	38			26	37	1		46	1	13	5	12	169.25	414.10	583.35			
Bella Coola.....	20			29	16	8							95.75	410.25	506.00			
<i>North-eastern District (No. 2)</i>																<i>47,317.68</i>		
Cariboo.....	582	6		165	120	59			18	30	68	15	3,214.50	10,578.58	13,793.08			
Quesnel.....	300			80	48	27			4	105	131	92	1,471.25	9,249.75	10,721.00			
Omineca.....	1,127	16	5	2,042	1,551	779	5	5	4	4	25	4	6,756.75	15,496.00	22,252.75			
Peace River.....	109			25					1		1		485.75	65.00	550.75			
<i>Central District (No. 3)</i>																<i>33,707.75</i>		
Nicola.....	119	2		116	167	58				1			620.00	1,435.55	2,055.55			
Vernon.....	311	4	3	163	109	61			2	6	17	5	1,774.00	2,497.50	4,271.50			
Yale.....	322		2	671	616	256	8		1	6	20	2	1,654.75	6,547.55	8,202.30			
Ashcroft.....	91	1		90	76	5			4	12	3	3	461.25	1,098.25	1,559.50			
Kamloops.....	435	5	1	334	388	102	14	28		2	72	41	2,436.75	4,907.90	7,344.65			
Lillooet.....	286	3	1	445	326	97	9		2	21	76	59	1,533.25	6,862.15	8,395.40			
Clinton.....	57			87	118	69	3	3	3	4	11	8	261.75	1,617.10	1,878.85			
<i>Southern District (No. 4)</i>																<i>16,971.95</i>		
Grand Forks.....	101			39	77	6		31		1			466.50	1,120.75	1,587.25			
Greenwood.....	173		1	130	160	35	2	28	4				781.25	2,037.60	2,818.85			
Osoyoos.....	162	2	3	92	60	1		9					955.25	671.50	1,626.75			
Similkameen.....	431	8		375	315	109	3	8	10	53	131	100	2,769.25	8,169.25	10,938.50			
<i>Eastern District (No. 5)</i>																<i>37,145.15</i>		
Fort Steele.....	351	7	9	311	336	131	99	10	2	7	27	10	2,110.25	5,047.65	7,157.90			
Windermere.....	68	2	3	46	114	14			2				698.25	1,090.00	1,788.25			
Golden.....	190	1	2	83	101	69		4	1	1	5		876.25	1,694.50	2,570.75			
Ainsworth.....	232	12	3	169	391	56	4	19		4			2,476.75	2,108.05	4,584.80			
Slocan.....	124	5		51	164	9							1,108.70	549.50	1,658.20			
Slocan City.....	49			46	69	7							235.00	506.50	741.50			
Nelson.....	496	18	4	297	620	154	15	51	6	1	16	6	4,114.75	5,671.00	9,785.75			
Arrow Lake.....	81			55	47	4							329.00	848.50	1,177.50			
Trail Creek.....	132	5	1	14	41	2		13					1,003.00	379.25	1,382.25			
Revelstoke.....	149	6	3	189	165	84		4	2		13	19	1,164.25	2,835.45	3,999.70			
Trout Lake.....	54		1	58	160	27							263.50	761.55	1,025.05			
Lardeau.....	50	3		64	106	9	7						485.75	387.75	1,073.50			
<i>Western District (No. 6)</i>																<i>44,532.22</i>		
Nanaimo.....	311	1	1	628	343	204	2	10					1,484.25	4,726.30	6,210.55			
Alberni.....	140	3	1	118	21	30		25		2			739.00	1,324.10	2,063.10			
Clayoquot.....	29			65	29	8			1				90.75	367.75	458.50			
Quatsino.....	51		1	104	143	67				1			234.75	645.90	880.65			
Victoria.....	303	24	2	33	32	6	3	1	8	7	2	6	3,743.50	992.32	4,735.82			
New Westminster.....	322	4	2	428	148	58		7		1			1,521.25	2,415.50	3,936.75			
Vancouver.....	2,549	149	29	191	253	158	2	8					24,848.00	1,398.85	26,246.85			
Totals	12,248	320	90	9,871	9,854	3,201	392	344	91	319	867	429	\$85,363.95	\$144,268.14	\$229,632.09	\$229,632.09		

BUREAU OF MINES.

REPORT BY JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST.

The permanent staff of the Bureau of Mines consists of John D. Galloway, Provincial Mineralogist; D. E. Whittaker, Provincial Analyst and Provincial Assayer; J. B. Adams, Laboratory Assistant; H. T. Nation, general office assistant; and H. Pearson, clerk.

The Bureau of Mines is a branch of the Department of Mines, which collects, compiles, and supplies to the public much technical information regarding mining and mineral properties in the Province. At the close of each year the Annual Report of the Minister of Mines is prepared by the staff of the Bureau under the supervision of the Provincial Mineralogist. This Annual Report contains detailed statistics of mineral production compiled by the Bureau, reports by each of the six Resident Mining Engineers on their respective districts, and the reports of the Inspection Branch. The reports of the Resident Engineers have also been printed as separate bulletins for the years 1924 to 1929, inclusive. Special bulletins descriptive of mining are issued at intervals.

The Bureau has a well-equipped Assay and Analytical Laboratory. Mineral and rock samples are examined qualitatively without charge. This is done for the purpose of encouraging the search for new mineral-bearing areas and to assist prospectors and others by enabling them to have determined, free of cost, the nature and probable value of any rock they may find.

The Bureau also has an excellent and comprehensive collection of British Columbia ores and mineral samples on exhibit for the public in its Mineral Museum.

With greater activity in mining the work of the Bureau has increased considerably during recent years. The routine work of the office consists of supplying to the public much information regarding mining in the Province, directing prospectors to promising areas, supplying statistical information, interdepartmental reports, etc.

During the field season of 1928 the Provincial Mineralogist made a number of special examinations involving field-trips in the southern interior and northern sections of the Province.

During 1929 two bulletins were issued, which gave summarized information regarding mining in the Province. Bulletin No. 1 covered the six-months' period ended June 30th, 1929, and Bulletin No. 2 was the Preliminary Review and Summary of Mining Operations for the year 1929, issued December 19th.

By arrangement with the Dominion Bureau of Statistics the British Columbia Bureau of Mines collects all Provincial mineral statistics required by both Bureaus. By this arrangement the mine-owner is only required to fill out one form in duplicate instead of making two separate returns as heretofore. An agreement has also been reached whereby the same average metal prices are used by both Bureaus in valuing the outputs of metals.

At the present time the practice of the Dominion Bureau is to use refinery and smelter production to arrive at the yearly output of metals; the British Columbia Bureau uses mine production figures. This of course causes a difference in the yearly quantities of metals produced as reported by the two Bureaus, but the variation is only slight. The method in use by the British Columbia Bureau of Mines has been followed for many years and was adopted in order to compile the mineral production for the Province by Mining Divisions and Districts. These detailed statistics of mineral production are shown in the Annual Reports of the Minister of Mines in comprehensive sets of tables. It is believed that the statistics as given, based on mine production, are informative and useful to those engaged in the mineral industry of the Province. No change in the present general system of statistics is therefore contemplated.

By the co-operation so far effected it is expected that the mineral statistics of the Province, as reported by the two Bureaus, will not differ in any marked degree. The work of collecting, compiling, and presenting mineral statistics is somewhat complex, in which many arbitrary rulings or methods must be used.

The attention of prospectors and miners is drawn to the following definition of mineral contained in section 2 of the British Columbia "Mineral Act":—

“ ‘Mineral’ means all valuable deposits of gold, silver, platinum, iridium, or any of the platinum group of metals, mercury, lead, copper, iron, tin, zinc, nickel, aluminium, antimony, arsenic, barium, bismuth, boron, bromine, cadmium, chromium, cobalt,

iodine, magnesium, manganese, molybdenum, phosphorus, plumbago, potassium, sodium, strontium, sulphur, tungsten, fluorine, vanadium, radium, uranium, lithium, thorium, titanium (or any combinations of the aforementioned elements with themselves or with any other elements), asbestos, emery, mica, and mineral pigments; but limestone, marble, clay, or any building-stone shall not be considered as mineral within the meaning of this Act."

Limestone, marble, clay, and building-stone are acquired under the British Columbia "Land Act."

It should be noted that in 1925, for purposes of administration, the mineral tricalcium phosphate was taken out of the "Mineral Act." Under the "Phosphate-mining Act, 1925," deposits of tricalcium phosphate may be acquired by the location of phosphate claims one square mile in area.

GEOLOGICAL INFORMATION.

By an arrangement made at the time the Province of British Columbia entered Confederation, all geological investigations and mapping in the Province were to be carried on by the Geological Survey of Canada; this agreement has been fully adhered to by the Dominion Government and has proved of great benefit to the mining industry of the Province. Each year a number of geological parties are kept in the field and in the aggregate a vast amount of information is available to the prospector and the mining engineer in the many excellent reports and maps covering British Columbia which have been issued by the Geological Survey of Canada.

For some years a branch office of the Geological Survey has been maintained in Vancouver, where copies of maps and reports on British Columbia can be obtained. The officer in charge of the British Columbia office is W. E. Cockfield and the address is 512 Winch Building, Vancouver, B.C.

ASSAY OFFICE.

REPORT BY D. E. WHITTAKER, PROVINCIAL ASSAYER.

During the year 1929 there were made by the staff in the Government Assay Office 6,785 assays or quantitative determinations and 355 analyses; of these the majority were for the Bureau of Mines or for the other departments, for which no fees were received.

The fees collected by the office were as follows:—

Fees for analyses	\$313.15
Fees for assaying	109.46
Fees for assayers' examinations	105.00
Total cash receipts	\$527.61
Determinations and examinations made for other Government departments for which no fees were collected:—	
Attorney-General's Department	\$296.00
Agricultural Department	2,280.00
Board of Health	720.00
Treasury Department	15.00
Forest Branch	1,023.00
Other departments	205.00
	\$4,539.00
Value of work done outside of Mines Department work	\$5,066.61

The value of gold melted during the year 1929 was \$642 in ten lots, as compared with \$205 in three lots in 1928.

FREE DETERMINATIONS.

In addition to the above quantitative work, about 2,000 qualitative determinations, or tests, were made in connection with the identification and classification of rocks or minerals sent to the Bureau for a report; for these no fees were charged, as it is the established custom of the

Bureau to examine and test qualitatively, without charge, samples of minerals sent in from any part of the Province, and to give a report on the same. This has been done for the purpose of encouraging the search for new or rare minerals and ores, and to assist prospectors and others in the discovery of new mining districts, by enabling them to have determined, free of cost, the nature and probable value of any rock they may find. In making these free determinations, the Bureau asks that the locality from which the sample was obtained be given by the sender.

EXAMINATION FOR ASSAYERS.

REPORT BY D. E. WHITTAKER, SECRETARY OF BOARD OF EXAMINERS.

I have the honour, as Secretary, to submit the Annual Report for the year 1929 of the Board of Examiners for Certificates of Competency and Licence to Practise Assaying in British Columbia, as established under the "Bureau of Mines Act," R.S.B.C. 1924.

A meeting of the Board of Examiners was held on March 13th, May 16th, and December 2nd, 1929. Two candidates applied for examination on May 16th and one passed the examination on that date. Two candidates applied for examination on December 2nd and both passed the examination on that date. One candidate applied for exemption under section 2, subsection (2), of the Act on May 16th. The Board recommended that certificates be issued to the above-mentioned four candidates.

In accordance with the recommendation of the Board, certificates have been duly issued by the Honourable the Minister of Mines to the four successful candidates.

LIST OF ASSAYERS HOLDING PROVINCIAL CERTIFICATES OF EFFICIENCY UNDER THE "BUREAU OF MINES ACT," R.S.B.C. 1924.

(Only the holders of such certificates may practise assaying in British Columbia.)

Under section 2, subsection (1).

Adams, J. B.....	Victoria.	Edwards, A. H.....	Trail.
Archer, E. G.....	Anyox.	Farquhar, J. B.....	Vancouver.
Armstrong, N.....	Vancouver.	Fingland, John J.....	Kaslo.
Ayres, D. A.....		Gardner, C. S.....	Victoria.
Austin, John W.....	Vancouver.	Grimwood, G. H.....	Rosebery.
Backus, Geo. S.....	Britannia Beach.	Grosvenor, F. E.....	Vancouver.
Baker, C. S. H.....		Hamilton, Wm. J.....	Anyox.
Bajus, N. J.....	Vancouver.	Hannay, W. H.....	Trail.
Barke, A. C.....		Harsant, R. C. C.....	
Beilby, E. B.....	Vancouver.	Hart, P. E.....	
Bernard, Pierre.....	Monte Christo, Wash.	Hawkins, Francis.....	Lake Hill.
Bishop, Walter.....		Hawes, F. B.....	Vancouver.
Boulding, J. D.....	Vancouver.	Hodgson, A. R.....	Anyox
Brachat, Victor A.....	Victoria.	Hurter, C. S.....	Prince Rupert.
Broughton, F. W.....	Vancouver.	Irwin, George E.....	Vancouver.
Buchanan, James.....	Trail.	John, D.....	Haileybury, Ont.
Buehman, A. S.....	Trail.	Kiddie, Geo. R.....	California.
Campbell, Colin.....	New Denver.	King, R.....	
Carmichael, Norman.....	New York.	Kitto, Geoffrey B.....	Victoria.
Church, George B.....		Lang, T. F.....	Vancouver.
Clarke, E. R.....	Vancouver.	Langley, A. G.....	Revelstoke.
Cobeldick, W. M.....	Scotland.	Laucks, I. F.....	Seattle.
Collison, H.....	Cobham, England.	Lee, Fred E.....	Trail.
Comrie, George H.....	Vancouver.	Lee, Geo. M.....	
Cotton, G. W.....	Trail.	Ley, Richard H.....	Victoria.
Craufurd, A. J. F.....	Rossland.	Levy, Frank.....	
Crerar, George.....		Lindsay, W. W.....	Kimberley.
Crompton, S. V.....	Vancouver.	Locke, V. F.....	Vancouver.
Crossley, C. E.....	Nelson.	Longworth, F. J.....	Boyd's, Wash.
Cruickshank, G.....		Manning, S. M.....	Trail.
Davidson, J. R.....	Sacramento.	Martin, S. J.....	
Day, Athelstan.....	Duncan.	Marsh, Richard.....	Spokane, Wash.
Dedolph, Ed.....		Marshall, H. Jukes.....	Vancouver.
Dockrill, Walter R.....	Chemainus.	Marshall, William S.....	Ladysmith.
Dunn, G. W.....	Rossland.	Meale, Eric A.....	East Helena, Mont.

Under section 2, subsection (1)—Continued.

Merrifield, T. T.	Trail.	Sim, Chas. John	Monte Carlo.
Miles, Arthur D.		Sloan, Wm.	Vancouver.
Milne, A. S.	Vancouver.	Snyder, Blanchard M.	
Mitchell, Charles T.	Copper Cliff, Ont.	Stephen, Wm. Gordon	Vancouver.
McCormick, Alan F.	Ruth, Nevada.	Stimmel, B. A.	Trail.
MacDonald, Alec C.	Vancouver.	Stockly, Galt	Princeton.
MacDonald, J. S.	Vancouver.	Sundberg, Gustave	Mexico City.
McIntosh, J. H.	Bamberton.	Tally, Robert E.	Spokane, Wash.
McIntosh, R. H.	Vancouver.	Taylor, E. S.	Vancouver.
McLellan, R. D.	Vancouver.	Taylor, H. L.	Vancouver.
Morgan, Richard	Trail.	Teed, A. J.	Vancouver.
Nicholls, Frank	Norway.	Thirkell, V. R.	Vancouver.
Okell, S. E.	Vancouver.	Thomas, Percival W.	Vancouver.
Parker, Robt. H.		Tretheway, John H.	
Parsonow, W. I.		Turner, H. A.	Vancouver.
Perkins, Walter G.		Vance, John F. C. B.	Vancouver.
Pickard, T. D.	Vancouver.	Van Agnew, Frank	Siberia.
Pirrie, Noble W.	Victoria.	Vaughan-Williams, V. L.	California.
Poole, H. W.	Vancouver.	Wales, Roland T.	
Prior, C. F.	Hedley.	Watson, Wm. J.	Ladysmith.
Puder, H. F. H.	Vancouver.	Watson, Thomas	Vancouver.
Raht, K.	Trail.	Welsh, J. Cuthbert	Butte, Mont.
Richmond, Leigh	Duncan.	Wells, Ben T.	
Ringwood, J. G. T.	Vancouver.	West, Geo. G.	Vancouver.
Robertson, T. R.	Vancouver.	Wenerstrom, L. H.	Anyox.
Rodgers, Ch. B.		Whittaker, Delbert E.	Victoria.
Rogers, G. J.	Knutsford.	Widdowson, E. Walter	Nelson.
Rombauer, A. B.	Butte, Mont.	Willemar, Douglas R.	Masset.
Schroeder, Curt A.		Williams, W. A.	Vancouver.
Segsworth, Walter	Toronto, Ont.	Williams, Eliot H.	
Shepherd, G. H.	North Vancouver.	Williams, J. R.	Vancouver.
Sharpe, Bert N.		Wilson, Thomas S.	Windermere.
Sharples, H.	Vancouver.	Wimberley, S. H.	Nevada, U.S.A.
Shore, J. T.	Vancouver.	Youngs, T. N.	Victoria.

Under section 2, subsection (2).

Archer, Allan		Heal, John H.	
Blaylock, Selwyn G.	Trail.	Hearn, Roy D.	Trail.
Bisset, D. G.	Trail.	Hilliary, G. M.	Idaho, U.S.A.
Bolton, George E.	Silverton.	Howells, J. O.	Calgary, Alta.
Brennan, Charles Victor	Britannia Beach.	Johnston, William Steele	Lachine, Que.
Browne, R. J.	Rossland.	Kaye, Alexander	Vancouver.
Browne, P. J.	Nelson.	Kendall, George	Vancouver.
Bryant, Cecil M.	Victoria.	Kidd, G. I.	Edmonton, Alta.
Bryden, James	Trail.	Kilburn, Geo. H.	Victoria.
Burwash, N. A.		Lathe, Frank E.	Montreal.
Cavers, Thomas W.		Lay, Douglas	Hazelton.
Clothier, George A.	Nanaimo.	Lewis, Francis B.	South Africa.
Cole, Arthur A.	Cobalt, Ont.	Mellish, Albert Henry	Premier.
Cole, G. E.	Rossland.	Merrit, Charles P.	
Cole, L. Heber	Ottawa, Ont.	Millen, J.	Trail.
Collins, H. E.	Stewart.	Murphy, C. J.	St. Catharines, Ont.
Conway, E. J.	Vancouver.	Musgrave, W. N.	England.
Coo, Cecil William	Toronto, Ont.	McArthur, Reginald E.	
Coulthard, R. W.		McBean, K. D.	Trail.
Cowans, Frederick		McDiarmid, S. S.	
Dawson, V. E.	Trail.	McGinnis, Wm. C.	Queen Charlotte Isls.
Dempster, R. C.	Rossland.	McKay, Robt. B.	Vancouver.
Dempster, A. S.	Rossland.	McLellan, John	Skidegate.
Dixon, Howard A.	Toronto, Ont.	McMurtry, Gordon O.	
Eardley-Wilnot, V. L.	Ottawa.	McNab, J. A.	Thompson, Nevada.
Ethredge, F. M.	Anyox.	McPhee, W. B.	
Fotheringham, D. F.	Trail.	McVicar, John	Edmonton, Alta.
Galbraith, M. T.		Maclennan, F. W.	
Gilman, Ellis P.	Vancouver.	Moran, P. J.	Vancouver.
Gray, Stanley		Newton, W. E.	Sandon.
Green, J. T. Raoul	Blairmore, Alta.	Nicolle, C. C.	Nelson.
Guess, George A.	Toronto, Ont.	Norrie, James P.	Kirkland Lake, Ont.
Harding, Wilson M.		Oliver, Chas. E.	Vancouver.

Under section 2, subsection (2)—Continued.

Oughtred, S. W.....	Ainsworth.	Stewart, A. G.....	Vancouver.
Outhett, Christopher.....	Kamloops.	Stroud, J. E. C.....	Anyox.
Owen, Francis J.....	Trail.	Sullivan, Michael H.....	Kellogg, Idaho.
Pellew-Harvey, Wm.....	London, England.	Sutherland, T. Fraser.....	
Pemberton, W. P. D.....	Victoria.	Sutherland, Wm.....	Glasgow, Scotland.
Reid, J. A.....	Cobalt, Ont.	Swinney, Leslie A. E.....	
Ritchie, A. B.....	Nelson.	Thompson, W. K.....	Trail.
Roaf, J. R.....		Thompson, H. Nellis.....	Anaconda, Mont.
Roscoe, Harold M.....	Anyox.	Watson, A. A.....	
Rose, J. H.....	Thompson, Nevada.	Watson, Henry.....	
Rutherford, R. C.....	Trail.	Weir, William.....	Anyox.
Sampson, E. H. S.....	Riondel.	White, E. Grove.....	Stewart.
Scott, John Mitchell.....	Stewart.	Willis, F. S.....	Trail.
Scott, Oswald Norman.....		Winslow, R. H.....	Vancouver.
Shannon, S.....		Wilson, Ridgeway R.....	Victoria.
Sharpe, G. P.....	Midland, Ont.	Workman, Ch. W.....	
Shorey, P. M.....	Trail.	Wright, Richard.....	Rossland.
Sloan, David.....	Three Forks.	Wynne, Llewellyn C.....	
Stevens, F. G.....	Mexico.	Yuill, H. H.....	

Under section 2, subsection (3).

Carmichael, Herbert.....	Victoria.	Hedley, Robt. R.....	Vancouver.
Galloway, J. D.....	Victoria.	Kiddie, Thos.....	California.
(Provincial Mineralogist.)		Marshall, Dr. T. R.....	London, England.
Harris, Henry.....	Tasmania.	McKillop, Alexander.....	Vancouver.

PREVIOUSLY ISSUED UNDER THE "BUREAU OF MINES ACT, 1897," SECTION 12.

Thompson, James B..... Vancouver.

REPORTS OF RESIDENT MINING ENGINEERS.

"MINERAL SURVEY AND DEVELOPMENT ACT."

During the session of 1917 the Hon. the Minister of Mines brought in the "Mineral Survey and Development Act," which was passed on May 19th, 1917, and under the provisions of which the Province was divided into six Mineral Districts, to each of which there was appointed a Resident Mining Engineer with headquarters at a centrally located point in such district.

In the district to which he is appointed the Resident Engineer is expected to devote his whole time to the performance of the duties of his office, and to carry on continuously a mineral survey of his district, keeping records of the same and of the mining and mineral developments taking place, and at the same time to assist prospectors and others with such advice as may be necessary and may come within the scope of a mining engineer's work.

Aside from special reports which may be called for by the Minister, the Resident Mining Engineers are expected annually to make a comprehensive report covering all matters relating to mining, mine development, and prospecting that have occurred within the year in their respective districts.

These annual reports of the Resident Mining Engineers follow, and form the basis of the information given in respect to the mineral industry and its development within the Province.

During the session of 1929 the "Mineral Survey and Development Act" was completely redrafted by the Hon. the Minister of Mines; one of the changes made was the doing away with the defining of the Mineral Survey Districts and headquarters, which can now be changed as necessary by regulation.

The section dealing with the duties of the Resident Engineers remains as before, and is as follows:—

"11. Each Resident Engineer shall, so far as practicable, throughout his mineral survey district assist miners and prospectors in the manner following, that is to say:—

- "(a.) By giving information as to mineral indications and as to ground open for location as mineral claims or placer claims as a result of knowledge gained during the carrying-out of the mineral survey of his district:
- "(b.) By examining samples and applying such tests as may be possible on the ground or in his office and advising as to the nature of any mineral and as to the best available methods of analysis, sampling, assay, and test:
- "(c.) By forwarding samples to the Minister of Mines for further examination and tests whenever in his opinion such course is necessary or expedient:
- "(d.) By reporting to the Minister of Mines the location and approximate cost of such roads, trails, and bridges as in his opinion are reasonably necessary in order to render possible the development of any mineral resources; and
- "(e.) Generally, by giving such advice, information, and directions as may be of assistance to miners and prospectors within his district."

PROVISIONS FOR THE PROTECTION OF INVESTORS.

The sections dealing with the protection of investors now read as follows:—

"15. Where it appears to the Minister of Mines:—

- "(a.) That a sale of shares in any mining company or in any mining property is being advertised or solicited upon statements, either of fact or opinion, which are not in accord with the actual facts and conditions as shown by the report of a Resident Engineer or of any official of the Department of Mines or by information on file in the Department; or
- "(b.) That any statements of the nature referred to in clause (a) are being published or circulated with the intention of influencing or which may influence such a sale of shares;

and if the Minister considers it advisable in the interest of any person or of the public, he may give or cause to be given such notices, either personal or public, by telegraphic dispatch, letter,

bulletin, advertisement, or otherwise as he considers necessary to prevent injury to investors; and it shall not be necessary in any notice so given to refer to this section or to state any fact or reason as preliminary to or leading up to the giving of the notice; and every notice so given shall be deemed to be given pursuant to this section, and shall be absolutely privileged.

"16. (1.) Where a corporation, other than a private company under the 'Companies Act,' acquires an interest in, or title to, or engages in work on any mining property situate in a mineral survey district, it shall forthwith notify the Resident Engineer of that district and the Provincial Mineralogist, and file with them full particulars thereof, and shall also file with them, as soon as it is issued, a copy of every prospectus or statement in lieu of prospectus which is required by the 'Companies Act' to be filed with the Registrar of Companies.

"(2.) Where a corporation, other than a private company under the 'Companies Act,' issues, publishes, or distributes, or causes to be issued, published, or distributed, any pamphlet, bulletin, circular, advertisement, or publication relating to any mining property situate in the Province in which the corporation has any interest or on which the corporation is engaged in work, the corporation shall forthwith file a copy of the pamphlet, bulletin, circular, advertisement, or publication in the office of the Resident Engineer of the mineral survey district in which the mining property is situate, and shall also forthwith file three copies of the same in the office of the Department of Mines at Victoria.

"(3.) If a corporation makes a default in complying with any requirement of this section, it shall be liable, on summary conviction, to a fine not exceeding twenty-five dollars for every day during which the default continues, and every director and every manager of the corporation who knowingly and wilfully authorizes or permits the default shall be liable to the like penalty."

NOTE.—All corporations to which these sections apply are specially requested to comply with the provisions of the Act.

NORTH-WESTERN MINERAL SURVEY DISTRICT (No. 1).

BY J. T. MANDY, RESIDENT MINING ENGINEER (HEADQUARTERS, PRINCE RUPERT).

(Reports marked * are by F. P. Caddy, Assistant.)

INTRODUCTION.

The North-western Mineral Survey District (No. 1) comprises Bella Coola, Skeena, Queen Charlotte, Nass River, Portland Canal, Stikine, Liard, and Atlin Mining Divisions. Excepting the Skeena River valley east of Terrace, this area of approximately 125,000 square miles embraces the Pacific drainage area of the Province from the north end of Vancouver island to the Yukon boundary and all of the Arctic drainage area of the Province north of the Peace river and its tributaries.

In this report each Mining Division is treated under a separate heading, with subheadings identifying the prominent sections in them. In the general summary the outstanding economic geological features are stressed and some suggestions regarding possible guides to development, exploration, and prospecting are offered. Under this heading also, the more important developments and new discoveries of the past year are pointed out and general information regarding transportation, roads and trails, prospecting activity, production, and future outlook is given.

For those who are interested in a detailed study of the district and particular areas in it a fairly complete bibliography is available. The Annual Report for 1927 contained a list of important reports dealing with specific areas in the district. Readers are also referred to Annual Reports, Preliminary Reviews, and Special Reports issued by the Department of Mines, and covering the years 1896 to the present. The following is a list of the more recent publications:—

Name of Author.	Publication.	Year.
H. T. James.....	Minister of Mines' Annual Report.....	1927
H. T. James.....	Minister of Mines' Annual Report.....	1928
J. T. Mandy.....	Bulletin No. 1, 1929. British Columbia Department of Mines.....	1929
J. T. Mandy.....	Bulletin No. 2, 1929. British Columbia Department of Mines.....	1929
J. T. Mandy.....	Report on the Taku River Area, Atlin Mining Division. British Columbia Department of Mines.....	1930
F. A. Kerr.....	Second Preliminary Report on the Stikine River Area. Geological Survey of Canada, Summary Report, 1928, Part A.....	1929
F. A. Kerr.....	The Development and Natural Resources of Northern B.C. Can. Min. and Met. Bull., July, 1929.....	1929
F. A. Kerr.....	Recent Mining Developments in Northern B.C. B.C. Miner, Nov., 1929.....	1929
C. Price-Green.....	Minerals and Mining Industries in the Areas served by the Canadian National Railways. Department of Natural Resources, Canadian National Railways.....	1927
C. L. Monroe.....	Placer Mining in the Atlin District. Transactions of the Canadian Institute of Mining and Metallurgy for 1929.....	1929
Dale L. Pitt.....	Aerial Tramway Construction in Northern British Columbia. Transactions of the Canadian Institute of Mining and Metallurgy for 1929.....	1929
G. Hanson.....	Mineral Deposits of Alice Arm District. Geological Survey of Canada, Summary Report, 1928, Part A.....	1929
G. Hanson.....	Memoir 159, Map 215A, Stewart Sheet (Geology); Map 216A, Bear River Sheet (Geology). Department of Mines, Geological Survey of Canada.....	1929
W. H. Boyd.....	Map 217A, Bear River Sheet (Topography). Department of Mines, Geological Survey of Canada.....	1929
Robert Dunn.....	A History of Mining in British Columbia. Canadian Mining Journal, Anniversary number, August, 1929.....	1929
W. R. Lindsay and R. L. Healy.....	Mining Methods at Hidden Creek Mine. Transactions of the Canadian Institute of Mining and Metallurgy, 1929.....	1929

GEOLOGIC DISCUSSION.

Three areas or zones of economic geological importance feature the district. These are the Coast Range granodiorite batholith, with pendant and inclusion areas, occupying the central position; the eastern contact margin of the batholith; the western contact margin. In past reports these three areas have been frequently described and their character and economic importance have been stressed. Many prospectors and operators in the district are, however,

not yet thoroughly familiar with the geologic features relative to the batholith, with which nearly all the important ore-bodies are genetically associated. A knowledge of batholithic geology is more useful to the North-western District prospector than his pick and as essential to the operator as his transit. It cannot be too definitely urged that a thorough familiarity with the economic geology of the batholith and its relative areas be acquired by all those interested in prospecting and development operations in the district. By the acquisition of this knowledge much wasted effort, sometimes very expensive, would be eliminated and constructive and profitable results in development of properties and prospecting would be hastened. Readers are especially referred to the following publications: Guide Book No. 10, issued by the Geological Survey of Canada; the Ore-deposits of British Columbia, S. J. Schofield, Transactions of the Canadian Institute of Mining and Metallurgy, 1921; the Coast and Islands of British Columbia between Burke Channel and the Alaskan Boundary, in two reports by V. Dolmage, Geological Survey of Canada, Summary Reports, 1921, Part A, and 1922, Part A. In the Annual Report for 1923, pages 34 and 35, is a very clear and concise description of the governing economic geological features of the district. Readers are urged to thoroughly digest these two pages.

To assist in the competent understanding of the important features of the batholithic geology in the district an ideal section from west to east is appended herewith. In this, notations of special mineral features, favourable and adverse conditions, and a diagram showing favourable mineral localities are made. Accompanying the two reports by V. Dolmage, referred to above, are maps with the geology shown diagrammatically. These geologic plans show different sections of the Coast from Burke channel to the Alaskan boundary and are most useful in indicating the favourable areas of pendants included in the Coast Range batholithic rocks. In Bulletins No. 1 and No. 2, 1929, issued by the Department of Mines, the accessibility and favourable features of these areas were stressed. It is hoped prospectors will give them more than the superficial shore-line investigation they have hitherto received and will intensively prospect the interior of these inclusions. When it is realized that the two outstanding mineral-deposits on the Coast, *Hidden Creek* and *Britannia*, occur in inclusion areas, and that if anything of importance is discovered seaboard transportation is at hand, these inclusions appear decidedly attractive for intensive prospecting. In addition to this is the fact that they are as yet, with the exception of a little shore-line prospecting, practically virgin to the prospector's pick.

As development progresses and new properties are opened up, much is being learned regarding structural and petrological conditions, favourable and adverse to the deposition of important ore-bodies. In this respect, however, the district is still very young. A rich field awaits an intensive scientific investigation of influences relative to ore-deposition. Such work would be of the greatest assistance to the speeding-up of production as well as to the elimination of useless and expensive effort.

To select one outstanding general instance, the Salmon River and Cascade Creek ore occurrences are profoundly lenticular in ore-shoot development. With the exception of general structural guidance, exploration for commercial ore-shoots in this area has been carried on with the element of luck as nine-tenths of the governing factor. For several years properties with similar petrological and structural conditions to those on the prolific *Premier* have been delved into conscientiously, but more or less haphazardly, in search for commercial ore-shoots. Little success has attended these efforts and operators have no criterion of how near, or how far, they may be from success or definite failure. On the *Premier* itself, although much is known of structure and that the ore is generally confined to the quartz porphyry and favours the neighbourhood of the porphyry-contact with the tuffs, no intimate chemico-petrological guidance regarding ore-deposition has been fully determined.

Ore-shoots are probably governed by very definite associated chemical as well as structural conditions. Although the relative importance of mechanical and chemical influences on ore-deposition is still debatable, the fact remains that ore-deposition is primarily a chemical process. That very definite and delicate reactions govern the chemistry of ore-bodies is probable, and that these reactions can be influenced by even small chemical differences of the rocks through which the metalliferous solutions circulate is a logical and probable conclusion. Many instances pointing to this influence have been uncovered by investigators, the most notable of which is perhaps the work of J. H. L. Vogt, showing the relation of the magnesium contents of norite to the nickel contents of associated ore bodies.

In the *Premier* there are many instances of low or scattered values (which do not constitute ore) in areas of favourable structure occurring in rocks visually, and perhaps even microscopically, identical to those in which extensive shoots of good-grade ore occur. With all conditions apparently equal, why should these localities in the formation not be favoured by concentration of ore-deposition? Perhaps the factor of chemical composition of the wall-rock, hitherto not considered in the equation, may be the answer. Neighbouring properties on both sides of Cascade creek have for several years been explored on the surface and underground in areas that contain, in places, similar structure and, to the naked eye, similar rocks to those in which the good-grade ore of the *Premier* occurs. These efforts have as yet met with no tangible success. Hopes buoyed up by scattered values, or the picking-up of small isolated good-grade lenses, and based on visually identical conditions to those on the *Premier*, have not been fulfilled. The Salmon River-Cascade Creek area, with its quartz-porphry sills intrusive into Bear River tuffs, breccias, and lavas, and extending from *Premier* to *Big Missouri* and beyond, has yet to produce its second productive mine.

In this area of such widespread promise and with definite evidence existing of a regional circulation of mineralizing solutions, where structure and perhaps even the microscope alone may fail as a guide to ore-concentration, it would seem that chemical research could very profitably be called in to assist in solving the problem. Evidence points to the existence of a chemical horizon within the porphyries that is favourable to ore-deposition. A slight variation in sodium, potassium, magnesium, calcium, or silica contents of the enclosing rock, a maximum or minimum of some element in the wall-rock, may be the secret of the requirement for concentrated replacement by metallic minerals. The establishment or otherwise of the existence of such a chemical horizon entails long and tedious research, but the ultimate benefit of such knowledge to the mining industry of the Portland Canal section cannot be overestimated.

It is urged that work along these lines be undertaken by the larger operating companies in the area, by the Department of Mines, or the Geological Survey of Canada. If such a chemical horizon in the porphyry can be established, exploration could be concentrated in these favourable areas, abortive effort would be cut to a minimum, and if there are profitable mineral-zones in the area, other than those now being mined, their discovery and production from them would be hastened. Hand in hand with the development of other and newer areas in the district, detailed research-work of this type would be of great assistance in the speeding-up of production.

PRODUCTION.

Although the district has only two steadily producing mines, *Hidden Creek* at Anyox and *Premier* in the Portland Canal section, these two mines are numbered amongst the five great producers of the Province. The *Premier* is responsible for the bulk of the gold-output of the Province and an appreciable proportion of its silver. The *Hidden Creek* produces about one-third of the Province's copper-output.

In considering the district from the standpoint of production, it must be remembered that the first steady output only started with the *Hidden Creek*, operated by the Granby Consolidated Mining, Smelting, and Power Company at Anyox, in 1914. The *Premier* came into production in 1919. These two mines have steadily maintained production and have continued to be the main source of output from the district. In its eleven years of operation *Premier* has disbursed nearly \$14,000,000 in dividends to its shareholders. During 1929 the *Bonanza* ore-body at Anyox was brought into a steady daily production of 400 tons of ore, resulting in an increased copper-output for the year from the *Hidden Creek* deposits. Although appreciable reserves of ore are still available from these deposits, continued future large tonnage production is dependent on the success of the intensive exploration for extensions of the *Hidden Creek* ore-bodies that is being undertaken by the Granby Company.

During 1929, on account of the lower-grade ore being mined at the *Premier*, the gold-output from this source decreased. The matter of future ore reserves in the *Premier* is being assisted periodically by the discovery of new ore-shoots in the upper horizons of the mine. A hopeful factor also is the discovery during the year of the indication of commercial ore-shoots below the fifth level, formerly considered the depth limit of commercial ore-shoots. Although nothing conclusive regarding this development has yet been proved, the outlook is encouraging and exploration is being vigorously pushed into the favourable area. The future prospect for sustained gold production from the district has been considerably brightened by the favourable

development of the *B.C. Silver* ore-bodies and the extension of *Premier* ore-shoots into that property. During the year the development of this property has brought it within measurable distance of definite production. The possibility of a still further northerly projection of these ore-bodies is a hopeful outlook for the more distant future.

The hopes and anticipations for the rapid bringing into production of several other substantial producers in the district since the advent of the *Premier* have not been fulfilled. In this respect, however, it must be stressed that these anticipations were in many cases based on wild, unsound, and irresponsible conclusions, which, rather than hastening the goal of the industry, have tended to retard it. Capital, particularly that subscribed locally, has been generally inadequate at the outset to fulfil the object for which it was intended. Exploration and development has frequently been under the direction of unskilled operators. Imprudent optimism and sometimes unscrupulous promise has tended to the expenditure of available funds on extravagant plants and buildings and the premature erection of mills. Added to these factors is the rugged physical nature of the country generally and the severe climatic conditions, the combating of which tends to slow and costly development.

During 1929, however, the district generally has made a marked advance towards the possibility of future new producers. Unsound and imprudent optimism is being markedly curtailed. Sounder and more conservative policies and methods of operation are being adopted. Competent mining engineering advice is being more generally utilized in the direction of operations. Most important has been the influx of large operating mining companies, with their skilled staffs and capital resources in the exploration of many promising prospects, both in new areas and the older camps. Generally, the district is turning a new page in its mining-development history, is putting its house in order, and is gradually getting down to sound business. With the promising mineral potentialities of the North-western District, this tendency to conservatism and the basic principles of efficient mining will hasten prosperity more than any other single factor. The prospects for future new substantial producers in the district are brighter than at any time in its history.

During 1929 the completion of the aerial tramway by the Premier Gold Mining Company to the *Prosperity* and *Porter-Idaho* has culminated in a new producer in the Portland Canal area. Good-grade silver-lead-zinc ore is being steadily accumulated at the beach terminus and shipped to the smelter. Small shipments of high-grade silver-lead ores have also been made from the *Black Hill*, *Melvin*, and *Mountain Boy* properties, also in the Portland Canal section.

Placer-gold production has been rather disappointing. In the Dease Lake area only a small output has resulted from hydraulic operations expected to return appreciable clean-ups. This has been largely due to the unsound and hazardous policy of undertaking extensive preparations for production before testing or valuing the ground it is intended to work. In these instances dams, flumes, pipe-lines, and ditches have been constructed, monitors installed, and what is expected to be profitable production has been started without any criterion of how or where gold values of economic extent occur. Sometimes the misleading results of a few pan-tests are taken as a criterion. Frequently the location of workings of old-timers are relied on as an indication of values, but this is generally an unsound conclusion. The old-timer was an expert placer-miner; he took what there was and stopped where the returns were lean. Placer-ground, to be profitably worked by modern methods, requires equally as accurate sampling and valuation as lode-mineral deposits.

It must not be inferred that, in areas previously worked by the old-timers, profitable ground available for modern methods of placer-mining does not exist. On the contrary, the chances are that extensive areas of ground profitable to modern placer-mining methods do exist in these localities. To successfully develop and obtain profitable production from them, however, modern skill and calculation must work hand in hand with modern machinery. In the Dease Lake and Liard sections are extensive areas of very promising placer-ground, worthy of intensive investigation relative to modern hydraulic and dredging methods. With intelligent and calculated exploration, accurate sampling and valuation, these areas hold promise of an appreciable output of placer gold.

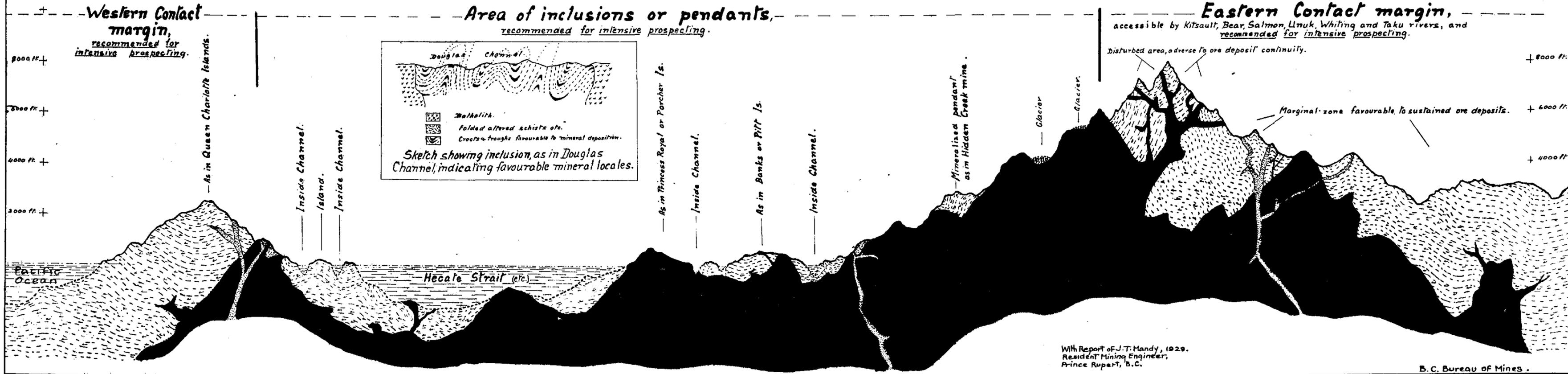
Production in the Dease Lake area has been confined during 1929 mainly to individual operators. Preparatory work aiming at possible production in 1930 from at least two hydraulic operations has been carried out during the 1929 season. Production from the Atlin area has also been confined to individual operators, the larger enterprises being still in the preparatory stage.

Generalized section indicating favourable mineral areas related to the Coast Range batholith.

Horizontal scale = 0 5 10 20 30 40 50 60 Miles.

Vertical scale = 0 1000 2000 4000 6000 8000 Feet.

-  Upper Jurassic to Tertiary. Basic, in part; granitic dykes and sills.
-  Coast Range batholith.
-  Jurassic, Triassic, in part, Palaeozoic. Altered volcanics and sediments.



The following list gives the production from lode mines in No. 1 District during 1929:—

Name.	Ore.	Gold.	Silver.	Copper.	Lead.
Portland Canal Mining Division—	Tons.	Oz.	Oz.	Lb.	Lb.
Mayou.....	2	.....	223	.....	904
Black Hill.....	20	.....	2,920	.....	6,460
Melvin.....	4	.....	647	.....	.....
Mountain Boy.....	4	.....	3,798	320	.....
Outland.....	1	.....	26	.....	257
Prosperity.....	1,584	32	107,546	.....	78,979
Premier.....	266,972	96,636	2,258,729	129,847	2,110,789
Woodbine.....	4	8	78	.....	277
Nass River Mining Division—					
Bonanza.....	112,489	366	34,856	4,242,507	.....
Golskeish.....	2,500	161	977	.....	.....
Granby Point (flux).....	6,860	248	9,897	.....	.....
Hidden Creek.....	1,600,103	3,896	229,015	32,503,466	.....
Saddle.....	3	.....	84	84	3,084
Toric.....	540	.....	10,565	.....	7,196
Skeena Mining Division—					
Western Copper.....	72	69	323	17,548	.....
Totals.....	1,991,218	101,416	2,659,694	36,893,772	2,207,946

The placer-gold output of No. 1 District for 1929 was 2,813 oz., valued at \$47,821, as compared with \$60,639 in 1928.

DEVELOPMENT.

In both lode and placer mining, development has been steadily pushed on many properties during 1929, with encouraging results in several instances. Exploration and development is being continued through the winter on a greater number of properties than at any time in the history of the district.

Outstanding has been the activity of the Consolidated Mining, Smelting, and Power Company of Canada in exploration of many prospects. Although some disappointments have definitely been met with, and as yet nothing conclusive has materialized regarding new producers as a result of this work, the activity of this company in the district is of immense value to the mining industry. With this work in progress, and under such capable direction, optimism for the materializing of new producers at any time is well founded. During the year the Consolidated Company established a thoroughly equipped and staffed assay laboratory at Prince Rupert. Much information and assistance to prospectors has emanated from this source. Several other large operating companies have become active in the area during the year and have prosecuted notable exploration and development.

Outstanding has been the United Eastern Mining Company's operation on the *Tulsequah Chief*, in the Taku River area, described in detail in the special bulletin issued by the Department of Mines. In the same area, and described in the special bulletin, the exploration of the *Manville* and other groups by the Alaska Juneau Gold Mining Company, in association with the Treadwell Yukon Company, is of especial interest.

In the Portland Canal section the outstanding feature has been the completion by the Premier Gold Mining Company of the tramway to serve the *Porter-Idaho* and *Prosperity* workings in the Marmot River valley, a decidedly creditable achievement in constructional engineering. For details of this tramway and also of the *Premier*, readers are referred to the outstanding paper by Dale L. Pitt, manager of the Premier Gold Mining Company, in the Transactions for 1929 of the Canadian Institute of Mining and Metallurgy.

At the *Premier* mine an important feature of the year's development has been the discovery of indications of commercial ore-shoots below the fifth level. If these indications can be proved to be of substantial dimensions the life of the *Premier* mine should be appreciably extended. In the same area the development of the *B.C. Silver* during the year has resulted in the alignment of ore-zones and ore-shoots that will make for more rapid progress on this property in the future than in the past.

Exploration and development work in the Portland Canal Division has been exceptionally active during 1929. A decided tendency to a more efficient policy in the development and explora-

tion of the promising prospects in the area is apparent. Although no new stable producers can be expected from this area in the immediate future, the trend towards sound mining principles and the availability of appreciable capital is hastening that possible goal on several properties. The work during 1929 showed a marked advance in this respect.

In the Portland Canal section constructive exploration was carried out by the North Country Mining Company in the Bulldog Creek area. On Georgia river an extensive programme of development has been launched by the Georgia River Mining Company. In the Marmot River section exploration on the *Prosperity* was actively pushed, underground exploration of an important discovery of high-grade silver ore on the *Melvin* was started, and considerable open-cutting and drifting was completed on the *Bi-Metallic*. In the Salmon River area energetic and efficient development was carried out on the Premier Border Mining Company's property adjoining the *Premier*, on the Outland Silver Bar Mines, Limited, property west of the Salmon River glacier, and on several other properties. The *Big Missouri* and *Unicorn* properties have also been extensively explored.

In the Bear River section the *Silverado* was energetically explored by the Premier Company and further appreciable work completed on the *Black Hill*, *Mayon*, *Independence*, and other properties. In the upper Bear River valley the *George Copper* was further diamond-drilled by the Consolidated Company and a very efficiently conducted programme of exploration was carried out on the *George Enterprise*. In the American Creek area underground exploration of the *Mountain Boy* was energetically pushed.

Of prospective importance to the future development of the Portland Canal area was the entry of the Power Corporation of Canada into this section during 1929. Work was undertaken with a view to the development of a power unit on American creek and surveys were made of the power resources of the headwaters of the Nass river. The future policy of this company in the Portland Canal area will be based on results obtained from these surveys. To supply power to the town of Stewart, for the immediate present the generating plant of the Dunwell Mining Company was taken over and put into commission by the Power Corporation.

In the Alice Arm section, Nass Division, the advent and activity of the Britannia Mining and Smelting Company in the thorough exploration of the *Toric*, *Dolly Varden*, and *Wolf* properties in the upper Kitsault valley offers a well-founded promise for the eventual materialization of stable producers from this promising but much-neglected section. On McGrath mountain the enterprise of the Kitsault Eagle Silver Mines, Limited, in the exploration of the *Sunrise* group zinc-deposits is an important step in the proving of the commercial possibilities of the McGrath Mountain deposits. Although this work has not as yet met with the success anticipated, the results are still inconclusive.

In the Observatory Inlet section, of importance to the life of the Granby Company at Anyox and the maintenance of production from the *Hidden Creek* mine has been the development of the *Bonanza* ore-body and the completion of the aerial tramway from the *Bonanza* workings to the concentrator. In the same area the completion of the aerial jig-back tramway to a stage allowing of its operation by the Silver Crest Mines, Limited, on the *Saddle* group, Hastings arm, will speed up exploration in this rugged terrain.

Of interest are two continuous and efficiently directed development operations in the coastal area of the Skeena Mining Division, the *Surf Point* on Porcher Island and the Los Angeles-Vancouver Mines, Limited, on the old *Drum Lummon*, Douglas channel. Although nothing conclusive regarding possible profitable production has yet materialized on these properties, the extensive exploration being carried out by the present operators should definitely determine this possibility. Both operations are confronted with the difficult problem of developing ore reserves of sufficient extent to warrant eventual milling, in an ore occurrence of acutely lenticular character. Of importance in the Coast area is the recent bonding of the *Gibson Girl* group on Gibson island by the Consolidated Company. It is hoped that this property, which has had inconclusive work carried out on it by three bonding operations in the past, will receive at the hands of the Consolidated the thorough exploration that its surface indications invite.

Placer-mining has shown several disappointments during the 1929 season. Developments under way, however, give promise of a future increase in placer-gold production. In the Dease Lake area, preparatory work on Mosquito creek, a tributary of Thibert creek, has been brought to the stage of possible production during 1930. At the mouth of Thibert creek Keystone-drilling by Vancouver interests to prove a dredging lease is a development of interest. In the Atlin

Division, preparatory development by the Consolidated Mining and Smelting Company of Canada on Boulder creek, the Compagnie Française des Mines d'Or du Canada on Otter creek, the Discovery Mining and Power Company on Pine creek, and the Delta Gold Mining Company on McKee creek are the most extensive placer developments ever undertaken in the district.

NEW DISCOVERIES.

Outstanding amongst the new discoveries of the 1929 season is that on the *Manville* group, Taku river, by Victor Manville, for details of which readers are referred to the special report issued by the Department of Mines. Since the publication of that report several new discoveries have been made in the Taku area, notably one of zinc-lead ore showing appreciable width and continuity. This is on the *Erickson* group, staked by Erickson and Ashby, of Juneau, Alaska. These prospectors have also made a discovery of reported promise on Crow creek, a tributary of the Inklin river, at the headwaters of the Taku river.

New discoveries of interest were also made in the Stikine River area on the Iskut river, Clearwater river, Limpoke creek, 4-Mile creek, Ehallueh lake at the source of the Iskut river, and Tsetogamus creek, a tributary to the Klappan river near its confluence with the Stikine river. Discoveries have also been reported up the Whiting river and the Unuk river. These new discoveries in the Taku, Stikine, Whiting, and Unuk drainage areas give a small indication of the mineral potentialities of the eastern contact margin still awaiting the attention of prospectors and of the vast area of virgin territory in North-western District as yet untouched by development.

In the older areas a new discovery of importance to the Portland Canal section was made at the head of American creek. This resulted in the staking of the *B.L.K.*, *Bryant*, *Dundee*, and *Virginia K.* groups by D. D. Kimball, of Stewart, and of several other groups in the locality by Stewart prospectors. In the Hastings Arm section a new discovery of interest was one of a spectacular showing of free gold on the *Elkhorn* group on Saddle mountain, made by J. Flynn, of Alice Arm. In the Coast area several new discoveries have been made, the most notable being that of a promising zone of copper-zinc-lead ore on the *Gibson Girl* group, made by George Keys and Frank Cole, of Prince Rupert. These new discoveries in the older areas of the district indicate that these areas, easily accessible and close at hand, still hold very attractive promise for intensive prospecting. Prospectors are urged not to neglect these sections.

PROSPECTING.

Discoveries made in the past and especially during the 1929 season demonstrate that the district offers an exceptionally promising field for prospecting. During the 1929 season prospecting has been more active than perhaps at any time in the history of the area. Many men have been well repaid for their efforts. Examining engineers representing large operating companies have shown exceptional activity and have been ever on the alert to examine promising new finds. Competition for the acquisition of likely-looking prospects has been intense. Never before in the history of the district has capital for the development of promising mineral-showings been within such easy reach of the prospector. Even greater activity in this respect is portended for the 1930 season. Prospectors are urged to take advantage of the present opportunity and to engage in intensive exploration of likely areas.

The immense promising area available for prospecting, in both old and virgin sections, offers ample space for thousands more prospectors than are at present in the district. Many sections of the western contact margin, inclusion or pendant areas within the batholith, and of the eastern contact margin are still absolutely virgin to intensive prospecting. The attention of prospectors is especially drawn to the interior area of the Queen Charlotte islands, particularly that of Moresby island. The importance of the pendant zones in Douglas channel, Gardner canal, Dean and Burke channels has already been stressed.

On the mainland the eastern contact margin is of prime importance. To assist in the location of promising sections for prospecting in this area a map showing the approximate eastern contact line of the batholith is submitted with this report. (See Taku River Area Report.) In prospecting this area prospectors are advised to select localities at least 3 or 4 miles east of the main contact. Although commercial ore-bodies can occur close to, or at the contact, there is a tendency for these occurrences to be unstable, lenticular, and restricted. It must be remembered, however, that the neighbourhood of small offshoots or spurs from the

batholith occurring at some distance from the main granitic mass are the most favourable localities of the eastern margin.

On the eastern contact margin the attention of prospectors is especially drawn to the trough of the Whiting river, 35 miles southerly of the Taku river, and to that of the Unuk river, 55 miles southerly of the Stikine river. The contact margin should cross the Unuk river about 23 miles from its mouth and about 3 miles east of the International boundary. On the Whiting river the contact should cross the valley about 27 miles from the river-mouth and about 5 miles east of the International boundary. There is no reason why the margin area accessible from the Unuk and Whiting rivers should not be equally as promising as that of the Taku, Stikine, Salmon, Bear, and Kitsault sections. Some prospecting was done in the Unuk section in 1900, but both rivers are as yet absolutely untouched by intensive prospecting. The Whiting and Unuk rivers are, however, reported to be torrential streams. Prospectors venturing up them should be thoroughly familiar with the handling of small river-boats in swift waters and are strongly advised not to undertake the trip alone. Some notes pertaining to the Unuk river are submitted in the section of this report devoted to the Portland Canal Mining Division.

TRANSPORTATION.

In a country possessing the rugged features of this district adequate transportation facilities are vital to the successful progress of the mining industry. During 1929 transportation throughout the district was considerably improved by valuable assistance in construction of roads and trails given by the Department of Mines. This has been an important influence in assisting progress in the district during the year. New trails have been built, old trails have been reconditioned, surveys have been made, and data gathered upon which will be based the location and route of several projected trails and roads. The co-operation of the Public Works Department in this respect has also been of great value.

Among the most important items receiving attention in this respect may be mentioned:—

Queen Charlotte Mining Division.—Road to the black-sand deposits of Graham island, surveyed and considered.

Skeena Mining Division.—Porcher Island road to the *Surf Point* mine; Williams Creek trail, Lakelse valley; Maroon Creek trail, Kitsumgallum valley.

Nass River Mining Division.—Saddle Mountain trail, Hastings arm; McGrath Mountain trail, Alice arm; Red Bluff trail, Alice arm; Upper Kitsault River road, Alice arm.

Portland Canal Mining Division.—Bulldog Creek trail; Georgia River trail; Cascade Creek road; Glacier Creek trail; Bitter Creek trail; Bear River trail; American Creek trail; trail via Bowser and Meziadin lakes to 23-Mile on the Dominion Telegraph trail.

Stikine-Liard Mining Division.—Devil's Elbow Mountain trail; Gold Pan Creek trail; Dease Creek road; Thibert Creek trail; Mosquito Creek trail.

Atlin Mining Division.—Otter Creek trail; Ruby Creek trail; Taku River-Tulsequah River road.

Of great importance to future transportation in the district, particularly in the Portland Canal area, is the acquisition in June, 1929, of the Canadian North-eastern Railway charter by the Consolidated Mining and Smelting Company of Canada. The prospect of the utilization of this railway up the Bear River valley and its eventual extension to the Finlay river at Fort Grahame helped to revive interest in the mineral potentialities of the hinterland. During the summer a preliminary survey was made through the upper Bear River valley and the Bear River pass into the Nass valley. The Consolidated Company has made no definite announcement regarding its future plans in connection with this railway system. The country this railway would tap is rich in mineral and other natural resources, possesses great scenic attractions, and is prolific in game. The completion of this railway would be a very progressive step in the industrial advance of the north.

For the first time in the history of the district the aeroplane came into use for the transportation of men, supplies, and equipment into outlying areas. Several exploration expeditions by aeroplane were also undertaken during the summer season. Towards the latter part of the season Western Canada Airways established a base at Stewart and a plane was available for charter. The introduction of aeroplane transportation during 1929 was an important factor in the development of remote areas. As a result of the work accomplished by the aeroplane in 1929, plans are being laid for organized and extended service during the 1930 season. Western

Canada Airways is preparing to establish bases at central points during the coming season. This means of rapid and efficient transportation is especially adapted to the rugged country of the North-western District. Its definite and permanent introduction will greatly facilitate and hasten mining development.

In areas accessible only by river the district has been fortunately supplied with good service. Deserving of special mention in this respect is the efficient and courteous transportation service rendered by the Barrington Transportation Company on the Stikine river from Wrangell to Telegraph Creek. This river can be travelled with comfort and promptitude and the Barrington transportation system is a vital factor in the development of the Stikine and Liard areas.

An improved transportation system on the Taku river is in course of preparation for the 1930 season. The Taku River Transportation Company, operated during the 1929 season by William Strong, has been taken over by interests associated with the Alaska Juneau Gold Mining Company and the United Eastern Mining Company. A new tunnel river-boat 64 feet long is under construction and will be ready to operate in the spring of 1930. Good accommodation with meals will be available on this boat. Very reasonable passenger and freight rates from Juneau to Tulsequah will be charged.

GEOLOGICAL SURVEY OF CANADA.

Commendable work by the Geological Survey of Canada, that will be of great assistance to operators and prospectors, has been continued during the 1929 season. After a succession of seasons spent in the Stikine River section the mapping of this area by F. A. Kerr has been completed. Towards the end of the season a brief reconnaissance of the Taku River area was made by Dr. Kerr. George Hanson has also completed the mapping of the Alice Arm section. The early publication of the preliminary geological reports on these areas has been very useful. The final detailed reports are being awaited with interest. During the summer season V. L. Eardley-Wilmot, of the Dominion Mines Branch, studied ore occurrences in the Portland Canal and Alice Arm sections, with especial attention to the silver contents of the ores. Results of this investigation will be of assistance not only to exploration, but especially to milling practice.

It is hoped that the Geological Survey of Canada will undertake the mapping of the eastern contact margins of the Taku, Whiting, and Unuk River troughs. With this work in hand, complete correlation of the economic geological features of the eastern contact margin of the Coast Range batholith from the Nass river to the Taku river will become available to the prospector and operator. This will embrace a stretch 250 miles in length of potential mineral area equally as promising as any on the American continent and largely untouched as yet by the prospector's pick.

NON-METALLICS.

With the exception of some sand and gravel excavated for road-construction, the district has as yet shown no non-metallic production. This is perhaps due to the fact that interest in metal-mining has obscured any latent possibilities that may exist for non-metallics. There is also the factor that the marketing of non-metallic products is somewhat obscure and in the nature of a specialty. Markets for these products have to be worked up and established.

Prospecting and investigation for the establishment of non-metallic industries should, however, not be overlooked in the district. The coastal area, with its accessibility and other facilities, offers an ideal area for such investigation. In this area the chief handicap of a profitable non-metallic industry is removed at the outset by the availability of immediate seaboard transportation to markets. The energetic and organized establishment of these markets is, however, of prime importance for the success of a non-metallic industry.

In the category of non-metallics it would seem that District No. 1 possesses possibilities for clay products, limestone, phosphate rock, building-stone, and mineral-spring industries. Several varieties of marine residual clays occur in many localities along the indented shore-line of the coast. cursory examination of these show in some instances a remarkable fineness and plasticity that indicates a possible content of appreciable kaolinite. In the Kumealon Inlet area the occurrence of emery, and possibly of refractories, is indicated.

Limestone occurrences are widespread, particularly in intercalated beds in the Prince Rupert and Bella Bella formations. The possibility for the occurrence of phosphate rock in or near fossiliferous beds of the Tertiary and Cretaceous sedimentaries of Graham island, in the Queen Charlotte group, should not be overlooked. Residual phosphates resulting from the leaching of

phosphatic limestones, clays, marls, and sandstones may also occur. Phosphate nodule occurrences in Miocene or Pliocene detrital deposits are also a possibility. The richer marine phosphate rocks are, however, very inconspicuous and difficult to recognize. Any limestone that seems heavier than usual should always be analysed for phosphate.

Mineral springs are also of widespread occurrence. It would seem that some of these springs offer an opportunity for exploitation for bottling purposes and possible development as medicinal-treatment resorts. Appended to the divisional sections of this report are some notes on the occurrence of thermal mineral springs. These springs are discoveries of long standing. Some of them are frequently visited by residents of the northern coast who report definite benefit in the alleviation of various ills. Very little is, however, known about them outside of residents and settlers in their vicinity. It would seem that their investigation may lead to the possible utilization of a dormant natural resource.

ASSISTANTS.

The examination-work of the Resident Engineer in the rapidly increasing active area of District No. 1 was greatly assisted during the 1929 season through the appointment of F. P. Caddy as Temporary Assistant Engineer. Mr. Caddy's services were available from August 7th to September 10th. Reports on the properties examined by him in the Portland Canal and Lakelse Valley areas are incorporated in those sections, marked thus *.

During the season an arrangement was also made by the Department of Mines whereby Herbert Carmichael made reports on certain properties in the Atlin and Queen Charlotte Mining Divisions. Mr. Carmichael's reports are also included in this report under his name.

ADDRESSES.

During the winter, addresses relative to the needs of the mining industry have been given by the Resident Engineer at central settlements and before various organizations. These have been well attended, and it is evident from the interest displayed at these meetings that much constructive benefit to the welfare of the industry can result from the dissemination of information and the open discussions of problems in this way.

OUTLOOK.

The mining industry in District No. 1 has shown a marked advance during 1929 towards sound and efficient principles and general healthy expansion.

The influx of appreciable capital and large, stable operating organizations, the tendency to a more constructive optimism and to the fundamental technical principles of mining, and the gradual elimination of unscrupulous undertakings are rapidly eradicating wasted effort and concentrating all forces of the industry on the efficient development of future possible producers.

The increased activity of prospecting, new discoveries of importance, and the opening-up of promising and extensive new areas indicate a continuous and rapid growth of activity in the North-western District, accompanied by ever-increasing possibilities of new producers.

The discovery and successful development of new or associated ore-bodies on the stable producers of the district and the gradual elucidation of the economic geology relative to these ore-bodies indicates that not only will production from these deposits be sustained, but that the information so gained will assist in the hastening of production from properties in course of development.

The outlook for lode-mining is bright and holds promise that not only will production be maintained, but that new producers will materialize in much more rapid sequence in the future than has been the case in the past.

In placer-mining the extensive preparatory operations being undertaken in the northern section of the district portend the possible restoration of this branch of the industry to an appreciable measure of its past prosperity.

REVIEW BY MINING DIVISIONS.

In the following report details of the mining activities and mineral possibilities of the district in the various Mining Divisions and sections are reviewed as follows:—

Queen Charlotte Mining Division—Graham Island section; Moresby Island section.
Bella Coola Mining Division.

Skeena Mining Division—Coast section; Canadian National Railway section; Kitsumgallum Lake section; Lakelse section.

Nass River Mining Division—Observatory Inlet section; Hastings Arm section; Alice Arm (Proper) section; Illiance River section; Kitsault River section.

Portland Canal Mining Division—Portland Canal (Proper) section; Georgia River section; Marmot River section; Bear River section; Salmon River section; Unuk River section.

Stikine and Liard Mining Divisions—Stikine River section; Dease Lake section.

Atlin Mining Division—Rainy Hollow section; Atlin Lake section; Taku River section.

QUEEN CHARLOTTE MINING DIVISION.

The Queen Charlotte Mining Division embraces the Queen Charlotte islands, of which Graham and Moresby islands are the largest. These islands form the most westerly extremity of the Province of British Columbia. The mineral occurrences of the islands were amongst the first to receive attention in the district. In 1852 the first discovery of gold in the north-western area was made at Thetis cove, on the west coast of Moresby island. Despite this, the promising mineral potentialities of the area have been only superficially investigated and have not received the attention they warrant.

GRAHAM ISLAND SECTION.

Graham island, about 2,500 square miles in area, is the largest of the Queen Charlotte Island group. The topography of the island is comparatively flat, in contrast to the southerly adjoining Moresby island. About 75 per cent. of Graham island is composed of Cretaceous and Tertiary sediments deposited unconformably on metamorphosed Jurassic and Triassic volcanic and sedimentary rocks. These two series are intruded by numerous dykes and sills up to late Tertiary in age.

Fossils are abundant in several of the sedimentary formations. Two well-defined, folded bituminous-coal basins of Lower Cretaceous age have been investigated in past years. The Cogwitz and Slate Chuck exposures of the Honna basin are metamorphosed in places into a refractory carbon that invites research for a possible utility of this substance in such material as battery plates and rods, cathodes, commutator-brushes, water-filters, septic tanks, etc. In parts the bituminous coal of the Honna and Yakoun basins possesses excellent coking qualities and may yet prove to be of commercial importance. A fairly probable bituminous-coal reserve has been estimated at about 293,000,000 long tons.* Tertiary lignite coal occurs at several localities, particularly near Skonun point on the north shore. The lignite reserve at Skonun point is estimated at 60,000,000 long tons. The probable total lignite reserve of Graham island has been estimated by the Geological Survey of Canada to be at least 1,000,000,000 long tons.* The quality is fair, with low ash and no tendency to slack on exposure. The contiguity to seaboard offers economical mining and transportation. Tarry seepages and bituminous shales are also known to occur on Graham island and have been investigated from time to time.

The widespread occurrence of deposits of organic origin offers an indication for the possible discovery of inconspicuous rock or residual phosphate that may be commercially important. An investigation of the Graham Island Tertiary and Cretaceous sandstones, clays, shales, and conglomerates for phosphate possibilities is recommended. Graham island abounds also in clays and shale-clays, some of which appear to be high grade, of good plasticity, with a possible appreciable content of kaolinite, and probably suitable for brick and tile manufacture.

Lode-mining on Graham island has been inactive during the 1929 season. One or two prospects that seem worthy of further investigation occur on the island, however. In this respect the attention of examining engineers is drawn to the *South Easter* group. The following is a brief description of this property:—

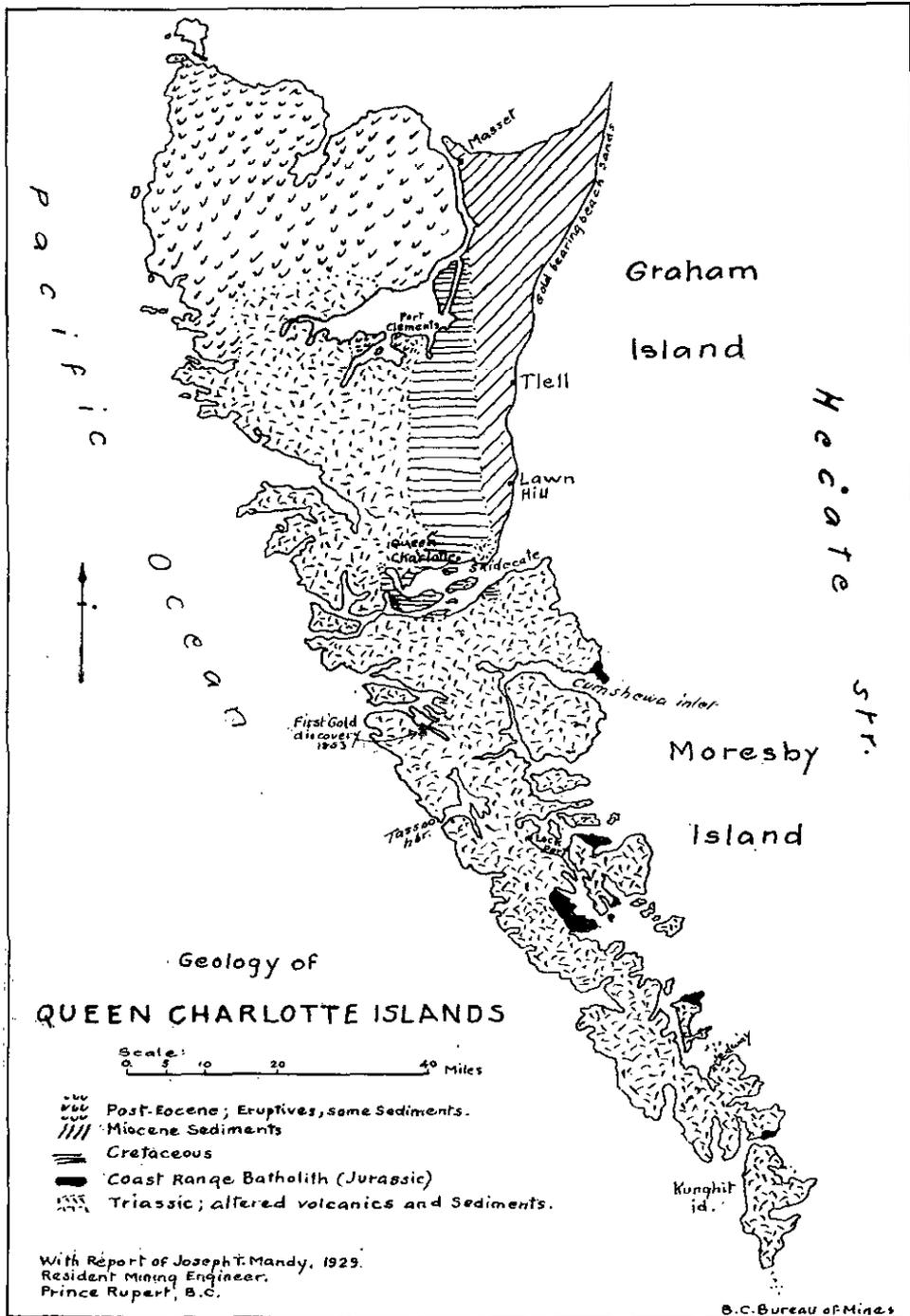
This group is one of the oldest on the Queen Charlotte islands. It consists of

South Easter. seven claims and is owned by J. McLellan, of Queen Charlotte, and associates.

The property is situated about 1 mile from the shore of Skidegate inlet and adjoins the Skidegate Indian Reserve. There is a good road from the camp to the beach.

The showing consists of three quartz veins in a sheared zone about 30 feet wide in a diabasic country-rock. One of these veins has been traced about 1,000 feet, averaging 8 feet in width.

* Geological Survey of Canada, Summary Report, 1912.



Mineralization consists of pyrite and galena with some zinc-blende and chalcopyrite, carrying \$10 to \$15 in gold. Some of the gold occurs in very fine mustard form and some spectacular high-grade ore has been found in places. A probable continuation of the *South Easter* vein is exposed on the Indian reserve. One hundred and forty pounds of selected ore from this exposure was shipped to the smelter and returned \$582 in gold. During 1915-16 the property was under lease to two miners who are reported to have shipped several tons of very high-grade ore taken out during the sinking of a 25-foot shaft.

In 1917 the property was bonded to the South Easter Mining Company, a subsidiary of the Northern Customs Concentrators, Limited, of Cobalt, Ont. This company installed machinery and sank a 100-foot shaft. At the 50-foot level the vein was drifted on 50 feet west and 75 feet east. The east drift indicated a promising ore-shoot. At the 100-foot level, 100 feet of drifting to the west and 250 feet to the east showed the vein to be considerably shattered and sheared, with an appreciable development of gouge in the vein-filling. A raise from the 100-foot level to the 50-foot level indicated that the ore-shoot on the 50-foot level extended 65 feet below the surface outcrop. Operations on the property by this company ceased in 1919 and no work has been carried out since that time.

It would seem that this exploratory work is by no means conclusive as to the possibilities of the property. The good definition and continuity of the vein on the surface, and the continuity of values on the surface beyond the projection of the ore-shoot indicated at the 50-foot level, leads to the reasonable assumption that other ore-shoots exist horizontally and possibly vertically beyond the one developed. The property is decidedly worth further exploration by either underground work or diamond-drilling.

MORESBY ISLAND SECTION.

In contrast to Graham island, Moresby island, lying to the south of it, has a rugged topography, with mountains rising abruptly from the sea to 3,000 and 4,000 feet altitude. About 95 per cent. of the rocks composing the island are altered Triassic volcanics and sedimentaries with some small isolated remnants of Cretaceous and Tertiary sediments. A few small patches of batholithic rocks are exposed on the east coast. The underlying batholith apparently dips west at a comparatively steep angle on this westerly contact margin, in contrast to the gently undulating dip on the eastern contact margin. This is a factor of importance, indicating that surface ore-exposures are comparatively high up in the zone of mineralizing influence emanating from the underlying batholith, with a possible tendency for improvement in grade in a lower horizon.* In the exploration of an occurrence like the *Swede*, near Lockeport, this factor might be profitably considered. On Moresby island is the most extensive western contact marginal area occurring in the district. Its copper-bearing potentiality is well worth intensive investigation.

During 1929 the usual assessments have been carried out on several properties. A greater interest has been evinced in the territory by examining engineers during the year. Properties in the Ikeda Bay, Jedway Harbour, and Huston Inlet areas have received detailed attention from engineers representing prominent mining corporations. Although nothing definite has yet materialized in the matter of exploratory operations by these companies, the interest displayed is a promising augury. Property-owners should take advantage of this growing revival of interest in the area by co-operating with stable operating companies in the matter of fair and equitable terms as an inducement to hasten exploration and development of a promising but long-dormant area. With the interest of operating companies aroused, the onus of a revival of mining activity in the area, and the possible development of permanent and profitable operations, rests primarily with the property-owners.

The attention of examining engineers is drawn to this group as a potential **Swede.** large tonnage low-grade copper-ore occurrence worthy of intensive investigation. This group, originally consisting of eight claims, is situated on Klunkwoi bay, about 1 mile south of Lockeport, on the east coast of Moresby island. The property is owned by Alex. Rogers and partners, of Lockeport.

The ore occurrence is chalcopyrite in an altered complex of amygdaloidal diabase with which is associated a fine-grained hornblende diorite. The pea-size amygdules in the diabase are composed of epidote and calcite. Chalcopyrite occurs as nucleus kernels or encircling rings in

* W. H. Emmons: Primary Downward Changes in Ore Deposits. Trans. Amer. Inst. Min. Met. Eng., Vol. LXXV., 1924, page 964.

the epidote amydules, from which fine veinlets radiate in all directions. The mineralization is comparatively sparse, but is widespread and in places shows a tendency to segregation aggregates of higher grade than the general ore tenor. In places bornite occurs in irregular veinlets of $\frac{1}{4}$ to $\frac{1}{2}$ inch width.

A zone-width of from 300 to 400 feet is indicated, with an indicated length covering the breadth of "Swede peninsula," a horizontal distance of about 2,000 feet. The zone appears to carry low-grade chalcopyrite mineralization throughout. The general copper content is about 0.6 per cent., in which are sections of concentration of from 1 to 2 per cent. copper. It is probable that the zone extends southerly to the other side of the bay, where a similarly mineralized formation is exposed. There is also a probability of parallel zones, as copper mineralization can be picked up lateral to the described zone. The zone has been explored by surface cuts and two tunnels about 200 and 90 feet long. With the exception of three small barren cross-dykes, these tunnels are mineralized throughout their length in the manner described. Samples of bornite ore from the "Bornite" tunnel showed values in platinum and palladium.

Although the ore is admittedly low grade, the extent of the mineralized zone, the fact that concentrations of higher grade than the general tenor do occur, coupled with the decided probability that the exposed ore occupies a horizon high above the underlying associated batholith, indicates that the occurrence warrants more intensive exploration than it has received. Diamond-drilling of this property is certainly warranted. The property is ideally situated on seaboard, with an appreciable water-power contiguous to the claims.

Following is the report by Herbert Carmichael on mineral properties in this Division:—

QUEEN CHARLOTTE ISLANDS.

REPORT BY HERBERT CARMICHAEL.

MORESBY ISLAND.

Introduction.

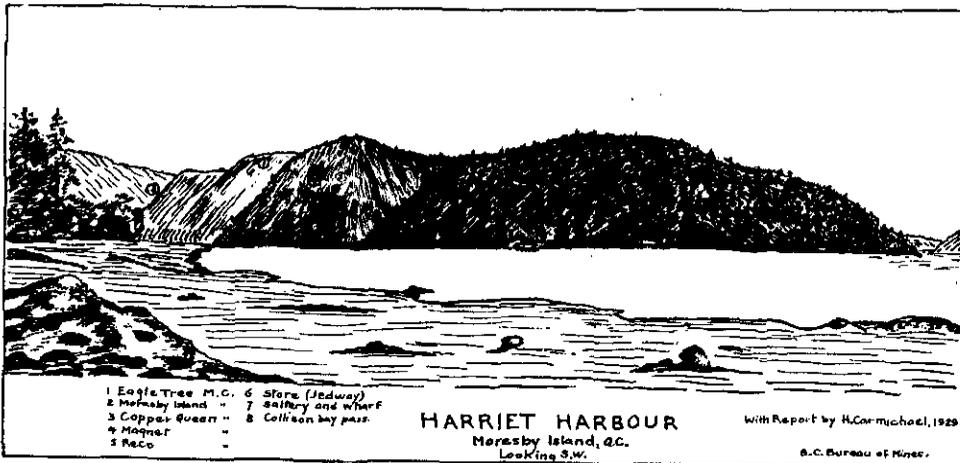
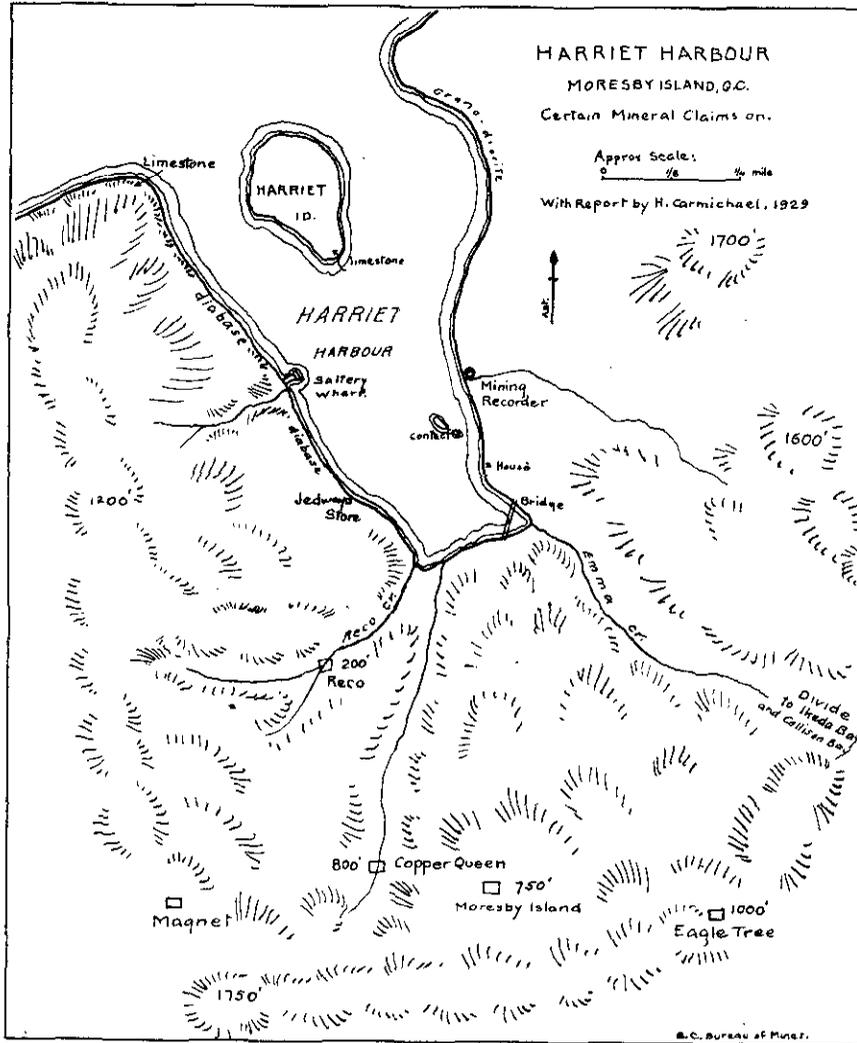
In the time at my disposal on Queen Charlotte islands I have largely confined myself to reporting on new discoveries or claims on which some work had been done since the last report of the Resident Engineer. There are, however, a number of claims which were not visited, but on which a small amount of work has been done; this work, I am told, has considerably improved the appearance of some of the properties.

Harriet harbour is on the south side of Skincuttle inlet, south-east coast of Moresby island, and is a convenient centre from which to visit any of the mineral properties in that district. Jedway is the Indian name for this bay and is used to designate the saltery and collection of houses situated on the south side of the harbour.

The accompanying plane-table survey will give a better indication of the locality than any written description. Geologically, the area seems a good one in which ore-deposits may be expected. It is at or near the contact of the Coast batholith and the older rocks of what Dawson called the Vancouver series; in fact, the contact may run the length of Harriet harbour, as where exposed. Granodiorite rocks form the eastern shore, while hornblende andesite occurs on the western. Interbedded with these latter volcanics, limestone is found on Harriet island at the mouth of the harbour. On the western headland the volcanics are overlain with limestone and both have been cut through by rhyolite dykes, striking north and south and dipping nearly vertically. The weathering of the limestone has left these dykes 4 or 5 feet above the surrounding ground.

It is probable that Moresby island has been subject to volcanic action or earth-movement in comparatively recent geological times. There have been numerous hot springs as evidenced by the siliceous veins and agates to be found everywhere, and one active spring is at work on Hot Spring Island, 21 miles north-west. On a former visit I found this spring had a considerable flow of water at a temperature of 200° F., but an earthquake of some violence occurred on May 26th, when the spring entirely dried up. I have since been told that it has started to flow again.

There are several small houses and shacks around the harbour in which shelter can be found, and I. Thompson, the Mining Recorder at Jedway, will be pleased to direct and assist visiting engineers. Hills rise rapidly from all sides of the harbour and trails go to the principal claims.



The ore-deposits in this section appear to be all of the same character—namely, massive deposits of magnetite which have the appearance of vein-dykes, but are probably replacements of limestone-beds. The deposit on the *Moresby Island* claim is rather different, there being hardly any magnetite, and chalcopyrite is more evenly disseminated through the mass.

Harriet Harbour.

McMillin. This property, consisting of several groups and claims in the vicinity of Harriet harbour, is owned by J. S. McMillin, of Seattle, Wash. The properties include the *Reco*, *Modock*, *Sandwich Fraction*, *Copper Queen*, *Magnet*, *Moresby Island*, and *Eagle Tree*. The showings on the *Reco* are reached by a trail from the head of Harriet harbour at about a quarter of a mile from the shore and an altitude of 200 feet. Here there is a deposit of magnetite, probably a replacement of limestone impregnated with pyrite, pyrrhotite, and chalcopyrite, having an average of from 1 to 2 per cent. copper; the dip is 30° to the north and striking east and west (mag.). An incline shaft has been sunk on the dip of the deposit, but the bottom was full of water. A little surface work has been done, but not enough to determine the width of the vein, but it would be at least 8 or 10 feet.

The *Modock* adjoins the *Reco* to the north. On the mountain-side a stream cuts through some dark igneous rocks which include a mineralized area 50 feet long by 12 feet wide. The magnetite carries about 2 per cent. copper as chalcopyrite, but not enough work has been done to form any estimate of the quantity of the ore.

Following the trail up the mountain, the *Sandwich Fraction* is crossed, on which no work has been done. The *Copper Queen* claim adjoins the *Sandwich Fraction* farther up the hill.

The old camp is half a mile back from the beach and is 800 feet above it. Seventy-five feet above the camp there is a well-defined deposit of magnetite dipping 30° to the north and striking east and west. A drift has been run on the strike of the deposit westerly a distance of 30 feet, showing the same character of ore all the way to the face. The foot-wall is well defined, but no crosscut has been run to the hanging-wall and the average width would be about 12 feet. The deposit has been cut by a small creek and a rock-slide and shows again on the east side of the creek. The wall-rock is granodiorite. From the look of the dump I would say it would run 5 to 10 per cent. copper. There are a number of fair-sized pieces of solid chalcopyrite on the dump, but it would require a detailed examination to say how much of this class of ore there was in the average run. At 150 feet below this showing a crosscut tunnel has been run in 375 feet, but did not strike the ore.

The centre of the *Magnet* claim is some 1,500 feet west of the *Copper Queen*, on what is known as Magnet mountain, altitude 1,400 feet. There are a number of shallow trenches and surface-stripping disclosing a body of magnetite 300 to 400 feet long by 70 to 100 feet wide, into which a short tunnel has been driven. At one point underneath the magnetite, chalcopyrite is seen, and this might prove to be more extensive under further development.

The *Moresby Island* claim lies some 1,500 feet east of the *Copper Queen* and a little lower in altitude. Here there is a surface ore-showing of considerable size which is probably a contact with or replacement of limestone. So far the work done has been entirely on the surface, consisting of open-cuts and pop-shot holes, but the ground lends itself to this work as there is very little overburden. The work shows an impregnation of garnetite rock with copper pyrites fairly evenly disseminated all through; though some places go better than others, an average would be from 1 to 2.5 per cent. copper. So far the surface work shows the mineralization to have a width of 250 feet by 300 feet long, but it may be both wider and longer than this when further work has been done. Twenty feet down the hillside a short open-cut discloses the same mineralization as seen above, proving that the ore-body extends to that depth, at least on the surface. No further work to prove depth has been done.

The *Eagle Tree* property lies to the south-east of the *Moresby Island* claim and at an altitude of a little over 1,000 feet, where there is a well-defined deposit of magnetite which has been stripped for 400 feet by open-cuts and has a width of from 2 to 12 feet. The magnetic iron carries an average of about 4 per cent. copper as chalcopyrite, but in places it runs double this amount. A crosscut tunnel lower down the hill has been run in 200 feet, but it is estimated that it has still 85 feet to go before striking the vein.

Huston Inlet.

The entrance to Huston inlet is 2 miles south-west from Harriet harbour. The inlet is 1 mile wide by 3 miles long and at the head there appears to be a pass leading to Carpenter bay and Rose harbour to the south. At the south-east end of the inlet is a bay into which a small stream discharges, where there is a salmon-saltery owned by Japanese. From this bay a trail runs to Collison bay, on the east coast, a distance of 3 miles and a direction of N. 55° E. (mag.). For the first 1½ miles the trail rises 150 feet to the mile, then rises more abruptly to about 550 feet, and then falls off to Collison bay.

Enterprise. To reach this group the Collison Bay trail is followed for 1½ miles, then the ore-showing is about 300 yards south of the trail and at an altitude of 550 feet.

The owners of the claim are Eustace Smith and others, of Vancouver. At this point there is a felsitic dyke 8 to 10 feet wide, with specks of copper pyrites fairly evenly disseminated through it, probably giving an average of 2 to 3 per cent. copper; not enough work has been done to determine definitely the strike or dip or even the size of this dyke and it may be wider than given above. Some 20 feet lower down the steep hill there is another open-cut which shows the dyke, but here it is not so well mineralized as up above. The wall-rock is granodiorite.

Houston. This claim, owned by A. J. Wilds and partners, of Jedway, is a quarter of a mile south of the Collison Bay trail and about 1½ miles from the beach, on a steep mountain-side having a slope of 36°. There is a massive outcrop of magnetite which is probably a replacement of limestone, now showing garnetite and carrying chalcopyrite. This deposit has a southerly strike and stands nearly vertically; at an altitude of 550 feet a small creek has exposed the ore-body, which has an approximate width of 150 feet, with pyrrhotite and chalcopyrite disseminated through it. On the surface it is black and appears to be entirely composed of magnetite, but on breaking through the surface a considerable percentage of pyrrhotite and chalcopyrite is found. To sample this large body properly would require more time than I could give to it on this trip, but I would judge that the average copper content would be from 1 to 3 per cent.

One hundred feet above this lower showing the deposit outcrops again, showing its massive structure and mineralized in the same manner as seen below. A tunnel has been driven a short distance on this showing, crosscutting the deposit.

These claims, owned by A. J. Wild and partners, are on the north side of **Hope Nos. 1 and 2.** Collison Bay trail, but not quite so far inland as the *Houston* group; they are 200 yards north of the main trail and about 1¼ miles from the beach. At an altitude of 275 feet on the *Hope No. 1* there is a massive showing of magnetite similar to that seen on the *Houston* claim. The deposit is some 30 feet wide, impregnated with pyrrhotite and chalcopyrite; owing to local attraction the compass is unreliable, but the strike is northeasterly and the dip nearly vertical.

The work consists of an open-cut and some stripping, and with this limited work, considering the size of the showing, it is difficult to judge the copper content. In some places there is solid chalcopyrite; then farther along it gives place to sparsely disseminated specks of copper pyrites, but it may range from 1 to 5 per cent. The country-rock is granodiorite.

Hope No. 2 adjoins *Hope No. 1*, and at 50 feet below the *Hope No. 1* vein and 200 feet or so to the east there is another massive deposit of magnetite. This has been prospected by some open-cut work and stripping, showing the vein to be 20 to 25 feet wide, but not carrying the same amount of copper as *Hope No. 1*. I do not believe it will run over 1 per cent. copper. The wall-rock is granodiorite.

The peculiarity of this section of the country are these massive magnetite-deposits occurring in a fairly siliceous country-rock. The magnetic-iron outcrops on Vancouver island have not the form and regularity of these veins, and, moreover, carry little, if any, copper, with the possible exception of the *Indian Chief* at Sidney inlet, where the copper occurs as bornite.

Dictator.—This claim is on the east shore of the inlet, about a quarter of a mile north of the saltery. There is an amygdaloidal andesite in contact with a much-altered limestone. A few shots have been put into this rock, showing a copper-stain, but no values.

Ajax No. 1.—This property is also on the east side of Huston inlet near the entrance. There is a fissured zone about 4 feet wide in an amygdaloidal andesite. Where there is some limestone not much altered, this zone is stained with copper, but does not carry any commercial values.

The weather was too rough to make the trip outside to Collison bay, but the following information was given to me by the Mining Recorder:—

No work has been done on the *Thunder* group at Collison bay recently; refer to the report by Geo. A. Clothier in the 1918 Annual Report.

The *Violet* claim joins the *Thunder* group on the north-east and is owned by I. Thompson, Jedway. The property has a vein-dyke of diabase slightly amygdaloidal, carrying copper in small stringers and bunches. A crosscut tunnel 25 feet below the showing cuts it, giving a width to the vein of 7½ feet, averaging 2½ per cent. copper as chalcopyrite and showing a lime hanging-wall and a diorite foot-wall. The vein has been stripped for 200 feet. There is another vein of quartz farther up the hill, carrying 2½ per cent. copper as bornite; little work has been done on this.

BLACK-SAND DEPOSITS OF GRAHAM ISLAND.

The Queen Charlotte group of islands lies in the Pacific ocean, the southern point being 140 miles north-west of Vancouver island and the north-eastern point is 60 miles west of Prince Rupert. Graham is the largest northerly island and Moresby, the southern. The east and north shore of Graham island is low-lying and has beaches which extend for miles. The western shore is bold, with few beaches, and the southern islands are practically devoid of the low-level shores seen on Graham island.

Numerous reports have been received by the Department of Mines of gold- and platinum-bearing black sands on Queen Charlotte islands, and recently a machine was mentioned as having been more successful in the recovery of the precious metals than some of the former appliances. I started my examination of these deposits with a considerable amount of scepticism as to a favourable report, as I had previously been over the black sands of Vancouver island and had investigated a number of black-sand gold-saving machines. The machines were often in the hands of persons who had only a vague knowledge of what the machines were supposed to do and were occasionally mere toys; in other cases they were no doubt designed to extract gold from an unsophisticated public.

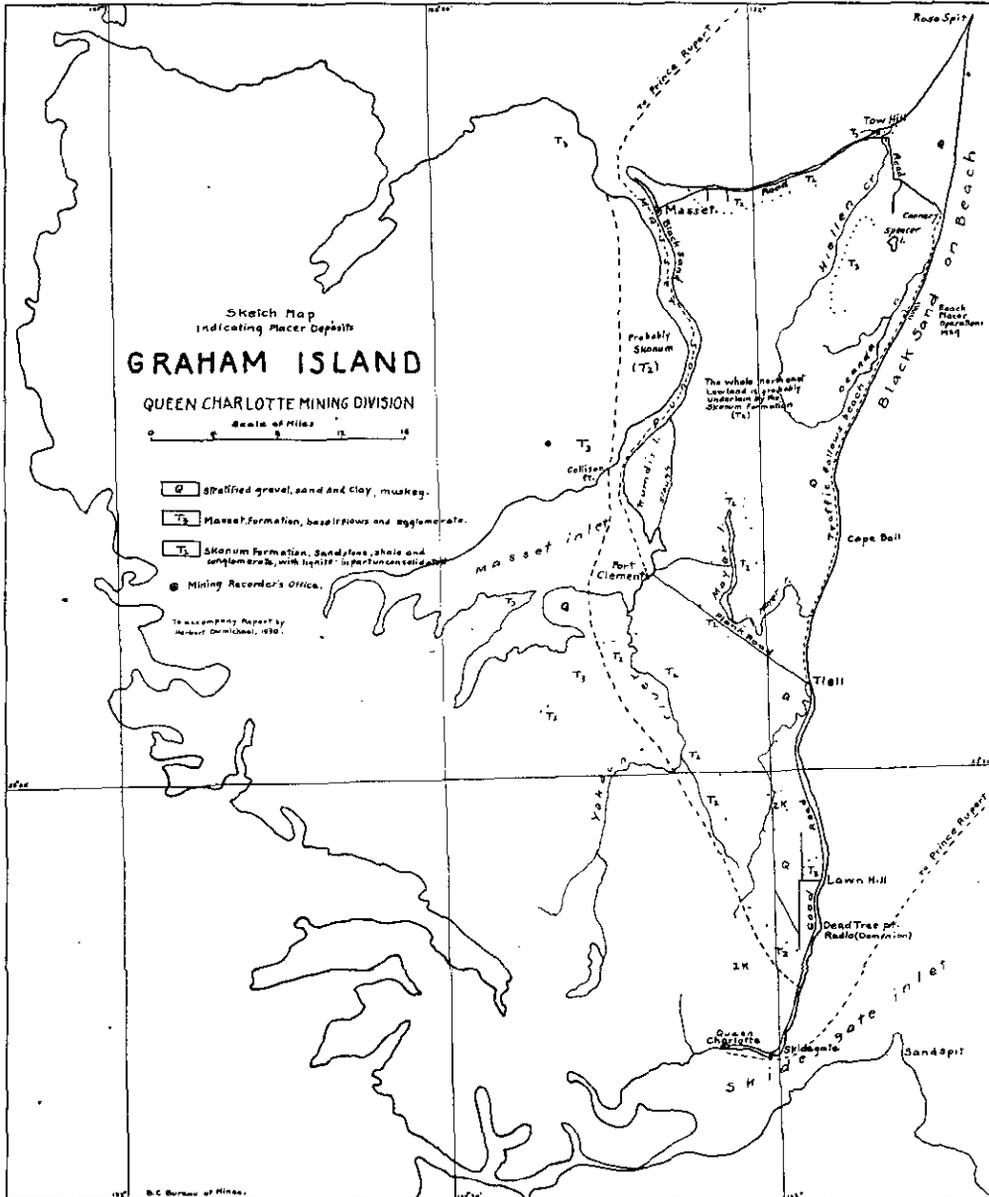
When I investigated the Graham Island deposits I was forced to change my views both as to the deposits and the machine used for saving the gold. The black-sand deposits are much more extensive than any I have seen on Vancouver island. It is probable that they cover all that part of Graham island on which glacial drift has been deposited to any extent; this approximates an area of 800 square miles.

It is unlikely that all this area will contain black sands that will pay to work, but there may be places where the sands might be so concentrated that they will pay, depending on the size of the undertaking and the area of sands that will be remunerative for such undertaking. There are places where the sands have been so concentrated by present-day streams that they have paid fairly good wages with a line of sluice-boxes and the most primitive method of moving the sand with shovels. Such areas are of limited extent and number. There are other less concentrated areas, but of much greater extent, which would probably support a larger undertaking in which the gravel would be entirely handled by mechanical power; this will be referred to later. The black sands carry both gold and the platinum group of metals. This has been proved by many assays made on samples from widely separated districts.

The origin of this gold and platinum is still a matter for speculation; it has been suggested that it came from quartz veins that existed on Graham island and that had been eroded. It seems, however, much more likely that the precious metals were carried by glaciers from farther north and deposited with glacial drift which forms the major portion of the eastern side of Graham island. South-eastern Alaska is known to contain many quartz veins carrying values in both platinum and gold, and it is more than likely that these were eroded by glacial action and millions of tons carried down and deposited on Graham island and the surrounding coast.

It is probable that these black sands have become concentrated by three different methods. First, by the action of glacial rivers when the sands were first laid down; the tendency of these rivers would be for a moderate concentration over a considerable area. Secondly, by wave-action; there is evidence that this has extended for a considerable distance beyond the present shore-line, probably by the elevation of the shore above the present high-water level. This is evidenced in test-pits which have been sunk 100 feet or more back from the beach at Masset inlet. The level of the ground where these pits have been dug is 15 to 20 feet above present

high-water level; they have been sunk to a depth of 8 or 9 feet and clearly show bands of black sands from 1 to 12 inches thick and have every appearance of wave concentration; there are layers of black sand with siliceous sand in between. There are large trees on this ground which must be 500 or 600 years old. Thirdly, there is the concentration of present-day streams which cut through these sands; none of these streams are rapid and the area concentrated is therefore not great.



NOTE.—Area to east of broken line probably contains deposits of black sand.

The only work now being done on the black sands is on the beach of the east coast of Graham Island by the Queen Charlotte Syndicate, of Vancouver. The workings are reached by motor-road from Masett to Tow Hill, a distance of 15 miles, thence by wagon-road to the east coast, a distance of 7 or 8 miles; this road is barely passable owing to the boggy nature of the ground. From the end of this road the beach has to be traversed, and, as the sand is not

particularly hard, the going is heavy and also it can only be done with comfort at low tide; this distance is 9 miles. If the operations are successful a road can be put in from Watun river, which would shorten the entire distance to 13 miles.

This point on the beach was selected on account of the concentration of the sands by a small stream known as Martell creek, where the high bank of the beach has been cut through by the stream. On reaching the beach all these streams meander about, first taking one channel and then another, thus making the area concentrated greater than would at first be expected; this is further aided by wave-action.

The bank above high water is about 25 feet high, composed of sand, with 4 feet of peat on the top; farther south this peat has in places a layer of 10 feet of sand on the top of it which has been blown in by the fierce gales from the south-east up Hecate strait. This sand-bank lies unconformably on clay and cemented gravel-beds, some of the clay-beds being quite thick; one measured 225 feet. They have a dip of 15° to the north, striking east and west. The cemented layers of ferruginous gravel are only a foot or two thick and lie both above and below the clay-beds. The clay-beds hold numerous shells, described by Dr. Dawson as *Leda fossa*.

The upper layers of sand near Martell creek are concentrated so that they contain 50 per cent. black sand and colours of gold can be found at any point by panning. The management states that values as high as \$11 to the cubic yard have been obtained. The writer panned the black sands of this creek in a number of places and got colours in nearly every pan. As nearly an average as possible was taken of the same sands amounting to about 5 lb.; this was carefully quartered in the assay office, but the resulting assay did not show any of the precious metals, though four half assay tons were put through. I am of the opinion that ordinary quartering cannot be relied on for this material, but that several pounds must be concentrated and the whole of the concentrate run down and the resulting metals calculated back to the amount of sand taken.

The concentrating action of the waves is curious. Hecate strait is subject to violent south-easterly gales which beat upon the eastern shore, driving northward. In fact, it is undoubtedly this action which has formed Rose spit (or Nai Koon, being the Indian name, meaning long nose). This promontory extends for miles out to sea. After a gale the entire aspect of the beach may be changed. What before showed black sand may be covered by a foot of white sand or the white sand may be removed, leaving the black sand. One striking peculiarity is that the black sand does not of necessity lie on any particularly impervious bed such as the clay or ferruginous gravel referred to, but may lie in a layer of distinct concentration on the top of white sand, mixing very little with it.

These concentrated layers may be from an inch to several feet thick; this variation in thickness and changes of location of the black sands is one of the factors which has to be taken into consideration in turning any black-sand venture into a profitable enterprise. Where concentration is great, such as at Martell creek, expensive methods of handling the sands may pay, but there are other places where it would not, but which might be quite attractive if worked on a larger scale.

The Queen Charlotte Syndicate proposes saving all the precious metals by the Hanssen precious-metal separator. This machine, the basic principle of which has been patented, is controlled by the Hanssen Positive Separation Mining Company, Limited. The Hanssen separator, operated by the Queen Charlotte Syndicate, is a simple but ingenious application of centrifugal force, particularly well adapted for separating the very fine gold or flour-gold and platinum from the dirt or heavy black-sand concentrates found on the east coast of Graham island.

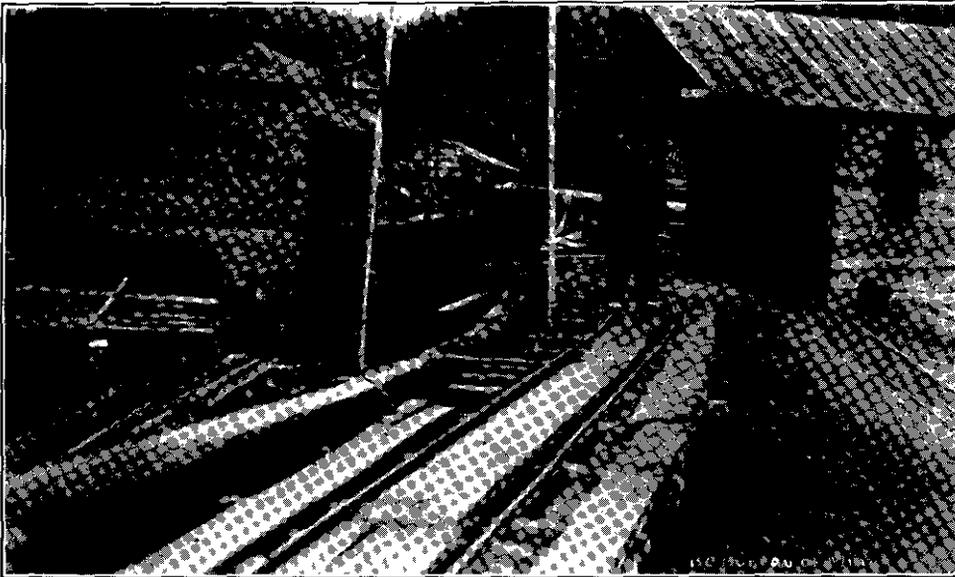
The machine consists of a bowl mounted in a casing, the bowl rotating at any desired speed. In the operation of the machine mercury is placed in the bottom of the bowl. When the machine is rotated the mercury will be caused by centrifugal force to flow upwardly along the inner wall until it forms a cylindrical wall or lining on the inside of the bowl. The auriferous and platiniferous sands are then fed into the feed-pipe with water. Special devices direct the pulp from the bottom outwards and upwards, and also give it an angular velocity equal to that of the bowl, causing it to travel upwards at a predetermined speed (depending on the nature of the feed) in a thin layer over the mercury. As soon as the gold- and platinum-bearing material is subjected to the action of the centrifugal force a separation of this material begins, the heavier particles moving to the outside.

In order to accelerate the separation of the heavy particles of metal from the other heavy particles (as magnetite, garnet, etc.) the pulp is kept agitated by special appliances, and the



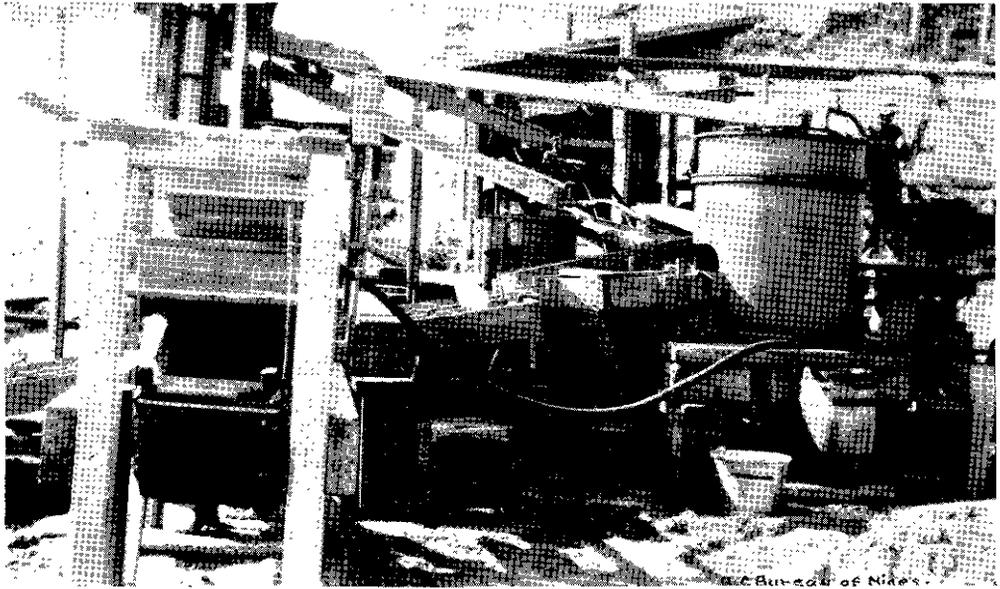
U.S. BUREAU OF MINES

Marmot Creek Wharf, Portland Canal.



U.S. BUREAU OF MINES

Ruby Creek Placers, Athol, M.D.



Graham Island—Black-sand Gold-saving Machine.



Graham Island—Black-sand Placers.

gold and platinum, having greater specific gravity than the mercury, will penetrate and remain in the mercury. In the case of clean gold it is quickly amalgamated thereby. Platinum and rusty or greasy gold will be retained against the wall of the bowl until the machine is brought to rest. The sand, being lighter than mercury, will pass over the surface and out of the bowl.

This machine had only been installed two days before my arrival and was given a test while I was there; it seemed to work perfectly, but it is still too untried to pronounce it an unqualified success. My fear is that it may not have the capacity for a large operation, but this might be overcome in two ways, either by multiplying the number of machines or by first concentrating the sand by jigging.

Provided careful prospecting showed that there was a sufficient body of payable sand, the following plan would seem to lend itself to a large operation: Suitable ground having been found, the centre of this would be chosen for the gold-saving plant. A portable tramway with light cars would be run out to one side; these cars to be filled by a gasoline or electric small shovel and hauled to the plant by rope, carried up an incline, and dumped into a bin. From the bin the sand and gravel would pass to trommels, which would screen out all over 40-mesh as being of no value; the trommels or screens would deliver to a Hancock jig, which for this class of work should have a capacity of 400 tons a day. The concentrates from the jig would pass to the Hanssen machine, where the values would be saved. Such a plant would allow of a large daily tonnage being put through, thus very much reducing the values at which it would pay to handle the sand. Further, the plant would be of such a nature that it could easily be moved from place to place where the values proved profitable.

If carefully thought out, both as to method of working and finance, I see no reason why some of the black-sand deposits of Graham island should not turn out to be paying ventures and hold good for a number of years, but it should be clearly understood that such undertaking must be approached with caution under expert advice and a thorough sampling of the ground made before any expense is incurred for machinery.

Taking a number of samples here and there over a deposit and getting them assayed in the way that would be done on a lode mine will, in my opinion, give results which may be entirely erroneous, either too high or unduly low. The method that suggests itself would be to take a small self-contained Hanssen separator on to the ground and run through it a definite yardage of sand from representative sections of the ground, then retorting the mercury and weighing the resulting precious metals and calculating the yield.

Black Sand on Masset Inlet.

Peter Kay has a black-sand claim about 1 mile south of Masset wharf. The bank is 15 or 20 feet above high tide and some 50 feet back amongst the timber. Several test-pits have been sunk 8 or 9 feet deep, showing layers of black sand from 1 to 12 inches thick; a sample of concentrates from this claim gave 0.6 oz. gold and 2 oz. platinum to the ton, but a general sample on assay gave no values. The southern end of the claim is cut by a small stream which has concentrated the sand; here two men were able to make good wages with a sluice-box, shovelling in the sand and pumping the water from the stream. Colours of gold can be got nearly anywhere by panning and some of the colours are a fair weight, by no means what is known as fine gold. This property is over 15 miles from where the other black-sand deposit is being worked and will serve to show the wide distribution of the values.

BELLA COOLA MINING DIVISION.

During 1929 this area has been comparatively inactive. The usual assessment was carried out on sixteen claims only. The Division was also neglected by prospectors; less than thirty claims, some of which were relocations, were recorded. The cursory prospecting that has been carried out in this region in the past by hunters and trappers has disclosed evidence of mineralization, probably sufficient to warrant more intensive exploration. There are sections of the Division that are geologically favourable for commercial mineral occurrences.

The eastern margin of the batholith-contact cuts through the interior region of the Bella Coola valley, about 20 miles inland, and offers a likely section for prospecting. Several inclusion zones within the granitic rocks of the batholith on Dean and Burke channels deserve more than the superficial shore prospecting they have received. The interior regions of these localities are admittedly rugged and rough, but their favourable aspects warrant the effort of intensive prospecting.

Residual clays occur in many localities along the indented shore-line of the Division. Thermal springs are known to occur in the coastal area and are frequently visited by local residents and settlers. It would seem that one or two of these offer an opportunity for exploitation as spa resorts and for the development of an industry in bottled products. The flow from individual springs is not very great, but in most cases is sufficient for even large-scale bathing establishments, particularly that in Eucott bay and possibly those in South Bentinck arm. These springs occur adjacent to the shore and flow from fissures in the batholithic quartz diorite. For a detailed description of these springs readers are referred to Summary Report, 1921, Part A, Geological Survey of Canada. The following is a brief description of the Eucott Bay thermal spring:—

Eucott Bay Thermal Spring. This spring is situated on the northerly shore of a very picturesque and practically landlocked bay on the west side of Dean channel, opposite Labouchere channel. A flat grassy fringe suitable for building-space surrounds the circular shores of the bay. Excellent sea and creek fishing, also good hunting, is procurable in the area. Several appreciable sources of water-power occur in the neighbourhood. That of Nascall harbour, about 3 miles north of Eucott bay, is estimated at 35,000 horse-power.

The spring issues from a fissure in a steep cliff of diorite about 200 feet from the shore and about 15 feet above high tide. The temperature of the water, without preliminary cooling, is too hot for bathing and is probably above 112° F. The salinity of the spring is not high, the main mineral salts contained being calcium sulphate and calcium bicarbonate. The following analysis of the Eucott Bay thermal spring is quoted from the Geological Survey Report:—

ANALYSIS.

Constituents.	Parts per Million.	Total Inorganic Matter in Solution.	Reacting Value.
		Per Cent.	Per Cent.
Carbonic acid (CO ₂).....	.....	.....	.....
Bicarbonic acid (HCO ₃).....	33.0	17.2	11.1
Sulphuric acid (SO ₄).....	80.0	41.8	34.4
Chlorine (Cl).....	8.0	4.5	4.5
Sodium (Na).....	16.0	8.3	14.1
Potassium (K).....	.....	.....	.....
Calcium (Ca).....	35.0	18.2	35.9
Magnesium (Mg).....	Trace	.....	.....
Iron oxide and alumina.....	3.0	1.5	.....
Silica (SiO ₂).....	16.9	8.7	.....
Total.....	191.9	.....	.....
Total solids in solution, residue dried at 110° C.....	145	.....	.....

To establish a complete estimate of the therapeutic value of this spring the water should be tested for radioactivity and the presence of lithium, barium, strontium, and iodine.

SKEENA MINING DIVISION.

The Skeena Mining Division extends from the entrance of Portland canal in the north to Milbanke sound in the south, and from the centre of Hecate strait on the west to the crest of the Coast range on the east. The Division is about 22,000 square miles in area. With the exception of a narrow strip along the Kitsungallum and Lakelse valleys in the north-east corner, which is on the disturbed fringe of the eastern contact margin, the Division is embraced by the central (batholith-pendant-inclusion area) portion of the batholith cross-section. Within its confines consequently falls the largest area of batholithic rocks and also the largest aggregate of inclusion and pendant area in the North-western District. When this feature is carried in mind the mineral occurrences and their characteristics can be more readily understood.

COAST SECTION.

Activity in the Coast section has shown a decided increase during 1929. Prospecting is gradually becoming more intensive and prospectors are displaying a greater interest in opening

up their showings. Examining engineers are displaying a keener inclination to pick up promising prospects in this area and have been quite active in the section during the year. Energetic development-work has been conducted on the old *Drum Lummon* by the Los Angeles-Vancouver Mines, Limited, and on the *Surf Point*, Porcher island, by the Timmins interests.

This property has usually been referred to as the Moulton property, but is known locally as the *Hidden Lake*. The claims of one group of owners are divided by a centrally staked claim known as the *Hidden Lake*, owned by W. H. Moulton, of Swanson Bay. Adjoining the *Hidden Lake* on the north are the *Black Bear* and *Grey Wolf*, and adjoining it on the south are the *Big Deer* and *Black Wolf*, owned by E. S. Tait and H. S. Ward, of Prince Rupert.

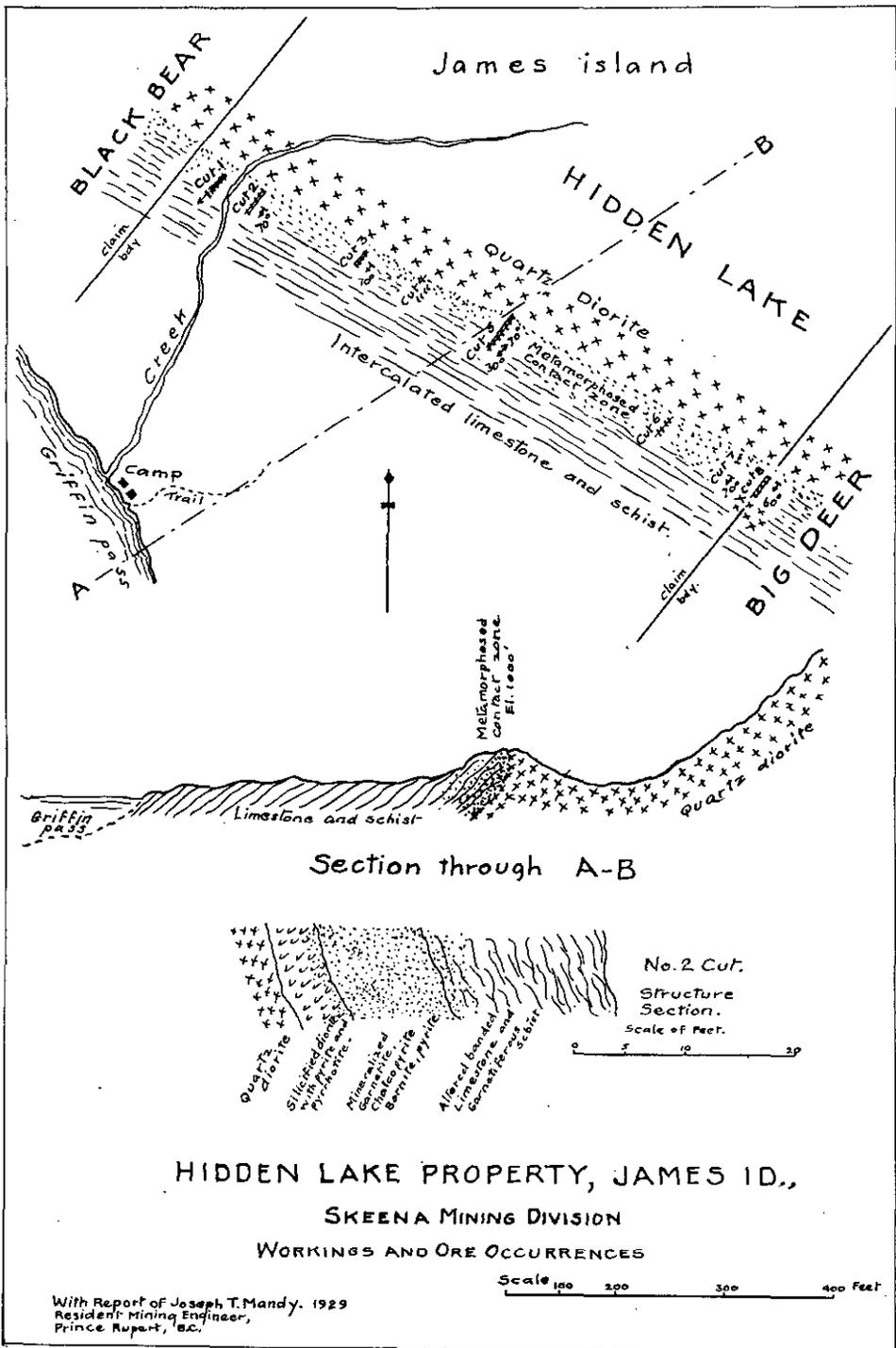
The property is situated on James island, on Griffin pass, between Mathieson channel and Sheep pass. Griffin pass is a narrow and shallow channel between James and Roderick islands and is composed of a series of four broads or salt lakes connected by three restricted and reefy narrows, through which the tide rushes with great force. The property can be reached from both ends of the pass, but the approach from the north end is unsafe for gas-boats, and it is advisable to anchor before the first rapids and complete the journey in a rowboat at slack or with a favourable tide.

The ore-showings are about 1,000 feet east of the beach in an inclusion of altered intercalated limestone and schist in contact with quartz diorite. The zone in which the mineralization occurs occupies a well-defined hogsback that rises up from the beach to 100 feet elevation, beyond which the diorite mountain-sides slope abruptly to 1,000 feet altitude. The mineralization consists of chalcopyrite, pyrite, some bornite, and an occasional speck of molybdenite, occurring in a gangue of garnetite, banded limestone, and epidote. The ore is best developed where the most complete alteration to garnetite has occurred and in association with stringers and patches of quartz. The mineralization of chalcopyrite and pyrite occurs in veinlets and also disseminated throughout the gangue. The ore-zone strikes N. 60° W. and dips 60° south. Quartz diorite occupies the foot-wall. On the hanging-wall the zone grades into banded limestone and garnetiferous schist carrying sparser mineralization. The occurrence is a typical contact-metamorphic deposit. The decided regularity of the contact is, however, a marked feature of the occurrence.

On the *Hidden Lake* the zone has been traced by eight open-cuts for about 1,100 feet. In the two most northerly cuts in the banks of a creek a width of 9 feet of even mineralization is exposed. A chip sample representative of the ore-exposure 9 feet wide in the face of the cut in the south bank of the creek assayed: Gold, 0.04 oz. to the ton; silver, 0.4 oz. to the ton; copper, 1.6 per cent. The long open-cut at the southerly end of the *Hidden Lake* claim exposes mineralization over a width of about 6.5 feet of a probably better grade than in the creek cuts. In this cut more bornite is evident. In the five intervening shallow cuts mineralization is sparse, with the exception of one near the southerly end, which shows a good development of ore across 3 feet. Heavy overburden covers the continuity of the zone beyond the two described extremes. An exposure of ore on the *Big Deer* is reported to occur on the beach 500 feet southerly of the *Hidden Lake* line. It can be reasonably assumed that the zone continues, both northerly and southerly, beyond the *Hidden Lake* exposures.

During 1928 some work was done on the property by the Granby Company. This exploration has, however, not been conclusive. The property offers every facility for economical operation and is worthy of further exploration. Diamond-drilling could be very conveniently carried out along the base of the hogsback. Besides information regarding mineralization, such diamond-drilling would determine the depth of the delimiting underlying batholithic rocks.

This company was incorporated in August, 1929, for the purpose of operating **Western Canada Graphite Co., Ltd.** graphite-deposits on Mussel and Kynoch inlets. The locality was visited during November, but the claim-holders were unfortunately not then on the ground. Two days were spent in searching the Bear River-Poison Cove area, the valleys of three streams that flow into the head of Lou Kent bay, Mussel inlet, and the area around the north shore and head of Kynoch inlet for the workings. A water-power staking by L. K. Lentz, dated August 16th, was located at the head of Lou Kent bay. Unfortunately, however, no workings could be located and no blazes or trails that might lead to them were found. The deposits are mentioned in the Summary Report, 1921, Part A, Geological Survey of Canada, and are described as disseminated graphite in schist.



The holders of the claims have been advised that on account of the present condition of the graphite market, and the intricate factors that govern the situation, the outlook for profitable graphite production is not bright, and that any operation for mining, milling, and refining of that commodity should not be embarked upon without very cautious deliberation. This does not imply that a profitable graphite operation on the Pacific coast is an impossibility at the present time. But it does indicate that to be profitable all conditions must be right, with the undertaking amply financed and under the direction of operators thoroughly familiar with the intricate factors governing graphite milling, refining, and marketing.

The low cost of the Madagascar and Ceylon production, the chief source of the world's graphite supply, has practically killed the graphite industry in Canada and the United States. The British market is largely supplied by Madagascar.

Originally, the problem confronting the Canadian graphite industry was largely technical. Now, however, with improved methods of concentration solving those technical problems, the success of the industry becomes a question of markets, the overcoming of old prejudices, and the removal of the present channels of supply. At the present time, cheap power, ideal transportation facilities, and a high-grade deposit are only half the battle in the graphite industry. The specifications of the graphite market are very severe. Before embarking on expenditure in connection with graphite production the advice is proffered to be certain, by experiment, of the quality of the product that can be delivered, by careful calculation of the cost of production, and by investigation of the possibility for marketing the product.

Pink Rose. This property was formerly known as the *Bolton* group. It consists of eight claims owned by a syndicate composed of Alex. McLeod, of Butedale, and associates. The property is situated on the north side of Klekane inlet, off Graham reach, and about 1 mile from the head of the inlet. There is a good trail from the cabin on the beach to the upper camp at 1,800 feet elevation. Exploration of the property has been continuously prosecuted by Alex. McLeod.

The ore occurrence is a contact-metamorphic development of chalcocite and bornite in an altered schist-limestone inclusion in quartz diorite. The ore occurs in lenticular aggregations of blebs from pea to walnut size and is best developed where the limestone has been completely altered to garnetite and epidote. The showing has been explored by open-cuts and a tunnel. In the large open-cut a 12-foot width of mineralized zone with about 2 feet of fair-grade ore is exposed. The tunnel at 2,200 feet crosscuts the zone at 65 feet in, from which point a drift is run, showing a similar character to the open-cut exposure.

To the east of this showing several open-cuts have been put in on a possible continuation of the main showing outcropping in a creek-bed. Fair mineralization is exposed in these cuts. The property is conveniently situated for economical operation.

High Tide. Two claims, *High Tide No. 1* and *No. 2*, were staked during the summer of 1929 on the old location of the *Payroll* group by L. W. Patmore, of Prince Rupert. The claims are on the south shore of Kiltuish (Long) inlet, Gardner canal, about 1½ miles from the head of the inlet. The long narrow margin of Kiltuish inlet follows the confines of a low-lying schist inclusion bounded laterally by high ranges of quartz diorite.

The ore-showing is in altered schist at the foot of a small bluff that rises from the shore at high-tide mark. The occurrence is a replacement in altered sedimentaries. An open-cut 12 feet long exposes a silicified zone striking N. 15° W., parallel to the general trend of the formation. The dip of the zone is not clear, but it appears to be practically vertical. Mineralization across 9 feet consists of pyrrhotite, massive in places, with pyrite and some fine disseminated chalcopyrite, in a quartz gangue. A sample across this 9 feet assayed: Gold, trace; silver, trace; copper, 0.2 per cent.

Continuity to the south is obscured by heavy slide material and to the north by the sea. The ore appears to contain better copper values than the assay indicates. This is probably due to an iridescent oxidation filament on some of the pyrrhotite and pyrite. The showing has, however, not been opened up sufficiently to indicate its possibilities. Further work is warranted. Initially this should be in the form of a deep cut diagonally towards the south-west into the face of the bluff.

Kildala and Bolton. These groups at the head of Kildala arm, Douglas channel, are owned by John Bolton and partners, of Kitimat. A good cabin and blacksmith-shed have been built. During the season some further stripping was done on the shore-line showings of the *Kildala*. The few small patches of pyrite with very sparse chalcopyrite exposed in this showing are not of importance.

On the *Bolton No. 2*, about $1\frac{3}{4}$ miles north-east of the *Kildala*, a cut 60 feet long along the east wall of a small creek has exposed veinlets and irregularly scattered bunches of pyrite with some chalcopyrite, in altered sedimentaries heavily garnetized and epidotized in places. A sample across 10 feet of the best mineralization assayed: Gold, trace; silver, trace; copper, trace. Although this showing is apparently low grade, it warrants further work, and the area in general warrants detailed prospecting.

Abruzzi. This group of nine claims, owned by Cesaro Venzazio, Louis Decaire, and associates, of Terrace, is situated on the north-westerly shore of Douglas channel, about 5 miles north-easterly of Old Hartley Bay. The occurrence is a replacement in altered schists in a wide schist inclusion in the batholith. The showing is in a belt 30 feet wide of folded, altered schists exposed on the beach, striking N. 30° W. and dipping 80° south. This schist-zone is very micaceous and garnetiferous in places and also shows marked alteration to chlorite from hornblende and actinolite.

Mineralization consists of a very sparse and spasmodic distribution of chalcopyrite, with an occasional massive development of pyrrhotite patches in the more siliceous parts. A few rare stringers of chalcopyrite $\frac{1}{4}$ to 2 inches wide cut irregularly through the zone. The best development of a possible commercial mineralization seen was 9 inches in width, extending about 10 feet in length.

The zone has been explored by a 12- by 8-foot open-cut and a shallow shaft intended to penetrate the hanging-wall. As this shaft was full of water it could not be examined. Although nothing of importance was exposed in the workings that were examined, as the exposure is evidently near the crest of a fold, the locality is geologically favourable. The occurrence warrants some further exploration.

Decaire. This group of four claims, owned by L. Decaire and associates, of Terrace, is situated about 2 miles south-westerly of the *Abruzzi* and about 2 miles up an unnamed creek. The property was not examined. The owners report the occurrence of a quartz vein 6 to 12 feet wide, mineralized with galena, zinc-blende, and pyrite. The showing has been opened by two small cuts and traced for about 60 feet.

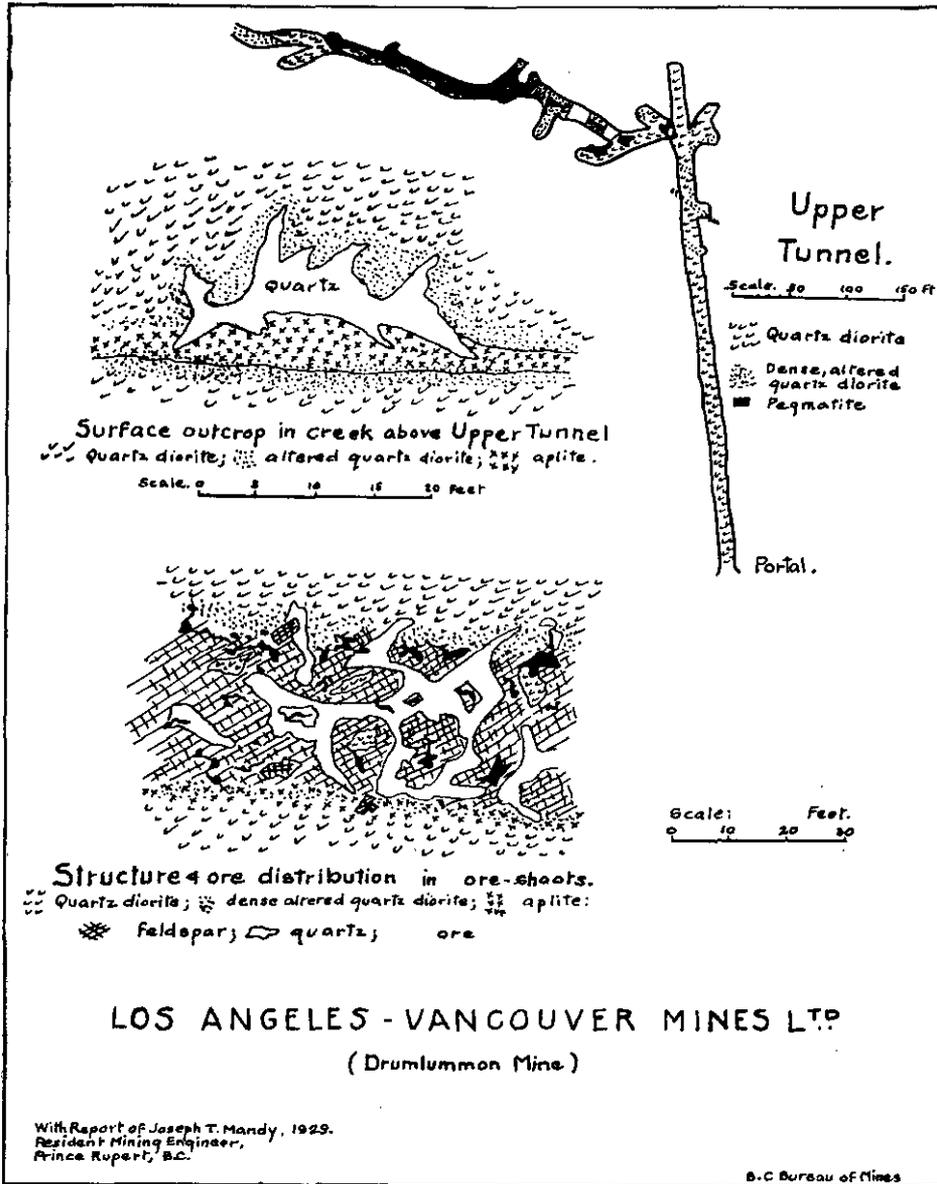
Los Angeles-Vancouver Mines, Ltd. This company is developing the old *Drum Lummon* property on Douglas channel. For a description of the ore occurrence readers are referred to the 1922 Annual Report and to the Geological Survey of Canada Summary Report for 1921, Part A. At elevation 239 feet a 9- by 7-foot crosscut tunnel is being driven to intersect the vein at 236 feet below the upper tunnel. At the time of examination (November 9th) this crosscut had been advanced 1,235 feet and it is calculated that an additional 370 feet should complete the intersection. In the upper tunnel 295 feet of drifting to the west, 20 feet of raising, and 10 feet of crosscutting had also been completed this season.

An incline tramway 600 feet long has also been constructed from elevation 82 feet to the portal of the lower tunnel. This incline is connected with the beach by a narrow-gauge railway 2,800 feet long. Snow-sheds are being constructed over exposed parts of the transportation system to permit of uninterrupted operation during the winter months. The property is well equipped and the operations are being efficiently and economically carried out.

When the vein is intersected by the lower tunnel it is planned to raise through to the upper tunnel, west of an ore shoot that shows in the upper tunnel drift. This will explore any possible westerly rake of this shoot and allow of sectional exploration for this shoot by intermediate drifting east and west. The crew of twenty-five men, continuously employed during the summer, was reduced to sixteen for winter operations.

The upper tunnel-workings at 475 feet elevation consist of a 500-foot crosscut to the vein, which is drifted on to the west, with several short crosscuts, two winzes, and two stopes. The ore exposed in the workings shows erratic and irregular lenticular distribution. Where it does occur it is confined practically entirely to the pegmatite. Where ore bunches are near the walls the quartz diorite is impregnated with sulphides for a couple of inches. The best development

of ore occurs near the walls, apparently favouring the hanging-wall and the more feldspathic portions of the pegmatite rather than the milky-quartz portions. The foot-wall is generally composed of an aplitic dyke. Along both walls the diorite is generally altered into a dense-textured siliceous ground-mass, probably resultant from replacement emanating from the pegmatite.



Mineralization is chiefly chalcocite and covellite, with some bornite and chalcopyrite. Although the mineral distribution is irregular and lenticular, the ore is high grade where it is encountered. The development of tonnage warranting mill-construction is, however, handicapped by the uncertainty and difficulty generally attendant with irregularly lenticular ore-bodies. The present operators recognize the erratic character of ore-distribution. They are, however, assuming the possibility of encountering a more stable ore condition in lenses of appreciable extent with development on the lower horizon.

Mineral Hill. This group of four Crown-granted claims, composed of the *Mineral Hill No. 1*, No. 2, No. 3, and No. 4, is owned by C. E. Moore and W. J. Goodwin, of Kitimat. The property is situated in the Kitimat valley, on Iron mountain, about 10 miles from seaboard at the head of Kitimat arm. The Iron Mountain deposit is described in the Annual Report for 1908. The claims have been further explored by the owners during the 1929 season.

Judging from the owners' description, the ore occurrence is of contact-metamorphic type in a zone of altered limestone and schist in contact with granitic rocks. The mineralized zone, striking N. 35° E. and dipping steeply west, is described as being 300 feet wide, consisting of garnetite and epidote, in which magnetite lenses vary in size up to one of 500 feet in length and 40 feet in width, cut by two or three dykes.

The showings are at from 250 feet to 1,600 feet altitude. On the surface the magnetite does not carry accessory mineralization, but in some of the cuts chalcopyrite and pyrite are well developed. In the summer of 1928 C. E. Moore staked another group of six claims, about 15 miles up the Kitimat valley.

M. & P. This group of four claims is situated on Raley creek, Kitimat valley, and is owned by C. E. Moore and associates, of Kitimat. The property is a relocation of an old group discovered a number of years ago and on which fairly extensive work had been done. The old workings are all caved in, but during the 1929 season the owners started to clean them out.

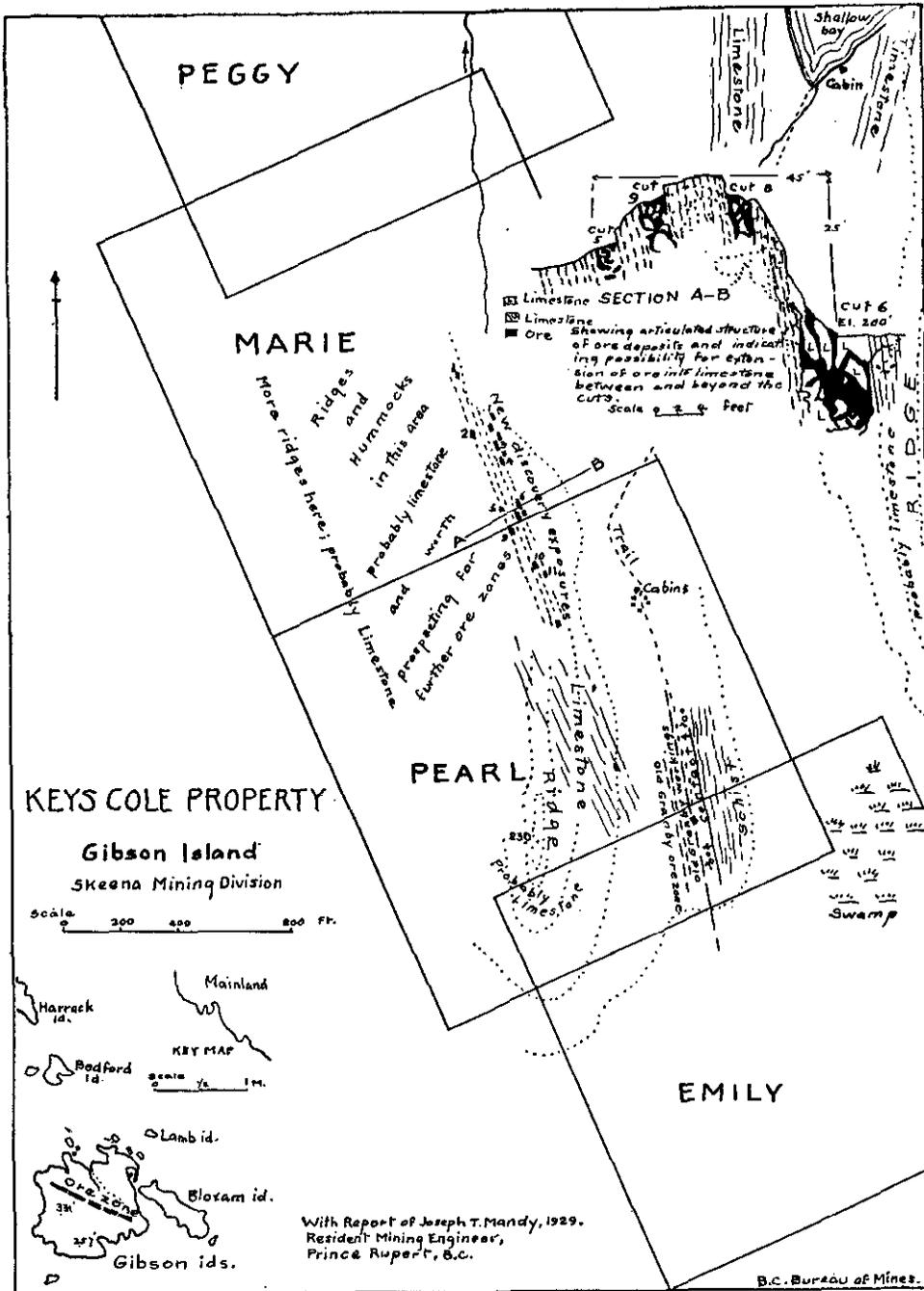
The owners describe the occurrence as a quartz vein of variable width in altered gabbro, traced through two claim-lengths. One ore-shoot of about 300 feet length is reported to have been uncovered, carrying values in gold, silver, and copper. At the ore-shoot the vein appears to be dislocated and pinched. The owners report that a grab sample taken from one of the old tunnel dumps assayed 2 oz. in gold to the ton, with some silver and copper values.

Detroit Western Mining Corporation. The stock of this corporation is held by a few Detroit and Eastern States individuals. The property being explored in this district is the old *Western Copper* group, situated up the Khutze River valley, about 5 miles from the head of Khutze inlet. The ore occurrence is described in the Annual Report for 1928. During the 1929 season a small shipment of ore was made and work continued in the shaft until about the middle of September. At the beginning of November operations closed and only a watchman left in charge. It is reported that machinery originally purchased from the Belmont Surf Inlet Company, and still at Surf inlet, has been sold by the Detroit Western Corporation to the Timmins interests. Prospects for a resumption of the operations on the Khutze Inlet property are not bright.

Gibson Girl. This group is a relocation of the old *Wild Goose* and consists of the *Emily*, *Pearl*, *Marie*, and *Peggy* claims, owned by Frank Cole and George Keys, of Prince Rupert. The property is situated on Gibson island, at the head of Grenville channel, about 27 miles south of Prince Rupert. The property was bonded in 1913 to Sir Donald Mann and some exploration carried out, including three diamond-drill holes. W. M. Brewer, in the 1914 Annual Report, refers to these holes as all located several feet from the ore-body on the foot-wall side and apparently pointed away from the ore-body.

In 1918 the Granby Company bonded the property and sank a shaft 20 feet deep to the tunnel-level and a further depth of 30 feet below the tunnel. The tunnel crosscuts the ore-zone for 65 feet, showing bands of quartz and limestone with an average low copper content. From the bottom of the shaft crosscuts were run 30 feet each way across the zone, showing bands of quartz and limestone averaging 1 per cent. copper, 40 per cent. silica, and 20 per cent. lime. This did not meet the requirements of the Granby Company and the option was dropped.

During the 1928 and 1929 seasons the owners discovered a second zone carrying very promising copper-zinc-lead mineralization and striking at an acute angle to the original zone. This showed promising horizontal continuity and widths. In the early summer of 1929 the Granby Company again bonded the property and after some superficial and inconclusive surface work on the new zone relinquished the option. Near the close of 1929 the property was bonded by the Consolidated Mining and Smelting Company. It is anticipated that the property will be thoroughly explored by the Consolidated Company and its value, or otherwise, definitely demonstrated.



The ore-deposit is a siliceous replacement in the Prince Rupert series of crystalline limestone in contact with hornblende-schist. At least three limestone-belts occur on the island intercalated with the schists, all of which are worth prospecting for further ore-bodies. The ore occurs in a broad reticulated structure along the bedding and cross-jointing of the limestone. Mineralization consists of granular chalcopyrite, zinc-blende, galena, and pyrite. In places the chalcopyrite and zinc-blende are developed into massive segregations. The original zone appears to be more siliceous and to contain more pyrite than is shown in the exposures on the newly discovered zone.

The big open-cut on the old zone south of the shaft exposes a width of 68 feet, composed of alternating bands of limestone and quartzose ore. A sample across one of the ore-bands 8 feet wide assayed: Gold, 0.02 oz. to the ton; silver, 3 oz. to the ton; copper, 6.3 per cent. In the four old open-cuts, now caved in, to the south-east of the shaft, similar mineralization is reported to occur, though over somewhat narrower widths. In the five old caved cuts to the north-west of the shaft similar mineralization over appreciable zone-widths is reported to occur. The original zone strikes N. 15° W. and dips 70° west to vertical.

The recently discovered zone strikes N. 40° W. and dips steeply east. Further surface work on this zone during the latter part of the season has extended the surface continuity of mineralization to about 1,100 feet. Some of the Granby open-cuts have been deepened and in some instances ore has again been exposed where it appeared to give place to limestone. In the series of cuts on this zone reticulated limestone-ore widths from 18 inches to 7 feet have been exposed. Samples from these cuts indicate a possible metal tenor of: Gold, 0.02 oz. to the ton; silver, 2.5 oz. to the ton; copper, 2 per cent.; lead, 1.25 per cent.; zinc, 4 per cent.

Providing sufficient extent of this deposit is proved, its commercial aspect is dependent on the amount of dilution from limestone reticulations in the ore structure; the possibility for shrinkage-stopping of run-of-mine grade; feasibility of selective mining and narrower widths, or the sorting-out of limestone dilution preliminary to milling. The deposit should be initially explored by deep open-cutting; a short crosscut tunnel at a point offering greatest depth midway along the new zone; the continuation of the old tunnel to cut the projection of this zone; and trenching and open-cutting on the *Emily* at the probable junction point of the two zones. If warranted, this work could be followed by diamond-drilling. Prospecting for further continuity and the discovery of other zones could advantageously be carried on simultaneously with this work. The property is exceptionally well situated for economical operation.

This group of claims, owned by Pete Brozet, is situated about a quarter of a mile east of the east shore of the head of Kumealon inlet, off Grenville channel, about 35 miles south of Prince Rupert. The intercalated limestones and crystalline schists of the Prince Rupert series constitute the low-lying confines of Kumealon inlet. About 1 mile east of the head of the inlet this formation contacts with the high-range granodiorite of the batholith. Limestone occupies alternating broad belts between hornblende-schist and a rock peculiar to this area that resembles a schistose pyroxenite (bronzitite). Sericite is widely distributed and in places are bands of a mineral resembling sillimanite. Small quartz stringers, with which are associated patches of a deep lilac transparent iolite (cordierite), occur in places in the amphibolites and pyroxenites.

The ore occurrence being explored on the claims consists of a heavily sericitized shear-zone of unknown width, carrying marcasite in fine dissemination and in small finely granular lenses. An open-cut 9 by 6 by 5 feet and a few small strippings have been excavated on this zone. A sample of sulphides from the open-cut assayed: Gold, *nil*; silver, *nil*. This occurrence is not of commercial importance.

The Kumealon Inlet locality is, however, of somewhat exceptional mineralogical interest and possesses characteristics that warrant investigation for non-metallic mineral occurrences of possible interest. The petrology very closely resembles that of the emery areas of Chester, Massachusetts; Peekskill, New York; and is similar to those of Greece and Asia Minor. To conform to this possibility is the widespread occurrence in the amphibolite and pyroxenite rocks of Kumealon of narrow-banded streaks of a very hard, greyish-black mineral resembling emery (admixed magnetite and corundum). A partial analysis of this rock type is said to have shown: Silica, 30 per cent.; magnetic iron oxide, 35 per cent.; alumina, 30 per cent.; lime, 1.2 per cent. This analysis suggests a low-grade emery. A qualitative analysis in the Bureau

of Mines shows this rock to be mainly sillimanite and ilmenite. The Kumealon area may be of interest with regard to abrasives and refractories.

This property embodies the old *Trisie* group and has been acquired by Noah **Surf Point.** Timmins and associated interests. It is situated off Welcome harbour, on the westerly slope of Porcher island, about 25 miles south-easterly of Prince Rupert. The occurrence is well described on the 1919 and 1928 Annual Reports and in the Geological Survey of Canada Summary Report, 1922, Part A.

Development has been continuously carried on during the year with a crew of sixteen men employed in one eight-hour shift. At the time of examination No. 1 tunnel had been advanced 715 feet and was being driven north to connect with No. 3 tunnel, which was also being advanced in the direction of No. 1. The property was also being sampled to ascertain the possibilities of developing tonnage.

Short and irregularly distributed lenses of auriferous pyrite, carrying good values, occur in an erratic quartz-vein system in quartz diorite. There are two directions of fracturing, one striking north-easterly and dipping south, the other striking about east-west and dipping north. The north-easterly veins vary from a few inches to about 6 feet in width; the east-west veins from about 1 inch to 2 feet in width. Generally the veins are tightly frozen to the walls and vary considerably in width in short distances. Small tightly frozen veinlets frequently branch from the main veins in varying directions. The occurrence has the characteristics of an irregular stockwork, with the vein-filling occurring along contraction joints and fissures.

Pyrite is the only evident metallic sulphide and is practically entirely confined to the quartz. No important pyritic impregnation of the silicified wall-rock occurs. The gold values are also confined entirely to the pyrite. A sample of vein-matter carrying about 75 per cent. pyrite and 25 per cent. white quartz assayed: Gold, 4.4 oz. to the ton; silver, 1 oz. to the ton. A sample of white quartz occurring adjacent to this ore in the vein assayed: Gold, *nil*; silver, *nil*. A sample of the silicified diorite wall-rock of this vein, showing a few specks of pyrite, assayed: Gold, trace; silver, trace.

It does not seem that the distribution of the veins in the barren diorite, and the sulphide lenses in them, is sufficiently closely spaced to allow of bulk mining to develop appreciable mill-grade tonnage. Mining would then have to be selectively confined to the irregular sulphide lenses. The economy of developing any appreciable tonnage reserve ahead of immediate operations is questionable.

This property, owned by C. O. Rowe, of Prince Rupert, consists of the **Rowe.** *Starboard Watch, Canadian Girl, and Rio Costello.* It is situated on the west slope of Noble mountain, Pitt island, about 40 miles south of Prince Rupert. The workings are at altitude 1,400 feet, about 1½ miles from the beach, with which they are connected by a good foot-trail. The showing consists of a quartz vein 4 to 6 feet wide in a shear-zone in granodiorite. The vein has been traced about 300 feet, striking north and south, is well defined, and dips at about 45° E. It has been explored by cuts and a short tunnel.

In the tunnel the vein is in places well mineralized with pyrite and some chalcopyrite, in bunches, seams, and disseminations. The sulphides carry from 0.07 to over 1 oz. to the ton in gold and in places about 2 per cent. copper.

This group of six claims, owned by P. M. Ray, J. L. Jollymore, and associates, **Marble.** of Prince Rupert, is situated 15 miles down the east shore of Banks island, about 5 miles south-east of Keyarka Indian Reserve and about 50 miles south of Prince Rupert. Banks island is composed mainly of batholithic quartz diorite in which are several inclusions of Prince Rupert limestone, dolomites, and schists. One bed of crystalline limestone outcrops close to the *Marble* and is exposed for about half a mile along the shore. The ore-showings of the *Marble* outcrop within 100 feet of the shore and occur in one of these inclusion areas. They consist of narrow bands of heavily epidotized and silicified greenstone sparsely mineralized with pyrite, chalcopyrite, and some molybdenite. A sample of the average mineralization assayed: Gold, trace; silver, 0.4 oz. to the ton; copper, 0.6 per cent.; molybdenum, 0.2 per cent.

This group is situated on the westerly side of Tucks inlet, about 4 miles **Drumharvey.** northerly of Prince Rupert. The property is owned by W. H. Montgomery, of Prince Rupert. It consists of the *Drumharvey No. 1, No. 3, No. 4,* and *No. 5* claims. The claims are at about 600 feet altitude on the south slope of Mount Morris

and about 1 mile from the beach. The ore occurrence is zinc-blende, galena, pyrite, pyrrhotite, and a little chalcopyrite in a glassy quartz, in the Prince Rupert schists. The mineralization is developed along small chloritized seams in the quartz. The owner reports a width of about 50 feet exposed in the bed of a creek by some stripping and a few shallow holes, and claims to have traced the vein outcropping a distance of about 400 feet, striking east and west, with undetermined dip. A sample reported by the owner to have been taken across about 12 feet in the centre of the vein assayed: Gold, 0.01 oz. to the ton; silver, 2.5 oz. to the ton; copper, trace; lead, 4.3 per cent.; zinc, 2.82 per cent.

At the head of Klekane inlet, off Fraser reach, a hot calcium-sulphate and sodium-chloride spring occurs about 600 feet from the beach and about 20 feet above high tide. On the shore of Ursula channel, about $2\frac{3}{4}$ miles north of Fisherman cove, a small hot spring issues from the quartz diorite about 1 foot above high tide. On this channel at the west side of Bishops cove a spring occurs about 60 feet from the shore and 10 feet above high tide. On Gardner canal, between Shearwater and Low points and about 12 miles from the entrance into Desolation channel, a very hot spring issues from the edge of a small cliff and about 2 feet above high tide. A hot spring also occurs on the south-east side of Brim river, 200 yards above the mouth. Brim river flows into Gardner canal 20 miles from its entrance into Desolation channel.

CANADIAN NATIONAL RAILWAY SECTION.

This section has been comparatively inactive. Between Prince Rupert and Terrace the bulk of the rocks belong to the Coast Range granodiorite batholith. There are in this stretch, however, several areas worth prospecting and the batholith itself should not be entirely neglected, particularly in localities where it shows zonal shearing and fracturing.

The Prince Rupert series contacts with the batholith at about mileage 16. Inclusions of basic schists from 2 to 6 miles wide occur at about mileages 36, 46, and 68. The eastern contact margin of the batholith crosses the railway at about mileage 82, from which point there is an exposure 8 miles wide of the Kitsalas series of Triassic porphyrites, andesites, tuffs, and breccias. Although this contact area is in the disturbed zone, featured by considerable fracturing and crushing and intrusions of numerous granitic dykes, a condition adverse to ore-deposit continuity, some of its mineral-deposits may warrant exploration and it is worthy of prospecting. The easterly edge of this band of Triassic volcanics is covered by the alluvial flats of the Kitsumgallum river, to the east of which, at Terrace, a wide spur from the batholith comes in. Several groups of claims are staked on cupriferous ores in the Kitsalas series in the neighbourhood of Amsbury. Of these the most extensive work has been done on the *Autumn* group.

This group of five claims is owned by George and Sam Alger, of Usk. It is situated 3 miles west of Amsbury Station, about three-quarters of a mile north of the old Lakelse sawmill, and about 83 miles east of Prince Rupert. The ore occurrence consists of a rather erratic distribution of chalcopyrite and pyrite in silicified zones in altered andesite bordering crystalline limestone. Mineralization occurs in granular disseminations and veinlets and is confined to the more siliceous parts of the formation. At some spots pyrite is developed in massive bunches 18 to 24 inches wide. Pyrite is the predominant mineral. The wall-rock is heavily epidotized. In two places a massive development of magnetite in contact with limestone has been exposed.

Three hundred feet west of the cabin at 225 feet altitude surface cutting and stripping exposes a zone 3.5 feet wide of quartz and epidote mineralized with chalcopyrite and pyrite striking N. 10° W. and dipping steeply south. A chip sample across 5.5 feet from the top of this open-cut assayed: Gold, trace; silver, 0.2 oz. to the ton; copper, 1.3 per cent. Twenty feet south of this cut a crosscut tunnel 15 feet long exposes similar mineralization. A crosscut tunnel 120 feet in length at 25 feet lower altitude penetrates crystalline limestone at the face, but failed to cut mineralization. At 70 feet in, a 20-foot crosscut to the east and one 25 feet to the west also failed to cut the mineralization.

At altitude 250 feet and 200 feet south of the above workings a cut 5 by 30 feet exposes 3.5 feet of banded mineralized andesite striking N. 32° E. and dipping 80° S. A sample representative of this cut assayed: Gold, 0.01 oz. to the ton; silver, 0.3 oz. to the ton; copper, 2 per cent. Thirty-five feet below this cut a crosscut tunnel for 40 feet penetrates limestone, but failed to cut mineralization.

At several other places at higher altitudes work has been done on showings of pyrite, marcasite, and magnetite, in which not much promise is indicated. In general the mineralization on these claims represents a pyritic propitilization of the contact-rocks, accompanied by intense silicification and epidotization. No zonal mineral-carrying structure could be observed.

KITSUMGALLUM LAKE SECTION.

The usual assessment was carried out on several properties in this area. The area was not examined during the 1929 season. For a description of the best-known properties readers are referred to the 1928 Annual Report.

LAKELSE SECTION.*

This area was examined by F. P. Caddy, Temporary Assistant Resident Engineer, who submitted the following reports:—

This group consists of the *Dummy, F'm Alone, Copper Queen, Summit, Surprise, Copper Queen.* Bluebell, Lucky Seven, Hidden Trail, Iron Hill, and Iron Cap.* It is owned by J. Bell, T. Turner, and associates, of Terrace. The property is reached by following the Terrace-Lakelse road to the 8-Mile post and then taking a good horse-trail up Williams creek to Bell's cabin, a distance of 7 miles. The trail then crosses the creek by a good bridge and climbs the north slope of the range by a series of switchbacks until it reaches a small plateau containing two lakes, estimated at from 1,500 to 2,000 feet below the crest of the range. Up to the beginning of the plateau the trail is fair, but afterwards becomes very bad.

The main showing consists of a large, almost vertical dyke in an altered argillite country-rock, striking south through the hill. It outcrops on the east side of a small gulch running down the face of the mountain and can be traced up to the top of a ridge which parallels the main range at a lower altitude, at which point it bends to the south-east. It has been exposed by cuts in several places.

The dyke, which is copper-stained almost everywhere, has been greatly altered and in places consists of bands of epidotite, garnetite, and magnetite. Other minerals observed consist of chalcopyrite, bornite, pyrite, and pyrrhotite in the lower part, while near the top of the ridge there are good showings of fine-grained galena, zinc-blende, and patches of solid chalcopyrite.

Not enough work has been done to be able to say very much about values. Fair gold and silver values are claimed and the width of the vein-matter over a vertical height of nearly 1,000 feet should average 8 to 12 feet. More work is required before a definite opinion regarding values can be formed. The dyke is well mineralized in many places, mainly with copper minerals, and merits systematic exploration.

A grab sample from the dump of a small open-cut at about 800 feet above the plateau assayed: Gold, *nil*; silver, *nil*; copper, *nil*. A chip sample over 2 feet of mineralized matter in the centre of a cut 12 feet wide at about 970 feet above the plateau assayed: Gold, trace; silver, 0.2 oz. to the ton; copper, 0.8 per cent. A chip sample over 18 inches of galena and zinc-blende in the middle of a cut 16 feet wide at about 1,370 feet above the plateau assayed: Gold, trace; silver, 6.5 oz. to the ton; copper, 1 per cent.; lead, 7 per cent.; zinc, 11 per cent. A chip sample taken over 12 inches of chalcopyrite 6 feet east of this assayed: Gold, trace; silver, 5 oz. to the ton; copper, 12.7 per cent.

In places the east wall of the dyke consists of limestone and there are occasional inclusions of limestone in the epidotite. On the top of the main range there is an outcrop of solid magnetite 8 feet wide, striking north-south and dipping 45° east. On the foot-wall there is a seam about 16 inches wide mineralized with pyrite. A sample across this assayed: Gold, trace; silver, trace.

This claim is situated on the top of Thornhill mountain and is owned by A. L. La Libertad.* Fitzpatrick, of Terrace. It is reached from a point between the 7- and 8-Mile posts on the Terrace-Lakelse road, where a fairly good trail switchbacks up to the top of the mountain. The last 1,000 feet is steep, but is just possible for a pack-horse.

The showing consists of a white quartz vein striking east-west along the top of the mountain and dipping south. It varies from a stringer to 4 feet wide and can be traced for nearly 1,000 feet. It occurs on the hanging-wall of a greenstone dyke, in granodiorite country-rock, and is somewhat sparsely mineralized with fine-grained galena, grey copper, specks of chalcopyrite, pyrite, and calcite. Fissures and fractures are filled with limonite. Its eastern extremity outcrops in a vertical bluff overlooking a creek which runs into Copper river. A grab sample of

quartz with chalcopyrite from the dump of one of the cuts assayed: Gold, 1.92 oz. to the ton; silver, 0.5 oz. to the ton.

Sadie.* This claim is situated on the top of Thornhill mountain, about 800 feet east of the new Forestry Department lookout cabin, and is owned by Michaud Bros., of Terrace. The showing consists of a replacement zone about 18 inches wide in a greenstone dyke, striking north and south and dipping east. It is well mineralized with chalcopyrite, pyrite, malachite, and azurite. A chip sample across 12 inches assayed: Gold, trace; silver, 1.6 oz. to the ton; copper, 9 per cent.

St. Paul.* This claim is situated on the east slope of Thornhill mountain, overlooking the top end of Lower lake, and is owned by Michaud Bros., of Terrace. The showing consists of a rather flat quartz vein striking S. 30° W. across the mountain and dipping at about 25° into the mountain. It has been exposed by open-cuts and short tunnels at intervals over a considerable distance. It varies from a stringer to 30 inches wide and contains visible gold in places, patches of scheelite, and a little galena and pyrite.

At elevation 4,000 feet a cutting about 30 feet long overlooking the top end of Lower lake exposes 18 inches of quartz with some scheelite. A chip sample over 18 inches assayed: Gold, *nil*; silver, *nil*. On top of the divide, at an elevation of about 4,800 feet, a crosscut has been driven through the vein, showing a width of 4 feet. The showing here is mostly white quartz with some pyrite and galena in fissures about the middle of the vein. A chip sample over 4 feet assayed: Gold, 0.50 oz. to the ton; silver, 0.1 oz. to the ton. The same vein has been exposed in several more cuts across the saddle on to the western slope of the mountain and maintains its width.

The vein is strong and well defined and merits systematic exploration and sampling. Should the results of this be encouraging, the vein could easily be drifted on from a point above the top end of Lower lake, which would give ample backs. Sufficient power could probably be obtained for driving a small compressor by using the water from an upper lake, which would give a head of 400 feet.

Annie Laurie. This claim is situated on the eastern slope of Thornhill mountain and is owned by Michaud Bros., of Terrace. The showing consists of a quartz vein mineralized with chalcopyrite, galena, and a little grey copper, striking S. 55° W. and dipping 78° north. The country-rock is granodiorite. The vein has been drifted on for 25 feet, with the 9-inch vein left standing on the hanging-wall for part of the way. In the face the vein is rather broken up. A chip sample over 9 inches of vein-matter in the drift-face assayed: Gold, trace; silver, trace.

Eureka. This property is situated about 1½ miles along the ridge south of the *St. Paul* claims. It is owned by Michaud Bros., of Terrace. The showing consists of irregular patches of molybdenite in a fine-grained grey granite, with white mica and chlorite. A small open-cut across the showing exposes some excellent molybdenite. More work should be done to prove continuity. The molybdenite so far exposed is in large patches and lumps and there would be no difficulty in producing a commercial grade by hand-picking. A sample of selected ore assayed: Gold, trace; silver, trace; copper, *nil*; molybdenum, 11.2 per cent.

NASS RIVER MINING DIVISION.

The Nass River Mining Division has the distinction of being the most important producing area in the district. The *Hidden Creek* copper-deposit, operated by the Granby Company, is one of the largest copper-producers in the Province.

Although this property has been producing on a large scale since 1914, and the potential reserves of the property have necessarily been diminished by that output, the outlook for continued copper production from this source for some time to come is favourable. This is evidenced by the bringing into production during 1929 of the *Bonanza* ore-body, and the hopeful outlook, based on well-founded structural theory, for possible results from intensive exploration for new ore-bodies and continuations of those already known. The Division harbours other potential copper areas, as yet only very superficially explored and developed. Notable in this respect is the Kitsault Valley copper-belt, which parallels the silver-belt of that area on the west and in which some promising showings are located.

This Division is also important as a potential silver-producing area. The Alice Arm section, particularly the area of the upper Kitsault, harbours the most important potential silver area

so far discovered in the district. In this area the old *Dolly Varden* property during its short operation between 1919 and 1921 produced 1,301,238 oz. of silver from 36,620 tons of ore.

The advent during 1929 of the skill and resources of the Britannia Mining and Smelting Company into Alice Arm and the active exploration by this company of the *Toric*, *Dolly Varden*, and *Wolf* offers hope for a continuous silver production in the not-distant future from this unwarrantedly neglected section.

The possible success of these efficient exploratory operations, culminating in the availability of milling facilities close at hand, will possibly result in revenue-producing operations on several small high-grade silver-deposits in the area. From some of these, important silver-producers may eventually materialize. During the 1929 season the zinc-deposits of the *Sunrise* group on McGrath mountain have been constructively explored by the enterprise of the Kitsault Eagle Silver Mines, Limited. The conclusive demonstration of the economic value, or otherwise, of the widespread zinc mineralization of this area is of constructive importance not only to this section, but also to the metallurgical future of the whole coastal region. With such widespread zinc-silver-lead mineralization and so many small potential producers of this type in District No. 1, any tonnage development of these metals that would warrant the inauguration of zinc-lead smelting and refining facilities on seaboard close at hand would undoubtedly revolutionize production from the North-western District and contiguous areas. Promising molybdenite-deposits also occur in the coastal section neighbouring the head of Alice arm. These have been attracting attention during 1929, tending towards their further development.

Much of the Alice Arm area still remains to be thoroughly prospected and several very promising localities are as yet quite untouched. Of interest in this connection is the probable continuity of the Dolly Varden and related volcanics from the upper Kitsault valley in a westerly direction right through to the Hastings Arm pendant in the neighbourhood of Saddle mountain. The area between the Kitsault glacier and Hastings arm consequently offers a very likely area for prospecting. The upper area of the Kitsault North-east fork, especially that section lying between the headwaters of this fork and Washout creek, contains an igneous rock complex that in places has been subjected to intense siliceous alteration and, where structure is favourable, is well worth detailed prospecting for both silver and copper deposits. During 1929 the Alice Arm mineral area has been extended to Kinskuch lake, situated over the Kitsault divide, to the Nass river. Several claims have been staked on reported promising discoveries.

OBSERVATORY INLET SECTION.

The first mineral claims were staked in the Observatory Inlet section in an extensive inclusion of argillite and volcanics in 1900. As an example of the characteristics of District No. 1 and an augury of its future possibilities, it is interesting to note that the *Hidden Creek* group was staked in 1901. It was not until about ten years later and the acquisition of the property by the Granby Company that the value of these deposits was realized. They were brought into production in 1914.

The ore-deposits of this property have been thoroughly described in former reports. Readers are especially referred to Geological Survey of Canada
Granby Summary Report, 1922, Part A. Briefly the ore occurs at or near the north-
C.M.S. & P. Co., south striking contact between argillite and a younger intrusive greenstone.
Ltd.

The formation has been acutely folded and faulted. The ore-bodies seem to favour the crests and troughs of the folds. The ore-deposits are replacements along the folded argillite contact or in sheared areas in the greenstone contiguous to the contact. The contact-ore differs from that in the sheared greenstone, in that it is generally more siliceous and intimately associated with pyrite, whilst that in the greenstone is generally an association of chalcopyrite and pyrrhotite.

Early in the year the *Bonanza* ore-body, about 3 miles southerly from Anyox, which had been under development for some time by the Granby Company, was brought into production. The aerial tramway from this operation to the plant was completed and production initiated, with a steady output of about 400 tons of ore a day.

It is estimated that there will be little change in the ore reserves of the Granby operation on the *Hidden Creek* deposits during 1929 as compared with 1928. On the *Bonanza* development has not progressed sufficiently to enable a definite criterion of the additional ore possibilities of this ore-body. It is reasonable to assume, however, that some additional tonnage of very good grade will be developed on this property. On this ore-body shaft-sinking operations on the

north side have progressed to over 500 feet. It is the intention of the management to continue this to about 800 feet, with the necessary lateral exploration and development.

Work on the *Hidden Creek* ore-bodies during 1929 has consisted of the usual development, together with shaft-sinking, from which future exploration will be done. The possibilities for development of additional ore-bodies at depth are hopefully anticipated.

The increased production from the entire operation during 1929 is accounted for by the *Bonanza* tonnage, a slight increase in the *Hidden Creek* tonnage, improvements in technical practice, and an increase in recoveries.

Improvements in the mill consisted of converting some of the rod-mills to ball-mills, together with an increase in flotation capacity. These factors combined made for more complete grinding, resulting in higher recoveries from an increased tonnage capacity. During the year there was no particular permanent change in smelting practice. One blast-furnace and two to three converters were continuously in operation and sintering was carried out on the usual scale. Some experimental work was carried out regarding the direct treatment of concentrates in the converters, but no final conclusions were formed regarding the practicability of this operation.

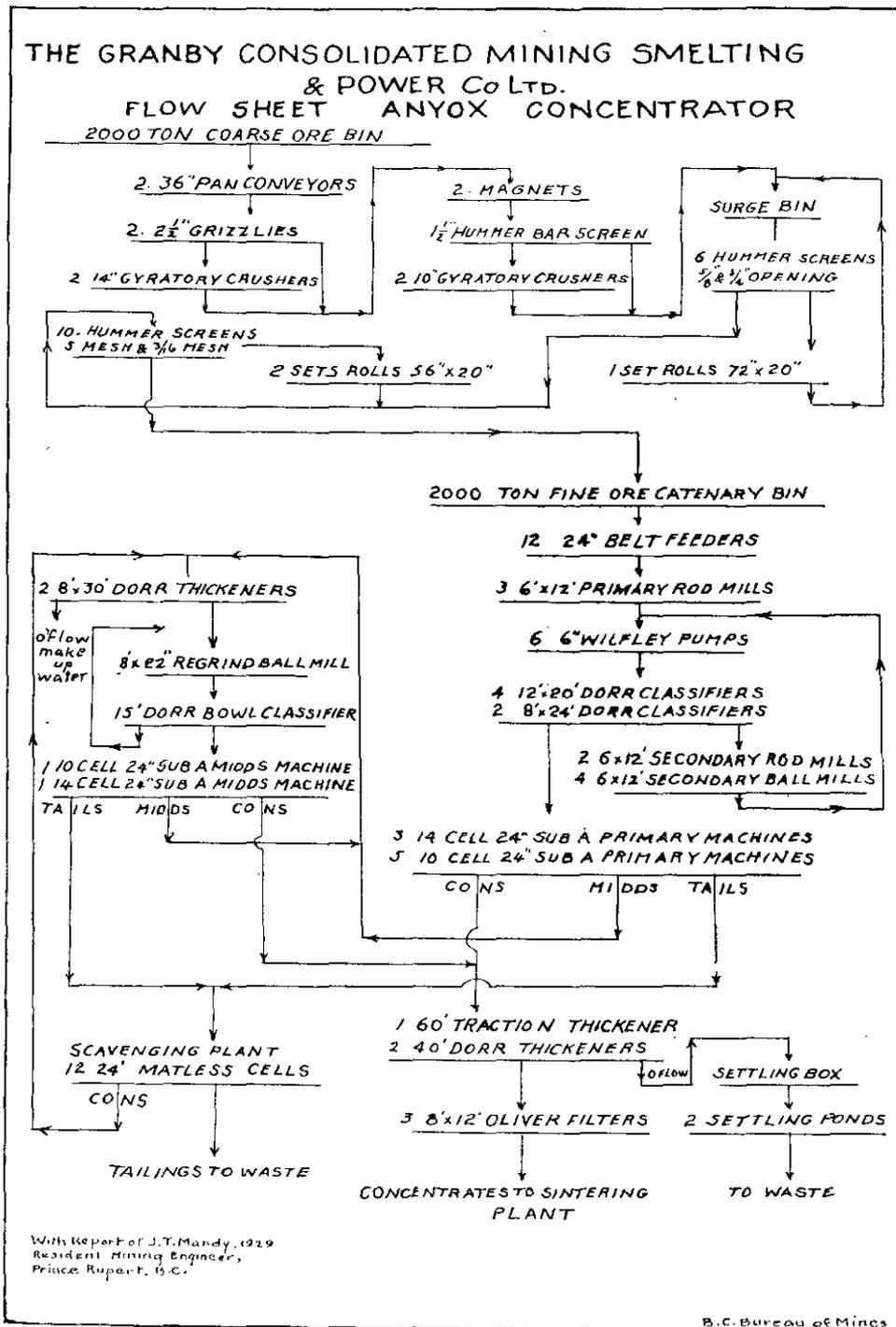
With the exception of a few small odd lots and the treatment of the usual regular shipments of *Premier* ore, no appreciable quantity of custom ore was received at the plant. No exploration is being carried out on outside properties at present. During the year the adjoining *Hanna* property was diamond-drilled, but the option procured on this property was later relinquished.

This company is developing the old *Saddle* claim. Several adjoining claims have also been acquired by the company by staking. The property is situated on the crest of Saddle mountain from about altitude 4,200 to 5,000 feet. From the beach camp a partially completed, 2-section jig-back aerial tramway operates to the intermediate camp and bunkers at altitude 2,525 feet and from thence to the tunnel camp terminal at altitude 4,400 feet, a contour distance of about 9,800 feet. Eight steel towers are distributed through this distance, with the longest span from the horizon tower to the beach, a distance of about 2,600 feet. It is intended to operate the tramway by gravity, with a 6-horse-power gasoline-engine booster for hauling supplies. With the contemplated serious exploration of this property, the construction of the tramway prior to the proving of any continuous ore-supply is justified by the exceptionally rugged nature of the terrain and its use as a necessary facility for hauling supplies and equipment.

The ore occurrence has been thoroughly described in the 1927 and 1928 Annual Reports. At the time of examination (October 6th) the drift-tunnel at elevation 4,400 feet had been advanced to 168 feet. The vein in this tunnel is 1 to 4½ feet wide, of banded and brecciated structure. A 1- to 2-inch streak of galena ore shows on or near the foot-wall from the tunnel portal to about 40 feet in. From that point to the face some isolated streaks and small bunches of galena were observed. At no place from the tunnel portal to the face at 168 feet does the sparsely intermittent mineralization exceed a width greater than a few inches. In the face at 168 feet the vein is 24 inches wide; banded with quartz stringers and included fragments of schist, and shows a few specks of galena and some streaks of iron oxide. A sample across this 24 inches of vein-matter in the face assayed: Gold, trace; silver, trace; lead, *nil*; zinc, *nil*.

On the surface, at the collar of the old shaft at altitude 4,600 feet and about 700 feet northerly from the tunnel, a good mineralization of galena, zinc-blende, and chalcopryrite can be seen across a width of 3 feet. This shaft was full of water and could not be thoroughly examined. The vein here strikes N. 55° W. (mag.) and dips 60° south in conformity to the strike and dip of the mica-schist country-rock. This vein appears to stop abruptly at a draw, about 40 feet wide and striking north and south, about 20 feet north-westerly of the shaft. At the time of examination this draw was snow-filled, but no continuity of the vein could be seen on the higher ground between the west side of the draw and the granite-contact that comes in about 150 feet farther west. It is possible this draw is occupied by a fault or a shear. It should be prospected. In several cuts on the surface promising mineralization occurs in branch veins across widths of from 1 to 2½ feet. These veins strike at acute angles to the main vein. A sample across 2.5 feet of vein mineralized with galena, zinc-blende, and chalcopryrite exposed in a cut 150 feet easterly of the shaft assayed: Gold, 0.06 oz. to the ton; silver, 5 oz. to the ton; lead, 7 per cent.; zinc, 8 per cent.

It is estimated the tunnel will have to be driven 675 feet to reach the downward extension of the vein showing in the shaft at altitude 4,600 feet. A contract has been let for the driving



of 400 feet of tunnel during the winter. Crosscuts should be driven to eastward at intervals in this tunnel to explore for the downward extension of the ore-shoots exposed in the branch veins on surface.

This group of four claims is owned by J. Flynn and associates, of Alice Arm. **Elkhorn.** It is situated on the eastern slope of Saddle mountain, Hastings arm. Late in the year Flynn made an interesting discovery of free gold on this property at an elevation of 3,575 feet. It occurs in a silicified zone carrying epidote and garnet in altered andesite and mica-schist, mineralized with fine-grained pyrite, pyrrhotite, some galena and zinc-blende. A small open-cut shows the zone to be about 3½ feet wide, striking N. 45° W. (mag.) and dipping steeply into the abrupt mountain-slope. Spectacular finely divided gold in streaks ¼ to 1 inch wide have been found in isolated patches. A sample taken from the small cut on this showing, and carefully scrutinized to avoid the presence of free gold, for the purpose of determining whether the sulphides carried gold, assayed: Gold, 0.16 oz. to the ton; silver, 0.5 oz. to the ton. Two other apparently parallel silicified zones carrying pyrite, pyrrhotite, some galena and zinc-blende have been found at 50 and 100 feet higher altitude. A sample from a small cut on the highest of these latter at altitude 3,675 feet assayed: Gold, 0.04 oz. to the ton; silver, 0.2 oz. to the ton.

These occurrences are on the claims to the south of the *Saddle* group (Silver Crest Company). An attempt was made by the owners early in October to explore the showings, but severe weather conditions intervened after provisions and equipment had been packed up the mountain. The showing merits intensive exploration. The whole surrounding area, which is a large inclusion of schists and volcanics within the batholith, warrants detailed prospecting.

On the *Gold Leaf* claim at about 500 feet lower altitude the owner reports the discovery of a quartz vein about 4 feet wide sparsely mineralized with pyrite and a few specks of galena. This showing was not examined. No work has been done, but values of \$2.20 to the ton in gold are claimed to have been obtained. This value is sufficiently promising to warrant surface-stripping and sampling in the effort to find possible shoots of commercial-grade ore. The claim joining the *Saddle* on the north was covered with snow and could not be examined.

Georgia Bay. This group of claims, owned by Carl Eklund and William Craig, of Anyox, adjoins the *Elkhorn* on the south. Encouraging values in gold and silver are reported from two silicified zones recently discovered. These claims were staked late in the year and the showings have not been opened up.

ALICE ARM SECTION.

Late in the season negotiations were initiated that may lead to the active development of the promising molybdenum-deposits lying contiguous to the east and west shores of Alice arm. The *Cariboo* group on Lime creek, owned by J. Wells, is under option to D. S. Tait, of Victoria, who, in September, 1929, incorporated the Tidewater Molybdenum Mines, Limited, on the opposite side of the inlet, for active development. How far these plans have proceeded or what action is intended for the future has not been ascertained. On the *Mohawk* group on Roundy creek further prospecting has extended the continuity of the vein, and good mineralization is reported to have been discovered at altitudes considerably lower than the upper showings. This property is reported to have been taken over by a recently formed company called the Winnie Mine Development Company, Limited, which intends to continue exploration when weather permits. The property will be examined by the Resident Engineer early in the 1930 season.

KITSAULT RIVER SECTION.

The Coast Range batholith contact parallels the Kitsault River valley about 4 miles to the westward. The Kitsault River trough consequently follows the eastern contact margin zone at an ideal distance from the actual contact to allow of easy access to what should be the most promising area of the marginal zone. By this means there is made accessible from seaboard an unbroken stretch of margin, parallel to the contact, 22 miles in length. This is the longest unbroken marginal stretch directly accessible from seaboard in the North-western District.

The northerly core of this area, from 2 to 3 miles wide and extending in a north-westerly direction from the headwaters of the Kitsault North-east fork to the Kitsault glacier, a distance of about 15 miles, is composed of massive and fragmental volcanic rocks of Lower Jurassic age. This, the Dolly Varden formation, has an estimated thickness of over 3,000 feet. Surrounding this formation, and overlying it with a more or less conformable contact, is the Kitsault River

formation of argillite, quartzite, sandstone, conglomerate, and interbedded tuffs, of an estimated thickness of over 2,500 feet. Towards the south-east corner of the area (McGrath mountain), and occupying the triangle between the Illiance river and the North-east fork of the Kitsault river, is an intrusive stock of gabbroic augite porphyrite with inclusions of tuffs, breccias, and argillites.

The area is featured by different types of mineralization, each characteristic of its own rock or formation zone. High-grade silver-zinc mineralization in quartz veins occurs in the argillites. Richly argentiferous primary silver minerals feature this type. Characteristic of the volcanic rocks are lode-like silver-lead deposits in a quartz-barite gangue and accompanied by minerals of the grey-copper group. Secondary enrichment of silver ore sometimes features this type. In a belt of silicification lying between the Dolly Varden volcanics and the batholith, chalcopyrite in replacement zones and quartz veins occurs. The augite porphyrite-argillite complex of McGrath mountain is typified by shear-zone deposits containing resinous sphalerite in a gangue of quartz calcite and country-rock.

For a detailed description of this property and its workings the reader is referred to the Annual Report for 1928 and to the Geological Survey of Canada Summary Report, 1928, Part A. The claims are situated on Esperanza mountain, about a mile from Alice Arm and about 4,000 feet from the wagon-road on the Dolly Varden Railway. The workings are at from 450 to 650 feet altitude. During the year the company procured the adjoining *Alice, Ingram and Pratt, Acadia*, and other groups, comprising, with the original holdings, sixteen claims in all.

The mineral-deposit is a fault-fracture quartz vein and relative branches in interbedded sandstone and argillite, mineralized with zinc-blende, galena, pyrite, pyrrhotite, arsenopyrite, grey copper, ruby silver, with occasionally some native silver, scheelite, and chalcopyrite. The strike of the main vein is variable, but generally north-easterly. The dip of the main vein is southerly, at an angle across the dip of the argillite bedding, but is quite variable. The best development of the vein is where the strike and dip is at an angle to the attitude of the formation bedding. A tendency to stringer-out is evident where the veins are concordant to the attitude of the formation. The ore occurs with a tendency to banding and generally favours the hanging-wall. Granular dissemination over the vein-widths is also noticed. The best developments of ore have been found in the so-called "rolls" or anticlinal folds of the vein. In places the wall-rock is appreciably impregnated with arsenopyrite and pyrite, and sometimes contains numerous small stringers from the main vein carrying in places a certain amount of mineralization. Folding and minor faulting complicates the attitude and consequently the tracing of the veins.

Between 1911 and 1927, 913 tons of sorted ore was shipped to the smelter. This contained 107 oz. gold, 68,905 oz. silver, 1,352 lb. copper, and 4,062 lb. lead. Although high-grade silver ore occurs in the deposit in lenticular development, to selectively mine it at a profit is practically an impossible undertaking. On the other hand, it is possible that, with careful and economical operation, sufficient mill-grade ore might eventually be developed to materialize a profitable small tonnage milling proposition.

For this purpose the property needs, first, a systematic surveying and methodical sampling of its workings, together with the plotting and correlation of the slips, rolls, and dykes that affect the veins. This work would form a basis for the inauguration of development-work necessary to make available at least a four-years' supply of milling-ore to feed a mill of about 75 tons daily capacity before the construction of a mill is undertaken. This means the blocking-out of about 110,000 tons, or about ten times the quantity on the dump at present. In this way all values would be recovered, and the bulk of the ore, which could not possibly be mined and shipped at a profit, would become revenue-producing.

In order to achieve this end the installation of power at the mine, a 2-drill compressor, would be an economical facility. Caution should be observed, however, in this prospective development not to succumb to the temptation to undertake mill-construction before it is warranted by an adequate ore-supply. At present 11,000 tons containing about 16 oz. of silver to the ton is estimated in the dumps. Thorough sampling of the present workings may indicate an appreciable immediate addition to this tonnage, which, with the inclusion of semi-shipping ore, may have an increased grade. The property has been operated throughout the summer and winter with a small crew.

Alice. This property, formerly owned by Neill Forbes *et al.*, of Alice Arm, consists of four claims adjoining the *Esperanza* on Esperanza mountain. It has been taken over by Esperanza Mines, Limited. The quartz vein, interbedded in argillite, varying in width from 2 inches to 3 feet, striking N. 70° W. (mag.) and dipping from 50° to 80° south, has been opened by a 68-foot crosscut and an 80-foot drift. Mineralization consists of galena, zinc-blende, grey copper, arsenopyrite, and in places argentite and ruby silver. Along the north-west tracing for about 2,000 feet the vein varies from 1 to 3 inches in width and is sparsely mineralized. Better conditions should be met with on the south-easterly extension of the vein towards the *Esperanza* line, where admixed and interbedded tufts and intrusive dykes do not appear to be such a feature of the argillites as they are towards the north-west.

A sample across 14 inches of an ore-shoot exposed above the portal of the tunnel assayed: Gold, 0.07 oz. to the ton; silver, 85.9 oz. to the ton; copper, *nil*; lead, 0.3 per cent.; zinc, 4 per cent.

At altitude 2,100 feet a 4-foot quartz vein, mineralized with irregular bunches of marcasite, outcrops. A sample of the best development of sulphide assayed: Gold, trace; silver, 2.4 oz. to the ton. No work has been done on this showing. The indicated silver contents warrants some exploration by stripping.

Anna Mack. This property, owned by W. Cummings, Alice Arm, adjoins the *Alice* on the north-west. An open-cut has exposed the continuation of the *Alice* vein, showing about 6 inches in width of sheared and brecciated quartz, very sparsely mineralized.

Acadia. This property, formerly owned by Neill Forbes, Alice Arm, consists of two claims on the easterly slope of Esperanza mountain towards Kitsault River valley. It has been taken over by Esperanza Mines, Limited. The showing consists of a 5-foot quartz vein in argillite, striking N. 60° W. and dipping 50° north. Mineralization is massive pyrrhotite, with which some chalcopyrite is intermixed, splashes of massive zinc-blende, and along the hanging-wall 6 inches of banded zinc-blende, pyrite, and some galena. Some work should be done on the southerly side of the creek to determine the extent and values of the ore-shoot exposed in the cut. A sample of ore from the dump representing the best development of the exposed mineralization assayed: Gold, trace; silver, 1.8 oz. to the ton; copper, trace; lead, trace; zinc, 3.9 per cent.; nickel, trace.

Billy Barton. This group of six claims on the easterly slope of Esperanza mountain towards the Kitsault valley was actively explored by the owners, J. Peacock and Tony Calfa. A 90-foot tunnel and two short crosscuts showed a series of 1- to 12-inch quartz veins following the bedding and jointing of the argillite formation. The veins are irregular and pronouncedly lenticular with sparse galena, zinc-blende, and pyrite mineralization. A selected sample of sorted ore from the tunnel dump assayed: Gold, trace; silver, 1.4 oz. to the ton; lead, 1 per cent.; zinc, 3 per cent. The showing as at present developed is not of commercial importance.

Utopia. Neill Forbes, of Alice Arm, has actively explored this property, situated about 1 mile south of the *Billy Barton*. A crosscut tunnel 130 feet long intersected the mineralized felsite dyke at 90 feet in. The tunnel continues diagonally across the dyke to the face, indicating a width of 14 feet. The dyke strikes N. 60° W. (mag.) and dips 45° south. In a tunnel 20 feet long, at about 25 feet higher elevation, directly above the lower tunnel, 2 to 4 inches of galena, pyrite, and some grey copper shows in the dyke and along the foot-wall. Although this mineralization is not developed in the lower tunnel, the showing warrants some further exploration. A selected sample from the dump representative of the ore-streak in the dyke assayed: Gold, 0.06 oz. to the ton; silver, 60.5 oz. to the ton.

Wolf. This property, lying south of the *Esperanza* and adjacent to the Dolly Varden Railway, was further explored by the owners, J. Fiva and associates, of Alice Arm, during the season. The ore occurrence is, like that of the *Esperanza*, quartz veins carrying galena, zinc-blende, pyrite, chalcopyrite, grey copper, ruby silver, and occasionally some native silver.

The veins vary from a few inches wide to an occasional development of brecciated stringers over several feet. The deposit differs from that of the *Esperanza* in that the veins appear to be conformable to the bedding of the argillite and to occupy zones of movement or shearing

occurring parallel to the bedding-planes. This is indicated by the development of gouge and brecciated wall-rock in the vein-structure. Lamprophyre dykes up to about 6 feet wide, and a diorite dyke 30 feet wide, which is probably a spur from that outcropping along the railway-track, are intrusive through the vein.

The deposit has been explored by surface cuts, about 450 feet of tunnelling, and a 40-foot raise to the surface. Small shipments of selected high-grade ore have been made. The closely sorted ore shipped assayed: Gold, 0.27 oz. to the ton; silver, 306.4 oz. to the ton. The lower-grade shipping-ore assayed: Gold, about 0.16 oz. to the ton; silver, from 80 to 130 oz. to the ton. As an individual operation, without the burden of overhead expense, close selective mining may yield some profit.

This property is located at about 2,000 feet altitude on the north-east slope of **Alice Arm-La Rose** Haystack mountain. A detailed description of the property and workings is **Mining Co., Ltd.** contained in the 1928 Annual Report. The vein, from a few inches to 3 feet wide, occurs in the argillites that cover the slope of Haystack mountain to about altitude 1,925 feet, where they appear to abut on the underlying volcanics which form the upper slopes of Haystack mountain. The bedding of the argillite strikes approximately N. 50° W. (mag.) and dips easterly towards Kitsault valley at about 45°. This structural condition seems to have a very important bearing on the economic attitude of the *La Rose* vein. Mineralization consists of galena, sphalerite, grey copper, pyrrhotite, pyrite, arsenopyrite, some native silver, and possibly argentite and ruby silver, in a quartz gangue.

Disappointing results have been met with on the No. 1 tunnel-level at altitude 1,900 feet in the argillites, and the prospects for improvement in the downward extension of the vein in this formation are not encouraging. It is evident, however, that where the high-grade ore was struck in the raise, about 20 feet up from the tunnel-level and from there to surface, it is either in, or very close to, a tuffaceous rock, heavily impregnated with pyrite and an undetermined black mineral. Again, in the upper tunnel near the mouth of the shaft at altitude 2,060 feet, the vein is contiguous to this tuffaceous rock and shows fair mineralization until it enters the argillites proper, when it immediately becomes shattered, sheared, and barren. A sample of the tuff rock accompanying the ore-shoot, showing a fine dissemination of pyrite, pyrrhotite, and small crystals of mispickel, assayed: Gold, 0.03 oz. to the ton; silver, 23.8 oz. to the ton. As this represents wall-rock, not the vein, it is an interesting indication.

The property has been inactive during the year. More work is, however, certainly warranted to determine the extension of the vein in the apparently ore-making tuff. This would best be accomplished initially by lateral development in both directions from the intermediate drift. The ore where it does occur is high grade and, as it appears to be associated with the contiguity of tuff and as the vein is strongly developed in that locality, the policy of determining the attitude of the tuff in its relation to the vein is well warranted. Further exploration could then be planned from the result of this work. Between 1918 and 1927, 79 tons of ore was shipped from this property. This returned: Gold, 15 oz.; silver, 15,579 oz.; lead, 2,688 lb.

This group of claims is owned by W. McFarlane and associates, of Alice Arm, **Homeguard.** It is situated on the east side of the Kitsault river, about 14 miles from Alice Arm. The ore-showings have been thoroughly described in the 1922 and 1924 Annual Reports. The property is under option to the Dalhousie Mining Company, Limited. During the year the claims were prospected by a Radiore electrical survey. The results of this survey are not known. It is understood that two additional discoveries of promising ore were made on the property during the latter part of the season.

This property of eight claims, together with the *Wolf* group of four claims, **Dolly Varden.** originally owned by the Dolly Varden Mines Company, Limited, was optioned by the Britannia Mining and Smelting Company, Limited, late in the 1929 season. The ore occurrence and workings are described in the Geological Survey of Canada Summary Report, 1921, Part A, and in the 1916, 1917, and 1922 Annual Reports. During the somewhat hectic high-grading operations on this property from 1919 to 1921, a period of high silver price, 36,620 tons of ore, carrying about 36 oz. of silver to the ton, was shipped from the property. Very little development ahead of production was carried out and an operation that offered good promise came to an untimely end.

Former diamond-drilling and limited exploration on both the *Dolly Varden* and the *Wolf* groups indicates the possibility of developing an appreciable tonnage of mill-grade ore. The

acquisition of the property by the Britannia Company, combined with the operation by that company of the *Toric*, augurs well for a possible appreciable scale continuous operation, providing the silver market threatens no permanent set-back. The Britannia Company plans to explore these properties intensively during the 1930 season. As the options on the *Dolly Varden* and *Wolf* were negotiated late in the season, extensive exploration was not possible during 1929. Other than sampling, no active work was done on the *Dolly Varden*. On the *Wolf* group 2,320 feet of diamond-drilling was completed by the Britannia Company in order to check results obtained in the drilling of former years.

This company was formed in November for the purpose of developing the **Torbrit Mining Co., Ltd.** *Toric* group holdings of the *Toric* Mines Company, Limited. The controlling interest in this company is held by the Britannia Mining and Smelting Company, Limited, with an option for the balance of the shares. The optioning of the *Toric* property by the Britannia Company early in the 1929 season is the most promising development in the history of the Alice Arm camp. Shortly after commencing exploratory operations on the property the Britannia Company strengthened its position in the area by staking a large number of claims in contiguous territory.

The property is situated on the east side of the Kitsault river, about 1 mile beyond Camp 8 terminus of the *Dolly Varden* Railway, and about 17 miles from Alice Arm. With the assistance of the Department of Mines and the Department of Public Works a good road has been provided from the railway to the camp.

The mineral-deposit is a coarse "graphic" intergrowth, in places showing brecciated structure, of barite, quartz, jasper, hæmatite, and ankerite. The metallic mineralization is fine-grained pyrite, galena, grey copper, with occasionally some ruby and native silver. Rhodonite and rhodochrosite are sometimes distinguishable in the gangue. A development of high-grade ore in places seems to favour the hanging-wall of the deposit.

At the time of examination a width of over 60 feet had been developed on the deposit underground, but the walls are irregular and not clearly defined. The vein strikes N. 80° E. and dips about 70° north. The exposures on the surface above the tunnel are only about 5 to 6 feet wide. At the edge of the Kitsault river is an exposure 12 feet wide, heavily pyritized. The wall-rock at this exposure is distinctly tuffaceous.

The definite correlation of the surface exposures with that in the underground workings had not been determined at the time of examination. Generally the deposit is indicative of an appreciable tonnage low-grade milling operation, the profit of which is dependent on the silver-market outlook. The Britannia Company has energetically carried on exploration throughout the summer and winter months.

The following information regarding the year's work on the *Toric* has been kindly furnished by C. P. Browning, general manager of the Britannia Mining and Smelting Company: "Some lateral extensions were made in the main level of this property. A total of 816 feet of underground work has been completed from the commencement of development in May to the close of the year. This entailed drifting, some crosscuts, a raise completed to a vertical distance of 125 feet above the tunnel-level, and a short distance in a winze just being sunk to test the deposit at depth. Four thousand and twenty-three feet of diamond-drilling was also completed, both underground and on the surface. The results from this were co-ordinated, giving considerable information regarding structure, widths, and values."

Utility Mines No. 1, Ltd. This company is developing the *Tiger* group, situated on the east side of the Kitsault river and immediately north of the *Toric*. The property has a well-defined vertical vein varying from about 5 to 15 feet in width. It outcrops in a series of five faulted blocks over a distance of about 400 feet. Some good-grade ore, with visible native and ruby silver in places, occurs in the various cuts and underground workings. No. 1 tunnel, at elevation 2,050 feet, has opened up four of the faulted blocks exposed in the various open-cuts between elevations 2,100 and 2,225 feet. No. 2 tunnel, at elevation 1,900 feet, is at present being driven to get under No. 5 cut (elevation 2,175 feet), where there is a good showing of ore carrying galena, grey copper, and pyrite, with some ruby and native silver over a width of 8½ feet. No. 3 tunnel, at elevation 1,750 feet, is being extended to reach the various surface showings at this depth.

The property is a very promising prospect. Commendable work is being done in mapping out and correlating the somewhat complicated fault conditions that affect the vein. A crew of

seven men was employed during the summer, with Ed. Pickett in charge. Active exploration was continued until the late fall. At the close of operations No. 2 tunnel is reported to have intersected the vein showing in No. 5 cut, with encouraging values indicated at the point of intersection.

Vanguard.

This group of four claims, owned by M. Peterson and partners, of Alice Arm, is situated on the west side of Kitsault river, about 5 miles north of Camp 2. The main workings are at altitude 2,800 feet. A detailed description of the ore-deposits and workings are given in the 1928 Annual Report. During the 1929 season further exploration is reported to have given encouraging results. This group lies on the west side of the Kitsault river, about 5 miles north of the Dolly Varden Railway terminus. It is situated in what is known as the Alice Arm copper-belt. Exploration has indicated two main zones of chalcopyrite and pyrite mineralization. The zones have been prospected on the surface by several open-cuts and explored underground by about 600 feet of crosscutting and drifting. Encouraging widths of copper mineralization have been encountered in this work. This season additional showings of high-grade ore have been exposed. The silver ratio of the *Vanguard* ore is high, which is a helpful factor.

Vanguard Extension.—This property adjoins the *Vanguard* on the south and is owned by M. Peterson, of Alice Arm. A short tunnel has opened a similar ore occurrence to that on the *Vanguard*.

Blue Bird.—This group, situated in the upper Kitsault valley, is owned by Archie McPhail, of Alice Arm. During the season the owner reported that surface-stripping and open-cutting had given very encouraging results.

Lucky Strike.

This group consists of the *Rambler*, *Sunnyside*, *Iron*, *Cascade Fall*, *Lucky Strike*, *Lucky Strike No. 2*, and *Silver Crown*. It is owned by J. Hauber and associates, of Alice Arm. The property is situated in the copper-belt and is located along the ridge running north from the West fork of the Kitsault river to Homestake mountain. The property seems worthy of the attention of examining engineers. The following is a description of the showings given by George A. Clothier in the 1922 Annual Report:—

“On the *Rambler* claim a tunnel has been driven across a vein that strikes N. 28° W. (mag.), showing its width to be about 16 feet. The hanging-wall is a fine grey breccia and the foot-wall at this point is argillite. The vein-filling consists of a breccia of slate and grey rock, cemented with feldspar, calcite, and quartz, which are liberally sprinkled with pyrite and chalcopyrite, assaying from \$2 to \$5 a ton in gold values.

“Ribs of sulphide in the decomposed surface rock would assay up to 7 or 8 per cent. copper, but the average of the whole would be low on account of so much oxidation. Sufficient depth to get below surface effects might show some good lenses of ore and a fair average value. This shear-zone has been traced north for over 600 feet, but, as the surface along the vein is comparatively level, depth on the vein could only be obtained by sinking.

“On the *Porcupine Fraction (Iron)*, just north of the cabin, an open-cut exposed a vein similar to the one in the *Rambler* claim, badly broken upon the surface. It is from 10 to 12 feet wide and shows considerable pyrite and chalcopyrite. About 250 feet east of this showing another vein has been uncovered, striking N. 70° E., or towards the other two parallel ones. This vein is also a filled shear-zone, stands vertically, is from 10 to 12 feet wide, and consists of quartz and calcite heavily mineralized with pyrite and chalcopyrite. There is also a little galena and zinc-blende showing in places. About 4 feet on the west wall is exceptionally well mineralized with mixed sulphides of iron and copper. Altogether this is a very good showing for an outcropping and warrants going down on for some depth. Unfortunately the ground is so flat here that there is no chance to gain much depth by tunnelling. A few pieces of fairly well-mineralized quartz were taken as a sample to get an idea of the proportionate values. The sample assayed \$2.40 in gold and 8.6 oz. in silver to the ton, and 2 per cent. copper. There are several isolated croppings on the flat which have not been traced anywhere.

“On the *Lucky Strike* claim, at an elevation of 3,800 feet, is the largest showing on any of the claims. Here a trench has been made across another breccia-zone, showing it to be at least 20 feet wide. Like the others, the vein gangue is quartz and calcite cementing the country-rock fragments, the whole well mineralized with pyrite, chalcopyrite, and some galena and zinc-blende. Either the galena carries high silver values, or there is present some grey copper or silver sulphides from surface enrichment, for the owners claim to have had assays up to 3 oz.

in gold and 65 oz. in silver to the ton. The open-cut gives a depth of 8 feet, but the ground is still full of oxidized seams.

"On the strike of the *Lucky Strike* and *Cascade Falls* croppings, and at 4,300 feet elevation, an open-cut and shallow shaft exposes a width of several feet of decomposed material, in which are ribs of stibnite and arsenical iron, with specks of galena and zinc-blende. This cropping is on the West Fork slope and appears to strike N. 70° E. A grab sample, to get possible silver values, gave a trace of gold and 0.4 oz. in silver to the ton.

"Farther north, on the *Lucky Strike* claim, at 4,600 feet elevation, an open-cut exposes a width of 12 feet of brecciated grey country-rock, quartz, feldspar, and calcite, in the centre of which are about 2 feet of calcite well mineralized with chalcopyrite. It is a strong, well-defined vein in grey andesite, in which it would be very possible to find a good shoot of copper sulphide. On the higher levels there are a number of slate-cappings which can be seen to the top of the mountain.

"From the exposures on these claims, and farther north on the *Vanguard* and *Homestake* groups, it would appear that in the copper-belt there are two series of parallel shear-zones, one striking parallel with the ridge at about N. 28° W. (mag.) and the other at N. 70° E. (mag.), with such strong mineralization in each fracture-zone that it would be interesting to explore them at their intersections.

"While the owners, as prospectors, have done a lot of work on this property, it is altogether inadequate to show up the property to any advantage. It would seem that the exposures made on the different veins showing their sizes and the amount and possibilities of the mineralization would warrant their extensive exploration by larger operators."

Moose. This group of five claims, owned by W. Strombeck and associates, of Alice Arm, is situated on the north side of Trout creek, about 3½ miles from the camp and terminus of the Dolly Varden Railway. Appreciable stripping and tunnelling has been done on this property in former years to explore a vein 10 to 22 feet wide carrying promising silver values. High silver assays can be obtained from selected samples, but the property would bear investigation from the standpoint of a possible appreciable mill-grade tonnage. The owners have been further prospecting the property during 1929. Late in the season an additional strike of a 4-foot vein carrying galena with good silver values was reported by the owners.

NORTH-EAST FORK OF KITSULT RIVER SECTION.

In this section of the Alice Arm area a likely-looking complex of semi-siliceous igneous rocks occurs. These rocks outcrop about 7 miles up the North-east fork, on the higher altitudes of the west side of Washout creek. They can be followed in a north-westerly direction to the ridge that slopes to the Kitsault river. In places they are of diabase and augite-porphyrite type. Inclusions of argillite indicate that the complex is intrusive into the Kitsault River formation. The complex is quite possibly relative to the McGrath Mountain augite-porphyrite and satellitic to a basic phase of the underlying batholith. The locality is deserving of intensive prospecting.

(See the 1922 Annual Report.) The property consists of fifteen Crown-granted claims owned by J. N. McPhee, of Butedale. It is situated on the south slope of Red Bluff mountain to Red Bluff creek. A syndicate was formed during the year to carry out some development. For this purpose a trail was constructed from the East Fork bridge to the camp-site, a distance of about 2 miles. A good cabin was also built at the foot of the bluff on which the showings are located.

The occurrence is an extensive zone of pyritized porphyrite cut by numerous dykes. Chalcopyrite is very sparsely distributed in narrow isolated seams along joint and fracture planes in the porphyrite. In past years some tunnelling into the pyritized bluff was carried out at altitude 3,025 feet, a 30-foot tunnel being driven in a N. 10° E. (mag.) direction. A sample representing both walls and the face of this tunnel assayed: Gold, trace; silver, 0.2 oz. to the ton; copper, 0.2 per cent. The mineralization and structural occurrence of these bluff showings is not encouraging. The locality is, however, worth prospecting for other and more substantially mineralized zones. Late in the season further prospecting is reported to have resulted in the discovery of some veins carrying chalcopyrite mineralization. Tunnelling into the base of the bluff to explore for a more intensive copper mineralization than that exposed in the upper tunnel-workings is contemplated for next season.

Fox. This property, owned by James Flynn *et al.*, of Alice Arm, consists of seven claims on the southerly slope of Red Bluff mountain. The main showing is a quartz-barytes vein of undetermined width and attitude in andesite porphyrite. Mineralization consists of zinc-blende in irregular grains, accompanied by pyrite and some galena. The vein has been traced for about 600 feet by three open-cuts in a westerly direction from an elevation of 1,600 to 1,735 feet. A short crosscut below the lower open-cut will shed some light on the width, attitude, and extent of mineralization. The showing warrants this work being done. A sample across 2 feet of vein exposed in the lower open-cut carrying zinc-blende in pea-sized spots and patches, with some pyrite and galena in a quartz-barytes gangue, assayed: Gold, trace; silver, 0.2 oz. to the ton; copper, *nil*; lead, trace; zinc, 5.1 per cent.

Observer. This property consists of eight claims, owned by Neill Forbes and Jim Flynn, of Alice Arm, adjoining the *Fox* group on the west side of Washout creek. There are several promising showings on this group, on which little work has as yet been done. The formation is andesite porphyrite and in places resembles a fine-grained quartz diabase. Not sufficient work has been done to allow of definite determination of the attitude and extent of the occurrences, which certainly warrant being opened up. The showings are of three types: (1) Disseminated chalcopyrite in a siliceous replacement zone; (2) brecciated quartz-barytes veins with similar mineralization to the *Fox* vein; (3) sheared zones carrying zinc-blende, galena, grey copper, and pyrite, in a quartz-barytes gangue.

At altitude 2,800 feet a quartz vein 18 inches wide, mineralized with pyrite, chalcopyrite, arsenopyrite, and zinc-blende, outcrops in a small creek, on the south bank of Washout creek. No work has been done on this vein. A sample across the 18 inches exposed assayed: Gold, trace; silver, 0.8 oz. to the ton; copper, 1.1 per cent. About 700 feet south-west, at altitude 3,175 feet, a similar occurrence to that on the *Fox* is exposed, with the exception that here there is some chalcopyrite and pyrite mineralization. A sample of the typical mineralization assayed: Gold, trace; silver, trace; copper, 0.2 per cent.

At altitude 3,200 feet on *Observer No. 7*, a siliceous replacement zone 6½ feet wide, striking N. 35° E. (mag.) and dipping 40° west, has been explored by an open-cut. Mineralization consists of veinlets and fine dissemination of chalcopyrite and pyrite in a bluish, dense quartz. A sample across 6.5 feet of this showing assayed: Gold, trace; silver, 0.1 oz. to the ton; copper, 0.9 per cent. Although the grade of mineralization is low at this cut, the zone is promising and should be traced by further surface stripping and cuts.

Over towards the ridge to the Kitsault valley several open-cuts between altitude 3,500 and 3,850 feet and a horizontal distance of several hundred feet expose a brecciated and sheared vein about 4 feet wide, mineralized with zinc-blende, pyrite, and some galena in places. In general the vein in these exposures strikes N. 30° W. (mag.) and dips 45° east. It is quite possible that this is one vein. More work is required to definitely determine it. A sample of a pay-streak 8 to 20 inches wide along the hanging-wall in the upper open-cut assayed: Gold, trace; silver, 3.2 oz. to the ton; zinc, 8.7 per cent. This showing warrants some more exploration. There are several other showings on the property, but little work has been done on them as yet.

ILLIANCE RIVER SECTION.

During the year this company has been carrying out enterprising exploration of the *Sunrise* group on McGrath mountain. The company also controls the **Kitsault Eagle Silver Mines, Ltd.** adjoining *Silver Chord* and the *Le Roi* and *Canyon* groups on Red Top mountain in the North-east fork of the Kitsault River area, about 12 miles from Alice Arm. During 1929 work has been concentrated on the *Sunrise*.

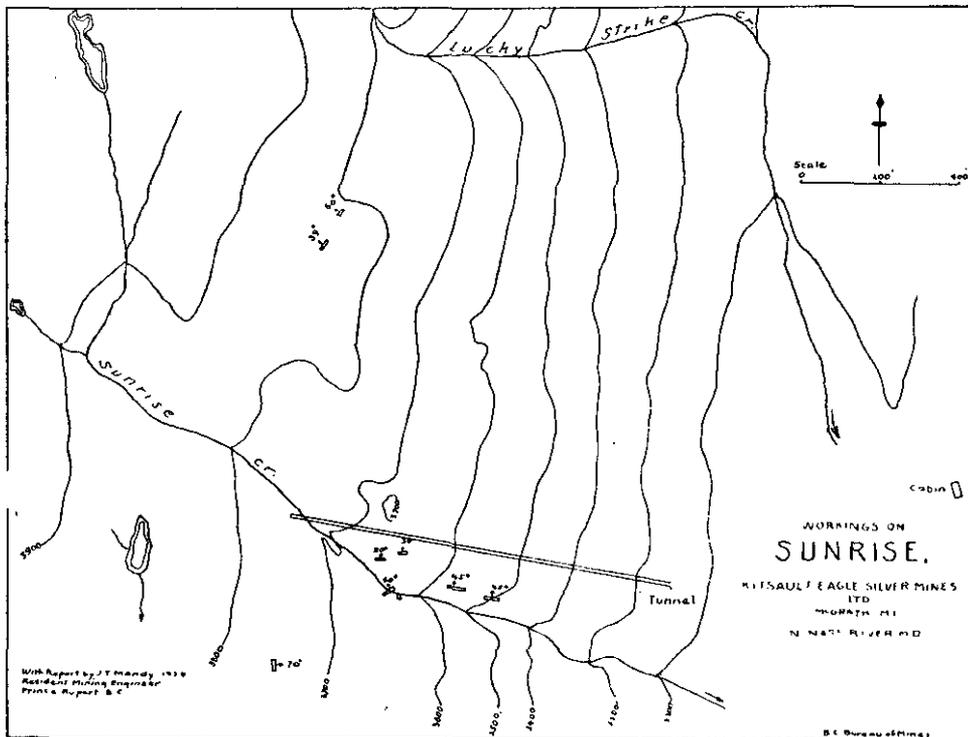
The *Sunrise* group comprises one surveyed and twenty-two unsurveyed claims. It consists of a grouping of three groups so as to enable the work to be concentrated on the *Sunrise* claim. With the exception of about six weeks' work on the *Standard* some years ago, the development on the *Sunrise*, which was staked thirteen years ago, is the first extensive exploration of the McGrath Mountain deposits. This exploration was energetically pushed throughout the year. A temporary suspension of operations early in January, 1930, was caused by excessive snow conditions.

The year's work was concentrated on the driving of a long crosscut tunnel, 6 by 8 feet, at altitude 3,200 feet in a N. 70° E. (mag.) direction for the main purpose of intersecting the

"Banded vein" at about 500 feet vertically below the surface outcrops. This tunnel was driven 1,160 feet, with two short crosscuts north and south. With assistance from the Department of Mines, the McGrath Mountain trail was considerably improved during the season.

The formation of the area is a folded complex of tuffs, coarse breccias, and bands of argillite, intruded by lamprophyre dykes and an augite-porphyrite stock. The veins occupy brecciated and sheared fault-planes in, or close to, the argillite inclusions in the augite porphyrite and frequently in the neighbourhood of small dykes. An irregularity of dip, and particularly of strike, features the vein system. Generally, however, the trend is between north-east and slightly west of north, with a comparatively flat northerly dip.

Surface-trenching and open-cuts have exposed several brecciated shear-zones varying from 18 inches to about 20 feet in width. Mineralization consists chiefly of zinc-blende, with minor quantities of pyrite and occasionally some galena, in a gangue of quartz and calcite veinlets and inclusions of country-rock. Mineralization is lenticular and bunched, but where it does occur is well pronounced. Sufficient surface work has not been done to enable a criterion to be formed of ore-shoot lengths. The limited amount of surface work, the varying strikes and dips, and



the probability of much faulting do not allow of any definite correlation of the veins exposed in the different cuts.

To ascertain the general metal tenor of the ore-shoots to be expected, the following samples were taken: Across a vein 3 feet wide outcropping in the right bank of Sunrise creek at altitude 3,525; this assayed: Gold, trace; silver, 0.6 oz. to the ton; lead, *nil*; zinc, 26 per cent. A sample representing 2 feet of the best mineralization on the hanging-wall of a vein 4.5 feet wide at altitude 3,650 feet assayed: Gold, 0.02 oz. to the ton; silver, 3.5 oz. to the ton; zinc, 28 per cent; antimony, *nil*.

In the course of driving the crosscut tunnel at altitude 3,200 feet, veins were cut at 175 and 400 feet in respectively. These are quite probably the extension of the Sunrise Creek outcrops at altitude 3,525 and 3,650 feet. It was estimated that the "Banded vein" should have been intersected at about 1,000 feet in. Unfortunately surface work on this vein has in no place

definitely defined its attitude. The accurate projection of this vein to the tunnel-level cannot therefore be accurately calculated. Nothing has been encountered in the tunnel that conforms to the "Banded vein" outcrop.

At about 1,000 feet in, however, isolated bunches of zinc-blende were encountered associated with a somewhat indefinite structure. The tunnel discloses a gradual change of the formation attitude from an easterly dip at the portal to a westerly dip at the face. Where the attitudes of exposed veins can be definitely determined they conform in dip, more or less, to the bedding of the formation. On the surface, formation exposures contiguous to the "Banded vein" indicate a westerly dip of about 45°, conforming to the westerly dip of the bedding-planes towards the tunnel-face. Should the "Banded vein" conform to this 45° westerly dip it would be encountered on the tunnel horizon at approximately 1,500 feet in.

It is possible that the ore encountered at the 1,000-foot point may be the extension at depth of a surface showing at the head of the creek at altitude 3,650 feet. At the 1,000-foot point in the tunnel the structure has been drifted on to the north for 80 feet, with bunches of zinc-blende in quartz-calcite stringers showing at intervals. At 950 feet a crosscut has been started into the north side of the tunnel, where it is estimated this structure will be cut at 40 feet in. During the winter the first vein encountered in the tunnel will be drifted on to north and the second will be explored by drifting to the south. As the best mineralization encountered on the surface seems to lie to the south of the tunnel, it would seem logical to confine initial drifting to that direction where possible. Before advancing the crosscut tunnel any farther it is planned to determine the attitude of the "Banded vein" by additional surface work in the spring. This is a sound campaign of development.

This exploration of the *Sunrise* group is of much constructive benefit to the McGrath Mountain area. It will shed much light on the economic importance of the zinc-deposits of this locality.

PORTLAND CANAL MINING DIVISION.

The Portland Canal Mining Division embraces Portland canal, 70 miles long, the drainage areas of the Salmon and Bear rivers, the northerly drainage area of the Nass river, and that of the Unuk river. This area is approximately 7,000 square miles in extent, and, excepting the Unuk River section, is accessible from the town of Stewart at the head of the Portland canal.

This Division is the most active in the district from the standpoint of exploration and prospecting, and second in production. Certain phases of importance to the Division are dealt with in the summary of this report. The area has been very active during the past year and has attracted the interest of substantial companies for the development of its prospects. The possibility of obtaining hydro-electric power through the interest in the Division of the Power Corporation of Canada, and railway transportation through the acquisition of the Canadian North-eastern charter by the Consolidated Mining and Smelting Company of Canada, holds promise for the more rapid future development of the area. The scope and eventual progress of these undertakings has, however, not been announced by the companies concerned.

Prospecting has extended the known mineral area. Promising discoveries have been made at the head of American creek and across the Bear River pass into the Nass. The activity of the Consolidated Mining and Smelting Company in the outlying areas of the Bowser and Tide Lake sections and its thorough exploration of the *Big Missouri* and *George Copper* properties is a hopeful augury for additional future producers. The outlook for production from the *Premier* for some time to come is favourable, and the promise of the *B.C. Silver* as a new producer in the near future is bright.

GEORGIA RIVER SECTION.

Active and efficient development was continued on this property during the **Georgia River Gold Mines, Ltd.** year and will proceed throughout the winter months. Compressors and other equipment were installed, bunk-house and residence erected, and assay office, warehouse, and office put under construction. With the contemplated installation of an electric-lighting system the property will be one of the best equipped in the district.

Work is being concentrated on the driving of No. 3 tunnel to intersect the southerly end of the south-west vein. This tunnel starts as a crosscut in a westerly direction for 190 feet, where it is turned northward for about 250 feet and then easterly, in which direction it had advanced about 80 feet without encountering the vein. In the surface open-cuts above this tunnel the

easterly dip of the vein and the indication of displacement by a northerly-striking shear-zone may have thrown the vein farther to the eastward than the position of the tunnel-face at the time of examination.

When the downward extension of the south-west vein is located it is planned to drift north-east to explore for the continuation at depth of the ore-shoot indicated in the surface cuts. The vein will then be drifted on to explore for ore-shoots towards No. 2 tunnel. The progress of this work will also involve crosscutting at depth for the Bullion vein and the intersection of that vein with the main vein.

The veins can be traced on surface for appreciable distances, with altitude variation of from 3,180 feet at No. 3 tunnel to 3,600 feet at No. 1 tunnel. Beyond this the main vein was traced to about altitude 4,600 feet, but snow on the higher elevations obscured its further possible tracing. The main vein, which is apparently a silicified zone averaging about 14 feet wide, does not carry encouraging mineralization. A sample of the general character of this vein selected at 4,000 feet altitude assayed: Gold, trace; silver, trace.

In No. 1 tunnel widths of from 4 to 30 inches have been drifted on for about 140 feet, with reported values of from 60 cents to \$170.24 in gold and silver.

At the time of examination (middle of October) the face of No. 2 tunnel showed a sheared zone with quartz stringers, sparsely mineralized with pyrite.

The Bullion tunnel has been described in the 1922 Annual Report. The occurrence is in an inclusion pendant of andesitic rocks of undetermined depth underlain by diorite.

This property is situated on the ridge east of the divide between Bulldog creek and Georgia river. It is reached by a very bad trail which leaves Burnt point, **North Country Mining Co., Ltd.*** on Portland canal, and crosses the 3,300-foot ridge between the canal and Georgia river. Stores and material are packed in on men's backs at a cost of 15 cents a pound. Development is being concentrated on the following claims: *Glory, Glory Extension, Ventura, and Fortuna*. A. Linke is in charge.

At the time of examination work was being concentrated on driving two crosscuts through a hard metamorphosed argillite in an easterly direction. The lower one is just above the valley-level and was in 50 feet; the upper, about 100 feet higher up, was in 20 feet. Approximately 400 feet higher up the hill and some distance to the south a little work has been done in a gulch running down the face of the hill. The rock is mineralized in places, with small showings of zinc-blende, chalcopyrite, and traces of galena. In the same gulch and 150 feet higher up there is a drift in a northerly direction, which is in about 60 feet. Here also are patches of mineralization, consisting of pyrite and galena with a little arsenopyrite. Another small cut on the opposite side of the gulch also showed slightly mineralized matter.

Considerably farther south, possibly half a mile, and at about the same elevation as the above, there is a strong outcrop of quartzite, averaging 4 feet in width, crossing a deep gulch. I was unable to find any evidences of mineralization in it, but to the west there was a little zinc-blende and pyrite.

The apparent strike of the showings is north and south. The dip is vertical or steeply to the east. No ore of commercial value has been found so far. A log-built bunk-house is being put up close to the lower crosscut.

Just beyond the present end of Bulldog Creek trail is a difficult stretch along a vertical bluff. Once that is passed there should be no difficulty in maintaining a reasonably even grade to the top end of the valley, a distance by estimation of at least 3 miles.

MARMOT RIVER SECTION.

The ore-deposits of this property are described in former Annual Reports.
Porter-Idaho. The property is now being operated by the Premier Gold Mining Company. The following information regarding the year's operations has been kindly supplied by D. L. Pitt, manager, Premier Gold Mining Company, Limited:—

"At *Porter-Idaho* an aggregate of 1,316 feet of drifting and raising was done during the year. This was accomplished in various tunnels and on various horizons. Some small and narrow shoots were outlined and will be mined later. Tunnels were also run into the *Porter-Idaho* ground from *Prosperity's* No. 3 level and some ore-bodies indicated.

"Efforts were concentrated upon the completion of the *Porter-Idaho* tramway, which was completed early in September and put into operation. This work, along with the power-line

constructed from the beach to the mine, has been brought to a successful culmination and now gives excellent transportation facilities for supplies and ore, and also gives electrical power at the mine. A 1,200-foot compressor, electrically driven, has been installed at the mine and furnishes the power for mining not only at *Porter-Idaho*, but also at *Prosperity*. No ore has been shipped from *Porter-Idaho* during the year."

This group is also being operated by the Premier Gold Mining Company. The following information concerning the 1929 operation has kindly been supplied by D. L. Pitt, manager: "A vigorous development campaign was carried on

during the entire year, pushing out drifts along indicated ore-zones and generally preparing the mine for production. With the completion of the *Porter-Idaho* tramway a method of transporting *Prosperity* ore was provided, and, by a mutual arrangement between these two companies, *Prosperity* ore is being handled over the *Porter-Idaho* tramway.

"In November *Prosperity* came into production and during the months of November and December some 1,650 tons of ore was shipped. According to our local sampling, the estimated content of this ore will be: Gold, 32 oz.; silver, 109,000 oz.

"At the mine proper various surface improvements were made, such as the completion of the bunk-house, which is now a modern steam-heated, electric-lighted building; a new warehouse, dry-house, and blacksmith-shop were built, and the proper snow-sheds and covered runways provided to ensure operation without interference from the snow during the winter."

This company was formed with a capital of 500,000 shares at \$1 each, 29,000 of which are under option to the Marmot Metals Mining Company. The property, which consists of one claim and four fractions—*Melvin* and *Melvin Fractions 1 to 4*—is Crown-granted and registered in the name of the company.

It is situated above the glacier at the head of the North fork of the Marmot river and to the east of and adjoining the *Prosperity* group.

The main working consists of a drift which has been driven for 40 feet on a high-grade stringer in a shear-zone in a country-rock consisting of volcanic tuffs and breccias. The stringer, which strikes N. 20° W. and dips very steeply to the south-west, is well mineralized with native silver, galena, zinc-blende, pyrite, and chalcopyrite.

A winze was started at a point about 20 feet in from the tunnel portal, which at the time of my visit was down 7 feet. A width of 26 inches of well-mineralized vein-matter was exposed in the bottom and some more left on the hanging-wall.

A chip sample over 14 inches of vein-matter next the foot-wall in the bottom of winze assayed: Gold, 0.06 oz. to the ton; silver, 2 oz. to the ton; lead, trace; zinc, 7 per cent. A chip sample over the next 12 inches of vein-matter assayed: Gold, 0.02 oz. to the ton; silver, 5.5 oz. to the ton; lead, trace; zinc, 7 per cent.

The property of this syndicate is situated on the north shore of the mountain overlooking the Marmot river and almost opposite the mouth of the North fork. The group consists of the following claims: *Stimulator 1 to 4*, *Northern Slope*, *Northern Slope No. 1*, *Gold Pan*, *South Slope*, *South Slope No. 1* and *No. 2*, and *Moonlight*. The syndicate is composed of Clay Porter, W. C. Blanton, C. W. Magee, and A. R. Casey.

The property is about 3 miles from tide-water and is reached by a fair horse-trail which has been constructed from the main Marmot River trail to a point about two-thirds up the hill, and then continues as a very steep foot-trail the rest of the way. Work is being done from a tent camp just on timber-line, at an elevation of 3,900 feet.

Several veins are being developed, which appear to be shear-zones occurring in granite. The *Panhandle* vein, which strikes S. 10° E. and dips 75° east, varies in width from 2 to 6 inches. It carries visible gold and some pyrite and has been traced for some distance by open-cuts. A sample across 6 inches of quartz exposed in an open-cut assayed: Gold, 0.24 oz. to the ton; silver, 8 oz. to the ton. A drift has been put in for a distance of 18 feet on the *Gold Pan* vein. Six inches of quartz has been left standing on the hanging-wall. A sample over 18 inches of mineralized vein-matter under the quartz assayed: Gold, 0.08 oz. to the ton; silver, 0.24 oz. to the ton. A sample over 6 inches of mineralized quartz at the portal of the drift assayed: Gold, 0.34 oz. to the ton; silver, 17.5 oz. to the ton. This vein has also been traced for several hundred feet. Its strike is S. 50° W. and dip 40° north.

The Magee silver-lead vein has also been traced for a considerable distance. An open-cut has been put in well up the hill and shows vein-matter 4 feet wide, striking S. 50° E. and dipping 80° south. It contains galena, zinc-blende, chalcopyrite, and pyrite in fair amount. A chip sample over 4 feet assayed: Gold, 0.68 oz. to the ton; silver, 11 oz. to the ton; lead, 0.8 per cent.; zinc, 7 per cent. The *Stimulator* vein is situated about three-quarters of a mile west of the others. It strikes S. 10° W. and dips 45° west. A drift has been put in for a distance of 40 feet on vein-matter 12 to 18 inches wide. A sample over 12 inches of gouge-matter with some quartz assayed: Gold, 0.04 oz. to the ton; silver, 0.3 oz. to the ton. Gossan quartz showing free gold can be found here.

This group appears to have some possibilities. High values may be expected at the intersection of the *Panhandle* and *Gold Pan* veins. A comparatively short aerial tram down to the road at the North fork would make it a simple matter to ship the ore.

A considerable amount of work has been done this season, the horse-trail constructed part of the way, and a foot-trail the rest; also foot-trails connecting the camp and the various workings and a lot of open-cutting and driving completed.

**Glacier Girl
Mining Co.**

This company was organized in 1928 to develop the *Glacier Girl* group of eight claims, situated on the east end of the ridge between the north and south glaciers of the Marmot river. In that year the holdings of the company were optioned to the Marmot Metals Mining Co., Limited (N.P.L.). The showings are described in the 1928 Annual Report. During 1929 the Marmot Metals Company carried out some surface-stripping on a section located in 1928 that carried silver and copper values. The indications from this work were discouraging and showed the sections carrying values to be restricted and lenticular. Commercial possibilities would be dependent on the discovery of further and sufficient lenses to warrant a profitable operation of selective or bulk mining. A complete geological and detailed survey of the property was made by the consulting engineers. It is reported that this did not indicate a very high probability of locating further high-grade silver sections in the large oxidized zone.

BEAR RIVER SECTION.

This company was organized in 1928 to assume ownership of the Silverado **Silverado Consoli.** Mines, Limited. A controlling interest in Silverado Consolidated Mines, Limited, **dated Mines, Ltd.** was at the same time obtained by the Premier Gold Mining Company for the purpose of carrying out exploration and development of the property. Active development by the Premier Company was carried out during 1929. Work on the No. 3 tunnel level, where the downward extension of the veins was crosscut, carried out during the first half of the year proved somewhat disappointing regarding the extent of the ore-shoots encountered. No. 3 tunnel, which had been advanced 412 feet in 1928, was carried to a total length of 1,048 feet in 1929, cutting two barren zones. Intermediate exploration from a 3-compartment, vertical raise 200 feet, and sub-levels at that elevation (No. 2 level), was then resorted to. Some 450 feet of drifting was done on this horizon. Although some ore was encountered in this work, the results are reported to have been disappointing.

From No. 2 level another raise was then driven 145 feet on the slope, an additional level established at that horizon, and some 150 feet of drifting completed. This raise was being carried on upwards towards surface at the close of the year. During 1929 a total of 1,913 feet of drifting and raising was done.

The Silver Bell Mining Company was incorporated under the laws of British **Silver Bell** Columbia in 1922 with a capitalization of \$2,000,000, divided into 2,000,000 **Mining Co., Ltd.*** shares of the par value of \$1 each. The registered office is at 404 National Bank of Commerce Building, Seattle, Wash. The company owns seventeen claims immediately south of the *Silverado*, about 1½ miles south-east of Stewart. The following are the names of the claims: *Silver Bell No. 1 to No. 3, Silver Bell Fraction, Silver Night, Silver Night No. 2, Night Fraction, Silver Bank No. 1 to No. 4, Silver Bank Fraction, Safe Key No. 2 Fraction, Safe Key Fraction, Bank Fraction, Silver Night Fraction, and Silver Fraction.*

The property is reached by a fair trail which starts from the *Silverado* wharf. The showings examined are above timber-line and below a glacier. They consist of a series of shear-zones in volcanics, containing some small seams and lenses of galena with some zinc-blende and pyrite. Very little work has been done, with the exception of a few open-cuts and trenches. Owing to

the proximity of the *Prosperity* and the *Porter-Idaho* groups on the east and the *Silverado* on the north, and the very similar geological conditions, the property is worthy of systematic prospecting.

This company's claims are situated on the west side of the Bear River valley, on the easterly slope of Mount Dolly at an elevation of about 3,000 feet, and about 3 miles from Stewart. No work was being done on the claims at the time of examination. The best opportunity for success on these holdings of the company lies in the eastern area of the *Lucille No. 1* claim, which is in the Bear River formation and some little distance from the granite-contact. Some further prospecting was carried out on this part of the property during the latter part of the season and additional discoveries were reported. No extensive development was carried out during the year. This property warrants some further development and exploration, but to be effective it should be planned and under the direction of a competent mining engineer.

On these claims, adjoining the *Bayview* on the north and east, some stripping and cleaning-out of the old cuts has exposed the No. 1 vein for a distance of several hundred feet. In one cut at elevation 3,475 feet the vein shows 23 inches well mineralized with galena and ruby silver. A sample taken across 18 inches of the showing in this cut assayed: Gold, 0.12 oz. to the ton; silver, 207.7 oz. to the ton; lead, 9.3 per cent.; zinc, 5.7 per cent. The drift on this vein at elevation 3,350 feet is advanced 145 feet, but will have to be extended to get under the possible downward extension of this high-grade lens. A sample taken across the 5-foot face of this tunnel assayed: Gold, 0.02 oz. to the ton; silver, 27.2 oz. to the ton; lead, trace; zinc, 1.6 per cent.

There is much ground on the property still to be prospected. The large pyritized porphyry dykes cutting through the claims in a north-westerly direction should be prospected for the possibility of a mill-grade ore. At elevation 2,975 feet, about 600 feet south-east of the camp, a large cupriferous pyrrhotite outcropping should also be prospected.

Dunwell Mines, Ltd.—An electrical survey was carried out on this property during the latter part of the summer. Indications from this work were followed up with diamond-drilling, the results from which are reported to be not altogether favourable. It is understood that further drilling will be continued during 1930.

This property was formerly known as the *Mobile*. Late in the season the group was optioned by Clay Porter, of Stewart, who intends to start active development in the spring of 1930. It is owned by H. P. Gibson and Louis Legg and consists of nine claims on the south side of Glacier creek, at an elevation of 4,000 feet. It is reached by a good trail from the *Dunwell* mill. The main showing consists of a well-defined vein in a shear-zone in argillites, striking north and south and dipping steeply to the west. It is mineralized with pyrite and zinc-blende. Erosion of the foot-wall has formed a well-marked trench running down the hill, leaving the vein standing on its western side. It can easily be traced for a considerable distance and its lower end descends into a narrow canyon with vertical sides.

A considerable amount of work has been done on this vein, consisting of several open-cuts and three drifts over a vertical distance of approximately 400 feet; the width varies from 18 inches to 4 feet. A chip sample over 24 inches of the foot-wall of the vein exposed in the cut assayed: Gold, 0.03 oz. to the ton; silver, 0.9 oz. to the ton; lead, trace; zinc, 2 per cent. A sample from the face of No. 1 drift, 50 feet in from the portal (60 feet vertically below the cut), over 24 inches of vein-matter, assayed: Gold, trace; silver, 132.6 oz. to the ton; lead, 1.6 per cent.; zinc, 5.4 per cent. A sample from the face of No. 2 drift, 80 feet in from the portal (30 feet vertically below No. 1 drift), over 18 inches of vein-matter, assayed: Gold, 0.02 oz. to the ton; silver, 2.2 oz. to the ton; lead, trace; zinc, 3 per cent. There is also a drift (No. 3) which is about 100 feet below No. 2. It is in about 110 feet.

Another showing occurs about a quarter of a mile to the west. It consists of a quartz vein with much the same physical characteristics as the first, but appears to be rather more heavily mineralized. It has been exposed in a creek-bed by an open-cut and shows a face 20 feet wide. It is fairly well mineralized with galena, zinc-blende, and pyrite. A chip sample over 36 inches of mineralized matter from the middle of face assayed: Gold, trace; silver, 10.6 oz. to the ton; lead, trace; zinc, 4.2 per cent. A sample over the next 27 inches to the west assayed: Gold, 0.02 oz. to the ton; silver, 1.4 oz. to the ton; lead, trace; zinc, 4 per cent.

Black Hill Mining Co. This company was incorporated in 1925 to develop a grouping of claims situated at the head of the South fork of Glacier creek. During 1929 an option was obtained on two-thirds of the stock of the Black Hill Mining Company by the Northern Metals Holding Syndicate, a development syndicate of 12,500 units of \$10 par value, organized by the North Coast Finance Company, Limited, of Stewart.

The ore-deposit consists of a series of east-west striking, steeply dipping quartz veins 6 to 8 inches wide, sparsely mineralized with galena, zinc-blende, grey copper, and occasionally some chalcopyrite. Another series of well-defined north-south striking, steeply dipping, quartz-calcite-barite veins 8 to 12 inches in width, well mineralized with zinc-blende, grey copper, galena, and jamesonite, carrying high silver values, also occurs on the property. These latter show indications of sustained ore-shoots for lengths of about 40 feet, with intervening spaces in the veins of 20 to 30 feet of low-grade material. The property offers promise for development of small tonnages of high-grade shipping-ore, with interesting indications of possible augmentation at the junctions of the two series of veins. The formation is a complex of intrusive andesite into argillite. The veins seem to favour the contact area of the two rocks and in places seem to follow the course of a dense rhyolitic dyke. In traversing the argillite the veins appear to "stringer out" and condense again on merging into the volcanics.

The showings are between altitudes 3,850 and 4,650 feet. Active and efficiently guided exploration was inaugurated early in the summer and continued into the winter months. A summer camp was established at altitude 4,200 feet and later a good winter log camp was erected on the sheltered slope of the mountain.

No. 2 tunnel on No. 3 vein was advanced 68 feet and, later, work was concentrated on driving No. 1 tunnel on No. 4 vein, 90 feet lower down the slope of the hill. These two veins should junction at approximately 312 feet from the portal of No. 1 tunnel, with backs at that point to about 125 feet. At the time of the first examination (June 20th) No. 2 drift-tunnel had been advanced 45 feet, showing the vein to be about 8 inches wide and well mineralized. A sample across the vein on the north wall of the face assayed: Gold, trace; silver, 52.6 oz. to the ton; copper, trace; lead, 0.2 per cent.; zinc, 6.2 per cent. A sample of a streak of massive sulphides 2 inches wide, about 20 feet from the tunnel portal, assayed: Gold, 0.04 oz. to the ton; silver, 82.3 oz. to the ton; lead, 6.4 per cent.; zinc, 6.3 per cent. A sample across an average 8-inch width of a vein exposed in a trench 30 feet long at altitude 4,600 feet assayed: Gold, 0.04 oz. to the ton; silver, 86.2 oz. to the ton; lead, 9.8 per cent.; zinc, 6.8 per cent. The outcrop of this vein is highly manganiferous. A sample across an 18-inch width of vein exposed in a very manganiferous outcrop at altitude 4,650 feet assayed: Gold, 0.01 oz. to the ton; silver, 5.1 oz. to the ton; lead, 0.3 per cent.; zinc, 2.1 per cent.

The property was again examined in October, when work was being pushed in No. 1 tunnel at altitude 4,475 feet. At that time this tunnel was advanced 78 feet on No. 4 vein with the objective of the junction-point of this vein with No. 3 at altitude 4,600 feet. An ore-shoot 41 feet long, averaging 12 inches in width, and heavily mineralized with zinc-blende, jamesonite, galena, and grey copper, in a calcite-barite gangue, was exposed on the west wall of the tunnel to within 9 feet of the face. In the face the vein had become shattered and sheared with only sparse mineralization. A sample across 1.3 feet of vein, 69 feet from the tunnel portal and 9 feet from the face, assayed: Gold, 0.10 oz. to the ton; silver, 112 oz. to the ton; lead, 11.5 per cent.; zinc, 4 per cent. A sample across 12 inches of vein, 54.6 feet from the tunnel portal, assayed: Gold, 0.02 oz. to the ton; silver, 47 oz. to the ton; lead, 8 per cent.; zinc, 8 per cent. A sample across 0.95 feet of vein, 37.7 feet from the tunnel portal, assayed: Gold, 0.06 oz. to the ton; silver, 31 oz. to the ton; lead, trace; zinc, 8 per cent. A sample across 0.95 feet of vein exposed in a cut on this vein at altitude 4,550 feet and about 160 feet horizontally beyond the tunnel portal assayed: Gold, 0.04 oz. to the ton; silver, 61 oz. to the ton; lead, 8 per cent.; zinc, 10 per cent.

From this work two shipments of selected ore totalling about 20 tons have been made to the smelter. It is reported that the shattered condition of the vein (showing in the face) continued for about 22 feet, when a second ore-shoot came in which is now being drifted on.

Ben Bolt Mining Co. This is one of the oldest holdings in the Portland Canal Mining Division, the claims being Crown-granted in 1912. The group is situated near the head of the South fork of Glacier creek, adjoining the *Black Hill*, and about 4 miles from the Bear River road. The occurrence is a wide brecciated quartz vein in

argillite carrying zinc-blende, galena, pyrite, in what is known as the "Portland Canal fissure-zone." The vein is heavily graphitic. Extensive underground exploration from tunnels at different levels was at one time carried out by the Pacific Coast Exploration Company. Three of the claims have reverted to the Ben Bolt Mining Company, 43 Victoria Street, Toronto, and the *Chicago Fraction* to Samuel Morrison, 1150 Main Street, Vancouver. The work has resulted in only partial exploration of the ore-shoots. The prospect has been idle for a number of years, but warrants further exploration for the possible development of mill-grade ore.

This company was incorporated in March, 1928, with the registered office in **Mayou Gold Stewart**. The property is situated on the north side of Bitter creek, above **Copper Co., Ltd.*** and on either side of the Radio-Stewart Company's property. The trail is a continuation of the trail to the latter property. The group consists of the following thirty claims: *Alberta, Alberta No. 1 to No. 7, Ophir, Ophir No. 1 to No. 3, Morgan, Morgan No. 1 to No. 6, Mayou Fraction, Mayou, Mayou No. 1 to No. 4, Dot, Dash, Russ, Sandy, and Mayou Fractional*. These are all owned by the company and are being surveyed.

The main showings consist of a series of narrow shear-zones mineralized with galena and associated with dykes in argillite country-rock. Work has been concentrated during the summer on driving three tunnels. No. 1 tunnel, at elevation 5,380 feet, has been driven for 120 feet on a small stringer of galena ore. This vein strikes N. 18° W. and varies from 2 to 18 inches in width. Near the end of the drift the vein has been cut off by a dyke.

No. 2 tunnel, at an elevation of 5,280 feet, has been driven about 130 feet on a small stringer striking N. 10° W. At this point a large dyke comes in at an acute angle from the west and apparently cuts the stringer off. The drift was continued for a further 70 feet to the far side of the dyke and another small stringer was encountered on its western contact with the argillites. It is probable that the original stringer follows the eastern wall of the dyke. No. 3 tunnel, at an elevation of 4,600 feet, was put in on a small showing of galena on a contact between the east wall of a dyke and the argillites.

The veins are small, but appear to be well mineralized. The mineralization consists chiefly of galena with some zinc-blende and pyrite. There are also several open-cuts in the hillside with showings up to 20 inches wide, containing a little galena. On the top of the mountain there is a copper-showing consisting of a dyke striking N. 35° W. and dipping south-west. This contains stringers of chalcopyrite up to 3 inches wide. It has been exposed by two open-cuts, but not enough work has been done to enable an opinion to be formed as to its value.

Work has been done from a tent camp above timber-line on the south side of the mountain. The claims are reached by a fairly good trail which leaves the main road near the north end of Bear lake, switchbacks up the hill, and then crosses the divide.

Radio-Stewart Mines, Ltd.—This property is situated on the north side of Bitter creek, adjoining the *Mayou*. Somewhat wider shear-zones than those occurring on the *Mayou*, but with similar mineralization, are exposed on this property and were further prospected during the season.

The holdings of this company of the *L.L. & H.* group are being operated by the **Bitter Creek Mines, Ltd.** Northern Metals Holding Syndicate. The claims are situated at an elevation of 3,400 to 4,000 feet in Harkley gulch, near the head of Bitter creek, about 7 miles east of the Bear River wagon-road. Camp was established and exploration proceeded during the summer months. The formation is a volcanic complex of augite porphyritic intrusive into argillite. Later pyritized sycnite dykes cut the formation. Development has been carried out on a fault-vein, 2.5 feet wide, carrying nodules of high-grade galena-grey copper ore in heavy gouge.

Two tunnels at elevations of 3,425 and 3,500 feet have opened up a replacement shear-zone in volcanics, with promising mineralization of galena and zinc-blende, some pyrite and arsenopyrite, over good widths. A sample across 3.7 feet in the face of the 35-foot upper tunnel on this zone at elevation 3,500 feet assayed: Gold, 0.12 oz. to the ton; silver, 7.5 oz. to the ton; copper, 0.2 per cent.; lead, 4.7 per cent.; zinc, 9.8 per cent.

In the lower tunnel, at altitude 3,425 feet, there is a 62-foot width of mineralization with 20 feet similar to the face of the upper tunnel. This is a promising showing and should be seriously explored with the idea of developing mill-grade ore.

This seam follows the same contour as the No. 2 South mine, is found to be "lying on end," and, previous to encountering a fault 200 feet from the portal, was 18 feet in thickness; on cutting the fault the seam was found to be 6 feet thick and all good clean coal. This is cut by machines of the post-puncher type.

NEW PROSPECT.

James Fairfoull, Overman.

This is a new mine commenced during the latter part of the year and is situated about 600 feet south of the entrance to the No. 2 North mine; also 75 feet above and connected to the surface haulage by a single-track road up the side of the hill 300 feet in length. This has been developed by an adit-level driven into the side of the hill and has reached a distance of 200 feet from the portal. During my last visit of inspection I found this seam of coal at the face of the level to be 27 feet thick, the upper 16 feet being very good clean coal and following the same contour and pitch of the seams below.

Tulameen Coal Mines, Ltd.

M. Y. Aivazoff, Managing Director, Vancouver, B.C.; Harry Smart, Vancouver, B.C.;
John C. Bennett, Mine Superintendent, Merritt, B.C.

No. 1 MINE.

William Strang, Overman; Thos. Dobie and Robert Gourley, Firebosses.

This mine is situated about 2 miles from Princeton and has been the scene of active developments during 1929. This mine was formerly operated by the Tulameen Valley Coal Company, but was taken over during the year by the Tulameen Coal Mines, Limited. The new company built a new tippie, increased the power plant, and made connections with the Kettle Valley Railway; this involved about 1 mile of standard track.

A considerable addition has been added to the power plant during the year. The 60-horsepower locomotive-type steam-boiler and the 14 by 20 single-cylinder steam-engine, used for driving a single-stage 12 by 14 Ingersoll-Rand air-compressor, has been supplemented by a large return-tubular boiler. A 600-foot R-2 Ingersoll-Rand 2-stage straight-line steam-driven air-compressor and the mine-fan, formerly driven by a gasoline-engine, is now driven by a steam-engine.

The seam averages from 7 to 8 feet of good clean domestic coal overlaid by a fairly good shale roof. This seam at the Tulameen mine has a general pitch east of 15° and has been developed by four adit-levels driven into the side of the hill from the surface croppings. The No. 1 or lower level is the longest and follows the strike of the seam for a distance of some 1,500 feet from the portal of the level, where faulting was encountered; the No. 3 level, situated about 100 feet above, is used as the main haulage-level, and the upper or No. 4 level is the return airway.

Seven hundred feet from the portal of the No. 3 level a slope has been driven to the dip, a distance of some 700 feet, and is used as the present haulage-slope. During the early part of the year some of the old caved and disused roads commenced to heat in the south side, or the faulted area, and as a result some of the old roads were cleaned out and others sealed off. Unfortunately, in the previous operations of this mine little thought was given to arrange the workings to deal with this most important feature, which often determines the difference between success and failure in operating coal-mines in this district, and it was for this reason that it was decided to stop all further developments in this slope, recover all pillar coal possible, and make the future developments by new openings from the surface.

All the coal is mined at the present time by hand and the use of explosives is avoided as much as possible for the purpose of producing a large percentage of lump coal for the domestic market. Edison electric safety-lamps are used by all the employees underground, while safety-lamps of the Wolf type are used by the officials for inspection purposes. All shots are fired by electric batteries and by the officials.

Ventilation is produced by a 5-foot, enclosed-type, belt-driven fan situated near the entrance to the No. 4 level. During my last visit of inspection ventilation measurements showed 12,000

The ore occurrence on this property is described in the 1928 Annual Report.

Rufus Argenta Mines, Ltd. The holdings of the company are situated on the north side of Bear River valley, about 20 miles from Stewart. During the early part of the season the continuation of the tunnel to cut the downward extension of the Erickson vein was carried out by the J. F. Duthie interests, of Seattle. These operations ceased in the early fall and J. F. Duthie was reported to have relinquished his option. The tunnel had been driven about 800 feet and nothing of importance had been developed.

It is understood, however, that late in the season a contract was arranged for the further advancing of the tunnel during the winter months.

Red Top.* This property is situated on the upper Bear river, facing south. It consists of the following claims: *Superior, Superior No. 1, Superior Fraction, Amazon, Amazon No. 1 to No. 4, Amazon Fraction, Red Top, Red Top No. 1, Red Top No. 1 Fraction, and Hector No. 1*. It is owned by J. Connors, James McNeil, and John McNeil, and is under option to a Vancouver syndicate, which carried on active exploration until the late fall, when operations were suspended. Work is being done from a tent camp at an elevation of 3,800 feet.

The outcrop, which has a general east-west trend, is at an elevation of 4,080 feet. It consists mainly of iron-stained brecciated quartz, carrying galena, chalcopyrite, pyrite, calcite, and barite. It has been traced along the hillside for close on 1,000 feet and has been exposed in several places by open-cuts. At its eastern end it appears to have been cut off by a large and well-defined quartz-porphry dyke, striking N. 50° W. and dipping nearly vertical. Another dyke of the same character comes in from the south, joins the vein, and runs parallel with it for several hundred feet.

A crosscut tunnel at an elevation of 3,865 feet has been driven through 370 feet of greenstone to under the outcrop. Drifting was started to the west, but at the time of examination the vein had not been found, though several small mineralized seams were cut in driving through the greenstone.

The lower showings are at an elevation of 3,000 feet and consist of disseminated chalcopyrite in greenstone, forming a vertical bluff stained with copper and iron. About 125 feet below this outcrop a crosscut tunnel has been driven north for a distance of 330 feet. The vein was found to be about 8 feet wide, but values appear to be low.

Docia.* This property is a new discovery. It is situated to the east of and adjoining the *Red Top*, at an elevation of 4,000 feet, and is owned by the McNeil Bros., of Stewart. The showing is just to the west of Cullen creek and consists of a vein of almost solid galena 12 to 14 inches wide. It contains a little pyrite and chalcopyrite. The strike is east-west and the dip to the south. It has been exposed by two small open-cuts about 50 feet apart vertically.

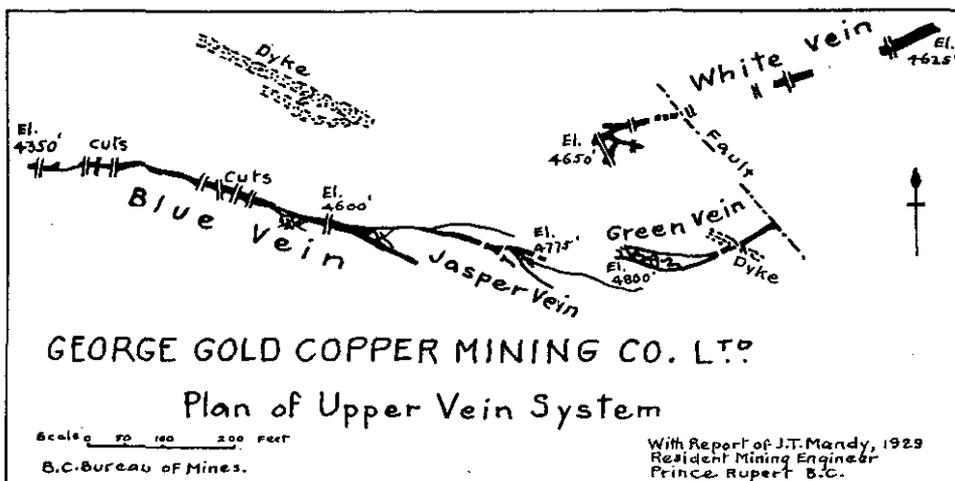
These claims are situated on the south side of the upper Bear River valley **Atlas Gold Copper Mining Co., Ltd.** and west of the *George Copper* claims. During the season a diamond-drilling campaign was carried out at elevation 2,380 feet. These holes were pointed from the *Bear Valley* claim to cut the extension of the *George Copper* lower zone occurring at about 500 feet higher elevation on the *Elgin* claim. These holes failed to find anything of importance and drilling was suspended.

Operations were then moved to the old workings on the line between the *London* and *Chicago* claims, where there occurs a flat-lying zone carrying pyrrhotite, pyrite, and some chalcopyrite. These operations showed discouraging indications and work ceased for the season.

George Gold Copper Mining Co., Ltd. During the early part of the year control of this company was acquired by the Consolidated Mining and Smelting Company of Canada. This company continued diamond-drilling throughout the summer season, completing 1,466 feet. The objective of this work was to explore the lower zone for the mineralization indicated in the tunnel in the zone at about 400 feet higher elevation. Nothing definite regarding the development of tonnage from possible extended mineralization of the zone has been determined by the drilling campaign so far. The Consolidated Company reports that it expects to continue work on this property during the 1930 season and may possibly undertake some underground work.

In the upper vein system is a definitely known showing of good widths and mineralization, with opportunity for appreciable backs and an inviting unknown factor to expand on. A sample

across a 6.5-foot width of the Blue vein, at altitude 4,325 feet, about 60 feet above its junction with the upper silicified zone, assayed: Gold, 0.06 oz. to the ton; silver, 0.4 oz. to the ton; copper, 2.9 per cent. A sample representing about 14 feet of the White vein, at altitude 4,700 feet, showing interbanded quartz, wall-rock, chalcopryrite, jasper, and some specularite, assayed: Gold, 0.1 oz. to the ton; silver, 0.4 oz. to the ton; copper, 1.1 per cent.



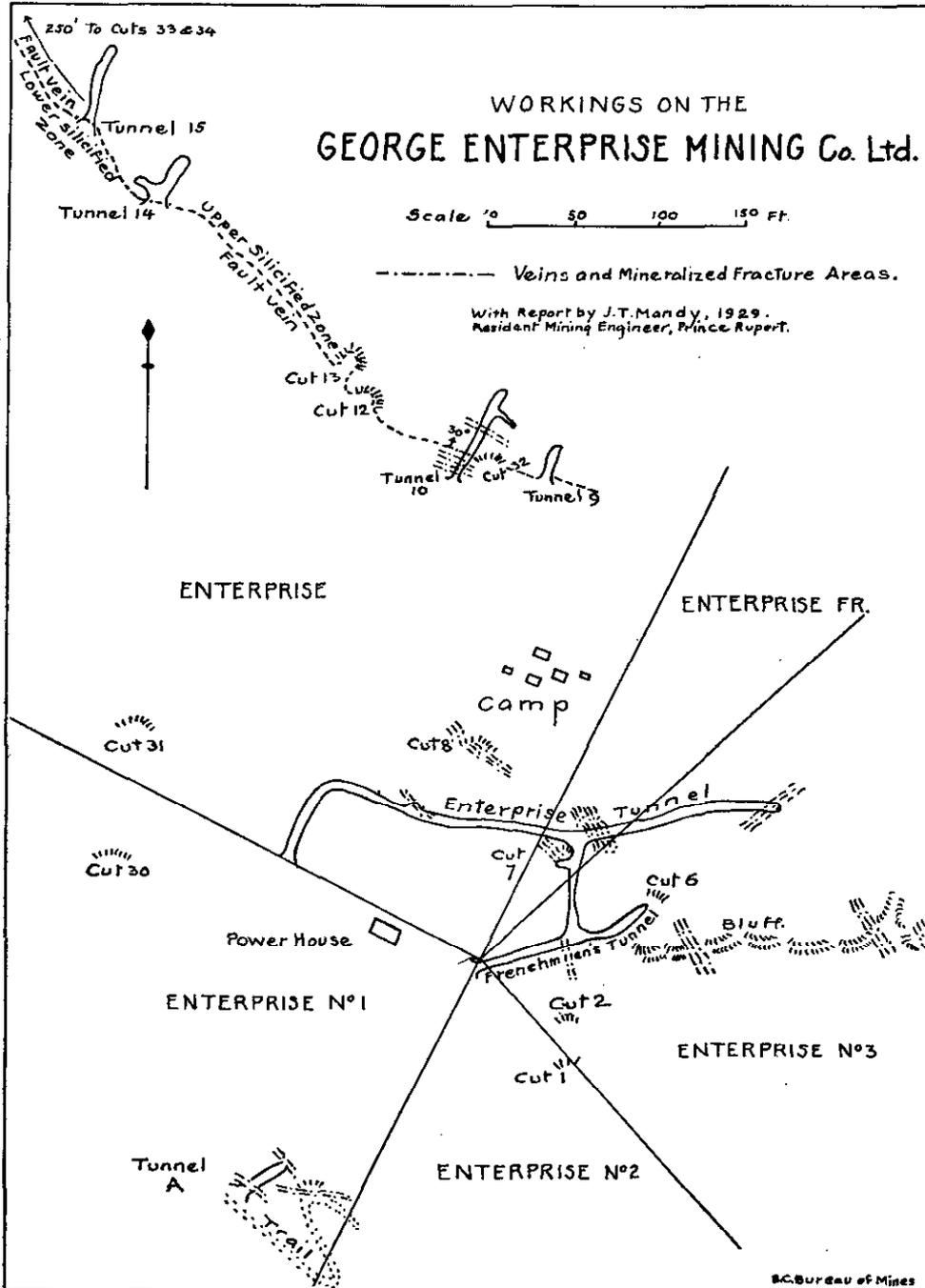
This company has actively and very efficiently explored two groups of claims **George Enterprise** in the upper Bear River valley. The *Heather* group is situated on the south **Mining Co., Ltd.** side of the valley at altitude 4,500 feet and adjoining the *George Copper* on the east, and about 23 miles from Stewart. Extensive surface work on this group disclosed only isolated patches of chalcopryrite mineralization and no defined structure.

On the *Enterprise* group extensive open-cutting and underground work developed showings of chalcopryrite associated with well-defined structure and indications of silver-lead values in a fault-vein associated with a mineralized silicified zone of undetermined width. The country-rock is the Bear River series of volcanic breccias, tufts, and flows of andesitic type. To the westward of the main ore-showings a granitic rock of monzonite type outcrops and may have a genetical relation to the ore-deposits. It would seem that some prospecting in the area between the present showings and this granitic rock would be constructive.

The showings have been described at length in the 1928 Annual Report. Early in the 1929 season a compressor plant was hauled in, installed, and the property well equipped for aggressive exploration. A well-conditioned camp was established at altitude 3,600 feet and a crew of fourteen men was continuously employed throughout the season. During the season tunnel 15 was extended from 5 to 20 feet. In tunnel 14 a crosscut was driven to the north. Tunnel 32 was driven 32 feet; in the Frenchman tunnel the crosscut across the zone from the drift was extended 7 feet. At the north end of the upper zone open-cutting was carried out. The season's work was concentrated on the driving of the new *Enterprise* tunnel, which was advanced to about 325 feet. In that distance encouraging though low copper values were cut in three indefinitely defined shears.

A sample taken from cut 15 (altitude 3,825 feet) on the foot-wall of the fault-vein, showing about 6 inches of gouge, assayed: Gold, trace; silver, 14.6 oz. to the ton; copper, 1.6 per cent.; lead, trace. A sample across 3 feet of the centre of the face of cut 18, showing a fine dissemination of chalcopryrite and some galena, assayed: Gold, trace; silver, 1.2 oz. to the ton; copper, 0.95 per cent. A sample across 40 inches of sheared zone in cut 7, at altitude 3,575 feet, showing veinlets of, and disseminated chalcopryrite, assayed: Gold, 0.14 oz. to the ton; silver, 3.4 oz. to the ton; copper, 2.8 per cent.

The property is equipped with a 5½ by 5, 220-cubic-foot portable Sullivan compressor with direct connection to a 60-horse-power Buda gasoline-engine. A Wyco 1-kw., 125-volt electric-light plant supplies light to the power-house and blacksmith-shop. The operations were under the personal direction of W. V. Smitheringale.



Montreal. This property, comprising eight claims, is situated on the Bear River-Nass divide. A detailed description of the showings is contained in the 1928 Annual Report. During the season J. Douville and partners, the owners, carried out additional stripping and open-cutting and more discoveries were made.

Southern Cross. This group of sixteen claims, owned by E. C. Morris and C. Lake, of Stewart, is situated on the east side of the Bear River glacier, at altitude 2,500 feet. Open-cutting and stripping during the season has exposed a showing of quartz veinlets over a width of about 20 feet in a formation complex of andesite and argillite. Mineralization consists of chalcopryite, grey copper, and some zinc-blende. The owners report having identified native silver in the occurrence. The showings are among the season's new discoveries and indicate good prospecting possibilities towards the Meziadin Lake area.

Treaty Creek. This group of sixty claims was staked and surveyed on behalf of the Consolidated Mining and Smelting Company of Canada during the late fall of 1928. The claims are situated on the north side of Treaty creek—formerly 20-Mile creek—a tributary of the Bell-Irving river, about 35 miles from the confluence of the Bell-Irving with the Nass river.

The claims are reached via the Bear River road and trail over the Nass divide, the Surprise Creek trail skirting Meziadin, thence to Bowser lake and the Bell-Irving. At present the trail has been put into good shape by the Departments of Mines and Public Works as far as Hanna creek, about 10 miles beyond Surprise creek, but from there on is reported to be in very bad condition. It would seem that a more direct route to this area, should improved transportation facilities eventually be warranted, would be via Tide lake and the Bowser river to Bowser lake and from thence to Todedada lake down the headwaters of Treaty creek. In view of the operations on the *Big Missouri* and at Tide lake, and the already available good road and trail conditions serving that area as far as Tide lake, this route should be given consideration in the event of improved transportation being warranted.

During July, 1929, the Consolidated Mining and Smelting Company of Canada transported men and supplies by aeroplane from Stewart to Bowser lake and inaugurated an active campaign of preliminary prospecting on the claims. Time was not available for the Resident Engineer to examine the showings during the season. The company reports, however, that values are scattered over a large mineralized area and appear to be mainly in gold, silver, and copper, although sufficient work has not been done to form a criterion of the possible value of the property.

Morning Canyon and Keystone. These groups are situated towards the mouth of American creek and are owned by Sam Deschamps, of Stewart. The *Morning Canyon* showings have been explored by open-cuts, stripping, and a 60-foot tunnel driven diagonally across a mineralized zone. Where the tunnel crosses the zone at 20 feet, the owner reports 7 feet of mineralization with pyrite, some galena and zinc-blende, and a little chalcopryite. From 20 feet to the face intermittent mineralization is reported, with 18 inches of fair mineralization showing in the face. During the season tunnelling was continued and a cabin built.

On the *Keystone* a quartz vein, 4 feet wide, mineralized with zinc-blende, chalcopryite, and some galena, in an andesite formation, has been opened up by a 50-foot tunnel, a 12-foot shaft, some stripping and open-cutting.

Heywood Mining and Development Co. This company was incorporated in 1928 for the purpose of exploring some claims staked in the same year. The company is capitalized at \$1,000,000, divided into 4,000,000 shares of the par value of 25 cents each. The property, consisting of fourteen claims on the east bank of American creek, was further explored during the summer by open-cutting and stripping.

Mountain Boy Mining Co., Ltd. This company has a capitalization of 6,000,000 shares of no par value. Four hundred and fifty thousand shares were offered to the public. The remainder is distributed as follows: 2,525,000 shares pooled until December, 1929; 2,500,000 shares to be retained in the treasury; 525,000 shares sold. The head office is at 112 St. James Street, Montreal.

The property comprises eight claims and three fractional claims. It is situated on the west side of American creek, about 18 miles from Stewart and 4 miles from the end of the Bear River road. The claims can be reached by the trails on either the east or west sides of American creek. Heavy pack-horse traffic and excessive rain put the east trail in bad shape during the

latter part of the season. The west-bank trail up American creek is, however, a better route and was put in good shape with assistance from the Department of Mines. The lower camp is on a ridge in the valley-bottom at altitude 1,700 feet. The upper camp at the workings is at altitude 2,415 feet. The general formation of the area is the Bear River formation of fragmentals and lavas with some argillite, intruded by numerous dykes of feldspar porphyry, augite porphyrite, and lamprophyre. The structure of the area is featured by zones of intense shearing and numerous faults. In places the intensity of these factors approaches a regional condition and gives the impression that where control is lacking a dispersal of mineralization accompanied by spasmodic and lenticular development of ore-shoots may occur.

The main showings on the property consist of two wide and erratically defined replacement zones. The filling of these zones consists mainly of an intergrowth of quartz and jasper with some barite. The Mann vein, 16 to 20 feet wide, strikes about N. 40° E. (mag.) and dips about 45° south. It has been traced for several hundred feet up the rugged talus-covered mountainslope from altitude 2,425 feet, spreading or swelling finally in a rugged gully at about altitude 2,600 feet, and terminating. This zone is generally spasmodically and sparsely mineralized with chiefly zinc-blende and some galena in places.

The Highgrade vein outcrops at about 3,000 feet altitude in a somewhat inaccessible, broken-up, and dangerous canyon area. It is 6 to 8 feet in width, strikes N. 40° W. (mag.), and dips 30° west into the hill. The vein is composed of a quartz-jasper-barite gangue with generally sparse mineralization. A streak of 8 to 18 inches in width, favouring generally the foot-wall, contains some small high-grade kidneys and veinlets of zinc-blende, galena, argentite, and a mineral thought to be stromeyerite, spasmodically distributed over a length of about 100 feet. It is understood that this vein has been traced for an appreciable distance. Other showings are reported to exist on the property, but were not examined.

During 1929 operations have been concentrated on exploration of the Mann vein in the Mann tunnel at altitude 2,440 feet; and of the Highgrade vein by a crosscut to the vein and a drift along it, at about 3,000 feet altitude, in the hope of intersecting the extension at depth of the ore-showings on the surface.

At the time of examination the Mann tunnel was advanced to about 200 feet along the foot-wall of the vein, with two crosscuts of about 35 feet at intervals to the hanging-wall. Fair, though patchy, mineralization of chiefly zinc-blende shows for a width of about 5 feet along the foot-wall from the portal to about 40 feet in. From there to the face, although the vein shows widths of over 20 feet, mineralization is very irregular and generally sparse. A sample across 5 feet of the foot-wall at the portal of the tunnel assayed: Gold, 0.02 oz. to the ton; silver, 10 oz. to the ton; lead, 2 per cent.; zinc, 11 per cent. This foot-wall shoot continues with lenticular irregularity for about 40 feet along the tunnel to the winze. It seems to be best developed along the cross-fractures.

From the westerly swing of the tunnel to the slip mineralization appears to be very irregular, with an occasional small patch of fair-grade zinc ore. The structure of the vein is noted to be banded and brecciated, with angular fragments of andesite in the vein-matter. The best development of ore is in the banded sections. A sample along the north wall of the second east crosscut, representing the first 15 feet from the drift, assayed: Gold, trace; silver, 8 oz. to the ton; lead, trace; zinc, 12 per cent. A sample along the last 13 feet of the north wall of this crosscut to the face assayed: Gold, trace; silver, 1 oz. to the ton; lead, *nil*; zinc, *nil*. A sample of the selected mineralization exposed in this tunnel assayed: Gold, 0.03 oz. to the ton; silver, 1.2 oz. to the ton; lead, 1.3 per cent.; zinc, 22 per cent. Should this vein, after intensive exploration, show a consolidation of ore-shoots, it may be possible that mill-grade tonnage of zinc ore could be developed.

In this development-work a marked irregularity of the walls, particularly the hanging-wall, features the vein. This is accompanied by a swelling and diminution in width, attended by irregularity of strike and dip in comparatively short distances. This is apt to sometimes give the appearance of faulting or dragging. Much faulting is assumed to have affected this deposit, but in this type of vein occurrence such conclusions should not be hastily formed. At 30 feet from the face the vein swings about 10° S. along a fracture-plane striking S. 20° W. and dipping 80° east. The tunnel continues on in the foot-wall rock and at the face would be about 25 feet west of the foot-wall of the vein.

At about altitude 3,000 feet development on the Highgrade vein was carried on from a crosscut tunnel and a drift along it for about 30 feet from the point of intersection by the

crosscut. At that point the vein is assumed to be faulted. Crosscutting to east and west had failed to pick up the extension up to the time of examination (October 10th). The character of the Highgrade vein exposed in this work is similar to that of the Mann vein, with sparse and irregular mineralization.

During the season a small shipment of about 4 tons of selected high-grade ore was made from the surface showings of the Highgrade vein above the tunnel. This shipment is reported to have returned nearly 1,100 oz. silver to the ton. In this showing a mineralization of galena, zinc-blende, argentite, and a mineral thought to be stromeyerite is very irregularly distributed through the jasper-barite gangue in small kidneys and in $\frac{1}{4}$ - to $\frac{1}{2}$ -inch veinlets along some of the cross-fractures. This character of mineralization favours generally 8 to 18 inches of the vicinity of either wall and can be picked up at irregular intervals over a distance of about 100 feet. To recover appreciable quantities of high-grade ore for shipment from this surface showing, very close selective mining and sorting would be necessary. A sample of carefully selected ore from these kidneys and veinlets assayed: Gold, trace; silver, 529 oz. to the ton; copper, 2.5 per cent.; lead, 16 per cent.; zinc, 8 per cent.

When the continuation of the Highgrade vein is located underground, future operations are planned to explore for the continuity and extent at depth of the high-grade ore-shoot indicated on surface. Exploration from the Mann tunnel for the underground intersection of the Highgrade vein with the Mann vein is also planned.

It is planned to continue operations during the winter from a crosscut tunnel starting a short distance north of the bunk-house at about altitude 2,400 feet. At the intersection of this tunnel with the Mann vein a raise will be started to connect with the Mann tunnel. The blacksmith equipment has been moved underground and the space between the winter crosscut portal and the drier-room will be covered in to shelter from severe snow conditions.

The property is equipped with an Ingersoll-Rand 310-cubic-foot, gasoline-driven, portable compressor installed at about 1,700 feet altitude.

This group of nine claims, owned by W. Bosence and partners, of Stewart, is situated on the west side of American creek, adjacent to the *Mountain Boy*. The showings are reported by the owners to consist of a quartz-jasper-barite vein, 7 feet wide, carrying mineralization of galena, some chalcopyrite and bornite, and a little grey copper, in an andesite formation.

Four hundred feet west and at about 1,000 feet higher altitude a silicified replacement zone about 13 feet wide, showing mineralization with chalcopyrite and bornite, is reported to have been stripped and open-cutted in places. Three other showings mineralized with pyrite and galena, but on which no work has been done, are stated to occur on the property. Late in the year it was reported that Montreal interests had concluded negotiations for the acquisition of these claims, with a view to carrying out exploration on them during the 1930 season.

Options have been procured by this company on the *Ruby*, *Blue Jay*, *Maybee*, *Louise*, and *M. and M.* group, comprising thirteen claims and one fraction, situated on the west side of American creek, east and north of the *Mountain Boy* and *Lucky Jim*. The project is being financed by the Osisko Rouyn Exploration Company, of Montreal. Late in October camp was established and operations started under the direction of W. J. Trethewey, of Montreal, with a view to preparing the showings for a thorough sampling. Exceptionally heavy rains greatly hampered the progress of the work, most of which was devoted to trail-construction to the showings on the *Ruby* claim.

Of the three veins reported to occur on the *Ruby*, only the lower vein, at about altitude 1,900 feet, had been opened up. On this there are two open-cuts about 500 feet apart. This vein was examined where it crosses a creek at about altitude 1,800 feet elevation. Here there was exposed a quartz-jasper-barite zone of appreciable but undetermined width and attitude and somewhat brecciated structure. Mineralization at this exposure was very sparse, but an occasional small patch of what might possibly be silver sulphides associated with galena, chalcopyrite, and bornite can be seen. Time did not allow other showings reported to occur on the property to be examined.

These groups, comprising twenty-four claims, owned by C. M. Bryant, Mathew Little, and D. D. Kimball, of Stewart, are situated on the east and west side of the head of American creek at about 4,300 feet altitude. The claims were staked during the middle of September on discoveries made by D. D. Kimball. The owners report exposures of galena ore 3 to 4 feet wide occurring at

**B.L.K., Bryant,
Dundee, and
Virginia K.**

intervals along a considerable distance below the edge of the glacier. Very encouraging values in gold, silver, copper, lead, and zinc are reported in the assay returns from samples taken by the owners. The area has only recently been prospected and it would seem that the discoveries warrant a systematic exploration.

Late in the year the Excelsior Prospecting syndicate was formed in Stewart to commence development of these claims. It is understood that this syndicate is capitalized for \$150,000, divided into 15,000 units of \$10 par.

Several other groups have been staked in the locality, including one group by the Northern Prospectors' Syndicate, of Stewart, on which showings of chalcopyrite are reported.

SALMON RIVER SECTION.

For a description of the ore-deposits of this property readers are referred to former Annual Reports and to Geological Survey of Canada, Memoir 132. **Premier Gold Mining Co., Ltd.** Thanks are due to D. L. Pitt, manager of the Premier Gold Mining Company, for the following information: * During 1929 development and exploration was carried on energetically and a total of 266,972 tons was produced. Of this, 74,617 tons was shipped to Tacoma, 27,212 tons to Anyox, and 165,143 tons went to the mill. The mill made 14,631 tons of concentrates, all of which was shipped to Tacoma for treatment. Metal production for the year amounted to a total of 96,636 oz. gold and 2,258,729 oz. silver. This shows a decrease of over 33,000 oz. gold and a decrease of about 110,000 oz. silver as compared with the 1928 production. As the milled ore showed an increase of about 3,000 tons during 1929, the gross decrease is accounted for by a decrease of nearly 12,000 tons of shipped ore. It is understood that this is due to the fact that the smelters to which the ore is shipped have limited the tonnage they would receive at various times during the year, and production was necessarily curtailed accordingly. The decrease in metal value produced is due partly to the reduced tonnage shipped and partly to lower-grade ore. It is also understood that the year 1930 does not hold any promise that higher-grade shipments will be made. Tonnage to be shipped cannot be forecast, as it is dependent on the smelter's ability to handle the ore.

During the year the mill tonnage increase amounted to an average of about 10 tons a day. This is due to better operating conditions in the mill and does not represent any increased capacity due to mill enlargement. At the end of 1929 the mill was treating about 450 tons of ore a day and it is hoped to maintain that tonnage during 1930.

The usual amount of prospecting and development work was done during 1929, with 8,705 feet of drifting and raising and 4,044 feet of diamond-drilling. Development has been successful in locating and further opening up new and known ore-shoots. The result has been the addition of a larger tonnage to the ore reserves than was recorded in 1928. The annual report of the Premier company shows ore reserves at the end of 1929 of 419,036 tons, as compared with 456,203 tons at the end of 1928, so that nearly as much ore was developed in 1929 as was mined out. The grade, however, of the ore reserves given is somewhat lower than in 1928. Most of the new ore has been found in the foot-wall country of the main ore-zone and in fairly close proximity to the known ore-bodies.

During the early part of the year development-work was carried on on No. 5 level to open up an indicated ore-shoot on this horizon. The preliminary work showed a small shoot of medium-grade ore which held some promise. Further development of this shoot, however, proved rather disappointing and only a small tonnage of ore has resulted from this work.

On No. 6 level a vigorous campaign of further development has been pushed into virgin country by drifting on this horizon. Up to the close of the year, however, no ore-bodies of commercial grade had been located on No. 6 level. Development on this horizon is continuing. There has been no construction on the *Premier* during the year, but the plant has been maintained at its usual standard.

Premier Border Mining Co., Ltd. This company has absorbed the old Northern Light Mining Company, the shareholders of the latter receiving an equality of shares in the Premier Border Company. During the year a thorough geological survey and surface-trenching was carried out for the purpose of mapping the mineralized sills

* Net figures for full production during calendar year.

occurring on the property and as a preliminary to intensive underground exploration. The property was equipped with a compressor and oil-engine and active underground exploration commenced.

The tunnel crosscutting the formation towards the Premier Gold Mining Company line had been advanced during the year to about 1,600 feet. Three porphyry-zones have been intersected by this work, with the face of the tunnel in porphyry. These zones will later be intensively explored by drifts, crosscuts, and diamond-drilling for commercial ore-bodies. Encouraging values in gold and silver were found in places in these zones, with an occasional commercial-grade assay. It is understood that stations are being cut in preparation for immediate diamond-drilling. About 400 feet of territory between the face of the tunnel and the *Premier* line still remains to be prospected.

The holdings of this company adjoin those of the Premier Gold Mining Company on the south and on the north. The northerly ground contains the extension of the north-east *Premier* ore-zone. Extensive development has been carried out on this ground for several years. Latterly, a more definite alignment of the ore-zone has been arrived at, and recent work is being rewarded with results that promise a sufficiently rapid increase of developed tonnage to warrant the hope of early continuous production. Through the courtesy of the management the following information of recent developments is available:—

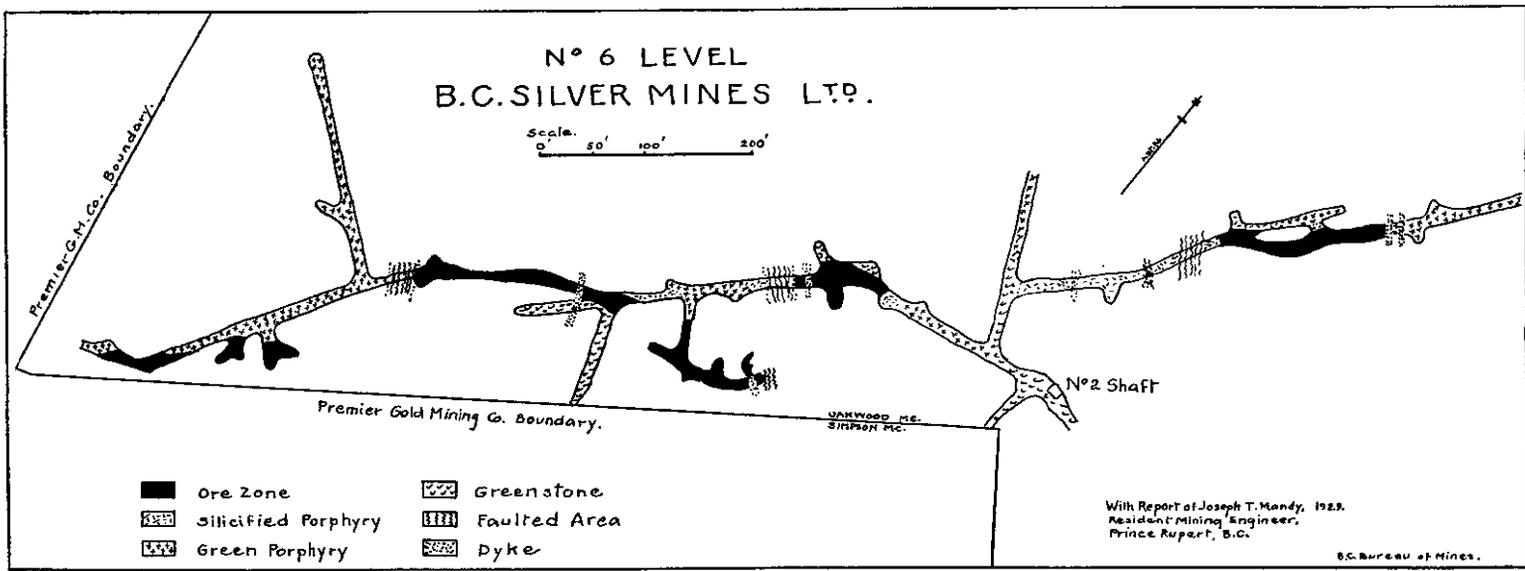
During the year energetic and continuous exploration has been carried on and new ore-bodies have been developed. Development-work included the deepening of No. 2 shaft to 573 feet below the collar of No. 3 level and station-cutting for No. 6 level and No. 7 level 100 feet below No. 6. A small amount of lateral work was done on No. 7 level before an excessive inflow of water made it necessary to stop work on this horizon. During the year a total of 3,600 feet of lateral development was done on No. 6 level, at the same horizon as *Premier* No. 4 level. To the south-west of the shaft one substantial shoot of milling-grade ore was encountered. This is probably the downward extension of the *Premier* 4 H stope shoot. Two other smaller ore-shoots were developed, one being the *Premier* 4 D extension and the other a new and independent ore-zone. North-east of the shaft a considerable amount of work was done and one main drive at this end of the level is towards the downward extension of the ore-bodies that were encountered on No. 3 level and investigated by No. 1 shaft and No. 4 level.

Work is being concentrated on the continuation of No. 6 level in a north-easterly direction to connect up with the sixth level of the adjoining *Sebakwe* property. At least three ore-bodies are expected to be penetrated in that distance on this level.

This company was registered in British Columbia in 1925. The registered office is at 19 St. Swithin's Lane, London, E.C. The Canadian office is at 612 Pacific Building, Vancouver. The property was acquired from the Bush Mines, Limited, for a share consideration of the *Sebakwe*. A total of 500,533 shares of *Sebakwe* are owned by the *Selukwe* Gold Mining and Finance Company, London, England, which company also controls the British Canadian Silver Corporation, Limited, which in turn controls the B.C. Silver Mines, Limited.

The property adjoins the northerly holdings of the B.C. Silver Mines and is being operated in conjunction with that undertaking and under the direction of the same management. The claims embrace the north-easterly extension of the *Premier-B.C. Silver* ore-zone. A crosscut tunnel, 1,200 feet long, has explored the area immediately north-east of the *B.C. Silver* and on a level corresponding to the No. 4 level of that property. A shoot of commercial ore about 250 feet long and 15 feet wide was developed on this level. It is interesting to note that this ore-shoot in the quartz porphyry is capped by a bed of tuff on No. 3 level and does not penetrate through to the surface. A vertical shaft 150 feet deep connects No. 4 with No. 5 level, where the ore-shoot has also been developed by drifting for an appreciable length.

Through the courtesy of the management the following information regarding recent developments is available. Some further work was done on No. 5 level without finding any more commercial ore. During the year the shaft was deepened 150 feet and the No. 6 level opened up. This is at the same horizon as the *B.C. Silver* No. 6 level. A long south-westerly drive at 340 feet from the shaft on the sixth level and 150 feet vertically below No. 5 level has penetrated a silicified quartz-porphyry area containing massive pyrite in places, which may possibly be the



downward extension of the fourth and fifth level ore-shoot. Work is progressing in the exploration of this horizon, which will be connected with the No. 6 level of the *B.C. Silver*.

In order to adjust the affairs of this company and place it on a sounder **Woodbine Gold** operating basis, mining-work was suspended early in the summer and a **Mining Co., Ltd.** reorganization of the directorate effected. Following the advice of the Department of Mines, and verification of that advice by an independent engineer, a conservative campaign of diamond-drilling to prospect for commercial ore-bodies on a lower horizon was put into operation. The results of this later work have not been examined.

The former exploration of this property has been quite extensive and consists of open-cutting and several short tunnels and underground exploration on the main tunnel-level. This embraces about 1,600 feet of crosscutting, 1,200 feet of drifting, 90 feet of raising, and a 70-foot incline winze. The characteristic feature exposed by this underground work is the acute fracturing and shearing in comparatively indiscriminate directions. In other words, a comparative lack of defined directional structure. A widespread pyritic mineralization is also apparent. In certain areas there appears to be a tendency for the mineralized sections of the porphyry to trend in a north-easterly direction, with a westerly dip. There is also a tendency for this replacement mineralization to become intensified in the areas of least fracturing and shearing and of greatest silicification.

These considerations are of importance in connection with the further exploration of this property. This should be confined to areas in the porphyry showing the greatest tendency to north-east zonal fracturing or control and a minimum of cross-fracturing. Such an area is indicated between 210 crosscut and the southerly end of 208 crosscut. As the apparent dip of the mineralization is westerly, diamond-drilling of this area to a lower horizon should be pointed in a north-westerly direction.

Efficient exploration by extensive stripping and open-cutting was carried out **Premier Extension**, on this property, adjoining the *Woodbine* on the north. This work exposed a wide north-south striking porphyry-zone of undetermined attitude and width. At altitude 1,140 feet No. 1 crosscut tunnel had been advanced 36 feet into the zone. The porphyry is generally pyritized and in a few isolated places is mineralized with zinc-blende and galena. The best development of these minerals seen is in a streak of about 9 feet in width on the south side of the tunnel portal. A sample across this 9 feet assayed: Gold, 0.02 oz. to the ton; silver, 0.3 oz. to the ton; lead, trace; zinc, 0.6 per cent.

This property, situated in the upper Salmon River valley, is controlled by the **Big Missouri**. Consolidated Mining and Smelting Company of Canada, Limited. Active exploration has been carried on continuously by this company, operating under the name of the Buena Vista Mining Company. A siliceous area encountered has been explored from 302, 306, and 307 drifts. Diamond-drilling has also been vigorously pushed. Although this work is still inconclusive, it is understood that the more recent results are giving much greater encouragement. During 1929, 2,017.5 feet of drifting, 371.5 feet of crosscutting, and 7,572.5 feet of diamond-drilling was completed.

The following statement regarding this property is taken from the Annual Report for 1929 of the Consolidated Company, included in the report of the president, J. J. Warren:—

"Exploratory work at the *Big Missouri* indicates the presence of considerable quantities of ore of commercial grade over minable widths. Further work must be done, however, before the extent of the ore-deposits can be definitely gauged and a policy for the permanent equipment of the property determined. It is probable that a small concentrating plant will be installed this year in order to sample the ore-bodies accurately, as hand-sampling cannot be relied on because of the more or less erratic deposition of the metals.

"This property is one of the most promising prospects now under development. Your company's position in regard to this property is that your treasury holds 53 per cent. of the capital of the Buena Vista Company, Limited (a British Columbia corporation), to which company the original Big Missouri Company (a State of Washington corporation) conveyed the *Big Missouri* group of claims near Stewart, British Columbia. The remaining 47 per cent. of the capital of the Buena Vista Company is in the treasury of the original Big Missouri Company, which is developing various other properties in the United States.

"Your company has advanced the Buena Vista Company \$127,000, for which bonds of that company are being issued in your favour."

This company was incorporated in 1929 to take over the *Unicorn* group of eight Crown-granted claims, and two other claims, situated in the upper Salmon River valley. Five hundred thousand shares of the capital stock of the company were issued for cash and 500,000 shares transferred to the vendors of the claims. The property is situated between Harris creek and the Missouri ridge, immediately north of and adjoining the *Big Missouri*. Through the courtesy of R. H. Stewart, H. L. Batten, and associates, consulting engineers, the following information is made available:—

Extensive and systematic exploration by open-cutting and stripping has been carried out on a series of east-west and north-south striking shear-zones. The result of this work will form the foundation of the underground exploration that is now being undertaken by the company.

The showings on the property are confined to a west zone and an east zone. The west zone on the *Good Hope* claim is a zone of mineralized porphyry striking north-westerly and dipping west. A series of east-west striking, southerly-dipping shear-zones, A, D, E, and F, and two north-west striking, westerly-dipping zones, B and C, occur in this area. From systematic sampling in the numerous open-cuts on B, C, D, E, and F, assays of about 0.20 oz. to the ton in gold and about 1 oz. to the ton in silver have been obtained across widths of from 8 inches to 3 feet, with an occasional high gold assay. Vein A is a mineralized shear-zone 40 to 50 feet wide, carrying generally low values in gold and silver, but showing a tendency for better mineralization near the foot-wall. The occurrences in the west zone show a general erratic distribution of values, with, however, a tendency for improvement at the intersections of cross-fracturing.

Underground exploration of the various showings of the west zone has been carried on from No. 2 tunnel, driven in a westerly direction to intersect C vein. No. 3 tunnel has been started near the south line of the *Good Hope* claim and is being driven in a N. 25° W. direction. At the end of September this tunnel had advanced 60 feet to the fringe of the west porphyry-zone. It is expected that D vein will be cut at about 200 feet from the tunnel portal, E vein at about 550 feet, A vein at about 750 feet, and a point vertically below No. 2 tunnel, with 200 feet of backs at about 1,100 feet. It is planned to drift on the various veins from the points of intersection by No. 3 tunnel.

Veins H and I occur in the tuffs of the east zone. They differ from those of the west zone in that they have better definition and the principal values are in silver. Vein H strikes north-south and dips flatly west. It is a quartz vein 24 to 30 inches wide, mineralized with pyrite and sparse galena and zinc-blende. Samples from several cuts assay from 0.15 to 0.2 oz. gold to the ton and from 6 to 22 oz. silver. It has been traced about 250 feet.

Vein I has been stripped for about 100 feet. It is a quartz vein striking east and west and dipping at 45° to the south, 12 inches to 3 feet wide, mineralized with pyrite, zinc-blende, and some galena. Native silver is said to occur in this vein. Samples across 10 to 24 inches of vein I assay from 80 cents to \$4 in gold and from 3.5 to 28 oz. in silver. This vein converges towards an intersection with vein H and shows a tendency to better values towards the latter vein.

Although the exploration of the showings on this property have not yet exposed ore-bodies of commercial extent, the encouraging values and indications obtained by the extensive surface exploration carried out justify an intensive underground exploration. Camp has been erected for the continuation of the work during the winter, and it is understood that the company plans the installation of a power unit for aggressive exploration during the 1930 season.

This property is situated 6 miles up the Salmon River glacier, on the western side, and consists of fourteen claims, all Crown-granted. The formation is a much-altered argillite merging into a highly siliceous rock, with a series of quartz-porphyry dykes running through the property on a general east-west trend. To the north of the dyke system there is a large irregularly shaped mineralized mass, consisting of siliceous matter impregnated with galena, zinc-blende, pyrite, pyrrhotite, and chalcopyrite, and, at least in one place, arsenopyrite. It is said to carry fair gold and silver values. A number of short tunnels have been driven into this mass at various elevations from 3,168 to 3,507 feet and all are in consistently mineralized matter.

On the south side of the dyke system and extending to the top of the bluff above the camp are several outcroppings of small veins, consisting of brecciated argillites, with the fissures filled with quartz, calcite, galena, zinc-blende, and some grey copper. The walls generally are well

**Outland
Silver Bar Mines,
Ltd.***

defined. The most promising showing is known as Johnnie's vein. This was cut by the No. 6 crosscut at elevation 3,882 feet, at about 400 feet in from the portal, and was drifted on for a short distance north and south. The vein, which strikes north-south and is nearly vertical, is well mineralized. It is about 4 feet wide in the south drift and 3 feet in the north. It is cut by a dyke running approximately N. 45° W., but continues on the north side with little or no displacement.

About 250 feet to the north there is an outcrop of what is almost certainly the same vein, and a drift, known as Johnnie's Vein Outcrop tunnel, has been driven for a short distance at an elevation of 4,069 feet. There is a good showing at the face of 4 feet 6 inches of well-mineralized vein-matter. A chip sample over 3 feet 6 inches assayed: Gold, 0.1 oz. to the ton; silver, 61.2 oz. to the ton; lead, 10.2 per cent.; zinc, 14.8 per cent.

Another vein, known as No. 1, which has an average strike of N. 45° W. and dips 55° south-east, has been driven on in two places at elevations 4,049 and 3,890 feet respectively. It averages about 1 foot in width and contains a high proportion of galena and zinc-blende. A crosscut just above the surface of the glacier, at an elevation of 3,168 feet, has been started from a point to the south of the dyke system and will be driven due west to prove the continuation in depth of the No. 1 and Johnnie's veins. Another crosscut at an elevation of 3,100 feet is projected from a point to the north of the dyke system, which will also be on a west course. This should prove the heavy sulphide mass. Gold and silver values are said to be fairly consistent, both in the heavy sulphide zone and in the smaller veins. The gold values are said to be higher when copper is present.

The equipment consists of a 212-cubic-foot Ingersoll-Rand compressor and a drill-sharpener. There is also a well-equipped assay office, with a crusher and grinder run by a small gasoline-motor. This property appears to have possibilities and it is being developed in an efficient and systematic manner.

This property is situated on the east side of the Salmon River glacier, almost opposite the Boundary glacier, and is owned by Fitzgerald Bros., of Hyder. **Silver Basin.*** The showing occurs on the north wall of a small canyon coming in from the east. It consists of a mineralized zone of shattered argillites containing stringers of quartz, calcite, galena, zinc-blende, and some pyrite. Not enough work has been done to form an opinion as to its value, but it is certainly worthy of further exploration. A chip sample over a 42-inch width of the zone assayed: Gold, trace; silver, 3 oz. to the ton; lead, 7.8 per cent.; zinc, 4.6 per cent.

UNUK RIVER SECTION.

In view of the apparent promising mineral possibilities of the eastern contact margin of this section and the fact that it has been sadly neglected in recent years a recapitulation of some of the available information pertaining to this area may serve a useful purpose. It would seem that the eastern contact margin accessible from the Unuk river and that in the Stikine Division, accessible from the Whiting river, offer very promising and practically virgin fields for the prospector. The Unuk River section forms the extreme north-westerly area of the Portland Canal Mining Division. Reference to the contact margin of the section is made in the summary to this report. In the following excerpts from previous reports on the section it will be noted that some fairly extensive development was carried out in the Unuk River section between the years 1900 and 1903. Doubtless the reported turbulence of this river and great transportation difficulties have retarded the subsequent development of this area.

In the Annual Report for 1901 is the following reference to the *Globe* and *Cumberland* groups. On the *Globe* group "the owners have installed, at considerable trouble and expense, a small stamp-mill with a capacity of 3 tons per twenty-four hours, with concentrating-table and copper plates. The motive power is an overshot wheel of 13 feet diameter, developing 10 horsepower. The ledge is stripped for 400 feet." On the *Cumberland* group, "two 5 by 6 tunnels, each 50 feet long, have been run and 30 tons of ore stoped out ready for shipment; 35 miles of trail have also been built."

The following is an excerpt from the Annual Report for 1903 of a letter written by D'Arcy Macdonald, Deputy Mining Recorder for the Unuk River at that time: "Leaving the granite, the next formation we encounter is a greenstone or serpentine, which extends up the river for some miles, where it forms a contact with a dolomite. At the contact, which has a south-easterly trend, the ledges of the different ores occur, having in nearly all instances a quartz gangue,

except where the solid lead of galena ores occur. There are also some irony dykes running parallel with the contact, which give fair assays in gold. Along the South fork we found some splendid float specimens of stephanite and other high-grade silver ores, which apparently did not come from very far, and no doubt, with prospecting, ledges of these minerals will be found. Already some shoots of this ore have been encountered on the *Cumberland* group.

"Above the latter group, on Sulphurets creek, there has been considerable placer-mining done, with varying success. Mr. Ketchum, who has been making annual trips in here for the past eight years, assures me there is a coarse gold in this creek, he having got nuggets which were worth as high as \$8.50, but the great difficulty is the water, which is so high in the summer months that it is impossible for an ordinary prospector to work the ground. Apparently, the only feasible way would be to outfit in October and go in and work during the late fall, winter, and early spring, which would be a very trying experiment for two or three men. The country abounds in game and furs. Both grizzly and black bear are plentiful and I have seen as many as five in one herd.

"If there were a trail or road into this vicinity there are unquestionably mineral leads which are worthy of development, in addition to the very favourable expectations of good placer or hydraulic ground, and it is believed that the prospects of the district would be assured was the transportation problem solved.

"The following are some of the assays made by Mr. Ketchum from the South Fork claims:—

"No. 1. Pyritic ore—silver, 13 oz.; gold, \$40 per ton.

"No. 2. Steel galena—silver, 12 oz.; gold, \$20 per ton; lead, 23 per cent.

"No. 3. Complex ore—silver, 17 oz.; gold, \$18 per ton.

"No. 4. Galena—silver, 36 oz.; gold, \$20 per ton; lead, 59 per cent.

"Picked samples from the camp have assayed:—

"Chalcopyrite—Copper, 32 per cent.; silver, 68 oz.; gold, \$122 per ton.

"Grey copper—Copper, 16 per cent.; silver, 5,000 oz.; gold, \$1.75."

The following is a report by J. W. Daily to R. T. Elliot, of Victoria, and is quoted from the Annual Report for 1911:—

"I beg to submit herewith statement dealing with the resources and location of Unuk river; the information contained therein is authentic in every detail and as complete as can be obtained.

"The Unuk river starts in a low divide in Northern British Columbia; it is 60 miles in length and flows in a southerly direction, emptying into salt water at Burrows bay, which is an arm of Behm canal.

"The distance of Behm canal, taking it from the East arm, is approximately 120 miles from Prince Rupert, and gives an outlet into Dixon entrance, which is easily approached from the Pacific ocean; there is also a short outlet through the West arm of Behm canal, which can be approached through Clarence straits from the main ocean.

"The Unuk river is divided from Portland canal on the east and the Stikine river on the west by a high range of mountains paralleling the river its entire length. The watershed between Portland canal and the Unuk river is divided by a glacier extending 35 miles, parallel with the river, the waters from the east of this glacier flowing into a tributary of the Portland canal, the water on the west side of the glacier flowing into the Unuk river, thus making it impossible to construct roads to connect the Unuk river with Portland canal. At the headwaters of the Unuk river there is a low divide, and a natural pass leading into the Iskut River country, giving a direct outlet to Laketon, Telegraph Creek, and the Dease Lake country.

"The resources of the Unuk river are chiefly quartz-mining and placer-dredging, with an abundance of timber, consisting of spruce and hemlock. The mineral lies almost entirely in British Columbia; there is no break in the Coast granite between Burrows bay and the International boundary-line. In 1900 the Unuk River Mining and Dredging Company purchased a group of five claims from Ceperley, Rounsefell & Company; for two years development-work continued on the property; in 1903 the construction of a wagon-road was started from deep water on Burrows bay to the quartz properties on Sulphate creek, a distance of 42 miles—27 miles of this road being in Alaska, 15 miles in British Columbia. The company has completed 25 miles of the road in Alaska and 10 miles in British Columbia; about 5 miles have yet to be completed in British Columbia and 2 miles in Alaska. Several groups of claims have been located in this vicinity; there are six claims half a mile north of the boundary-line on the east side of the river, showing a large body of low-grade ore, containing copper, gold, silver, and lead.

Four miles farther north there are three claims owned by Divelbliss, Mackenzie & Buck, showing gold values at \$40 to the ton. Six miles north of the boundary-line seven claims have been located and some tunnel-work done on them; this ledge is 100 feet wide and runs the entire length of the seven claims, carrying silver, copper, gold, and lead. At what is known as Glacier creek, about 9 miles north of the boundary-line, there are two claims located, carrying free gold on the surface to the amount of \$10 to the ton; on the opposite side of the river two claims were located this summer, showing a high percentage in copper. Twelve miles up from the boundary-line is a group of five claims owned by Ceperley, Rounsefell & Company, of Vancouver, on which several hundred feet of tunnel-work has been done, showing a large amount of mineral, carrying gold, silver, and lead. L. T. Watson also has some claims located near the Ceperley group, the value of which I am unable to state. Three miles farther north the Unuk River Mining and Dredging Company owns five quartz claims, on which a large amount of work has already been done, much ore now being in sight on the ground. This company also holds a lease for dredging and prospecting of 5 miles in the bed of Unuk river; machinery is on the ground and work was started drilling and prospecting it this summer, the company expecting to continue next summer. This tract of dredging-ground consists of about 6,000 acres of land. The work done on the ground this summer showed good value. Mr. Divelbliss also holds a lease of 4 miles of the river-bed; while there is still unlocated in this country many well-defined ledges and a large area of country not prospected. Once this road is opened up the country will, in my opinion, fast develop into one of the most promising mining districts in British Columbia. On the Unuk river there is ample water-power to run any machinery necessary for mining or even for electric railroad."

In 1905 F. E. Wright, of the United States Geological Survey, visited the Unuk River region and submitted a report to the Canadian Government. The following extract is that part of this report dealing with the economic geology of the area:—

Mineral Deposits.

The occurrence of placer gold near the headwaters of Unuk river and its tributaries has been known for many years. In the earlier eighties prospectors discovered gold-bearing gravels up Sulphide creek and spent several seasons profitably in extracting the gold by means of rockers and other primitive methods. The difficulties of transportation, however, were so great that they ultimately abandoned their claims. In the succeeding years occasional prospectors visited the region, relocated the placer deposits, and also discovered well-mineralized veins carrying good values in silver, gold, and lead. A primitive trail was built along the north bank of the river and access to the region thus facilitated. The present wagon-road follows approximately the blazes of this old trail.

The most promising claims which have been staked are situated on Sulphide creek and have been acquired by the company interested in construction of the wagon-road. Other locations have been made near the head of South Fork, also near Boulder creek and Canyon creek.

Sulphide Creek.

Recent discoveries have been made on this creek near its mouth and consist of two veins which have been developed by several short drifts and open-cuts. One of the veins outcrops along a narrow gulch and has been traced about 1,000 feet up the gulch. It strikes usually N. 25° W., dips 30°–60° N.E., and varies in width from 2 to 8 inches. The vein-minerals are chiefly tetrahedrite (grey copper), pyrite, sphalerite, galena, and native silver; near the surface they are usually altered and enveloped in a soft ferruginous matrix of weathering products. The native silver is a product of the surficial alteration of grey copper. About 100 tons of ore are reported to have been taken from this vein and to have given high assay returns, particularly in silver. The country-rock consists of altered limestone and breccia with some quartzite and slate, cut by intrusives of several types. The second vein outcrops a short distance south of the first vein, and is exposed along the face of a steep cliff where it is easily recognized by its brown oxidized coating. At the surface it appears to be 20 to 30 feet wide and is heavily mineralized in spots with pyrite, fine galena (steel galena), and occasional sphalerite and chalcopyrite. Native gold is said to have been observed in the oxidized portions of this vein, which has been prospected by a short tunnel 25 feet long, at 1,400 feet elevation above sea-level. The vein shows distinct banding and strikes N. 5° W., with dip 80° to 85° E. A fine-grained basic dyke is exposed along the west side of the tunnel. On both these veins the development-work which has been accomplished is not sufficient to permit definite statements in regard to their future. The indications, however, appear sufficiently favourable to warrant the test which the company plans to give the property in the near future.

At the junction of Sulphide creek and Unuk river the river-gravels contain some free gold, and fine colours can be seen in every pan of material tested. The gold is flaky and considerably worn. No thorough sampling has yet been done and depth to bed-rock is unknown. As the river-valley, however, is wide and has passed through a long period of glacial erosion, it is probable that bed-rock is at

some distance from the surface. Local irregularities were observed in the bed-rock floor near the placer-gravels and similar variations may also be expected at the claims. It appears that these placers might be exploited by dredging, but large boulders are likely to be encountered.

South Fork.—Near the headwaters of South Fork, below Sulphide creek, a second group of claims has been located 16 miles above its junction with the Unuk river, on veins within the sedimentary belt east of the Coast Range granite. These claims were not visited by the writer. Well-defined deposits are reported and plans for future development are contemplated.

Boulder Creek.—Below South Fork on the same side of Unuk river prospects have been located on similar veins near Boulder creek, a glacial stream, about 10 miles in length and rising near the Coast Range contact.

North Fork.—The territory drained by North Fork and by Glacier creek, two glacier-fed streams reported to be about 15 and 18 miles long respectively, has not been prospected systematically. The ore-bodies which have been discovered are similar to others in this belt, and are frequently rich in galena, with good values in silver. The same statement applies to the region near the headwaters of Unuk river.

Canyon Creek.—In the vicinity of Canyon creek several ore-bodies have been discovered, and are significant because of their close proximity to the granite-contact along which Canyon creek has cut its course. The principal prospects near Canyon creek are the *Black Bear* claim and the *Daily Boy* group. The first is located on a vein 2 feet wide, outcropping along the selvage of a diorite-porphyrity dyke, and contains auriferous pyrite and pyrrhotite. The *Daily Boy* group is located in a gulch adjacent to Canyon creek, on veins occurring in altered black slates, argillites, and quartzites. The entire assemblage of strata is folded and faulted considerably and is characterized by intense induration and mineralization by sulphides, especially pyrite. On weathering they often become covered with a deep brown crust of ferruginous compounds, not unlike brown paint in appearance. The complex is cut by lamprophyric dykes of variable width and loose contact selvages. The veins which have been discovered in this gulch contain, besides pyrite, pyrrhotite and occasionally galena and sphalerite. No development-work of note has been done on either of these prospects.

Summary.

The geologic cross-section exposed by the Unuk River valley, across part of the Coast range, consists of two parts; on the west, a wide belt of Mesozoic granitic masses, formed during the same general period and grouped into one great unit, the Coast Range batholite, which on the east intrudes partially metamorphosed and probably Palæozoic sedimentary rocks in which ore-deposits have been discovered. A discussion of the type of metamorphism of this rock-complex leads to the inference that its metamorphic changes were largely due to the contact action of the intrusive granite; that the impregnation of these rocks by metallic sulphides was essentially concomitant with their contact metamorphism; that at the time of the granitic invasion this sedimentary belt was nearer the surface than the invaded strata on the coastal side of the batholite; and that the different physical conditions resulting from differences in relative position to an intrusive are important factors in determining not only the type and intensity of metamorphism, but also the kind and degree of sulphide mineralization.

From these considerations it is inferred that the sedimentary belt to the east of the Coast Range granite in the Unuk River section merits investigation and may reward careful prospecting for ore-bodies. The difficulties of transportation which have been encountered heretofore will be materially decreased by the completion of the wagon-road to Sulphide creek. Prospectors will then be able to devote a large part of their energy to the search for and development of metalliferous veins in the region.

The Unuk river was visited by Geo. A. Clothier, former Resident Engineer of District No. 1, in 1920. In the 1920 Minister of Mines' Report will be found an account of his trip. The following is Clothier's report of the best means of access into the region:—

The Unuk river is reached from Ketchikan, Alaska, where all the coastwise boats, from Seattle and Vancouver to Alaska ports, call each way. From Ketchikan there is gas-boat service to Bell Isle hot springs at the mouth of Burroughs bay, with which arrangements can be made to be taken to the mouth of the Unuk river at the head of the bay. All supplies, including a river-boat or small gas-boat, can be procured at Ketchikan, for either has to be used from the mouth of the river. A river-boat is built about 24 feet long, shovel-nosed at both ends and with a slightly curved bottom for handling in swift water. It is fitted with oars, poles, and a long line for "lining" up the fast water. A "kicker" can be used to good advantage as a help in fast water. There is no use in one man attempting to go up the river alone; two at least and preferably three are better. The river is navigable in this way for about 25 miles from the saltchuck or about a mile or two above the canyon. From there is a good foot-trail to the upper end of the canyon over which all supplies must be packed on men's backs for about 4 miles. Here, if one is lucky enough to find an old boat, he can go on up the river, by poling and lining, for another 12 miles to the South Fork, 14 miles to the mouth of Sulphurets creek, also flowing into the Unuk from the south, and about 20 miles to the head of the main river, though I believe it is navigable for only a short distance above Sulphurets creek. The game is goat, bear, and birds. A great deal of trapping has been done in that section, but I have no information as to the chances along that line now. The best time to get in is early in the spring as soon as the ice goes out, which is generally the latter part of April or the first of May. It is a dangerous trip at any time, but much worse during high-water time. If one wants to stand the expense, I believe that there are men in Ketchikan who will take you up in a gas-boat.

STIKINE AND LIARD MINING DIVISIONS.

These Mining Divisions constitute over 70,000 square miles of the area of the North-western Mineral Survey District. Transportation into the Divisions is via Wrangell, Alaska, and the Barrington Transportation Company river-boats up the Stikine river to Telegraph Creek. This company offers an excellent, prompt, and courteous weekly service to any point between Telegraph Creek and the mouth of Stikine river. Freight rates to Telegraph Creek are \$60 a ton, to the Chutine (Clearwater) river \$50 a ton, and to the mouth of the Iskut river \$25 a ton. The passenger rate on the river-boats, including meals and berth, is \$50 from Wrangell to Telegraph Creek and return. The trip from Wrangell to Telegraph Creek occupies from two to three days, depending on river conditions, and about one day returning.

From Telegraph Creek a 70-mile motor-road leads over the Arctic divide to Dease lake, from whence small-boat navigation on Dease lake and down the Dease and Liard rivers gives access to the region beyond the Yukon and North-west Territories boundary.

For several seasons a Dominion Geological Survey party under F. A. Kerr has been carrying on an active survey of the Stikine River area. It is understood that this work was completed during the 1929 season and that the final report is in process of preparation. A second preliminary report has been published in the Geological Survey of Canada Summary Report, 1928, Part A, to which readers are referred.

During the 1929 season the prospecting carried out was what might be called a matter of elimination. Several parties of outside prospectors entered the region. Of these, a party under A. Skelthorne, employed by the Mining Corporation of Canada, conducted extensive exploration which resulted in several discoveries. One of these, on 4-Mile creek is reported to be of exceptional interest. Some prospectors who came in failed to penetrate the unfavourable granitic area extending along the Stikine from the Iskut to the Chutine and departed for other fields without getting into the more promising sections of this worthy area.

In this connection it must be stressed that whereas the 70-mile stretch along the immediate confines of the Stikine trough from the Iskut River mouth to the Chutine River mouth is in the disturbed marginal area and can be rightly considered as generally unfavourable to the continuity of sustained ore-bodies, yet very favourable areas probably exist to the eastward of this stretch and also along the drainage areas of these rivers. The following description of the contact may help to clarify this point. The Coast Range granite-contact strikes into the area in the form of an inverted "S," with the bottom or easterly shank paralleling the Iskut river on its south bank, the central spine following due north for 70 miles along the east bank of the Stikine river, and the top or westerly shank following the southerly drainage area of the Chutine river. This throws the 70-mile stretch of the Stikine river between the Iskut and Chutine rivers, practically entirely in granite, and the immediate vicinity of the Stikine proper, between these points, not sufficiently distant from the main contact to be entirely favourable. The Iskut and Chutine rivers penetrate the marginal contact-zone on the south and north of this inverted "S" and are exceptionally promising areas for prospecting. It is in these sections and the drainage region north of the Chutine river that the most promising discoveries have been made. The headwaters of the several streams that penetrate the 70-mile north-south margin of the contact to the eastward are equally as promising but less accessible.

In the Iskut River area forty-eight claims were staked during August by A. Vreath and partner on Johnnie mountain, prospecting for the Consolidated Mining and Smelting Company of Canada. This staking was not completed until late in the season and the showings have not yet been explored. It is understood the Consolidated Company intends doing some work on them during the 1930 season.

In the same area the Bronson claims, staked a number of years ago, have received the attention of examining engineers.

About 5 miles up Ball creek, a western tributary of the Iskut river about 90 miles from its mouth, a group of fifteen claims was staked at the end of September by G. V. Carson for the A. B. Trites interests.

Towards the close of the season a group of claims about 7 miles from the mouth of the Iskut river was staked by Barrington Bros. on a showing of galena ore from which some nice-looking specimens had been brought out.

Devil's Elbow Mountain. On the *Silver Cap* group of two claims, owned by Pete Hamel and Dan McShane, several small disconnected showings of chiefly zinc-blende with occasionally some galena have been prospected by stripping and several open-cuts. Lenticular showings of pyrrhotite and magnetite carrying a little chalcopyrite have also been open-cutted. A sample across the best showing, in a 12-foot open-cut, at altitude 3,900 feet, assayed: Gold, 0.02 oz. to the ton; silver, 0.6 oz. to the ton; lead, *nil*; zinc, 4 per cent.

These mineral occurrences are very irregular and lenticular in form. They are associated with a complex of highly metamorphosed argillite and limestone, in places altered completely to garnetite and intersected in all directions by spurs from the underlying granite. The occurrence represents very shallow and shattered pendant remnants and does not offer much commercial promise.

On the *Stikine* group, owned by Jack Bodel and C. A. Tervo, of Telegraph Creek and Victoria, the usual assessment has been carried on. Similar small lenticular showings of zinc-blende in garnetite, in which are patches of good-grade ore, are affected by the same adverse geological conditions as the *Silver Cap* showings and do not offer much commercial promise.

On the *Peelock* claims, owned by Sandy McNab, of Telegraph Creek, five extensive open-cuts covering 150 feet along a bluff face have been driven in solid garnetite, in which some very sparse zinc-blende and galena mineralization is revealed after careful search. The showing is not of commercial importance and is acutely affected by the generally adverse geological condition of Devil's Elbow southerly slope.

On the *Apea* group, owned by Pete Hamel and Dan McShane, of Telegraph Creek, exploration was carried out during the season. This group was not examined. It is situated at about 5,500 feet altitude in a pendant complex of argillite and limestone that can be seen to be less disturbed than the area already described, and to be of about 3,000 feet thickness above the underlying granite.

The *Central* group, owned by Pete Hamel, is situated on the lower altitudes of Devil's Elbow southerly slope. Time was not available for the group to be examined, but an engineer who had seen the showing reported it to be the most promising showing on the mountain. It has been explored by open-cuts which are reported to have exposed good chalcopyrite mineralization in a replacement zone.

The northerly and south-easterly slopes of Devil's Elbow mountain, which are farther away from the granite-contact, would offer a more promising region for prospecting than the slope to the Stikine river.

Jackson. This group of twelve claims is owned by Frank Jackson, of Jackson's Landing. It is situated at altitude 3,500 feet on the south side of the Chutine river, about 1½ miles from the stream and about 4 miles from the mouth of the river. Three well-defined shear-zones occur in a light-coloured pyritized volcanic associated with gabbro. Two of the zones, 3 to 4 feet in width and several hundred feet apart, strike north-westerly and dip steeply south. What appears to be the main zone, in which undelimited widths up to 10 feet are exposed, strikes approximately north-east along the crest of the ridge for a distance of about 700 feet. The outcrops are intensely oxidized, but in the solid places show encouraging mineralization of zinc-blende, some galena, chalcopyrite, malachite, and azurite, with a little grey copper. A sample across 3.5 feet of quartz vein mineralized with pyrite, chalcopyrite, specularite, and some galena assayed: Gold, 0.02 oz. to the ton; silver, 2.4 oz. to the ton; copper, 0.4 per cent.; lead, trace. A sample of the solid material on the dump from an oxidized outcrop 5 feet wide at 3,650 feet altitude assayed: Gold, trace; silver, 4.8 oz. to the ton; copper, 1.6 per cent.; lead, 1 per cent.; zinc, 5 per cent. A sample of the solid material from the dump of an oxidized outcrop 7.5 feet wide assayed: Gold, trace; silver, 3 oz. to the ton; lead, 1 per cent.; zinc, 6 per cent. A sample from 4 feet of solid vein-matter from a heavily oxidized outcrop totalling 10.2 feet in width assayed: Gold, trace; silver, 3 oz. to the ton; copper, 0.4 per cent.; lead, 0.8 per cent.; zinc, 6 per cent. The showing warrants systematic exploration and the area, particularly the lower elevations, should be further prospected.

Near the head of Limpoke creek thirteen claims were staked during July for Barrington Bros., of Wrangell, on a reported extensive low-grade showing of chalcopyrite occurring in what appears from hand samples to be a pegmatite. Supplies and equipment were taken in late in the season for the exploration of the occurrence during the winter.

On 4-Mile creek a new discovery on an old location was made by A. Skelhorne's prospectors, prospecting for the Mining Corporation of Canada, and twelve claims were staked in August. The ore is disseminated chalcopyrite in massive pyrrhotite, reported to occur over good widths and traced for about 1,500 feet. This showing will be opened up during the coming season.

In the Klappan River area an aeroplane expedition early in June, headed by W. George, of Stewart, resulted in the staking of eight claims on Tsetogamus creek, on which interesting chalcopyrite-showings are reported.

Several miles south of this discovery a similar showing on the north-west shore of Ealuc lake was discovered late in the season by Joe Williams, of Telegraph Creek, and eight claims were staked. Towards the middle of October ten claims were staked by Mike Williams, of Telegraph Creek, about 3 miles west of Gnat creek, near the headwaters of the Tanzilla river. The route taken to these claims was from Riley's, on the Telegraph Creek-Dease Lake road, and following the summit of the Hotailule mountains for about 20 miles in a south-easterly direction. The claims are situated about 5 miles east of the foot of Thenatodi lake. The staking is reported to be on an old discovery made by two placer-miners in 1898.

PLACER GOLD.

The placer-gold production of Stikine Division for 1929 was \$646 and for Liard Division \$5,780.

Barrington Co., Ltd. Leases held by this company on Barrington river (North fork of the Chutine river) were not operated during the season. Extensive drilling operations had disclosed discouraging values in several leases that were consequently dropped. Only the Discovery claim and leases 256 and 257 are retained by the company. The restricted yardage of pay-gravel that has been indicated does not appear to warrant dredging operations. As the character of the occurrence is essentially a dredging proposition, the company is faced with the problem of working out a suitable and economical method of operation.

Thibert Creek. Vancouver interests headed by H. D. Wright and J. R. Walton have been conducting drilling operations on dredging lease No. 145 at the mouth of Thibert creek. The drilling operations were being directed by Barney J. O'Reilly, assisted by Clayton J. Leeds, who are experienced drillers. At the time of examination eleven holes had been drilled and it was expected to drill two or three more. These holes were being drilled systematically across the present bed of the creek. No plan of the drill-logs and values was available for inspection, but it was stated that bed-rock had been struck at depths of from 25 to 30 feet and that the results were promising, with some holes showing up to 60 cents a cubic yard.

It had been estimated that 50 per cent. of the gravel depth drilled was composed of old tailings that had come down the creek from the extensive workings of past years higher up the creek. It was thought that better-grade material might be found in what appears to be an old bed of the creek lying northerly of the present creek course. If this can be substantiated the effect of dilution from the old tailing covering would be avoided. Constructive drilling could be carried out in the attempt to trace this old bed.

It is understood that the 1929 operation was a skeleton prospecting with a view to determine the most efficient type of drilling campaign necessary to prove area and values. It was estimated by the operators that ground carrying 30 cents a cubic yard could be worked profitably. The nearest point from which a criterion of costs can be formed is the Yukon territory. There, large-scale dredging can be conducted at a cost of from 27 to 38 cents a cubic yard, dependent on the percentage of thawing necessary and lost time, and exclusive of depreciation.

The matter of a profitable dredging operation on lease 145 can only be determined by further methodical, careful estimation of yardage available, systematic sampling, and accurate determination of values to the cubic yard. In making this computation it must be stressed that the total yardage value must be sufficient to amortize the initial investment and yield a desired profit. Providing the exploratory work being carried out is sufficiently extensive, an accurate criterion should be available to the operators regarding the possibility of working the ground by dredging at a profit or not.

Mosquito Creek. The Mosquito Creek Hydraulic Association has conducted efficient and extensive preparatory work to reach the "pay" that occurs north of a northerly-sloping reef-rim in the canyon. This has necessitated extensive

solid rock-work to shoot away the reef at the end of the Adsit lease. This work was about completed at the season's close and it is expected that this property will be brought into production during 1930. During 1929 a small amount of coarse gold has been picked up from bed-rock indiscriminately during the course of the preparatory work. A 5 by 5½ portable Ingersoll-Rand, 120-cubic-foot compressor, operating an Ingersoll plugger hammer-drill, has been installed for the rock-work. A 1,200-foot capacity sawmill run by a 10-horse-power water-wheel is also in operation. Sixty-five 12-foot 2-inch boxes had been installed up to the end of the season. Block riffles are being used with Hungarian (grill) lips. About 240,000 cubic yards are roughly estimated in the Adsit lease which will be worked on a lay.

A maximum of 1,000 inches of water is estimated as available during the season. This falls to about 300 inches during the latter part of the season. For future operations it is intended to augment the water-supply by drawing from Adsit lake and damming the upper Mosquito creek. It is estimated that this will give a constant seasonal supply of about 1,200 inches. Operations are in charge of J. R. Gibson.

Several holes have been drilled on the Adsit lease. These are reported to have given very encouraging results. This lease occupies a small natural and protected collecting-basin from the Adsit and Porcupine Lake areas. This conformation of drainage-channels into a restricted and protected area promises a good prospect of a profitable operation.

Gold Pan.—In this area the individual operations on the Vickery, Cameron, and Drapich leases have been active during the season, with an estimated recovery of slightly over 200 oz. of gold.

Unfortunate results attended the operations of the Dease Creek Mines, Dease Creek. Limited (head office, Seattle), which ceased operations on August 27th after two very disappointing clean-ups. The failure of this operation is an example of the results that attend the hazardous policy of embarking on extensive production-work without first thoroughly testing the ground by systematic drilling for values and yardage, and the failure to employ the advice and guidance of accredited and capable mining engineers with placer-mining experience.

Unfortunately placer-mining in the Liard Mining Division has suffered from the failure of several such ill-conducted operations in recent years. There is little doubt that the territory holds good promise of profitable placer-gold operations. Success, however, can only be achieved by strict attention to sound mining principles.

This company, with office at 609 Nova Scotia Building, Vancouver, conducted extensive preparatory work on two hydraulic leases. This company is a
The Cassiar Hydraulic Mines, Ltd. reorganization of the Joy Mines, Limited. Excellent camps have been erected and a telephone system installed from the lake to the camp. At the time of examination (October 19th) 14,005 feet of 7- by 2-foot ditching and 1,080 feet of flume had been completed, and 14,500 feet of ditch and 2,000 feet of flume from Lyon gulch to Buck gulch was under construction. With the exception of some panning, no drilling or test-pitting had been carried out to ascertain the value of the ground to be worked.

ATLIN MINING DIVISION.

The promising developments on the *Tulsequah Chief* group, the discovery of the exceptional surface showing on the *Manville* group, and the several other interesting discoveries in the Taku River area during 1929 have brought the Atlin Mining Division into prominence as a very important potential lode-mining area, with good promise of appreciable base-metal and associated gold and silver production in the not-distant future.

The attention of important operating companies is being directed to this Division in no uncertain manner. The future for a rapid and sound development of its resources, both in lode-mineral and placer gold, holds very bright promise. Besides the new Taku River area, it is understood that engineers representing strong Eastern interests have bonded a promising property on Tutshi lake, about 8½ miles from Log Cabin, on the White Pass & Yukon Railway.

Unfortunately the development of the promising interior of the Atlin Mining Division has been retarded by a roundabout and inconvenient means of access attended by high transportation costs. This route is via Skagway and the White Pass & Yukon Railway to Carcross, thence down Tagish lake to Taku Landing at the head of Graham inlet, where transfer is made to a railway 2½ miles long to Scotia Bay, and then across Atlin lake by boat to Atlin. Ice conditions do not permit boat traffic on the lakes until about the beginning of June. Freight rates on

commodities from Prince Rupert, Vancouver, and Victoria to Atlin vary from \$51 to \$66 a ton for car-load lots. For machinery the rates to Atlin are \$51 a ton for car-load lots and \$56 a ton for less than car-load lots. Generally, for less than car-load lots the rate varies from \$74 to \$103 a ton. For ore in sacks, not exceeding a value of \$100 a ton, the rates from Atlin are \$8.25 a ton for car-load lots and \$9.25 a ton for less than car-load lots.

With the prospects of the Pacific-Yukon highway in the offing, and the possible developments in the Taku River region necessitating an improved transportation system for that area, the possibility for a future direct transportation line from Atlin down the Taku River valley to seaboard is not entirely remote. There is no doubt that the most direct and logical outlet from Atlin to seaboard is down the Taku River valley, a distance of 143 miles. Of this, 16 miles lies on the Alaskan side and 127 miles on the Canadian side of the boundary. Of this, 30 miles of road has already been constructed from Atlin to the O'Donnel river. From a point of view of construction the route is reported to offer no difficulty whatever. If future developments should warrant the construction of this Taku River-Atlin transportation line, the greatest hindrance to the rapid development of the interior of the Atlin Division will have been removed.

TAKU RIVER SECTION.

A special bulletin descriptive of this section has been issued by the Department of Mines. For the convenience of those who may not have seen this bulletin it is reprinted at the end of this report (*see page 124*).

Since the bulletin on the Taku River area was written, the Alaska Juneau Gold Mining Company has increased its holdings by acquiring options on the *Walker* and *Moose* groups of claims, adjoining the *Manville* on the north-west, and also on the *Big Bull Eatenson*, adjoining the *Manville* on the south. This company now controls fifty-four claims, amounting to 2,200 acres, in the area.

Up to December 31st the Alaska Juneau Company had completed 3,500 feet of diamond-drilling in holes Nos. 1, 2, 3, 4, 5, and 6 (uncompleted). Although the ore-zone has been cut in all the completed holes at depth, showing extensive widths, the ore occurrence, as was to be expected, is indicated as having a lenticular development of ore-shoots. Whereas some holes show only mineralized ore-zone, others show good widths of commercial ore.

Eight hundred feet of underground work was also completed up to the end of the year. In this work good widths and lengths of commercial ore have been indicated, but the extensive surface croppings are being indicated as having a lenticular development in depth. An interesting feature in connection with the mineralization being met with in the underground work is the appearance of finely divided pyrrhotite in places. Development on the *Manville* has been very energetically and continuously pushed by the Alaska Juneau Company with a large crew. The progress made is exceptionally creditable and the results have been quite encouraging. During the winter months dog-team transportation has been operating on the river-ice from Taku point to the *Manville* camp.

The developments to the end of the operating season on the *Tulsequah Chief* group by the United Eastern Mining Company are included in the special report. Of subsequent interest is the incorporation of the Taku Mines Company, Limited, on December 30th for the purpose of developing the *Tulsequah Chief*. This company, with registered office in the Royal Trust Building, 626 Pender Street West, Vancouver, is constructed of an authorized capital of \$5,000,000, divided into 5,000,000 shares. It is understood that the United Eastern Mining Company, in return for money advanced for development as needed, will eventually acquire a 60-per-cent. interest in the company, the remaining 40-per-cent. interest going to the original bonders and owners of the property. The stock of the company acquired by the United Eastern Mining Company will go into its treasury. About 90 per cent. of the stock of the latter company is in the hands of the United Eastern Mines Corporation. The money required for development by the United Eastern Mining Company is supplied to it by the United Eastern Mines Corporation.

The United Eastern Mining Company management has intimated that, should the satisfactory development of the *Tulsequah Chief* continue through the summer and winter of 1930, the operating schedule allows for a probable mill-construction and power-plant installation starting in the spring of 1931. It must be distinctly understood, however, that this programme is entirely dependent upon the continuance of a satisfactory showing in the development-work.

Several further discoveries were made in the Taku River area late in the 1929 season. Buck Sparling is reported to have staked a group of claims on a promising discovery adjoining the *Tulsequah Chief* on the east.

This group of nine claims was staked towards the end of September, 1929, and **Erickson-Ashby**, is owned by Erickson, Ashby, and associates, of Juneau, Alaska. The claims are situated on the north slope of the south bank of the Taku river, almost directly opposite the *Manville* camp, and cover the ground from the river-bank to about altitude 4,000 feet.

The following description is from information supplied by one of the owners: The formation is andesitic flows and fragmentaries with some belts of limestone, and is cut by acid dykes. Mineralization appears to be associated with felsitic dykes and consists of dense crystalline, dark zinc-blende, with interspersed grains of galena, associated with pyrite, pyrrhotite, and a little chalcopyrite. Good widths and appreciable continuity, with good lengths of ore-shoots on the surface, are reported. Values are in gold, silver, lead, with predominating zinc. No development has been done on these claims.

Samples of the occurrence selected from the owner's stock by the Resident Engineer as being typical of the mineralization assayed:—Galena sample: Gold, trace; silver, 22.9 per cent.; copper, *nil*; lead, 5.7 per cent.; zinc, 2 per cent. Zinc-blende sample: Gold, trace; silver, 0.9 oz. to the ton; copper, *nil*; lead, *nil*; zinc, 18.4 per cent. The galena sample showed finely divided galena in a dark siliceous rock. The assay indicates a high silver ratio (about 4 oz. of silver to the unit of lead). The zinc-blende sample was disseminated dense crystalline "black-jack." The assay indicates the important factor referred to regarding the *Tulsequah Chief* and *Manville* ores, that the zinc part of the ore contains practically no silver.

This group was staked subsequent to the *Erickson*. It consists of eleven **Maidas** claims, *Maidas No. 1* to *No. 11*, and is owned by P. E. Hallum, G. Norman, and associates, of Juneau. The claims adjoin the *Erickson* on the south-east and are staked on what is presumed to be the easterly extension of the *Erickson* vein. The property covers the upper westerly slope of the mountain to the junction of the Taku river and its South fork. The geology, ore-zone occurrence, and mineralization appear from the description of the owners to be similar to that of the *Erickson*. The owners report the ore-body to be 22 feet wide, striking north-westerly and dipping vertical. Eight feet of the vein-width is reported to be well mineralized. A metal content is reported of: Gold, 0.075 oz. to the ton; silver, 16 oz. to the ton; lead, 8 per cent.; zinc, 26 per cent.

This group of six claims was also staked late in the season. It consists of the **Mohawk** *Mohawk No. 1* to *No. 6* and is owned by P. E. Hallum, W. H. Wilson, and associates, of Juneau, Alaska. The claims adjoin the *Maidas* group on the south-east and are aligned on the southerly slope of the mountain down to the South fork of the Taku river, to cover the possible south-westerly extension of the *Maidas* showings.

These four claims are owned by Paul Black, W. Nowell, and associates, of **Lucky Strike**, Juneau, Alaska. The property is situated on the west side of Flannigan slough, about 15 feet east of the International boundary. The owners report two wide quartzose zones, mineralized with pyrite, some zinc-blende, and an occasional speck of galena.

Late in August, Erickson and Ashby staked several claims on Crow (Yeth) creek, a northerly tributary of the Inklin river, about 8 miles from its junction with the Taku river. The occurrence is reported to be a wide zone of quartz stringers mineralized with cube galena, zinc-blende, and pyrite. No work has been carried out on the showings.

RAINY HOLLOW SECTION.

This section occupies a small area in the extreme north-westerly corner of the district, about 26 miles south of the Yukon boundary. It is centred around the drainage region of the Klehini river, which flows into the head of Chilkat inlet, a prolongation of the Lynn canal. The section is reached via Haines, Alaska, 15 miles south of Skagway. From Haines a good motor-road has been built for a distance of 43 miles to Pleasant camp on the International boundary, from where a wagon-road and trails lead into the area.

Stampede. This group is owned by J. O. Stenbraten, who has done considerable stripping and open-cutting. The property is situated on the north side of a tributary of the Kiehini river, about 6 miles by trail from Pleasant camp. The camp and showings are at about 4,500 feet altitude. The main showing is a quartz-vein system from 1 to about 7 feet wide, mineralized with pyrite, in diorite, and traced for over 3,000 feet. The values are chiefly in gold. These are generally low grade, but an occasional high assay indicates the possibility of the occurrence of high-grade shoots. The showing is described in detail in the 1927 Annual Report. During the season the property was under option to the Alaska Juneau Gold Mining Company, which after carrying out extensive exploratory work in further trenching and shaft-sinking relinquished the option. It is understood from the Alaska Juneau management that this action was influenced chiefly by the inaccessibility of the property rather than a lack of merit.

ATLIN LAKE SECTION.

Lode-mining in this section has been comparatively inactive during 1929. Owing to the death early in the year of J. M. Ruffner, the organizer of the Atlin Silver Lead Company, continuation of work on this property has been held up. An engineer representing the Atlas Exploration Company examined this property in June, but apparently negotiations have not culminated in a deal.

At the *Engineer* a crew of about twenty-five men started early in April in further exploration of the lower levels. This work was later suspended. Although future prospects for profitable operation under present conditions are not considered bright, definite information regarding any resumption of operations on this property is not available.

It is understood that engineers representing the Noah Timmins interests have bonded a promising gold-silver-copper property on Tutshi lake and intend initiating exploration during the 1930 season. Some notes on this and neighbouring properties are appended herewith.

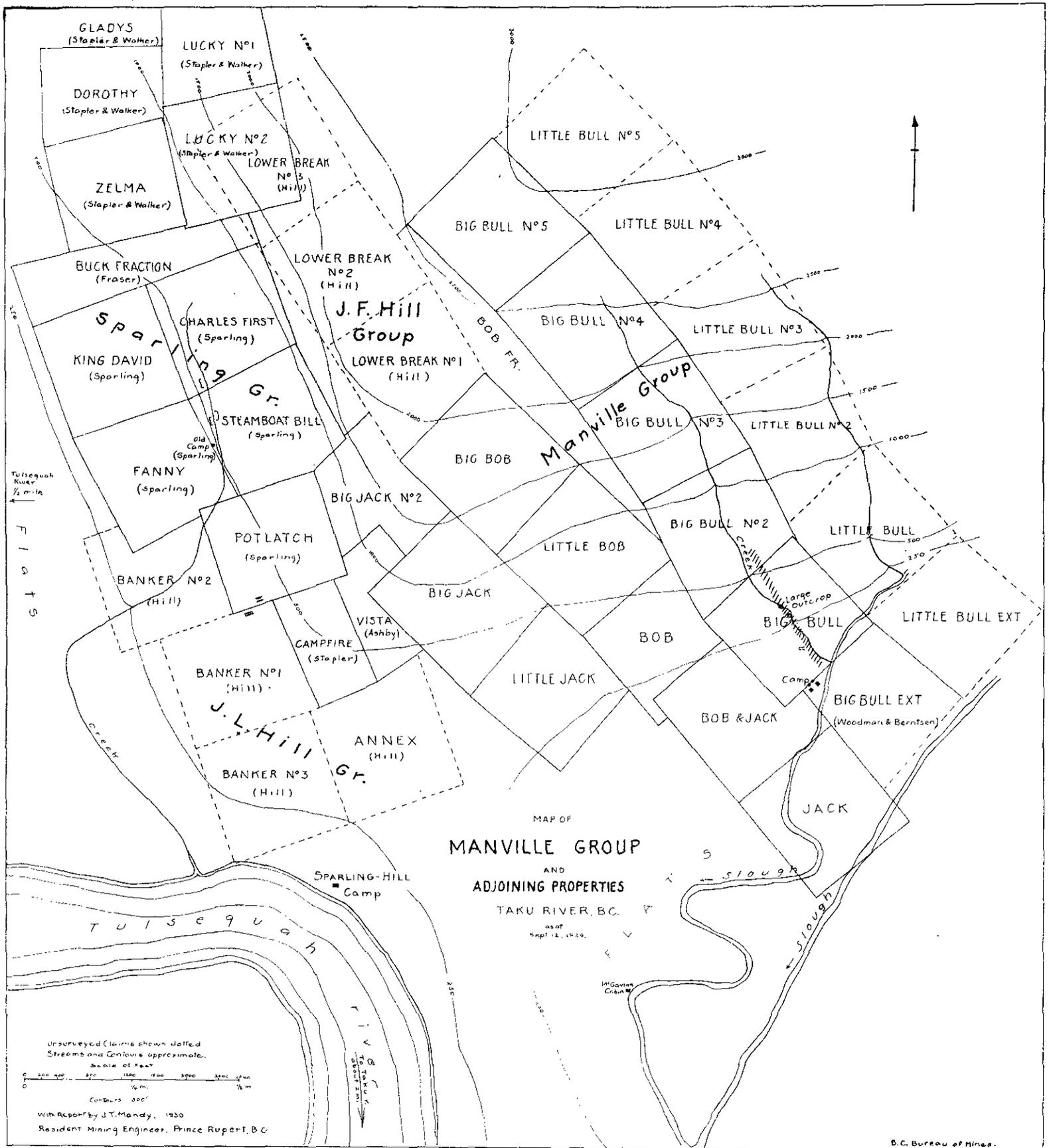
On scrutinizing former Annual Reports on this section, it is very apparent that many promising lode-mineral prospects worthy of intensive exploration exist in the Atlin Lake area. For years these have been idle. There is also an extensive deposit of magnesite of remarkable purity lying dormant in the neighbourhood of Atlin. This, together with the known geology of the area, indicates good possibilities for a non-metallic industry. The opportunities also for large-scale placer-gold operations are well known. The mineral resources of the area are described in detail in a special bulletin, by W. M. Brewer, issued by the Department of Mines in 1915.

Despite the exceptional mineral resources of this area, the region has remained comparatively inactive. The fact must be acknowledged that the development of the country is retarded by an inconvenient and expensive transportation system, and it will not be fully developed unless this condition is alleviated. The remedy, apparent and logical, lies in the construction of a direct transportation system down the Taku River valley to seaboard, approximately 143 miles in length. With the developments that are now taking place in this latter area and the mooted Pacific-Yukon highway, the hope for the materialization of this remedy to the struggles of the interior Atlin region may perhaps be fulfilled in the not distant future.

Jessie. This is a restaking of the old *Great Northern* group, originally staked by Joe Bussinger in 1906. The property consists of eight claims owned by Joe Bussinger, of Prince Rupert, and is situated at about 4,000 feet altitude near the south end of Tutshi lake (altitude 2,800 feet). It is reported by the owner that the property was examined in September by engineers representing the Timmins interests and bonded by them for exploration to start in the spring of 1930.

The owner describes the showing as a shear-zone 6 feet wide in an andesite formation, with limestone and gabbro in places, occurring about half a mile from a granite-contact. The zone strikes north-east and dips 65° north. Mineralization consists mainly of chalcopyrite and pyrrhotite with some galena and a little zinc-blende. The average assay of ore-shoots in the zone is reported to be: Gold, 0.15 oz. to the ton; silver, 23.6 oz. to the ton; copper, 4.9 per cent.

To reach the claims it has been necessary to go in via Carcross to Windy Arm, then across a 3-mile portage to Tutshi lake, then 18 miles up the lake by boat. The property can, however, be reached from Log Cabin on the White Pass & Yukon Railway, a distance of 8½ miles. It is intended to repair an old trail leading in from Log Cabin.



Big Thing. This is a group of eight claims staked on a new discovery by Joe Bussinger near the south end of Tutshi lake and northerly from the *Jessie*. The owner reports the showing on this group to occur at about 4,000 feet altitude and to be similar to, though lower in grade than, the *Jessie* showing. Assays of from a trace to \$2 in gold and about 2 per cent. copper are reported to have been obtained.

PLACER-MINING.

REPORT BY HERBERT CARMICHAEL.

DESCRIPTION OF PLACER PROPERTIES.

During the season of 1929 there was considerable activity amongst the placer-miners and a number of the properties give promise of becoming producers of some size.

Lake Surprise Mining Co., Ltd.—This company is working on Ruby creek, which flows into Surprise lake on the north side; work was started this year by building a flume and hydraulicking with the object of reworking old ground. This creek yielded large returns to individual placer-miners, but was never carefully cleaned up. Matson & Schultz have leased the property from the above company, which has its headquarters in Seattle.

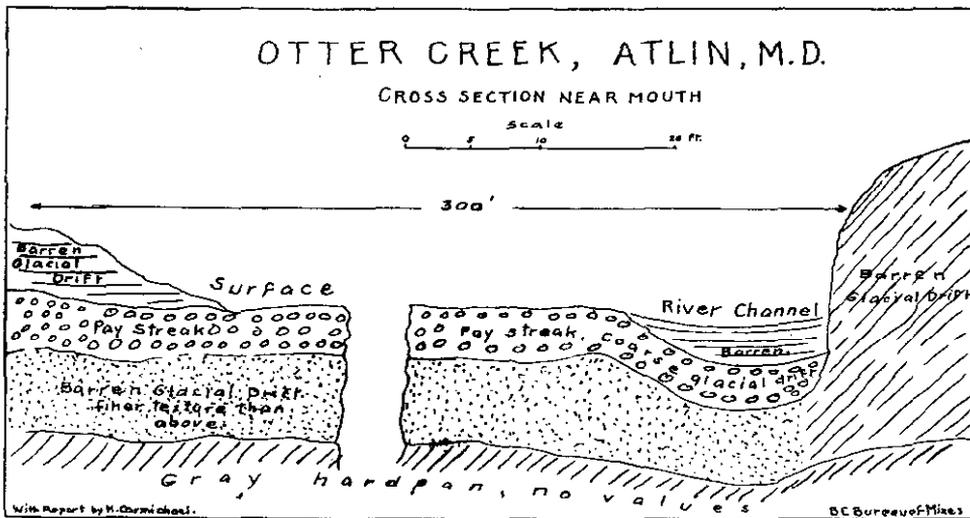
Boulder Creek.

Boulder creek flows into Surprise lake 3 miles east of Ruby creek. Boulder Creek Placers owns the whole of this creek and it is controlled and operated by the Consolidated Mining and Smelting Company of Canada, Limited.

There is some length of ground on this creek that was never worked, and to get sufficient grade to work this, 500 feet of bed-rock flume was built this year on a lower grade than the old flume, the total distance back from the lake being 2,000 feet. Piping is being done with a 4-inch monitor under a 100-foot head, the top of the bank being 55 feet above the flume; but this bank does not contain any values and none are expected until the unworked ground on bed-rock is reached.

Otter Creek.

Otter creek flows into Surprise lake on the south side, a short distance from the outlet of the lake. The Compagnie Française des Mines d'or du Canada, of Paris, France, under the management of J. E. Moran, controls this creek. This creek has been prospected for a considerable distance from the mouth and showed good pay-dirt, but the company has always been short



of sufficient water to work it. To overcome this difficulty a flume and ditch is being constructed along the hillside on the south side and from ½ to 1 mile back from Surprise lake. This will take in the waters of Wright, Idaho, Casino, Union, and eventually Quartz creeks, delivering the same to a dam high up on Otter creek—a total distance of nearly 9½ miles.

from Pacific in a southerly direction and is at an elevation of 4,456 feet. The chief work carried on during the year was stripping and tunnelling.

CEDARVALE SECTION.

D.W.—Operated under option by the Consolidated Mining and Smelting Company, Limited; G. Shannan, superintendent. The original owner is Steve Young, of Cedarvale, and I have been informed that the option held by the above company has been dropped. Operations in the inclined shaft were discontinued in February and some stripping was started which continued until October 14th with an average employment of twelve men. No ore was shipped during the year. Camp accommodations were found to be in good order.

HAZELTON SECTION.

Rocher Deboule.—Operated by the Aurimont Mines, Limited; Nichol Thompson, president; G. L. Salter, secretary-treasurer; D. Harris, manager. Operations continued here until April 11th, 1929. The production for the year, which amounted to 80 tons, was shipped to Trail. I did not visit the mine owing to the short period of operation making it impossible.

Silver Cup.—Operated by the Duke Mining Company, Limited; W. Dornberg, managing director; Gus Kvist, superintendent; E. Bertlin, mine foreman. Operations at this mine continued from the beginning of the year until the month of December with an average crew of forty men. I had occasion to request several matters to be remedied during the year, and on my last inspection found this operation to be in reasonable compliance with the requirements of the "Metalliferous Mines Regulation Act."

Mohawk.—D. Harris, manager; H. Harris, superintendent. This mine, with a crew of ten men, has operated throughout the year with the exception of about two weeks. The work consisted chiefly of development by tunnel. No ore was shipped during the year. The power plant consists of a portable compressor of 45 horse-power. The camp buildings are adequate and sanitary.

SMITHERS SECTION.

Duthie.—Operated by the Atlas Mining Company, Limited; O. Banks, managing director; C. B. North, assistant manager; A. G. Hattie, superintendent; A. Nelson, mine foreman. Operations were continuous throughout the year with an average employment of ninety-six men; the development of the ore-body being the chief work. A 2-compartment shaft 100 feet deep has been put down from No. 5 level, and a large amount of drifting and crosscutting has also been done. The mill was idle for the first five months of the year while new machinery was being installed, but commenced operations during the month of June and continued until the end of the year. A modern camp has been completed, including an emergency first-aid room in charge of a qualified first-aid man. During my inspections I found the management always willing to co-operate with me in all matters for the welfare of the workmen.

Duchess.—Operated under option by the Consolidated Mining and Smelting Company, Limited; S. Giegerich, superintendent; G. Bell, foreman. Operations at this mine were carried on from the beginning of the year until August 8th with an employment of eighteen men; work then closed for the year.

TOPLEY SECTION.

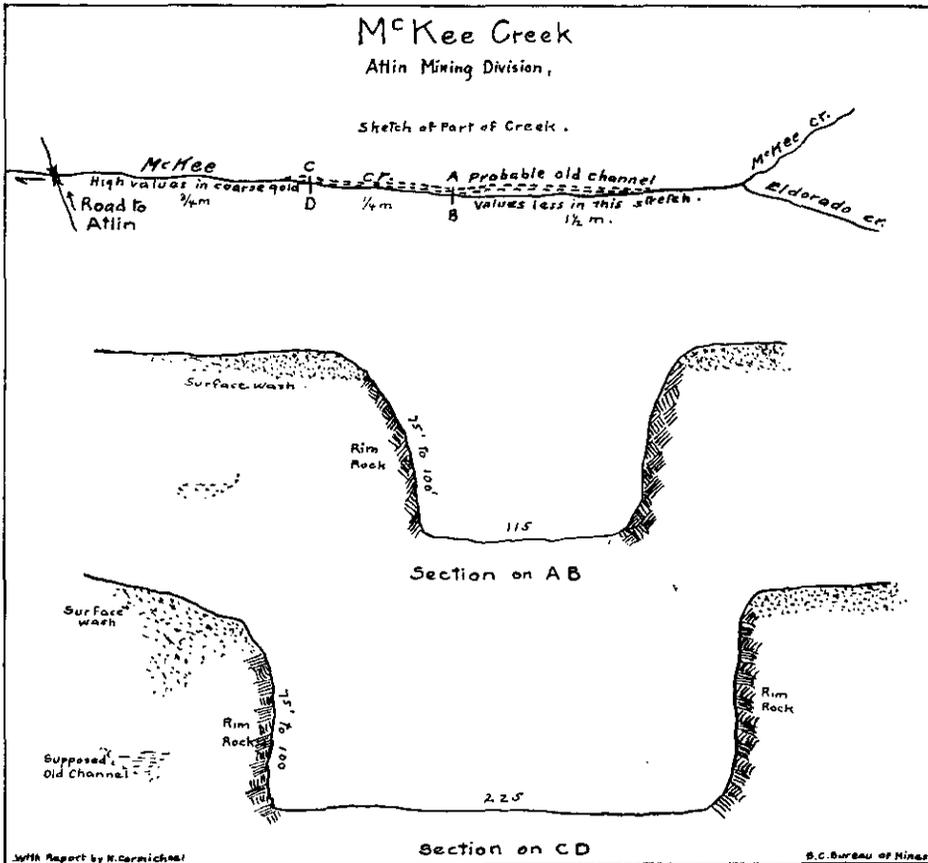
Richfield.—Operated by the Topley-Richfield Mining Company, Limited; J. C. McCutcheon, superintendent; W. W. McDowal, mine foreman. Operations here were carried on throughout the year with a crew of thirty-seven men until the end of October, when the mine was closed down. On my last visit in October I found that the rails and equipment had been removed to the surface from No. 2 level.

Golden Eagle.—Operated by the Topley Silver Mining Company, Limited; T. D. Pickard, managing director; A. Beaton, mine foreman. This property was under option and operated in the early part of the year by this company. In the month of April, however, the option was dropped. Several buildings on the surface had to be changed during the year to more fully comply with the regulations.

SIBOLA SECTION.

Emerald.—Operated by the Consolidated Mining and Smelting Company; H. C. Hughes, superintendent; B. D. Gallagher, mine foreman. This property is some 65 miles from the

bridge on the main road the gold values in the bed of the creek suddenly became much less than they had been below. This raised the speculation that the present creek-bed from this point up did not follow the old channel. This inference was borne out by the fact that the rock which forms the right bank of creek at this point appeared to have a large amount of sedimentary deposit behind it and also that values had been found by drifting on that side of the channel. This is further supported by the fact that values were again found farther up where the present creek-bed leaves the supposed old channel; this can only be definitely ascertained by further prospecting. In the earlier days work on the creek was hampered by lack of water; this has



now been overcome by making two storage-reservoirs—one at the head of McKee creek and the other at the head of El Dorado creek, a tributary of McKee.

Work has been delayed this year by the necessity of removing a large quantity of slide-dirt containing no values. This dead-work has consumed a considerable amount of time and money, but is now nearly completed, and there does not appear to be any further obstacle in the way of piping into the old channel and demonstrating what values it contains. Should this be successful there should be 1½ miles of virgin ground which should yield pay-dirt for many years to come.

O'Donnel River.

There is no hydraulicking on this river, but Nathan Murphy and T. Prplich are drifting during the winter and washing the extracted dirt during the summer months.

REPORT ON THE TAKU RIVER AREA, ATLIN MINING DIVISION, NORTH-WESTERN MINERAL SURVEY DISTRICT.

BY J. T. MANDY, RESIDENT MINING ENGINEER (HEADQUARTERS, PRINCE RUPERT).

INTRODUCTION.

The Taku river is the drainage-channel for about 5,000 square miles of the north-western section of British Columbia. The river and its tributaries occupy the next important drainage-trough of the Pacific slope north of the Stikine river.

The mouth of the Taku river is about 140 miles north-westerly of the Stikine River mouth. It empties into the head of Taku inlet about 25 miles north-east of Juneau, Alaska, and about 320 miles north of Prince Rupert, British Columbia. The British Columbia-Alaska boundary crosses the river about 20 miles from its mouth, throwing the important extent of the area in Canadian territory east of the Alaskan Panhandle. The area is reached by direct and frequent steamship connection from Prince Rupert or Vancouver to Juneau, and thence by launch and river-boat up the Taku river.

Recent mineral discoveries in the Taku River region give promise of the dawn of a new and important mining area. The interest aroused by these discoveries in mining circles and amongst the general public has resulted in many inquiries for information regarding the territory. To meet this situation it would seem that the best interests of that region and all those seeking information can be served by the incorporation of all available data in the form of a special bulletin.

In this report the Taku River area is necessarily treated in only a general way. More detailed attention is given to that part which lies east of the Alaska-Canadian boundary-line, and especially that area through which passes the eastern contact margin of the Coast Range granodiorite batholith. Geological inference and practical experience in the older mineral areas to the south have definitely established the economic importance of the mineral potentialities of the eastern contact margin of the batholith. The concrete evidence that these economic mineral potentialities extend northward in no uncertain manner through the contact-zone in the Taku River area is of great importance to the future development of British Columbia's northland.

The section especially embraced by this report, and in which it would seem the best opportunities for important mineral discoveries exist, is situated east of the International boundary between latitude $58^{\circ} 35'$ to $58^{\circ} 50'$ north and longitude $133^{\circ} 10'$ to $133^{\circ} 40'$ west, approximately 300 square miles in extent. This section forms part of the Atlin Mining Division, North-western Mineral Survey District (No. 1).

In view of a possible misleading interpretation that may be placed on statements appearing in the press, it must be stressed that the Taku River area is totally unsurveyed geologically and no geological maps exist relative to the area. Unfortunately the Geological Survey of Canada has hitherto not been able to extend its work to the Taku River trough. The nearest area in which geological survey work has been carried out is in the Stikine River area, lying about 140 miles southerly. In the British Columbia Minister of Mines' Annual Report for the year 1923 is the first recorded opinion relative to the mineral potentialities of the district. Now that the region has shown definite promise of important ore-bodies, it is hoped the Geological Survey of Canada will take steps to systematically map the area, and correlate its rock formations with those of the southerly lying Stikine River area.

The area is as yet unserved by roads or trails, but is very easily accessible by water route from seaboard. The nearest settlements are Atlin, about 143 miles north of the mouth of the Taku river, and Juneau, Alaska, about 30 miles by water route south-westerly. An efficient transportation system has been inaugurated by the Taku River Transportation and Trading Company. This was made necessary by the 1929 discoveries and the development operations undertaken by the Alaska Juneau Gold Mining Company and the United Eastern Mining Company in the vicinity of the Tulsequah river, the most important tributary near the contact-margin zone. This transportation system emanates from Juneau by launch to the mouth of the Taku river, and thence by river-boat to the mouth of the Tulsequah river. With good connections and tidal conditions over the Taku River bar, it is possible to make the journey from Juneau to the mouth of the Tulsequah river in one day.

The situation of the area on the westerly fringe of the Interior plateau or dry belt excludes severe or abnormal climatic influences. To the west the high altitudes and extensive ice-fields of the Coast range assume the role of a watershed and obviate any excessive precipitation in the bordering region to the eastward. Field observation indicates that rain and snow precipitation is moderate, considerably less than in the coast area to the west, and decreases steadily to the east. The timbered areas are comparatively free from underbrush. The winters are cold and dry, the summers moderately warm and sunny. About the beginning of November, slush-ice begins to form in the Taku river, and navigation is impeded by about November 15th. Towards the beginning of May the lowlands are reported to be free of snow and river navigation becomes possible again.

The topography of the country embodies generally those topographic features which are common with other parts of the Pacific slope and the eastern contact areas of the Coast Range batholith. The terrain is, however, in general, not so rugged and rough as that of the Kitsault, Bear, and Salmon River valleys in the Alice Arm and Portland Canal sections to the southward.

The Taku River area east of the International boundary is well supplied with game. Moose frequent the neighbourhood of the Tulsequah river and the slough and bench areas northward along the Taku river towards Atlin. Geese frequent the slough areas and are reported to nest in these localities. The large slough area west of the confluence of the Tulsequah river with the Taku river is an outstanding beaver region, featured by innumerable dams and colony houses. Black and brown bear are often seen along the river-banks. In the higher altitudes mountain-goat abound.

The operators and prospectors of the area, through their courtesy, hospitality, interest, and co-operation, greatly facilitated the work of examination.

HISTORY.

Despite the fact that the region is so favourably situated geologically and is so easily accessible, it was not until the spring of 1929 that its mineral potentialities attracted warranted attention. A small amount of prospecting, emanating from Atlin, for placer gold had been carried out in earlier years in the upper reaches of the Taku river, above the confluence of the Inklin and Nakina rivers. Stories are now told of lode-mineral finds in that section, made by the old-time placer prospectors, who, as is the way with placer-gold miners, paid little attention to them. During the past season several aeroplane expeditions were launched in the effort to relocate these reported discoveries. In 1925 some placer-gold leases were taken up in the Nakina River area by Kansas City interests. These were, however, not further prospected or developed.

A limited interest in the lode-mineral possibilities of the area was first germinated by the discovery several years ago, by W. Kirkham, of Juneau, of copper-zinc-lead ore about 8 miles above the confluence of the Tulsequah and Taku rivers. This discovery resulted in the staking of the *Tulsequah Chief* group. In 1923 this property was bonded to the Alaska Juneau Gold Mining Company, which did about 60 feet of unsuccessful tunnelling and relinquished the option. The property was examined in that year by George A. Clothier, at that time Resident Mining Engineer for the North-western District. In the Annual Report for 1923 he very definitely pointed out the favourable potentialities of the property and of the area in general. This is the first recorded official statement relative to the mineral potentialities of the Taku River region. To Mr. Clothier, of the British Columbia Department of Mines, must be given the credit for having first definitely recorded the mineral possibilities of the area and for having attracted attention to them.

In 1928 a syndicate represented by W. A. Eaton and Dan J. Williams, of Juneau, again optioned the *Tulsequah Chief*. These operators, after aligning the two zones of the deposit, turned the old Alaska Juneau tunnel to the left and within a short distance penetrated No. 1 zone carrying good-grade ore over an exceptionally promising width. In the spring of 1929 this syndicate bonded the property to the United Eastern Mining Company, of Los Angeles, which has attacked it very energetically, efficiently, and with exceptionally promising results.

This development attracted the attention of prospectors to the promise of the area. In the early part of May, 1929, a group of eight Juneau business-men grubstaked V. Manville, also of Juneau, for a projected lengthy exploration trip into the Taku River area. After only about two weeks in the field, Manville discovered an exceptionally imposing surface outcrop of copper-

zinc-lead ore, near the confluence of the Tulsequah and Taku rivers, and staked the *Big Bull* and other claims, now known as the *Manville* group. Almost immediately, competition arose between outstanding mining corporations for the acquisition of this property. This culminated in July in the extraordinary situation of three companies submitting an unlimited number of sealed bids, which were opened on a stipulated date. These negotiations resulted in the Alaska Juneau Gold Mining Company acquiring a working option on a 55-per-cent. interest in the property for \$75,000, which involved a cash-down payment of \$25,000.

The *Manville* discovery and subsequent deal, coupled with the promising development of the *Tulsequah Chief* under the direction of J. B. Stapler, of the United Eastern Mining Company, finally attracted the attention of prospectors and brought the mineral potentialities of the Taku River area into the limelight. Towards the latter part of the 1929 season, prospectors began to arrive in the country. It should be clearly understood, however, that there was no rush or stampede such as was pictured by the daily press. In September, when the area was examined, not more than forty prospectors were in the territory. Most of these were congregated around the mouth of the Tulsequah river. Only very desultory prospecting had been carried out by these men, mainly in the lower altitudes. Several interesting further discoveries had been made, however.

SUMMARY AND CONCLUSIONS.

The achievement by active exploration and development, and the comparative ease and rapidity of results attending more or less cursory prospecting effort, portends a promising future for the region. A very small section of the area has as yet been only skimmed. A large extent of geologically favourable virgin territory, equally as promising as that in which ore-bodies of economic importance have already been discovered, awaits the prospector's pick. During one brief season the Taku River section has produced one semi-developed mine, one exceptionally promising new find, and several other interesting discoveries.

An important and favourable feature of the area is that the geology and the already discovered ore-bodies show promise of mineral occurrences of size. Although high-grade ores of the precious metals are not to be expected, the discoveries and geology indicate that the area harbours low-grade base-metal ore-bodies carrying appreciable supporting values in gold and silver. Such a combination does not unduly excite the imagination into hazardous calculations of unwarranted millions. The problem of developing the Taku ore-bodies into profitable production will call for skilled, careful, and conservative handling. The character of the main discoveries is, however, of the type that indicates appreciable tonnage mines necessitating metallurgical expansion and the employment of much labour. These are factors that tend towards stability and expansion of operations, with a widespread influence on the future prosperity of British Columbia's north-west and the industrial development of the coastal area in general. It is in this light that the successful development of the complex sulphide deposits of the Taku River area is of the utmost importance.

The chief ore occurrences so far discovered are a low-grade complex of copper, zinc, lead, and iron sulphide mineralization. The factor of values in these deposits, particularly that of the *Tulsequah Chief*, is somewhat intricate. If carelessly scrutinized, misleading impressions can occur. Widths and mineral distribution that may have an important bearing on mining methods and the value of ore mined are involved questions in the matter. These associated conditions will be extended under a later heading. For the purpose of this summary it can be taken that the values contained in the ore-shoots as they were developed at the time of examination are as follows:—*Tulsequah Chief*: Gold, 0.1 oz. to the ton; silver, 3.5 oz. to the ton; copper, 1.75 per cent.; lead, 0.6 per cent.; zinc, 6 per cent. *Manville* group: Gold, 0.12 oz. to the ton; silver, 6 oz. to the ton; copper, 2 per cent.; lead 1 per cent.; zinc, 15 per cent.

It is unfortunate that, with the present status of the zinc market, little profit, if any, can be expected from the content of this metal in the ore. Whether this condition will improve or not, it is evident that should appreciable production of this metal materialize from the Taku deposits, the problem of its profitable marketing must inevitably be met by the establishment of zinc-lead smelting and refining facilities on seaboard and close at hand. With the zinc-lead content of so many smaller deposits of the North-west awaiting the deciding factor of stable tonnage that will materialize such a metallurgical facility, the possible influence of the Taku deposits on the expansion of the coastal mining industry is profound.

Considered from a concentration and separation aspect, it would seem that, although the problem is intricate, the ores should offer no refractory difficulty. A clean separation of metallic

sulphides, delivering three and possibly four products, should be economically achieved. It is not possible as yet to establish from available data any definite ratio between the precious-metal content and that of the base metals. The important indication in this respect, however, is that neither the gold nor appreciable silver values are contained in the zinc sulphides. Judged from assay results, it would seem that the gold, with some silver, is associated with the copper sulphide, with an occasional indication of some gold content in the pyrite. Some of the silver value would probably have to go with the zinc. The bulk of the silver, however, seems to be associated with both the copper and lead sulphides. An occasional exceptionally high gold-silver assay with low copper, lead, and zinc value indicates the possible presence of a gold-silver-telluride or other rare mineral rich in the precious metals.

In considering the concentration and separation of these ores, it is of importance to note that the problem will be considerably eased by the expert experience of the Bunker Hill and Sullivan Mining and Concentration Company, one of the leading silver-lead-zinc mining and smelting companies of the world. This company, through its affiliation with the Treadwell Yukon Mining Company, is associated with the Alaska Juneau Mining Company in the development of the *Manville* and other groups in the Taku area. Working on a somewhat similar ore in the *Errington* mines, Sudbury, Ontario, the Treadwell Yukon Company is reported to have evolved, with comparative success, a process giving high extraction and clean products of copper, zinc, lead, and iron sulphides, at a reported cost of \$1.50 a ton of ore treated, on a 320-ton mill-capacity basis. The appreciable quantity of barite indicated in the gangue of the Taku ores may also be recovered profitably as a by-product.

Should the *Tulsequah Chief* and *Manville* ore-bodies show economic extent and be developed to the stage warranting mill-construction, an ideal condition exists for mutual co-operation on the part of the two companies concerned. One centrally located mill of large capacity, situated near the confluence of the Taku and Tulsequah rivers, and jointly operated, would be of decidedly mutual benefit. The proportionate division of construction cost, the capacity increase, the cutting of overhead and staff costs, etc., should not only be reflected in decreased milling costs, but would also be carried proportionately right through the operations, with favourable effect on the grade of ore it would be possible to mine profitably.

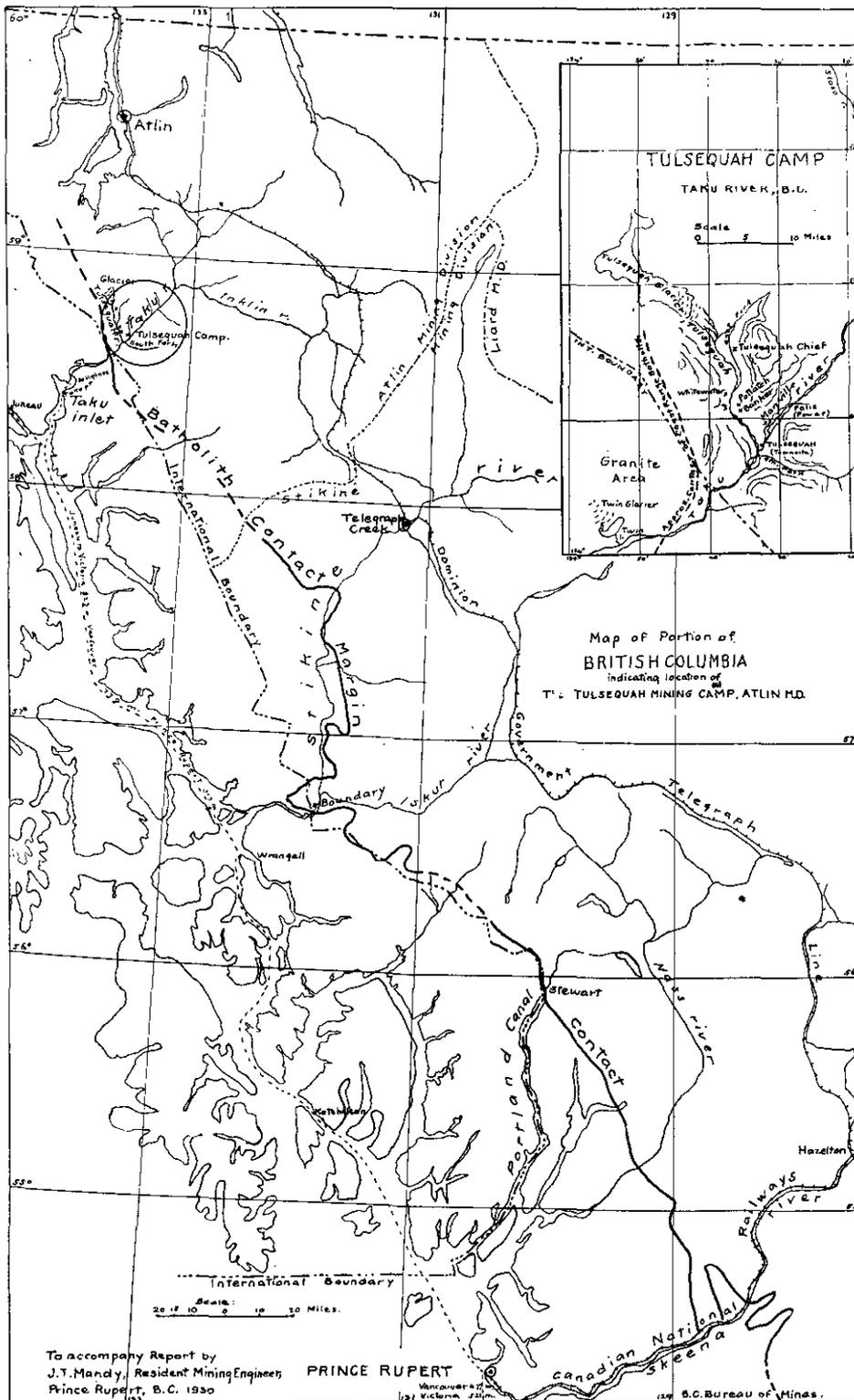
Were such a mill open also to the reception of custom ore, many prospects and smaller operations that might materialize would be assisted in their initial exploration and possibly brought into a continuous small tonnage production. In the profitable operation of low-grade, complex base-metal ore-bodies such as are indicated in the Taku discoveries these considerations of economy are of the utmost importance. Not only are they sometimes a deciding factor in the profit of individual properties, but also in the success of the mining industry in low-grade base-metal areas.

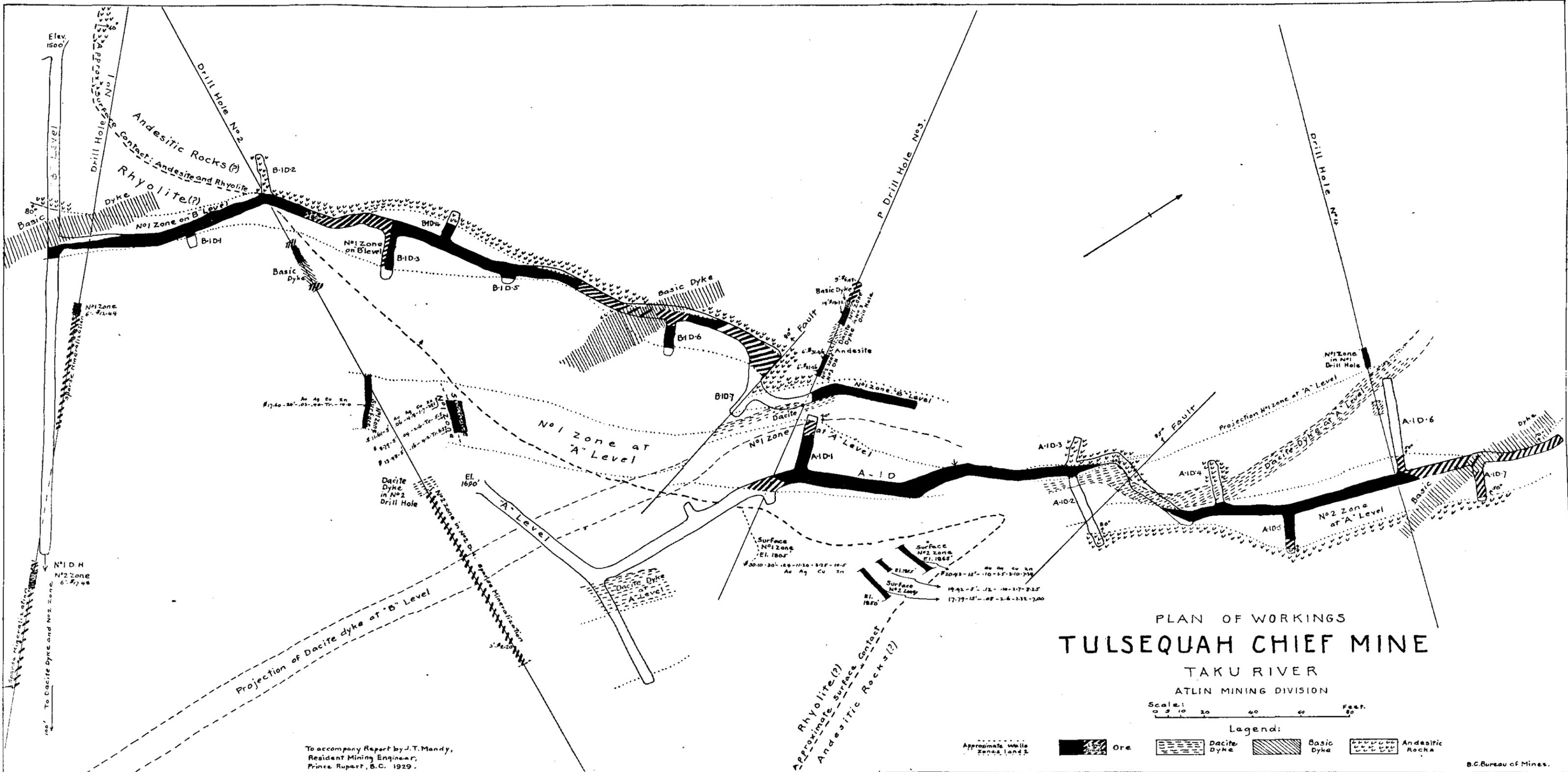
TRANSPORTATION AND ACCESSIBILITY.

The Taku River region is conveniently accessible by water route during the summer season. Improved river transportation facilities are being planned by the Taku River Transportation and Trading Company. Road and trail facilities are being considered by the British Columbia Department of Mines and the Department of Public Works. Surveys for routes and location of these facilities were carried out during the past season. Through the instrumentality of the Minister of Mines, arrangements were made whereby Customs clearance was obtained at Juneau, Alaska, for passengers and baggage for aeroplane transportation into the Taku River area. During the coming season augmented aeroplane transportation by Western Canada Airways from a conveniently situated port is being planned. The Barrington Transportation Company, of Wrangell, Alaska, also plans to operate a transportation system on the Taku in 1930.

River navigation on the Taku is open from about the beginning of May to the middle of November. Between that period navigation is impeded by ice. During part of the winter, dog-team transportation over the frozen river is possible. It cannot be definitely said as yet whether horse and sleigh winter transportation over the river-ice is feasible.

The region is reached by the regular Canadian National or Canadian Pacific Steamship service from Prince Rupert or Vancouver to Juneau, Alaska. From Juneau the 75-horse-power gasoline-launch "Amy," with equipment of scows for carrying freight, operates to a float-house transfer-station at Taku point, at the south side of the mouth of the Taku river, a distance of about 30 miles. The "Amy" makes this run about twice a week and takes about five hours on the trip. This service is operated jointly by the United Eastern Mining Company and the Alaska



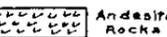


To accompany Report by J. T. Mandy,
Resident Mining Engineer,
Prince Rupert, B.C. 1929.

PLAN OF WORKINGS
TULSEQUAH CHIEF MINE
TAKU RIVER
ATLIN MINING DIVISION

Scale: 0 10 20 40 60 80 Feet.

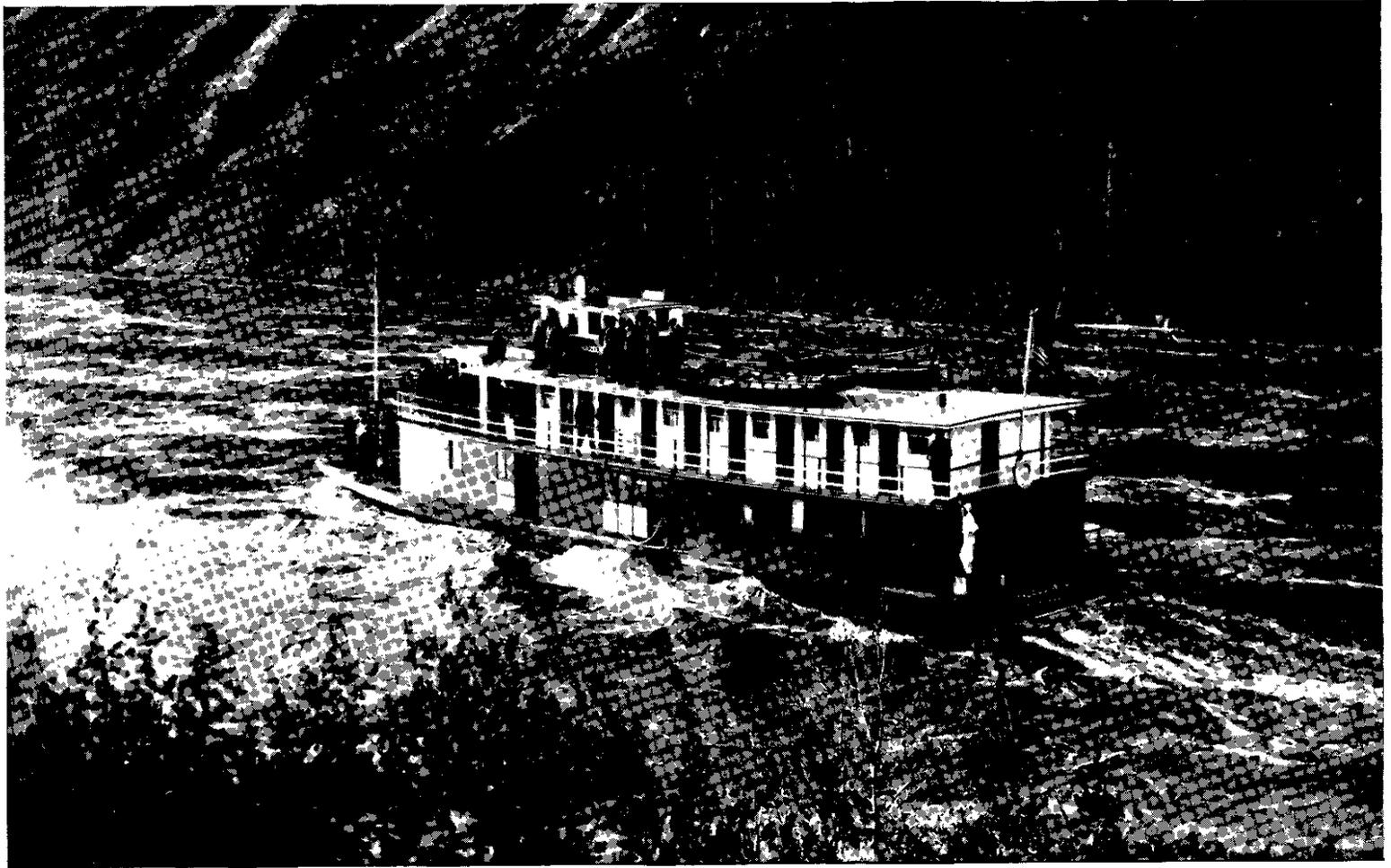
Legend:

 Ore	 Dacite Dyke	 Basic Dyke	 Andesitic Rocks
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B. C. Bureau of Mines, 1930

Taku River, British Columbia. Tulsequah River entering on Left.
1. Tulsequah, Proposed Townsite. 2. Mauville Group. 3. South Fork of Taku River.



" Hazel B." Boat on Stikine River.

No. 3 tunnel, at elevation 5,230 feet, is run on a bearing N. 10° W. (mag.) for a distance of 36 feet. It is said that a small high-grade stringer was met with, but this would hardly seem sufficient warrant for continuing in country-rock; and it is considered far preferable to confine work to Nos. 1 and 2 tunnels, following the veins known to carry some values. Frequent assays are of course quite imperative to guide progress with any intelligence.

This group, owned by J. C. Holsclaw, is situated on the Snowshoe plateau, **Big Yank.** a remarkable park-like, sparsely timbered area several square miles in extent at the headwaters of French Snowshoe creek, lying between elevations of 5,700 feet and 6,300 feet; excellent feed for horses grows on this plateau.

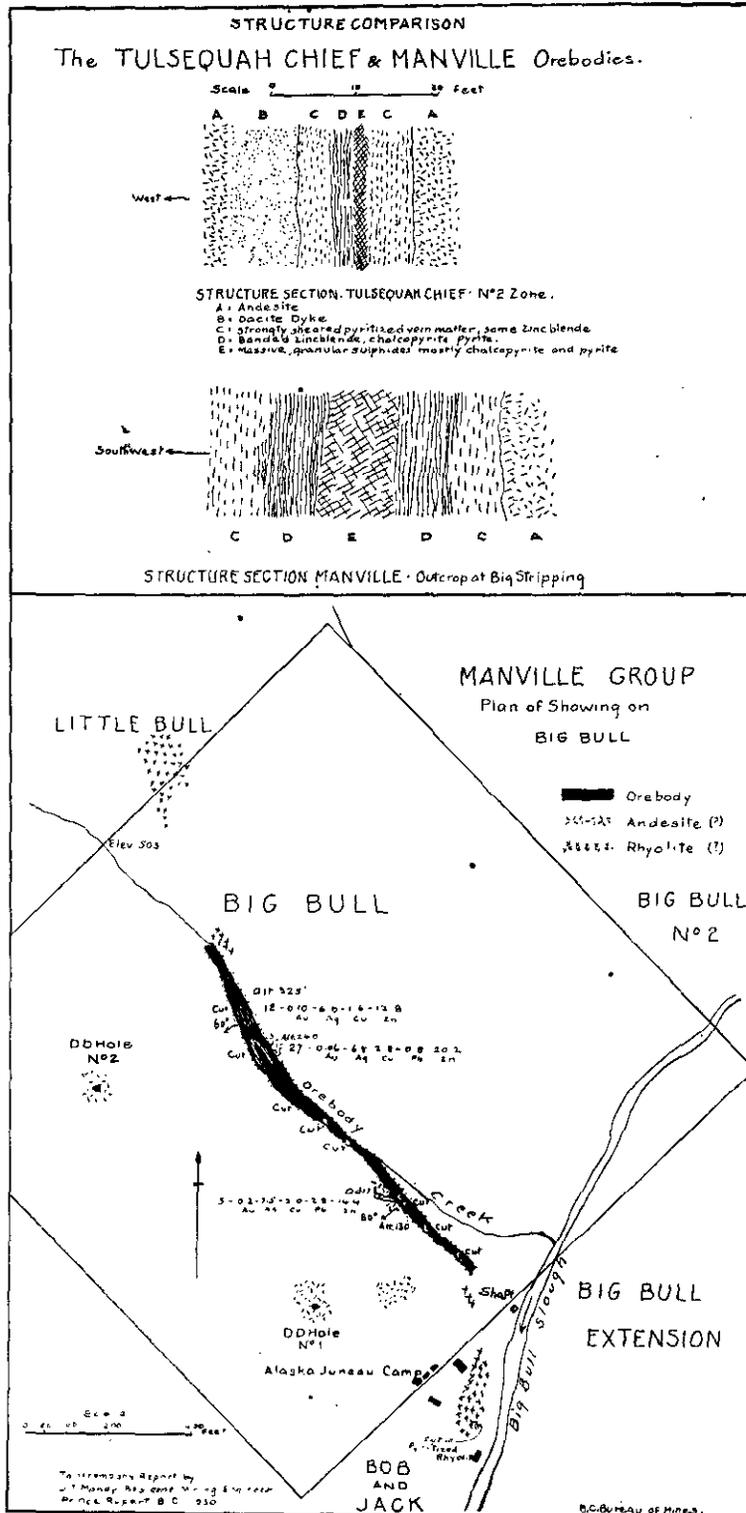
At one point on this group within an area of about 100 yards by 200 yards there is a remarkable development of quartz veins, some of which are highly oxidized. The country-rock is quartzite, or quartz-schist, striking N. 50° W. (mag.) and dipping south-west at about 45°. The veins vary in width from mere stringers up to 20 feet. In general they either follow the the schistosity planes or cut across these more or less at right angles. The largest veins are those which cross the formation and many of these are highly oxidized.

Three samples were taken, one of a quartz vein 3 feet in width where it seemed that the owner had been working, another was a general grab sample of oxidized quartz from a large number of veins, and the third was a sample across a highly oxidized cross-vein 20 feet in width. The first- and last-mentioned samples showed upon assay no gold or silver and the second only traces. It is not necessarily to be inferred from these assays that all of the veins on this property are barren or nearly so, but rather that some of the veins at points showing much oxidation carry no appreciable values. A large number of samples would be required to thoroughly test this property.

HORSEFLY SECTION.

This group, owned by E. T. Creighton and E. Matthew, is situated about 2 miles north-east of Bunting lake and is reached by a branch road and trail from the Williams Lake-Horsefly road. The mode of mineral occurrence exhibited is that of an intrusion of felsite in serpentine. In the latter there is a development of several quartz veins, large and small. These are probably dykes rather than veins and samples taken showed no gold or silver values. The felsite intrusive contains a small amount of garnierite and selected portions assayed 0.1 per cent. nickel. This rock is described by the Bureau of Mines as "a hard compact felsite containing much ankerite, but no lime."

Volcanic Ash.—Within a very short distance of the Black Creek road, a few miles from Horsefly, there are exposed on the banks of the Horsefly river, beds of volcanic ash. Time only permitted of a brief examination, but it is evident that the deposit merits attention.



particularly pronounced towards the mouth of the river. About 2 miles above Taku point a delta-bar has been formed that can only be crossed by even shallow-draught river-boats at high tide.

From the mouth of the Taku river to the Tulsequah river the river-bed is featured by a very gradual gradient, there being a rise of only 70 feet from sea-level in this distance of 26 miles. At normal water the river in this stretch is consequently not excessively swift and can be easily navigated by small river-boats equipped with 6-horse-power outboard motors.

Above the Tulsequah river the course of the stream rises more steeply and the flow is consequently swifter. It is said to be navigable by small 16-foot outboard-motor powered boats, with the aid of poling and lining in the more rapid stretches, as far as the confluence of the Nakina and Sloko rivers, 31 miles above the mouth of the Tulsequah river.

The low-lying valley-bottom of the Taku river, from its mouth to the junction with the Tulsequah river, is about $2\frac{1}{2}$ miles wide and is generally featured by numerous slough, swamp, and flood areas, with a few interspersed ridges and elevated patches above flood-water mark. For 15 miles up-river from its mouth the stream is distributed through many shallow channels. At about half a mile west of the International boundary the stream is confined for a short distance to a canyon 200 feet wide, with rock banks about 50 feet in height. Beyond the International boundary the stream is again distributed through several shallow channels to beyond the confluence with the Tulsequah.

In the immediate vicinity of the mouth of the river, and west of Taku point, the tongues of the great Norris and Taku glaciers reach to the water's edge. Masses of ice, crumbling from these glaciers, are sometimes drifted by tide and wind 3 or 4 miles up-stream into the mouth of the river, and are a factor to be contended with in navigation, especially at night, and in any construction of piers and wharves that might be undertaken.

Between the river-mouth and the International boundary the tongues of Twin glaciers on the north side, and Wright glacier on the south side, reach to the confines of the valley-bottom. These are features that would have to be considered in any road-building that may be undertaken. East of the International boundary, with the exception of the immense glacier at the head of the Tulsequah river, there are no glaciers with consequential bearing on the area described herein.

Many small streams flow into the Taku from both banks. The most important tributaries are: The Sittakanay river, 3 miles south-west of the International boundary, but having its source and flowing for 9 miles through Canadian territory; the South fork of the Taku river on the east side, 5 miles north-east of the International boundary; the Tulsequah river on the west side, 6 miles north-east of the boundary; King Salmon creek on the east side, 17 miles above the Tulsequah; Inklin river on the east side, 24 miles above the Tulsequah; Sloko and Nakina rivers, 31 miles above the Tulsequah. These tributaries and the subsidiary creeks all offer the best means of access to cross-sectional prospecting of the Taku River area.

Camps are situated at Taku point at the mouth of the river; Bullard's Landing, 4 miles up the river from Taku point; De Vigne's camp, 2 miles beyond Bullard's; at the *West Hill* property, 3 miles south-west of the International boundary; at Tulsequah, B.C., on the west bank of the Taku river, 26 miles from its mouth; and at the *Manville* group, 3 miles north of Tulsequah, B.C.

TULSEQUAH RIVER.

The Tulsequah river is the scene of the most active mineral development at present, with much promising area still available for prospecting. A detailed description may prove of interest.

The main stream has its source in an immense unnamed glacier, 14 miles north-westerly of its junction with the Taku. It is a much more rapid stream than the Taku. For the first $8\frac{3}{4}$ miles from its mouth to the *Tulsequah Chief* warehouse on the east bank there is a difference in elevation of the river-bed of 95 feet. From that point to the glacier, 5 miles, there is an estimated rise of a further 75 feet, so that the gradient of the main river-bed would average about $\frac{1}{4}$ per cent. for its entire length. An East fork of the river follows a subsidiary valley for about 10 miles to the north-east.

The bed of the Tulsequah is spread over a width of half a mile and is featured by innumerable shallow, fast-flowing, and continuously changing channels, separated by shifting sand and gravel bars. Navigation by small boats is extremely difficult and dangerous, and even with high-powered outboard motors necessitates frequent poling, lining, incessant pole-sounding

for depth, and search for new channels. At low water no particular channel would offer a complete thoroughfare without the necessity of lining and portaging over bar rapids.

The valley of the river varies from $\frac{1}{4}$ to $1\frac{1}{2}$ miles wide. On the east side a ridged bench margins the river for a distance of about 10 miles from its mouth to the East fork. With the exception of a few places, this is above flood-water mark. At the junction of the Tulsequah and Taku rivers, on the west side, a slough and beaver-dam area $2\frac{1}{2}$ miles wide and 4 miles long is a marked feature.

A remarkable periodical flood condition affecting the Tulsequah river is a matter to be noted by prospectors and operators. This emanates, in all probability, from the dammed-up water of a lake beneath the glacier at the head of the river. Pressure from the accumulating water during the summer months bursts the barrier, with the result that an enormous volume of water is suddenly belched into the valley, causing the river to rise 10 to 15 feet in a matter of two days, with an equally rapid subsidence. This year one of these floods was subsiding at the time of examination (September 1st). They are said to occur annually, at about the same period of the year. After one of these floods the entire formation of the river-bed is changed and totally new channels and bars result.

The *Tulsequah Chief* warehouse and river camp are situated on the east bank of the Tulsequah river, about $8\frac{1}{4}$ miles from its mouth. The camp of the *Pottatch* group (Sparling) is located about 3 miles up the Tulsequah from its mouth.

GEOLOGIC FEATURES OF THE AREA.

Geological work in Northern British Columbia has been mainly done by officers of the Geological Survey of Canada, although some reconnaissance has also been done by the Alaska branch of the United States Geological Survey. Information regarding mineral resources is also contained in the Annual Reports of the Minister of Mines.

While the geologic work that has been done has little bearing on the small area considered in this report, some of the available information is of assistance in understanding the geologic features of the area. The following bibliography lists the more important reports and articles regarding areas in Northern British Columbia:—

Name of Author.	Publication.	Year.
C. W. Hayes.....	<i>National Geographic Magazine</i>	1892
J. C. Gwillim: Report on the Atlin Mining Division	Part B, Annual Report, G.S.C.....	1899
F. E. Wright: Unuk River Region.....	United States Geological Survey.....	1905
D. D. Cairnes: Atlin Mining District.....	Memoir No. 37, G.S.C.....	1910
W. M. Brewer: Atlin Mining Division.....	B.C. Department of Mines.....	1915
W. E. Cockfield: Explorations between Atlin and Telegraph Creek.....	Summary Report, G.S.C., Part A.....	1925
F. A. Kerr: Dease Lake Area.....	Summary Report, G.S.C., Part A.....	1925
F. A. Kerr: Second Preliminary Report, Stikine River Area.....	Summary Report, G.S.C., Part A.....	1928
F. A. Kerr: The Development and Natural Resources of Northern B.C.	Canadian Mining and Metallurgical Bulletin July.....	1929
F. A. Kerr: Recent Mining Development in Northern B.C.	B.C. Miner, November.....	1929

No geological survey party has as yet been into the Taku River area; with the exception of reconnaissance-work as outlined in the bibliography, the nearest geologic mapping to the area is contained in the Atlin sheet by Gwillim. The Stikine River area, 140 miles to the southward, has been mapped by F. A. Kerr, of the Geological Survey of Canada, and this map and accompanying report are now in course of preparation.

The accurate classification of the rocks and formations of the area and their correlation with those of other areas would be of great service to operators and prospectors. It is hoped this work will be taken in hand by the Geological Survey of Canada in the near future.

It must be stressed that the rock classification in this preliminary report is based on field identification only. No microscopical determinations have been made. This classification is consequently only approximate and open to revision. Accurate determination of the rocks must await a detailed study with the microscope.

The Coast Range granodiorite batholithic rocks constitute the bulk of the lower area of Taku river, from its mouth to within 5 miles west of the International boundary-line. There the contact crosses the river, striking in a northerly direction, and apparently follows this course about 6 miles west of the Tulsequah river. The rocks east of the contact consist mainly of the older igneous groups, probably Triassic or Jurassic, with some limestone and altered sedimentaries. This series is intruded by younger rhyolite, dacite, and felsite dykes and sills, which in turn are intruded by basic rocks of lamprophyre type.

The igneous rocks of the Tulsequah area are much altered and difficult to identify in the field. They are generally fine-grained and compact, heavily silicified, and in places characterized by widespread development of epidote and other products of alteration. They appear, however, to be of andesitic type. Associated with these are fine-grained interbedded tuffs of light-grey colour. Although a definite brecciated structure was noted in some of the volcanics, they are generally of dense texture and no large areas of coarse fragmentaries were noted. A belt of micaceous schists occurs on the west bank of the Tulsequah, as a probable resultant of metamorphosed sediments.

Argillites and slates are reported by prospectors to occur towards the head of the Tulsequah river. Flanking the east and west sides of Tulsequah glacier, two deep-red coloured mountains of about 5,000 feet altitude, surrounded by the general grey igneous and volcanic rocks of the area, are prominent features of the landscape. This red coloration may have resulted from the oxidation of pyritized argillites; it is, however, significant of a mineralized area and would be well worth prospecting. Up to the time of examination few prospectors had penetrated that distance up the river, and although several attempts had been made, none were met who had actually examined the rocks of this region. Several other zones, heavily discoloured by iron oxides, can be observed in the higher altitudes. These are all well worth immediate prospecting.

Folding and evidence of acute stress is observed near the contact west of the International boundary. Easterly this condition is gradually minimized, and the structure, well defined in certain localities, assumes the more stable and definite character that would be conducive to the confined circulation of mineralizing solutions and the deposition of sustained ore-bodies. No evidence of acute regional folding was observed in the area adjacent to the Tulsequah river. Major fracturing, accompanied in places by well-defined shearing, has occurred along both a north-easterly and a north-westerly direction.

"Tight" areas are observed in some localities, but adjacent to these are generally areas of well-defined structure. This condition, if due to differences in the rock texture and association, would have a minimizing effect on the regional dispersal of circulating mineral-bearing solutions and would tend to confine structural stresses to certain definite directions. A confined zonal circulation of mineral solutions should result from such a condition, and it is consequently indicative of sustained ore-bodies of good width where conditions for mineral precipitation have been favourable. Prospecting, if intensified in these structurally favourable localities in this area, should result in the discovery of important ore-bodies.

ECONOMIC GEOLOGY.

The region embraces a section of the eastern contact margin of the Coast Range batholith. Within this there are areas of favourable structure. These are prime factors in the deposition of ore-bodies of economic importance. The discoveries already made and the structural conditions affecting the area indicate the probable occurrence of appreciable potential tonnage ore-bodies. These factors, coupled with the already known mineralization, do not promise exceptionally high-grade ore-bodies with restricted widths, nor bonanza values in the precious metals. Isolated occurrences of high-grade silver ores will doubtless be discovered, but these cannot be expected to be a general characteristic of the region.

A low to medium grade general tenor of the ore-bodies with an essentially base-metal mineralization can be expected. This is a factor, however, that tends towards a healthy and prosperous industrial condition. Appreciable base-metal production calls for populous communities, metallurgical expansion, establishment of both foreign and home markets, and, most important of all, the necessary establishment of industries for the manufacture of finished articles for consumption by these markets. The economic influence of a possible appreciable base-metal production from the Taku River area on the industrial future of British Columbia's coastal area is of great importance.

The mineralization of the chief ore-bodies discovered are of two main types:—

1. Copper, zinc, lead, and iron sulphides carrying appreciable gold and silver values, in a barite-calcite-quartz gangue.

2. Antimony and iron sulphides, with very minor quantities of copper, lead, and zinc, but carrying decided gold values, and practically negligible silver contents, in a quartz gangue.

It is possible that these two types of mineralization may merge along the margin of the zones to which they are confined. This is indicated on the *Banker* and *Pottlatch* groups, north-west of the *Manville*, where a small amount of stibnite is associated with a characteristic zinc-blende-galena mineralization. On the *Banker* there is also an occurrence of high silver values possibly associated with a grey-copper mineral.

ORE-BODIES OF TYPE 1.

The mineralization of the *Tulsequah Chief* and *Manville* ore-bodies belongs to type 1. In these deposits zinc-blende, chalcopyrite, pyrite, with minor quantities of galena, occur in very fine-grained texture. The mineralization is partly massive and partly finely disseminated. The massive sections of the ore-bodies are generally confined to the central portions of the zones and gradually grade to a fine dissemination near the walls. A massive mixture of fine-grained chalcopyrite and pyrite, with a few indistinct bands of very fine-grained zinc-blende, frequently occupies the centre of the zones. With the bands of zinc-blende gradually increasing in width, this central portion of massive chalcopyrite and pyrite gradually grades on both sides into a dense dissemination of very fine-grained zinc-blende with a minor admixture of fine-grained chalcopyrite and pyrite, which gradually diminishes in density towards the walls. A decided banded or relict structure is characteristic of these ore-bodies.

These occurrences are characteristic replacement ore-bodies in shear-zones. In places, generally in the central portions of the zones, the sulphides have totally replaced the sheared rock. Towards the walls the replacement is more or less incomplete, with a dispersal of mineralization in the sheared rock near the walls. Two main directions of fracturing occur, one striking north-easterly and the other north-westerly.

The geological features and mode of occurrence of the *Tulsequah Chief* and *Manville* ore-bodies are similar. The shear-zones occur in what appears to be an interformational sheet of altered pyritized rhyolite in an andesitic country-rock of dense texture. The formation has been subjected to comparatively gentle folding along north-south striking axes. On the *Tulsequah Chief* the shear-zones strike north-easterly and on the *Manville* the zone strikes north-westerly. Whether the *Manville* shear penetrates the andesites to any extent could not be established. On the *Tulsequah Chief*, however, the shear-zones are confined to the light cream-coloured rhyolite and are delimited by the surrounding grey-coloured andesites. On this property the rhyolite appears to plunge in a northerly direction, a feature that gives hope for continuity at depth of the ore-bodies in that direction beyond the vertical projection of their surface pinching at the margin of the rhyolite and andesite contact.

On the *Tulsequah Chief* a very dense-textured and siliceous dyke of dacite type, cutting both the rhyolite and the andesite, may have an important influence on the ore-bodies of that property. No. 2 ore-zone lies in contact with, or closely adjacent to, this dyke on its east side. No. 1 ore-zone strikes at an angle of about 25° to the dyke on its west side and abuts on to it a short distance south of the surface pinching of the zone. Although the age of this dyke in relation to the ore-deposition may be debatable, it would appear from its mode of occurrence to have preceded the formation of the ore.

It would seem that on the *Tulsequah Chief* the stresses have been readily transferred through the rhyolite and then faded against the buffer of tenacious dacite in contact with the dense and tough andesite. The same medium of stress confinement would also have a damming influence on circulating mineral-bearing solutions and prevent a dispersal of values in the area within the scope of that confinement. The probabilities on the *Tulsequah Chief* are, then, that within the confined northward area of the rhyolite and conforming to the northerly plunge of the sheet, higher-grade ore over more restricted widths should occur than to the southward. In the southerly horizon the tendency would be for a dispersal of values over greater widths, and consequently a lower-grade ore.

On the *Manville* no dacite or acid dyke was observed associated with the ore. The rhyolite area, however, appears to spread or fan out in the low-lying ground towards the south-east.

In this direction, then, a dispersal of mineralization and lower-grade ore over greater widths than towards the north-west can be expected. Acid dykes cutting the altered rhyolite occur on the *Banker* and *Pottlatch* groups, adjoining the *Manville* on the north-west. On account of the heavy overburden covering the low-lying ground in which these showings are situated, and the limited amount of work completed at the time of examination, no relation between them and the ore-bodies could be established.

Basic dykes of lamprophyre type cut both the rhyolite and the andesite and are the youngest rocks of the series. The similarity of these rocks in colour and texture to certain phases of the andesite make their visual determination difficult when they enter the latter. The only effect that these basic dykes seem to have on the ore-bodies is to cause their shattering and impoverishment with included dyke-rock in the areas of intersection. Faulting occurs to a minor degree, generally along north-south striking planes.

The ore-bodies of type 1 are probably medium to low temperature deposits, formed at an appreciable depth below the old surface from sluggishly circulating solutions. Replacement probably emanated from the centre of the zones with lateral temperature segregations. Mineral deposition is probably related to the concluding period of the batholith intrusion.

ORE-BODIES OF TYPE 2.

The ore-bodies of this type are characterized by a main metallic mineral content of stibnite, with accompanying pyrite and very minor quantities of galena, in a fine-grained quartzose gangue. This stibnite occurs in massive granular form in reticulated structure in the vein-matter, and also as a fine dissemination of minute needle crystals in the gangue-matter. The pyrite is in fine-grained scattered dissemination through the gangue.

The typical ore-bodies of this type appear to be confined to a diabasic rock, cut by numerous felsite and small quartz-rhyolite dykes. They seem to favour the area somewhat closer to the batholith contact than the ores of type 1. The deposits occur in well-defined replacement shear-zones along the course of felsite dykes. These dykes have probably formed lines of weakness in the surrounding country-rock along which the fracturing and shearing has been readily carried and sustained.

The typical deposits are characterized by a high gold content and abnormally low silver values. Adulteration with arsenic and copper seems to be practically entirely absent. No chalcopyrite or copper carbonates were observed in the mineralization. An assay for arsenic returned *nil* and that for copper showed a trace. These are important factors in connection with the possible economic value of this type of deposit from the standpoint of its antimony content. In the manufacture of pure antimony the presence of arsenic and copper is extremely undesirable. Zinc and lead are also practically entirely absent. From the standpoint of their antimony content, therefore, the characteristic deposits of this type discovered in the Taku region are exceptionally pure. Whether the gold content of these ores is related to the stibnite or to the pyrite is not established.

The antimony market is unfortunately a restricted one and is at present affected by a duty on the metal recently imposed by the United States Senate. The bulk of the world's production, however, comes from the Hunan deposits in China, and the demand is at present reported to be moderate. The apparent purity of the Taku deposits, coupled with their high gold content, may offset the handicaps of an antimoniferous ore. Should they be proved to be of important extent, this type of ore-body may be of economic value. The typical ore-bodies of this type occur on the *Whitewater* group on the west bank of the Tulsequah river, about 4 miles south-west of the *Tulsequah Chief*.

An intermediate type of ore carrying minor quantities of stibnite associated with zinc-blende, galena, arsenopyrite, and some chalcopyrite, occurs on the *Banker* and *Pottlatch* groups, adjoining the *Manville* on the north-west. These occurrences are in quartz-filled fractures, with lateral dissemination areas, in an altered rhyolitic rock cut by acid and basic dykes. On the *Banker* the ores are featured by a high silver content, associated probably with the presence of some grey-copper mineral; an appreciable gold content is also present in these ores.

The ore-bodies of type 2 are probably of low temperature origin, formed comparatively near the surface. The structure indicates that they were formed from rapidly circulating solutions covering at least two impulse periods. Although the definite genesis of these deposits could not be established in the field, they are probably related to the final thermal activities of the batholithic intrusion and later in origin than the ore-bodies of type 1.

MINERALIZATION RELATIVE TO MINING METHODS.

Should the complex sulphide ore-bodies of the Taku region ultimately prove to be of commercial extent and grade, their structure and mode of mineral occurrence suggests a method of mining that might be advantageously employed to meet the constantly changing economic aspect of the metal market. The characteristic central segregation of chalcopyrite that apparently occurs over good widths and appreciable lengths in the *Tulsequah Chief* and *Manville* ore-shoots may permit the mining and treating of a good-grade copper-gold ore when the market price for copper is advantageous and that for zinc and silver is not. The ore containing mainly a zinc content, occurring lateral to the chalcopyrite segregations, could be attacked when the market price for zinc became advantageous.

It would seem that on both the *Tulsequah Chief* and the *Manville* the opportunity may prevail to selectively mine an ore containing from 3 to 9 per cent. copper, 0.2 oz. gold to the ton, and 2 oz. silver to the ton, with a reduced content of zinc. In considering this means of meeting the metal-market situation, however, there are many intricate factors to be carefully calculated. In mining selectively for the copper-gold contents a dilution with zinc could not be avoided at any time. The economic point of zinc dilution relative to mining widths and costs, the bearing of this factor on milling practice and costs, the comparative costs of mining methods relative to tonnage production and grade of ore mined, the factor of interest, are all interlocking questions involved in the calculation. The mode of occurrence of the mineralization in the *Tulsequah Chief* and *Manville* ore-bodies, however, suggests the possible economy of such a selective type of mining. The scheme is mentioned as being worthy of consideration on account of its bearing on the ultimate possible profitable operation of the Taku River complex sulphide ore-bodies, should they prove to be of economic extent.

MINERAL PROPERTIES.

The important properties in the area are: The *Tulsequah Chief*, *Manville*, *Big Bull Extension*, *Potlatch* (Sparling), *Banker* (Hill), and *Whitewater*.

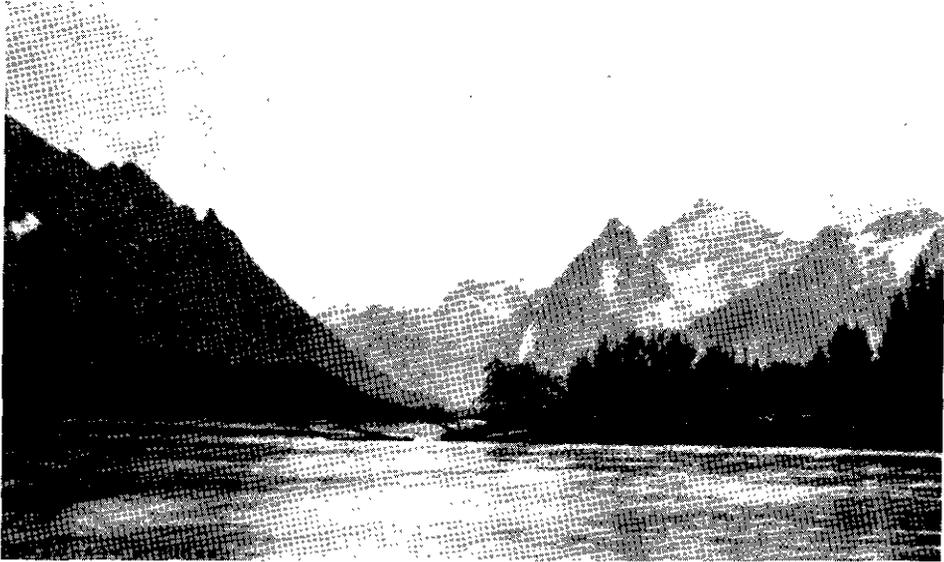
TULSEQUAH CHIEF.

(See Annual Reports for 1923 and 1928.) This property comprises eighteen surveyed claims. It is situated on the eastern bank of the Tulsequah river, about $8\frac{1}{4}$ miles north-easterly from its confluence with the Taku. It was originally staked by A. W. Kirkham, of Juneau, Alaska, and bonded to the Alaska Juneau Gold Mining Company in 1923. This company relinquished its option in the same year. In 1928 the property was bonded to Dan J. Williams, W. A. Eaton, of Juneau, and associates. In the spring of 1929 this syndicate bonded the property to the United Eastern Mining Company, of Los Angeles, which has been developing it from that date.

A warehouse and log cabin are located at the landing-point on the Tulsequah River bank. The operating camp is situated on a bench area at altitude 1,050 feet. A crew of thirty to forty men has been continuously employed during the season. The workings are at 1,500 and 1,700 feet altitude. The property is efficiently equipped with a compressor, machine-drills, blowers, and steel-sharpening outfit. A skidway haulage system in two sections, powered by 8- and 10-horse-power gasoline-engines, operates from the warehouse on the river-bank to the camp, and from thence to the portal of the lower tunnel. Operations are being conducted under the personal supervision of J. B. Stapler, general superintendent and manager.

Geologic Features.—The ore occurrence consists of two replacement shear-zones in altered and pyritized rhyolite, in a formation of dense-textured andesitic fragmentaries and flows. No. 1 zone strikes N. 45° E. and No. 2 zone N. 20° E. Both zones show a tendency to an erratic, but generally steep, westerly dip. The two ore-zones are separated by a dacite dyke 8 feet wide, striking parallel to and in contact with No. 2 zone. The rhyolite is exposed in a wedge-shaped outcrop which seems to plunge beneath the andesitic rocks to the northward, about 150 feet north of the open-cut on No. 2 zone at an altitude of 1,865 feet.

Several hundred feet north of this point, and near the falls of Tulsequah creek, at altitude 1,950 feet, an isolated oxidized knob of rhyolite outcrops through an andesite and on the west side of the continuation of the dacite dyke. This outcrop is probably a spur from the northward-plunging rhyolite. Southward, the rhyolite spreads out fan-shape in irregular contact with the andesites and is intruded at intervals by basic dykes. At the Tulsequah River bank (altitude 165 feet) the rhyolite attains a width of several hundred feet, shows several phases of alteration, and is strongly sheared and impregnated with pyrite.



Taku River, South Fork—Looking up from Mouth of Tulsequah River.



Taku River at Mouth.



Tulsequah, Proposed Townsite at Confluence of Tulsequah and Taku Rivers.



Telegraph Creek Settlement on Stikine River—Looking Down-stream (West).

Mineralogic Features.—The mineralization of No. 1 and No. 2 zones is very similar. It differs, however, in form of distribution and in grade. Both zones are mineralized with very fine-grained chalcopyrite, zinc-blende, pyrite, and some galena, in a dense quartz-calcite-barite gangue. The chalcopyrite occurs intimately intermixed with pyrite, partly in fine-grained massive development generally towards the centre of the zones, and partly in fine-grained lateral dissemination gradually giving place to an intensifying fine-grained zinc-blende dissemination. The zinc-blende mineralization in turn gradually diminishes laterally in intensity to a comparatively barren sheared margin near the walls. The central chalcopyrite segregation seems to be more generally confined to No. 1 zone, which is consequently perceptibly better in grade, where developed, than No. 2 zone. No. 2 zone is decidedly low in grade where developed and shows a tendency to greater widths, with a consequent tendency to dispersal of mineralization.

Ore-zones and Workings on Surface.—No. 1 ore-zone has been traced on the surface by three open-cuts from an elevation of about 1,680 to 1,805 feet in a horizontal distance of 200 feet. In these workings the zone shows an average width of about 20 feet, assaying: Gold, 0.1 oz. to the ton; silver, 4.7 oz. to the ton; copper, 1.2 per cent.; zinc, 10.1 per cent. This zone strikes N. 45° E. and converges towards a dacite dyke striking N. 20° E., which lies easterly of it. At elevation 1,825 feet, and about 60 feet northerly from the upper open-cut, the rhyolite on the west side of the dacite dyke seems to plunge beneath the andesite and No. 1 zone abuts on the dyke and undergoes a pinching. This condition continues towards the north. In this direction the formation is a "tight" dense andesitic rock. The dacite dyke continues on to northward, cutting the andesite, but a careful examination failed to reveal the continuation of either No. 1 or No. 2 ore-zones in this direction. It would seem that the fracturing and shearing, readily transferred through the rhyolite, have diminished against the buffer of dacite in contact with the tough andesite.

At altitude 1,865 feet, No. 2 zone has been exposed on the surface for a length of about 30 feet, showing ore-widths of from 5 to 15 feet, assaying: Gold, 0.1 oz. to the ton; silver, 1.4 oz. to the ton; copper, 2.7 per cent.; zinc, 7.5 per cent. This zone strikes N. 20° E., has a general steep westerly dip, and lies adjacent and parallel to the dacite dyke. Surface continuity towards the north is affected adversely by the same conditions governing that of No. 1 zone. About 800 feet to the south of the open-cuts on No. 2 zone, and at altitude 1,025 feet, a wide exposure of pyritized rhyolite has been open-cutted. In places this shows massive fine-grained pyrite similar to the development of that mineral in the upper cuts on No. 1 and No. 2 zones. Zinc and copper mineralization is not evident in these lower cuts. Further work is required to definitely correlate these lower showings with either of the two zones.

Underground Development.—The ore-zones have been explored by A and B level tunnels at altitudes 1,690 feet and 1,500 feet respectively. At the time of examination (September 5th) about 1,400 feet of development had been completed in these two tunnels; 600 feet of this work is crosscutting, of which 175 feet, or about 30 per cent., is lateral work in the ore-zones. Of the 800 feet of drifting, about 500 feet, or 62 per cent., is in ore of promising grade.

On A level about 160 feet of drifting and 22 feet of crosscutting is on No. 1 zone, westerly of the dacite dyke, and about 170 feet of drifting and 56 feet of crosscutting is on No. 2 zone, easterly of the dyke. No. 1 zone is indicated at this level, carrying fair mineralization. Its width is indicated to average about 9.5 feet, but varying from 30 feet at the southerly end of the drifting to 6 inches at the northerly end, where it enters the tough, dense andesite. It is interesting to note that the pinching of No. 1 zone on A level occurs about 80 feet north of the vertical projection of its surface pinching.

No. 2 zone is indicated on A level carrying only fair mineralization, a decidedly lower-grade ore than No. 1 zone. Its width is indicated to vary from 6 to 24 feet, with an average of about 17 feet. At the time of examination the face of A level drift in No. 2 zone showed pronounced fracturing and shearing, with a development of sericite and kaoln. Both zones show an erratic but generally steep westerly dip on this level.

At the time of examination B level development was entirely on No. 1 zone. A continuation of the crosscut for 125 feet in cherty rhyolite beyond the intersection of No. 1 zone had failed to pick up No. 2 zone in that distance. Of the 700 feet of work completed on this level, 370 feet is drifting and 68 feet is crosscutting on the zone. The work on No. 1 zone on this level shows a decidedly better grade of ore than on A level. The chalcopyrite content in particular shows

a marked increase. For appreciable lengths in the drift 2 to 3 feet of a massive fine-grained intermixture of chalcopyrite and pyrite occurs in the zone structure. When examined the drift-face was composed of 3 feet of solid granular chalcopyrite and pyrite and 2 feet well mineralized with chalcopyrite, pyrite, and zinc-blende. No. 1 zone on B level has a steep easterly dip as opposed to the westerly dip on A level. It also shows a tendency to an irregularity of strike along short distances. No. 1 zone is indicated on B level to have a width varying from 3 to 24 feet and averaging 11.5 feet. At the time of examination four diamond-drill holes had penetrated the zones, showing encouraging values and widths at depths up to 180 feet below B level. Deeper level holes were projected for drilling.

Operations on the *Tulsequah Chief* closed for the 1929 season on November 3rd. The total underground development completed during the four months of operation was 1,919 feet of underground exploration and 4,043 feet of diamond-drilling in seven holes. In the face of the many obstacles confronting the management, particularly that of transportation, this is an exceptionally creditable performance. At the close of operations the management reports that the condition of A level drift on No. 2 zone showed no change and small bunches of ore were continuing to occur. A crosscut to the east from No. 1 zone on this level, north of A-1 D1, is reported to have penetrated the dyke and opened 26 feet of good-grade ore in No. 2 zone. B level drift was reported to have continued in good-grade ore, with a fine showing in the face at the conclusion of operations. In that area a crosscut to east through the dacite dyke, started since the examination, is reported to have opened a very encouraging grade of ore in No. 2 zone.

Estimate of Ore.—At the present early development stage of the *Tulsequah Chief* an estimate of the ore, both with regard to value and tonnage, can only be approached with considerable reserve. With regard to tonnage, the completed work only permits a roughly approximate estimate of indicated ore. A calculation of values, based on gross assay returns, is liable to be extremely misleading, particularly with the inclusion of the zinc factor. What will constitute ore from the standpoint of profit in the eventual possible operation of the *Tulsequah Chief* is yet to be determined. Entering especially into this equation are metal-market conditions, working costs, percentage of metal recovery from metallurgical operation, transportation costs, expenditure necessary to bring the property into profitable production. Relative to these unknown factors is the type, width, and grade of ore that could eventually be mined profitably. At the present stage of development any tonnage estimate is of little practical value and apt to be misleading.

If calculated over their entire widths, the general metal tenor of the ore-zones is low grade, and for appreciable sections either definitely uncommercial or nearly so. On the other hand, restricted sections of these stretches, if mined selectively, may be productive of definitely commercial ore. On A level No. 1 zone is indicated with an average width of 9.5 feet, assaying: Gold, 0.12 oz. to the ton; silver, 4.6 oz. to the ton; copper, 1 per cent.; lead, 0.6 per cent.; zinc, 6 per cent. On A level No. 2 zone is indicated with an average width of 17 feet, assaying: Gold, 0.04 oz. to the ton; silver, 1.5 oz. to the ton; copper, 0.6 per cent.; lead, 0.8 per cent.; zinc, 5 per cent.

At the time of examination No. 1 zone was indicated on B level with an average width of 11.5 feet, assaying: Gold, 0.07 oz. to the ton; silver, 3 oz. to the ton; copper, 2 per cent.; lead, 0.6 per cent.; zinc, 4.5 per cent. A sample taken across 5 feet of the drift face indicates the possibilities of selective mining in this type of ore-body. This assayed: Gold, 0.12 oz. to the ton; silver, 3.7 oz. to the ton; copper, 5.1 per cent.; lead, trace; zinc, 12.2 per cent.

Summary.—The results of development on the *Tulsequah Chief* are decidedly encouraging. It is the outstanding recent mining development in the North-western District. It can be seen, however, that many problems and factors of uncertainty are still to be faced by the operators before a definitely profitable operation is assured. These involve chiefly continuity, grade, and extent of the ore-zones and the ore-shoots in them, mining and milling methods and costs, and metal-market conditions. The mode of occurrence of the ore-bodies and the complex nature of the mineralization in them make these problems somewhat intricate.

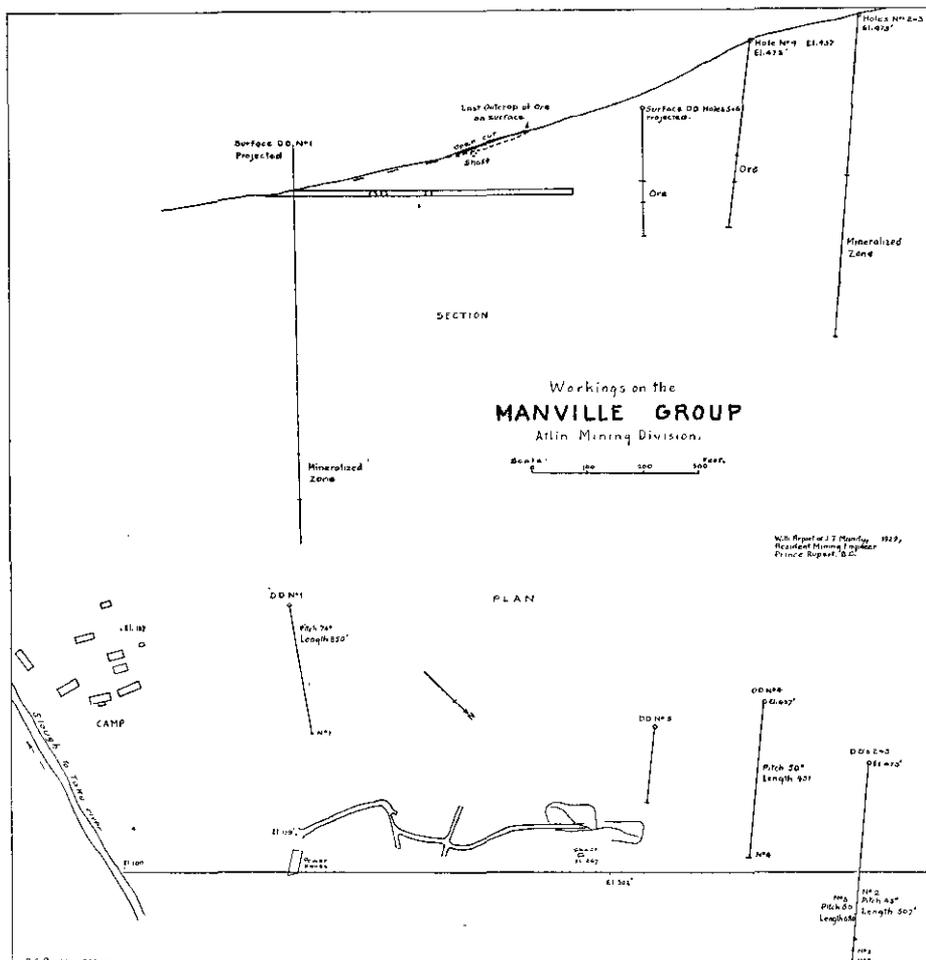
Regarding the continuity and grade of the ore-bodies, the indicated northerly plunge of the rhyolite is an important and hopeful factor. If this can be substantiated, higher values over more confined widths can be expected towards the northward, with successively lengthening continuity of the zones on the lower levels in this direction, in conformity to the plunge angle of the rhyolite. More consistent extension of the zones can be expected towards the south within

the confines of the rhyolite. Due, however, to the lack of confinement of the stress area in that direction, a dispersal of values over greater widths may be encountered.

The mineralization is concentrated into ore-shoots at intervals in the zones. It would appear that in the area of confinement these ore-shoots are of appreciable length and separated by short stretches of low-grade material. To the southward, however, the ore-shoot concentrations can be expected to occur in a more lenticular form in comparatively extensive areas of low-grade mineralization. Should the results of the present stage of exploration be sustained, the ore occurrence is indicative of an appreciable tonnage operation.

MANVILLE GROUP.

This property comprises eighteen claims and two fractions. It is situated up a winding slough on the west side of the Taku river near the mouth of the Tulsequah river, about $3\frac{1}{2}$ miles north-east of Tulsequah townsite. The camp is located 50 feet above the bank of the slough on a benched ridge that rises gradually to altitude 1,000 feet and slopes on its west side



to the Tulsequah river. The Treadwell Yukon Mining Company is associated with the Alaska Juneau Gold Mining Company in this venture. Including the adjoining *Banker* and *Potlatch* groups recently optioned by the company, the Alaska Juneau holdings in the area comprise thirty-three claims and three fractions.

Geology and Mineralogy.—The ore-body consists of a replacement shear-zone, showing where exposed a width of 36 feet in what appears to be an altered, pyritized rhyolite, in an andesitic country-rock.

The mineralization is a fine-grained mixture of zinc-blende, chalcopyrite, pyrite, and sparse galena, in a dense barytes gangue with some quartz and calcite. The texture of the mineralization is remarkably fine-grained with a decided banded structure. In places where total replacement by massive granular sulphides has occurred the shear-planes of the zone are still plainly preserved in the banded ore structure (relict structure).

The zone has been traced along the banks and bed of a small creek by a series of trenches and stripping for 900 feet from altitude 110 feet at the southerly end to altitude 350 feet at the northerly end. To the southward the zone is covered by heavy silt and clay overburden of the river-valley bottom at altitude 90 feet. To the northward, from altitude 350 to 400 feet, creek-boulder overburden obscures continuity, but float can be picked up in the creek-bed. At this point the creek swings to the west and further continuity of the zone is covered by heavy overburden. At altitude 600 feet and about 1,200 feet north of the most northerly stripping the pyritized rhyolite formation is exposed in the high bluffs of the ridge. The ore-zone strikes N. 50° W. (mag.) and dips 60° S.

Development.—At altitude 325 feet a 12-foot width (not delimited) is exposed by stripping for a length of 50 feet in the creek-bed. This shows 3 feet of massive granular zinc-blende and chalcopyrite on the foot-wall side; next to this is 4 feet of sheared schistose rhyolite with disseminated sulphides, then 5 feet of massive granular zinc-blende, chalcopyrite, and pyrite in banded structure. A sample across this 12-foot exposure assayed: Gold, 0.10 oz. to the ton; silver, 6 oz. to the ton; copper, 1.6 per cent.; lead, trace; zinc, 12.8 per cent. At this point the zone appears to be striking N. 50° W. and dipping 60° S.

From altitude 275 to 240 feet a stripping in the creek-bed, 90 feet long, exposes a width of ore 27 feet wide, with andesite on the east or foot-wall and the width not delimited on the hanging-wall side; 20 feet of the middle portion of the zone is massive granular sulphides in banded structure, with several feet in the centre of mixed chalcopyrite and pyrite. On either side of this is heavily sheared vein-matter with disseminated mineralization. A sample across 27 feet of this exposure assayed: Gold, 0.06 oz. to the ton; silver, 6.8 oz. to the ton; copper, 2.8 per cent.; lead, 0.8 per cent.; zinc, 20.2 per cent.

At altitude 130 feet, 450 feet southerly of this exposure, a tunnel starting near the hanging-wall had been driven for 30 feet diagonally through the zone into the hanging-wall andesite. On account of the gentle hill-slope it is intended to continue this tunnel until sufficient depth has been gained to allow of safe and useful crosscutting to the zone again, when it will be followed by a drift. At the tunnel portal 3 feet of sheared decomposed mineralized rhyolite lies next to the hanging-wall. This grades into semi-massive granular zinc-blende with admixed chalcopyrite. A sample representing a 5-foot width of the undecomposed portion assayed: Gold, 0.2 oz. to the ton; silver, 7.5 oz. to the ton; copper, 2 per cent.; lead, 2.8 per cent.; zinc, 14.4 per cent.

Eighty feet southerly of the tunnel a small trench exposes the ore-body very much sheared, but showing good mineralization of zinc-blende, chalcopyrite, and pyrite; 150 feet southerly of the tunnel another small trench in low ground exposes the zone showing heavy decomposition.

A diamond-drilling campaign for depth exploration is also under way. No. 1 hole was set up at altitude 215 feet, with the hole pointing 60° on a line normal to the strike. At the time of examination 586 feet had been drilled. It is expected to cut the zone at about 700 feet.

Examination of the cores showed a rock formation of altered andesite and interbedded tuffs intruded by basic dykes. The tuffs are generally fine-textured, but a fairly coarse brecciated structure was noticed in some of the core sections. No. 2 drill-hole set-up is at altitude 425 feet, about 400 feet west of the upper exposures.

Seven frame buildings for camps, storehouses, etc., were in process of erection. Two Ingersoll 6 by 8, 320-cubic-foot compressors operate two Ingersoll jack-hammer drills each. Ingersoll jack-hammer drills are being used in the underground work and are reported to be giving good results. A glacier-fed waterfall 3½ miles north-east of the camp, on the left bank of the Taku river, will be used for power. Power rights for this stream have been applied for.

Summary.—The surface showing on the *Manville* group is an exceptionally imposing one in width, grade of ore, and structure. With the exception of the absence in the *Manville* of the dacite dyke that is associated with the *Tulsequah Chief*, the two ore occurrences are identical in character. Both are low to medium temperature replacements in shear-zones in rhyolite. Generally, the *Manville* ore-body may develop greater widths than the *Tulsequah Chief*, but

there may be a possible tendency for a dispersal of values in the wider areas of the rhyolite that may exist, such as is indicated in the southerly continuity of the *Tulsequah Chief*. Lacking the dacite dyke control or barrier that is a beneficial factor on the *Tulsequah Chief*, this condition on the *Manville* may result in a more pronounced lenticular development of ore-shoots, in conformity to the contact of the enclosing andesitic rocks.

Mineral replacement has been intense and, where conditions are favourable, good-grade ore over minable widths can be expected. The exceptional widths and grade of the surface croppings cannot, however, be expected to be the general character of the ore-deposit. Structural conditions promise appreciable depth continuity of the ore-body. Sufficient work has, however, not been done to enable any criterion to be formed of ore-shoot attitude, lengths, and intervals.

In the diamond-drilling, whereas the shear-zone may be cut at appreciable depths, disappointments as well as encouragement may be expected with mineralization and grade at intervals of intersection. The showing is an exceptionally promising one on surface. It should be remembered, however, that much remains to be proved in depth. Should a fair measure of the present surface indications be sustained, the property should develop into an important appreciable tonnage producer.

BIG BULL EXTENSION.

This property consists of one claim adjoining the *Big Bull* claim of the *Manville* group on the south. The north line of this claim lies about 350 feet south of the *Manville* tunnel. The claim covers the slough and the low-lying silt area to the southward. The property was staked by Andrew Berntsen and C. E. Woodman, to cover the possible southerly continuity of the *Manville* ore-zone.

On the north bank of the slough, and just south of the *Manville* line, a small hand churn-drill hole put down from the bottom of a shallow shaft is reported to have penetrated mineralized material. Thirty feet west of this shaft a shallow pit is reported to have exposed solid zone-matter carrying pyrite. On the south side of the slough two shallow shafts through the silt are reported to have picked up oxidized rhyolite material. These workings were all filled with water and could not be examined. It is very probable, however, that the continuation of the *Manville* ore-zone underlies this claim. About 250 feet south-westerly of the churn shaft a small cut has been put into a ridge of silicified pyritized rhyolite. A sample of pyritized rock from the dump assayed: Gold, trace; silver, 0.3 oz. to the ton. This point lies well inside the vertical projection of the extension on the dip of the *Manville* zone. Several other claims have been staked to cover the slough area southerly of the *Manville* group.

BANKER GROUP.

This group was staked in July of 1929 and comprises the *Banker No. 1*, *Banker No. 2*, *Banker No. 3*, *Annex*, *Campfire*, and *Vista* claims. It is owned by J. L. Hill and associates, of Juneau, who bonded the group to the Alaska Juneau Gold Mining Company in September, 1929. The claims are situated on the left bank of the Tulsequah river, about 6 miles southerly from the *Tulsequah Chief*. They adjoin the *Manville* group on the west and the *Pottlatch* group on the south. A joint camp for this group and the *Pottlatch* group is on the bank of the Tulsequah river at altitude 75 feet.

The showing is at altitude 160 feet, about 100 feet south of the south line of the *Pottlatch* group. It consists of a north-west striking, steeply dipping to vertical, silicified zone in what appears to be an altered, dense-textured rhyolite, cut by altered basic dykes. Mineralization consists of zinc-blende, arsenopyrite, galena, and some stibnite, pyrite, pyrrhotite, and possibly a grey-copper mineral, irregularly distributed in quartz veins and stringers 18 to 24 inches in width. A few stringers, 1 to 2 inches in width, sparsely impregnated with grains of pyrrhotite, contain a light-green coloured diffusion that suggests the possible presence of nickel. Zinc-blende is the predominating mineral in the quartz veins and occurs in small bunches and patches of dense texture. The showing was explored by several open-cuts. A sample of the characteristic mineralization, selected from the dumps, assayed: Gold, 0.16 oz. to the ton; silver, 147 oz. to the ton; lead, 8.8 per cent.; zinc, 13.6 per cent. Although nothing of commercial importance was developed in these exposures, in view of the showings on the adjoining *Manville*, the occurrence is worthy of further exploration.

Another group of claims, consisting of *Lower Break No. 1, No. 2, and No. 3*, adjoining the *Potlatch* on the west and the *Manville* on the north, has been staked by J. L. Hill. This group has also been bonded to the Alaska Juneau Company.

POTLATCH GROUP.

This group comprises the *Potlatch, Fanny, Steamboat Bill, King David, Charles First, and Buck Fraction* claims. It is owned by Buck Sparling, of Juneau, who bonded the claims to the Alaska Juneau Company in September. The camp is situated on the same site as that of the *Banker* group.

The lower showing is at altitude 170 feet, just north of the south boundary-line, and about 250 feet north-east of the *Banker* open-cuts. This consists of a sheared, silicified zone of undetermined width and attitude, in an altered, somewhat calcareous, rhyolite. The shear-planes strike N. 40° W. and have a vertical, to steep easterly, dip. Mineralization consists of a sparse irregular distribution of zinc-blende, galena, and pyrite in quartz stringers and veinlets. Some epidotization of the calcareous parts of the zone is evident. Light-green coloured diffusion bands associated with pyrrhotite grains, similar to those on the *Banker*, also occur in this showing. A sample from the shaft-dump assayed: Gold, 0.08 oz. to the ton; silver, 3.6 oz. to the ton; lead, trace; zinc, 2.2 per cent.; arsenic, 2.01 per cent.; antimony, trace.

At elevation 625 feet a shear-zone 30 feet wide, in altered rhyolite in contact with andesite, has been open-cutted. Several quartz-filled fractures striking N. 20° W., parallel to the shearing and standing vertical, occur in the zone. The whole zone is more or less sparsely mineralized, but the chief mineralization of the zinc-blende and pyrite is confined to the quartz veins. A sample across the main quartz vein, 13 inches wide, in the shear-zone assayed: Gold, trace; silver, 1 oz. to the ton; zinc, 3.6 per cent. Time was not available for the examination of other showings reported to occur on this property.

WHITEWATER GROUP.

This group of eight claims, owned by Art Headman, Ray Walker, and Ray Rice, of Juneau Alaska, is situated on the right bank of the Tulsequah river, about 4 miles south-west of the *Tulsequah Chief*.

The formation in this area is a fine-grained diabasic rock cut by rhyolite and felsite dykes. The main showing is at altitude 800 feet and consists of four well-defined, parallel shear-zones 3 to 8 feet wide and about 25 feet apart. The zones strike N. 10° E. and dip 60° S. They outcrop on the steep bluff on the west bank of a fair-sized creek. They can be clearly traced down this rock-slope for about 75 feet towards the creek-bottom, where slide-rock obscures further possible continuity. In the face of the canyon on the east side of the creek continuity is not evident. The shear-zones seem to occupy the locations of felsite dykes which have possibly formed lines of weakness in the country-rock and have been subjected to refracturing and shearing. The felsite has generally been completely replaced by a fine-grained quartzose gangue.

Mineralization consists of chiefly stibnite in massive reticulations, and in minute needle-shaped crystals disseminated in the quartz gangue. Fine-grained pyrite is also disseminated through the gangue-matter, with an occasional speck of galena. The outcrops of the zones are very heavily oxidized to limonite and earthy antimony oxide. An average sample across 6 feet of unoxidized vein-matter assayed: Gold, 0.8 oz. to the ton; silver, 0.2 oz. to the ton; copper, trace; lead, trace; arsenic, *nil*; antimony, 6 per cent. This is an exceptionally pure antimony ore, and taking into consideration the high gold content, it would seem that the occurrence is well worth investigation. Attacked from the view-point of the gold content alone, the probability of an antimony penalty would have to be considered. Investigation may, however, show that the absence of adulteration with copper and arsenic would make the antimony content of the ore marketable as well as the gold.

At the time of examination very little work had been done on the property. About 800 feet westerly of the main showing, two smaller shears, carrying similar mineralization, had been located cutting through the banks of a small creek, and during the examination a third shear in this creek, carrying massive stibnite, was discovered. Altogether the structure of the locality is well defined. If the type of ore indicated can be proved to be commercial, the area should be thoroughly prospected and further discoveries should undoubtedly result.

NORTH-EASTERN MINERAL SURVEY DISTRICT (No. 2).

REPORT BY DOUGLAS LAY, RESIDENT MINING ENGINEER, AND F. P. CADDY, ASSISTANT.

(Reports marked * are by F. P. Caddy.)

INTRODUCTORY.

The North-eastern Mineral Survey District comprises the Omineca, Cariboo, Quesnel, and Peace River Mining Divisions, and occupies a large portion of Northern British Columbia, having an area of nearly 100,000 square miles. The northern, western, and southern boundaries of this district are the arbitrary boundary-lines of the Mining Divisions, but these, where practicable, always follow the watersheds of the country. The eastern boundary is the British Columbia-Alberta boundary-line. The western boundary is roughly 100 miles from the Coast, while the northern and southern boundaries are about 200 miles from the respective Provincial boundaries.

The outstanding geologic features are the two great parallel batholiths, the Coast range and the Cassiar-Omineca batholith, which cross the district in a north-westerly and south-easterly direction, about 175 miles apart. Besides these two great mineralizers, there are numerous intrusions of batholithic rock throughout the district with which mineral occurrence is associated.

The district offers every indication of potential wealth in lode-minerals, in non-metallic minerals, and in coal. The placer-mining field has been under extraction for the past seventy years, but field-study supports the view that this field still offers major possibilities.

The mineral properties in the district are described under the various Divisions and sections, as follows:—

Omineca Mining Division—Skeena section; Hazelton section; Smithers section; Telkwa section; Houston section; Topley section; Burns Lake section; Sibola section; Manson section; Fort Grahame section.

Cariboo Mining Division—Prince George section; Barkerville section.

Quesnel Mining Division—Quesnel section; Likely section; Keithley section; Horsefly section.

Peace River Mining Division.

A general description of the geographic, geologic, and topographic features of the district was given in the Annual Report for 1917.

In the 1927 Annual Report a list of the more important reports on this district was given, and in the 1928 Annual Report a list was given of reports on the district published during that year.

During 1929 the following reports on the district were issued:—

Name of Author.	Publication.	Year.	Page.
George Hanson and T. C. Phemister.....	Geological Survey of Canada, Summary Report, 1928, Part A	1928	50A
Douglas Lay.....	Annual Report	1928	138
Douglas Lay.....	Bulletin No. 1, British Columbia Department of Mines.....	1929	21
Douglas Lay.....	Bulletin No. 2, British Columbia Department of Mines.....	1929	30

GENERAL SUMMARY.

Great activity has been maintained in the district throughout the year and keen interest has been evinced in the search for and acquisition of prospects of promise, more especially on the part of the larger operating companies. Never before has the search extended over such a wide area, and for the first time in the history of the district the aeroplane has been freely used for purposes of prospecting and reconnaissance in the more inaccessible portions of the district north of the Canadian National Railway. Prospecting has been carried on by private individuals and by parties organized by companies.

Of decided interest was the acquisition of the controlling interest in the Owen Lake Mining and Development Company, Limited, by Noah A. Timmins, president of Hollinger Consolidated Mines. This took place at the end of June and involved a substantial cash payment.

The acquisition of the Canadian North-eastern Railway by the Consolidated Mining and Smelting Company of Canada, Limited, likewise the great publicity given to the need of a western outlet for the Peace River district, aroused profound interest by reason of the bearing these matters have on the development of the mineral resources of the northern portion of the Omineca Mining Division. By reason of such, prospecting and reconnaissance in the region affected received added impetus.

Owing to the agricultural development in the Peace River Mining Division, it is no exaggeration to say that no other portion of the Province was more in the eye and mind of the public during the year; and this interest seems likely to be sustained.

Inseparable from extensive mining development is the element of disappointment, and major among the elements of disappointment experienced during the year was the cessation of operations at the *Richfield* group in October by the Topley-Richfield Mining Company, Limited, and at the *Silver Cup* in December by the Silver Cup (Hazelton) Mining Company, Limited. Offsetting this, new discoveries of promise have been made during the year.

The production this year will be rather lower in silver, lead, and zinc than was the case last year. Practically the entire production was made during the last half of the year. The output of placer gold was somewhat less than last year. The production of coal, all from Telkwa Collieries, Limited, was slightly less than last year. The production of diatomite by the B.C. Refractories, Limited, from its quarry at Quesnel was about the same as last year—about 200 tons.

Among important features of general mining development may be mentioned:—

(1.) Completion of the *Silver Cup* mill (Nine-mile mountain, Hazelton) and commencement of milling operations in May, followed by cessation early in December. (The appearance of this property is not that of an exhausted mine, and it is hoped that close examination of the conditions will warrant continuing operations.)

(2.) Resumption of milling operations at the *Henderson* by Duthie Mines, Limited, on June 1st.

(3.) New ore strikes made at the property of the Babine Bonanza Mining and Milling Company, Limited.

(4.) The active development which has taken place on gold-quartz properties in the Cariboo and Quesnel Mining Divisions and the hopeful results which have been achieved by the Cariboo Gold Quartz Mining Company, Limited, on Lowhee creek; and also by I. E. Moore on the *Hudson* group on Cunningham creek. On Yanks peak, near Keithley, in the Quesnel Mining Division, there has been much activity. High but spotty gold values in surface exposures at the *Midas* group and at the *Yanks Peak* group justify intelligent development, but no step beyond development is justified at present.

(5.) A large amount of development has been carried on by the Consolidated Mining and Smelting Company of Canada, Limited, at various optioned properties throughout the district, but options held on several properties have been relinquished. Much work with promising results has been done by this company on the *Emerald* group in the Sibola section, where it is intended to carry on operations during the winter.

(6.) F. H. Taylor did a considerable amount of prospecting on his *Grubstake* group, north-west of Owen lake, and also optioned the *Three Star* group on Boo mountain, near Palling, some 10 miles west of Burns Lake. Subsequently, it is understood that this option was assigned to the Topley-Richfield Mining Company, Limited.

Western Canada Airways, Limited, established an air base at Prince George during the year, and aeroplanes were on charter during the year at this point.

On July 1st C. W. Moore was temporarily appointed Assistant Resident Engineer for the purpose of making a special study of the placer-mining sections of the district. F. P. Caddy, also appointed temporarily, divided his time after August 1st between the North-western and North-eastern Mineral Survey Districts.

A reconnaissance trip was made during the year through the region between Morice lake and the South fork of the Zymoetz (Copper) river, a region geologically promising, but hitherto not examined.

The mineral resources of the four blocks of land in Lillooet, Cariboo, and Peace River Divisions, which may be granted under certain conditions to the Pacific Great Eastern Railway, were investigated by R. W. Brock and staff. This was part of the complete survey of natural



Usk, on Skeena River, above Kitsulas Canyon.



Tulsequah Chief Mine.



Premier Mine and Tram.

resources undertaken during the year by C. R. Crysdale, Chief Engineer, and staff, for the Canadian Pacific Railway, Canadian National Railways, and the British Columbia Government.

The geology of the Owen Lake area was studied by George Hanson and A. H. Lang, of the Geological Survey of Canada.

V. L. Eardley-Wilmot, of the Dominion Department of Mines, examined properties in the district as part of a general study of the silver ores of Canada.

Summing up the results of the year, it may be said that, in spite of disappointments, steady expansion of the mining industry is taking place, as evidenced by the development going on at widely separated points.

The writer desires to express his thanks to the prospectors, operators, and mining men of the district for many courtesies extended.

PRODUCTION.

Lode-mineral.—The following is a list of shipping-mines in the No. 2 District for 1929:—

Name.	Crude Ore shipped.	Ore milled.	Lead Concentrates.	Zinc Concentrates.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Tons.	Tons.	Tons.	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.
Omineca Mining Division—									
Babine-Bonanza.....	30					673		13,013	
Duthie mines.....		10,370	397	465	202	186,899		538,597	443,138
Mohawk.....	54		17	17		6,864		13,927	16,533
Rocher Deboule.....	72				10	2,823	5,760		
Silver Cup.....		4,102	539	47	14	64,092		253,401	23,060
Totals.....	156	14,472	953	529	226	261,351	5,760	820,938	482,731

ROADS AND TRAILS.

Substantial aid was rendered by the Department of Mines during the year not only in connection with mining roads and trails to individual properties, but also in connection with those which affect mineral areas, and which consequently are of great general utility. Funds for the latter class were provided at the last session of the Legislature under the "Loan Act."

Among the more important may be mentioned the following:—

(1.) The road northwards from Fort St. James to Finlay Forks via Manson Creek, the purpose of which is to give transportation to the northern portion of the Omineca Mining Division. In this connection it may be stated that the Dominion Government is clearing the Finlay and Parle Pas rapids to permit of the plying of large water-craft on the Peace river above the Rocky Mountain canyon to Finlay Forks, and above this point. When this work is completed, likewise the road, a summer route will be thrown open between British Columbia and Alberta.

(2.) The pack-trail from Kimsquit, on Dean channel, via Sakumtha pass to Eutsuk lake. This trail was completed during the year to Tesla lake. A further 8 miles remain to be constructed to Eutsuk lake in order to give communication between Canadian National Railway points (Burns Lake and Houston), via this route, and the Pacific coast.

(3.) A road from Houston to Owen lake via the Morice river to afford transportation to the Owen Lake Mining and Development Company, Limited, and incidentally affording readier access to the Morice Lake region of mineral promise. A dirt road has been nearly completed between these points, and it was possible to get a car over the road in frosty weather in the fall, although much remains to be done before the road can be used for motor-trucking, except in winter. This road is also one of the links in the route from Kimsquit via the Sakumtha pass to Canadian National Railway points.

NEW DISCOVERIES.

Many new discoveries have been reported this year, the majority of which have been examined. Among those examined may be mentioned the following:—

(1.) *Toulon* group—a new discovery on an old property by employees working under the direction of John Willman, a copper mineralization in volcanics associated with an aplite dyke, situated a few miles from Usk.

* (2.) *Mitts* group—a discovery by E. Mitts and O. Berg on the North fork of Chindemash creek, near Usk. A copper mineralization with subordinate amounts of lead.

* (3.) *Waverley* group—a discovery of galena and zinc-blende of obvious commercial significance; situated on Seven Sisters mountain, between the headwaters of Flint and Oliver creeks. This discovery was made by M. Orr and H. Macdonald.

(4.) *Glacier Gulch* group, near Smithers—a discovery of bismuth minerals by S. F. Campbell and Grover Loveless.

(5.) *Grandview* group on Milk creek, at the headwaters of the Telkwa river, by T. Riley and associates; in part apparently a relocation of the *Surprise* group. Several well-mineralized quartz veins varying in width up to 5 feet occur at a high elevation. The minerals present are galena, arsenopyrite, and copper carbonates.

* (6.) *Golden Eagle* group, Topley—a discovery of commercial significance of another vein on this property, carrying rich silver minerals, made by the owners, C. Matheson and D. Heenan, after the option on the property had been relinquished by Topley Silver, Limited.

(7.) *Three Star* group on Boo mountain, near Palling, 10 miles west of Burns Lake—a discovery of copper pyrites by V. Schjelderup, P. Sandnes, and K. Nysven. Now under option to the Topley-Richfield Mining Company, Limited.

(8.) *Grubstake* group, situated just north of Nadina mountain—a discovery made by P. Pouport while prospecting for F. H. Taylor. Exposures show two different types of copper mineralization, accompanied by high-temperature minerals.

Of reported new discoveries which have not yet been examined may be mentioned the following:—

(1.) A copper mineralization west of Driftwood river, some 14 miles north of Takla lake, staked by Neil McMillan for Angus W. Davis. The latter states that this is a showing of merit, on which work will be done by his principals next year.

(2.) A copper mineralization discovered by A. Michell and Frank Martin, situated about 20 miles south-east of the foregoing and a few miles west of Takla lake.

(3.) A copper-showing in the vicinity of Thutade lake, at the headwaters of the Finlay river, owned by J. H. Johnson and associates.

The foregoing are here listed to facilitate reference. A full account will be found in the body of this report of all such as have been examined.

New discoveries of coal were reported at Cedarvale and on the South fork of the Zymoetz (Copper) river. Both were investigated, but in neither case were commercial possibilities apparent. Reports on these appear under "Coal."

PROSPECTING.

The outstanding geologic features of the district are the two great parallel batholiths, the Coast range and the Cassiar-Omineca batholith, which cross the district in a north-westerly and south-easterly direction, about 175 miles apart. The former constitutes the western boundary of the district, and the latter is to be found at or near the headwaters of the Finlay river and its easterly-flowing tributaries, the south-eastern end being situated between the Nation and Manson rivers. Besides these two great mineralizers, there are numerous intrusions of batholithic rock at widely separated points throughout the district, with which mineral occurrences are associated; e.g., Rocher Déboulé and Nine-mile mountains, Hazelton; Hudson Bay mountain, near Smithers; Nadina mountain, near Owen lake; intrusions at various points near Babine lake; Timothy mountain, at the headwaters of Moffat creek, in the Quesnel Mining Division.

It is in the vicinity of the contacts of batholithic rocks with volcanic or sedimentary rocks that mineral occurrences are to be expected. Owing to the fact that the Cassiar-Omineca batholith is far distant from transportation, hitherto prospecting has been most active on the eastern fringe of the Coast range and in the vicinity of the batholithic intrusions of the interior above mentioned, but following the discovery and development of the *Ferguson* mine on the Ingenika river the fringes of the Cassiar-Omineca batholith have received during the past two years much attention. This interest has been greatly stimulated by recent public discussion as to the need of a western outlet for the wheat of the Peace River area and the possibilities of railway-construction.

It seems, however, desirable to point out that the discoveries of the year again emphasize the fact, the importance of which has been so frequently stressed in these reports, that areas adjacent to existing transportation are well worth close investigation.

In the Annual Reports for the years 1917, 1921, 1923, 1926, 1927, and 1928 much general information will be found on the subject of prospecting, likewise a detailed account of the physiographic and geologic features of the district. The region adjacent to the Cassiar-Omineca batholith is dealt with in the 1926 Annual Report, and also in the Summary Report, 1927, Part A, Geological Survey of Canada. Information of great general value will also be found in "Geology and Economic Minerals of Canada," by G. A. Young, published by the Geological Survey of Canada. It is unnecessary to repeat herein the detailed information given in these reports, but attention is directed to the following areas:—

(1.) The areas more immediately adjacent to the contact of the Coast Range batholith, or satellites therefrom, with the volcanics and sedimentaries of the interior; e.g., both sides of the Skeena river, between the mouths of the Zymoetz (Copper) and Kitwanga rivers; the headwaters of the Telkwa river; the Sibola section; Morice Lake region.

(2.) The triangular-shaped area immediately north-east of Hazelton, bounded by the Suskwa, Babine, and Skeena rivers. There are numerous granitic intrusions in this area which is of general geologic promise.

(3.) The region between Babine and Takla lakes.

(4.) The Nechako plateau west of Fraser lake, or, in other words, both sides of the Canadian National Railway line between Houston and Fort Fraser. Within this area occur the mineral-deposits of Owen lake, Topley, the *Stella* group (molybdenite) at Endako, and the recently discovered *Three Star* group near Palling. Search in this region might well be directed first to the location of any intrusions of batholithic rock, followed by more intensive search in the vicinity of the latter.

(5.) Fort Grahame section. A fairly full account of this section will be found in the Annual Report for 1926; also much valuable information is contained in the Summary Report, 1927, Part A, Geological Survey of Canada. It is evident that the fringes of the Cassiar-Omineca batholith, which are to be found at or near the headwaters of the Omineca, Osilinka, Mesilinka, and Finlay rivers, are of geologic promise.

(6.) The most promising areas for mica are the two Mica mountains, one being situated opposite Fort Grahame, on the west side of the Finlay river, and the other at Tete Jaune, on the Canadian National Railway. It should be borne in mind that pegmatite mica dykes may also contain cassiterite and radioactive minerals such as uraninite (pitchblende). Such minerals by reason of their black colour will be very readily noticed, and it is suggested that if found samples of such should be sent to the Bureau of Mines for examination.

(7.) Headwaters of Moffat creek, in the Quesnel Mining Division. Discoveries in this region made some years ago, and which form the subject of a report in the Annual Report for 1917, would seem to warrant further prospecting in this region. It might be mentioned that these discoveries occur on the mountain known locally as "Timothy mountain," named "Boss mountain" on Map 1L, "Central British Columbia." Further, the mountain marked "Timothy mountain" on this map is not the Timothy mountain referred to above.

(8.) Placer-gold possibilities. Reference is invited to the report of C. W. Moore, Assistant Resident Engineer, which has already been issued in Bulletin No. 2, 1930, and is reprinted at the end of this report.

SUBSIDY ON POWDER USED BY PROSPECTORS.

Bona-fide prospectors are reminded that a subsidy is paid by the Department of Mines to the extent of 25 per cent. of the legitimate retail cost of powder actually used in prospecting. Copy of the regulations can be obtained upon application to the Department of Mines, Victoria.

COST OF TRANSPORTATION.

The following figures are representative of average costs prevailing in this district:—

Railway Transport.—Six cents a ton-mile for L.C.L. lots; 2½ cents a ton-mile for car-load lots. Transport of ore depends upon the value and is as low as ¼ cent a ton-mile.

Motor-truck Transport.—For large quantities of freight on good mountain roads, from 22 to 42 cents a ton-mile. On bad roads the cost may greatly exceed this.

Pack-horse Transport.—For large quantities of freight over good trails, \$1.25 a ton-mile. For small quantities of freight an approximate figure is \$2 a ton-mile.

Water Transport on Swift Rivers.—With large craft plying, up-stream rate from 24 to 50 cents a ton-mile; down-stream rate about one-quarter of the foregoing. With small craft the up-stream rate is about 60 cents a ton-mile.

LECTURES TO PROSPECTORS.

During the winter lectures were given by the Resident Engineer, as usual, at various centres throughout the district on matters connected with development and prospecting, for the purpose of disseminating information helpful to prospectors and others interested in mining in the district.

OMINECA MINING DIVISION.

SKEENA SECTION.

Usk.

Much activity took place during the year at properties in the vicinity of Usk.

Valhalla and Kleanza. These groups are under operation by Columario Gold Mines, Limited, John Willman being in charge of operations. Much development-work has been carried out during the year, including two adit-drifts on No. 4 vein, 93 feet apart vertically, each about 550 feet in length, and one adit-drift on No. 5 vein at the same level as the lower tunnel on No. 4 vein, about 270 feet in length. Crosscutting has also been carried out on the upper tunnel on No. 4 vein to No. 3 and No. 5 veins respectively.

In the case of No. 4 vein on each level, at a point about 300 feet from the portal, an intrusion of aplite was met with, which appeared to interrupt the continuity of the vein. On the upper level one fairly well-mineralized quartz-lens of a length of approximately 200 feet and of an average width of about 3 feet was encountered between the portal and the aplite intrusion. On both sides of the latter occurs another quartz-lens about 80 feet in length and of an average width of about 2½ feet. In the lower level quartz is more or less continuous for a length of about 200 feet and the width varies from a few inches up to 5 feet. Short raises have been run up from this level at three different points, which appear to indicate a more steeply-dipping body of quartz than shows on the level above.

On the upper level crosscuts have been run to No. 5 vein and also to No. 3 vein. The latter has probably not been positively identified on this level. No. 5 vein at the point of crosscutting shows as a narrow well-mineralized vein, the maximum width of which is about 15 inches. A sample taken from this vein just south of the point of crosscutting, across a width of 12 inches, assayed: Gold, 1.3 oz. to the ton; silver, 2.7 oz. to the ton.

It is stated that further investigation on the surface of No. 4 vein has been carried out beyond the aplite intrusion above referred to, which indicates the likelihood of the continuation of the vein in this region.

On No. 5 vein, when last inspected by F. P. Caddy, an adit-drift had advanced a distance of 75 feet, at the same level as the lower tunnel on No. 4 vein. The strike of No. 5 vein is S. 30° E. (true) and dip 50° north-east. A sample taken across 12 inches of quartz and pyrite on the hanging-wall, 6 feet back from the face at that time, yielded, upon assay, a trace of gold and 0.3 oz. silver to the ton. Since inspection the management states that this tunnel has been advanced a total distance of 270 feet, and that the average vein-width is about 2 feet and mineralization fair.

It is understood that the various exposures of quartz in these workings have not yet been thoroughly and systematically sampled, but that the intention is to carry out such sampling in the near future. Such appears quite essential, inasmuch as gold values cannot be determined by mere inspection. Much light would be thrown upon the matter by a systematic assay plan.

This company appears to be making a painstaking effort to economically develop its property, the possibilities of which can only be determined by further investigation. It is understood that the firm of R. H. Stewart, H. L. Batten & Associates are acting in the capacity of consulting engineers, and during the year the property was examined by H. L. Batten and by V. Dolmage. The management states that owing to impassable roads in the fall it was necessary to suspend operations for a short time. Refer also to the Annual Reports for the years 1920, 1921, 1925, 1927, and 1928; also to Summary Report, 1925, Part A, Geological Survey of Canada.

This group (formerly known as *Old Hickory*; see Annual Report for 1918) **Independence.*** is situated on the western slopes of the Bornite range, at an elevation of 400 feet, and is about 1½ miles due east of Usk. It consists of five claims—*Independence, Independence No. 1, Avalon, Apex, and Sterling*—and is owned by A. J. Kelch.

The showings consist of a mineralized zone in andesitic volcanics; striking N. 65° E. (true) and dipping 85° to the south-east. The average width of the zone is about 2 feet and it is

rather sparsely mineralized with patches of chalcopyrite, bornite, pyrite, and malachite. It can be traced on the surface up a succession of small bluffs to an elevation of 700 feet.

At the foot of the lowest bluff, and just above the level of an alluvial terrace above Kleanza creek, a drift has been run on the vein for a distance of 232 feet, but without encountering a commercial ore-body. A sample of selected ore from the dump outside the tunnel assayed: Gold, trace; silver, 0.5 oz. to the ton; copper 16 per cent. It is claimed that the zone can be traced to the top of the mountain.

Emma. A considerable amount of work was done on this property during the year by A. J. Lowary and associates. In the 1928 Annual Report a description is given of the adit crosscut directed to probe the downward continuation of a mineralized shear-zone outcropping about 50 feet below the crosscut. This shear-zone was penetrated, disclosing only a sparse mineralization, and a drift followed the shear-zone for a distance of 29 feet. The face of this drift shows a width of 2 feet of quartz, which exhibits no great promise, but in view of the fact that this drift is more or less vertically below the surface outcrop, and in view of the work already done at this horizon, it would seem advisable to continue this drift for a limited distance to intercept any possible rake of the ore-shoot into the hill. This vein strikes about N. 75° W. (mag.) and dips at 80° to the south-west.

At 400 feet vertically below this tunnel the old tunnel described in the 1914 and 1918 Annual Reports, and subsequently caved, was cleaned out and retimbered where necessary and continued to a total distance of 284 feet from the portal. For the first 200 feet approximately, a strong quartz vein from 2 to 6 feet in width was continuous. Mineralization with bornite, chalcopyrite, and malachite is on the whole sparse, although there are spots where mineralization is fair. This vein strikes about N. 75° E. (mag.) and dips at an angle of from 30° to 45° to the north-west. At the point at which quartz pinches out the tunnel is swung to the left, that is away from the vein, and at the face the bearing is about at right angles to the course of the vein. It is quite possible that the quartz vein can be recovered by breaking into the right-hand wall of the drift at about the point at which quartz terminated.

It seems evident that these two tunnels are run on two different veins which dip in opposite directions. Although mineralization is on the whole sparse in both, nevertheless both veins exhibit considerable strength, are fairly well mineralized in spots, and their intersection would appear to be a likely place in which to look for an ore-shoot. This could be reached by a raise at a suitable point from the lower tunnel. It would seem that some effort might be made to pick up the quartz vein in the lower tunnel as above indicated; a short exploratory raise in the mineral nearest the face of this tunnel would also seem justified.

Operations were discontinued in the summer. Refer also to Annual Reports for 1914, 1918, 1923, 1924, 1927, and 1928; also to Summary Report, 1925, Part A, Geological Survey of Canada, page 116.

Four Aces. On this group, owned by M. Allison, a new discovery was made during the year. It is that of a copper mineralization, in the vicinity of an aplite dyke, in volcanic flow-rocks, and somewhat resembles the type of mineralization on the *Toulon* group, described elsewhere in this report.

At elevation 1,675 feet, close to the boundary-line between the *Four Aces* and *Golconda* claims, an open-cut shows the andesitic volcanics intruded by an aplite dyke, and on the north side of the latter, extending to a distance of 15 feet from the dyke, the volcanics are mineralized with bornite, chalcopyrite, and small amounts of malachite. A sample across 15 feet at this point assayed: Gold, trace; silver, 1 oz. to the ton; copper, 1.1 per cent. The dyke can be traced at intervals extending up the slopes of Bornite mountain in a direction approximately S. 72° E. (true) and further open-cuts should be made in the vicinity of the dyke.

Another type of mineralization occurs on this property—namely, that of the continuation of the *Emma* quartz vein system—and is described in the Annual Report for 1927. Refer also to Annual Reports for the years 1914, 1918, 1923, 1924, 1927, and 1928; also Geological Survey of Canada, Summary Report, Part A, 1925, page 116.

Toulon. This group is situated on the left bank of Chindemash creek, is distant about 4 miles from Usk, and is owned by Major McConnell. Small-scale operations were carried on during the year under the direction of John Willman and a new discovery was made. This consists of a copper mineralization in andesitic flow-rocks which follows an aplite dyke.

The showings occur in the immediate vicinity of 2-Mile creek, a northerly-flowing tributary of Chindemash creek. On the steep mountain-side, the slope of which varies from 35° to 45°, an aplite dyke striking about N. 20° E. (mag.) has been exposed between elevations 2,050 and 2,630 feet at several different points. The western boundary of the aplite has been well defined, and the andesitic, and in places porphyritic, volcanics intruded are mineralized with bornite and chalcopyrite for varying distances up to a maximum of 30 feet from the dyke. At the time of examination no cuts had been made on the eastern side of the aplite, the work of open-cutting being more laborious on that side owing to heavier cover. The total length over which open-cuts extend on the west side of the aplite is about 900 feet. The mineralization consists of bornite, chalcopyrite, and malachite, and in places follows the jointing planes and cracks in the volcanics; in places it occurs as a dissemination and in places in the form of amygdules.

A sample taken at one point where the mineralization was widest, representing a width of 30 feet from the dyke westwards, assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, 1.6 per cent. This property warrants further investigation.

At a lower elevation, about 2,500 feet west of the above-described mineralization, occur some well-mineralized (with copper) quartz veins, on which some adit-tunnels were run some years ago. These are described in the Annual Report for 1914, pages 133 and 134.

This property is situated on the mountain range between the North fork of **Shenandoah.*** Chindemash creek and St. Croix creek and is owned by R. W. Seelye and associates. Sheldon L. Glover is superintendent in charge of operations. The most important showing on the property appears to be a shear-zone replacement in andesitic volcanics, striking east and west at a mean elevation of 5,000 feet, paralleling the ridge between the North fork of Chindemash creek and St. Croix creek, and dipping into the hill at an angle of 53°. It has been traced by open-cuts at frequent intervals over a distance of 1,800 feet and is said to have been traced by surface showings very much farther. The width of the first 1,800 feet averages 4 to 5 feet. It appears to be a strong vein and is well mineralized on the surface with chalcopyrite and copper-stains almost throughout. At elevation 4,900 feet an adit-drift has been run from the surface for a distance of 170 feet, but the vein seems to be broken up and mineralization is somewhat sparse. At the date of inspection (September 25th) the vein in the face was about 6 feet wide between walls and consisted of 30 inches of mineralized matter on the hanging-wall and another 6 inches on the foot-wall, the ground between appearing barren. A sample over the 30 inches assayed: Gold, 0.02 oz. to the ton; silver, 0.6 oz. to the ton; copper, 0.7 per cent.

It is understood that it is the intention of the management to concentrate work on the drift during the remainder of the season, and, if results are favourable, eventually to open up the vein from the St. Croix side of the mountain.

A small hydro-electric plant is being erected near the North fork of Chindemash creek at an aplite dyke striking about N. 20° E. (mag.) has been exposed between elevations 2,050 and 2,400 feet long, with a fall of 210 feet, is being installed. This will supply a 30-inch Pelton wheel driving a 37½-kilowatt, 440-volt Westinghouse generator. The current will be stepped up to 2,200 volts and carried 2½ miles to the top of the mountain, where it will be stepped down again to 440 volts and used to operate a 30-horse-power motor driving a compressor of 108 cubic feet a minute capacity. The power-house, which is built of round timber framing covered with corrugated iron, is almost completed. The Pelton wheel, countershaft, and generator are in place, and the transmission-line, pipe-line, and dam should be completed this fall, so that the management will be in excellent position to start intensive work next season. Practically all the plant is already on the property.

This group, a new discovery of the year, is situated on the south side of the **Mitts.*** North fork of Chindemash creek, opposite the *Shenandoah*, and is reached by following the Chindemash Creek trail past the *Shenandoah* trail, crossing the creek, and continuing up the hill by a new trail, which was being constructed by the owners at the time of inspection. The group consists of twelve claims, is owned by Ole Berg and Ed. Mitts, and is under option to R. E. Doan, of St. Gabriel, California.

The main showing (elevation 4,000 feet), on which practically no work has been done, consists of a siliceous mineralized zone, which appears to be lying parallel with the face of the mountain. It has been exposed by natural agencies from the head of the rock-slide for a distance of approximately 500 feet down the mountain. To the east it appears to underlie a

dyke at the foot of a vertical bluff of andesitic volcanics. There are copper-stains in many places and scattered mineralization consisting of chalcopyrite and a little galena. Nothing can be said about its width, as at no place had the vein been broken through. The general trend is about east and west and the dip is to the north at about 40°.

A selected sample containing galena assayed: Gold, trace; silver, 0.8 oz. to the ton; copper, trace; lead, 7 per cent. Another sample containing chalcopyrite assayed: Gold, 0.10 oz. to the ton; silver, 3.4 oz. to the ton; copper, 6.5 per cent.

This group is owned by A. A. Macdonald and is situated on the east side of the Skeena river, on the right bank of an unnamed creek flowing into the latter about 5 miles above Usk. A belt of volcanic rocks about 25 feet in width is very sparsely mineralized in places with copper pyrites, malachite, azurite, and specularite. At the time of inspection (June 2nd) a surface trench had been run on the right bank of the creek for a distance of about 60 feet, following more or less the strike of the volcanics in a direction S. 52° E. (mag.), and at the end of this crosscutting at right angles had been commenced. The volcanics dip at about 45° to the north-east. A sample of selected portions of the mineralized rock assayed: Gold, trace; silver, 0.3; copper, 1.6 per cent.

Triune. This group, owned by L. E. Moody, is situated near the summit of Kitsalas mountain. Apart from two quartz veins, which will be described later, the mineral occurrences on this property consist of two zones of disseminated copper minerals, bornite, chalcopyrite, and malachite, in a country-rock which appears to be a silicified and altered volcanic of andesitic type. These two zones are said to intersect at the top of the mountain, but the intersection on the date of inspection (August 3rd) was covered with snow. One zone appears to strike about N. 55° E. (mag.) and the other to strike about N. 55° W. While mineralization is very fair at a few points, it is on the whole sparse. Although exposures are not adequate to prove continuity, they would seem to justify further open-cutting.

At 4,350 feet elevation on the eastern slopes of Kitsalas mountain, at the foot of a steep bluff, a disseminated copper mineralization shows for a distance of 28 feet. A sample taken across this distance assayed: Gold, trace; silver, 1.1 oz. to the ton; copper, 1.5 per cent. This assay may not be truly representative of the width of the mineralized zone at this point, as there is cross-shearing exhibited at this point, which may be locally enriched. Incidentally it might be noted that at the base of this bluff there is rather a remarkable example of ice-grooving.

At elevation 4,460 feet an open-cut exposes a mineralized width of 17 feet, the zone striking S. 55° W. (mag.) and dipping 70° south-easterly. A sample across 17 feet at this point assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, 1.6 per cent. Following along the strike of this mineralization up the mountain, the rocks again show a mineralization at 4,575 feet.

At elevation 4,650 feet, close to the summit of the mountain, a sparse mineralization shows over a width of 50 feet. This strikes about N. 55° W. (mag.). The intersection of this zone with that just described is said to show a good mineralization, but was covered with snow on the date of inspection. Open-cuts show that this north-westerly striking zone extends down the mountain-side, and one such discloses a fair mineralization extending over a width of 15 feet.

On the *True Blue* claim, at the head of the divide between Lowrie and Philips creeks, on the left bank of the latter, a quartz vein exhibits rather a remarkable example of post-mineral movement. The vein is exposed by open-cut for a distance of about 25 feet along its dip. Its width varies from a few inches near the surface to 18 inches at the bottom of the exposure. The vein after mineralization has become involved in the stresses, evidently of a complicated nature, which produced schistosity in the enclosing andesitic volcanics; the effect of which has been to cause the quartz to assume the form of a number of separate cylinders, of varying diameters, lying horizontally the one on top of the other, the diameter of the cylinders corresponding with the respective vein-widths at different points. The cylinders at the surface have a diameter of 3 or 4 inches; those at the bottom of the exposure have a diameter of about 15 or 18 inches. The quartz vein is well mineralized with chalcopyrite and pyrite and a small amount of galena. A selected sample of the best-mineralized portions assayed: Gold, 0.12 oz. to the ton; silver, 1.8 oz. to the ton; copper, 4.1 per cent.; lead, 0.5 per cent.

On the eastern slopes of Kitsalas mountain, at elevation 4,100 feet, a shear-zone 2 feet in width strikes S. 73° W. (mag.) into the hill and dips south-easterly at a fairly steep angle. Mineralization is mainly bornite in a quartz and calcite gangue. A sample of selected portions assayed: Gold, 0.02 oz. to the ton; silver, 8.3 oz. to the ton; copper, 16.1 per cent.

This group, together with the *Mac* and *Buster* groups, is under option to R. E. Diadem.* Doan, of St. Gabriel, California. It is understood to be the intention of the management to install a portable compressor and drive a tunnel from the lowest suitable point above the railway-track. For a description of the *Diadem* refer to the Annual Reports for the years 1923, 1925, 1926, 1927, and 1928.

Lucky Jim.—Work was carried on during the year at this property, situated on Kleanza creek, by the Consolidated Mining and Smelting Company of Canada, Limited, but this company subsequently relinquished its option.

Pitman.

Diorite. This group is situated on Hardscrabble creek, within a very short distance of the railway-track, and is owned by J. M. Dechene. Hardscrabble creek has cut down deeply through volcanic flow-rocks, and in the vicinity of the exposures flows through a canyon, the walls of which are almost perpendicular and approach a height of 500 feet at one point.

On the left bank of the creek the volcanics are intruded by an apparently horizontal aplitic dyke which cuts across the bedding-planes and is capped by a cover of volcanics from 10 to 15 feet in thickness. This dyke is mineralized with chalcopyrite and specularite and a little bornite. At its southern extremity a large open-cut was made originally close to the edge of the canyon, and a shipment of hand-sorted ore was made from this point in 1916. This is the only point at which the dyke can be reached or even inspected closely, because approach to other parts of it is quite impossible owing to the precipitous canyon-walls. Viewed from the opposite side of the creek, numerous copper-stains are seen in this dyke. On the east side of the open-cut mentioned a shear-plane forms the wall of the open-cut. It would seem advisable to break into this, because it seems likely that the dyke has been faulted at this point, and the dislocated portion in that case might be found at the level of the bottom of the open-cut. The dyke where exposed by this open-cut shows a small amount of copper minerals. It is also suggested that above this open-cut on the hillside one or more shafts might be sunk to ascertain the values carried by the dyke. The cover of volcanics does not seem likely to exceed 15 feet in thickness. A sample taken from the dump by the open-cut assayed: Gold, 0.14 oz. to the ton; silver, 0.8 oz. to the ton; copper, 2.8 per cent. This sample is of the best ore showing in the dump.

Somewhat south of this open-cut, and below it, the volcanics are intruded by a tongue of granodiorite. About 50 feet below the open-cut a short tunnel is run in the volcanics, without disclosing anything of importance.

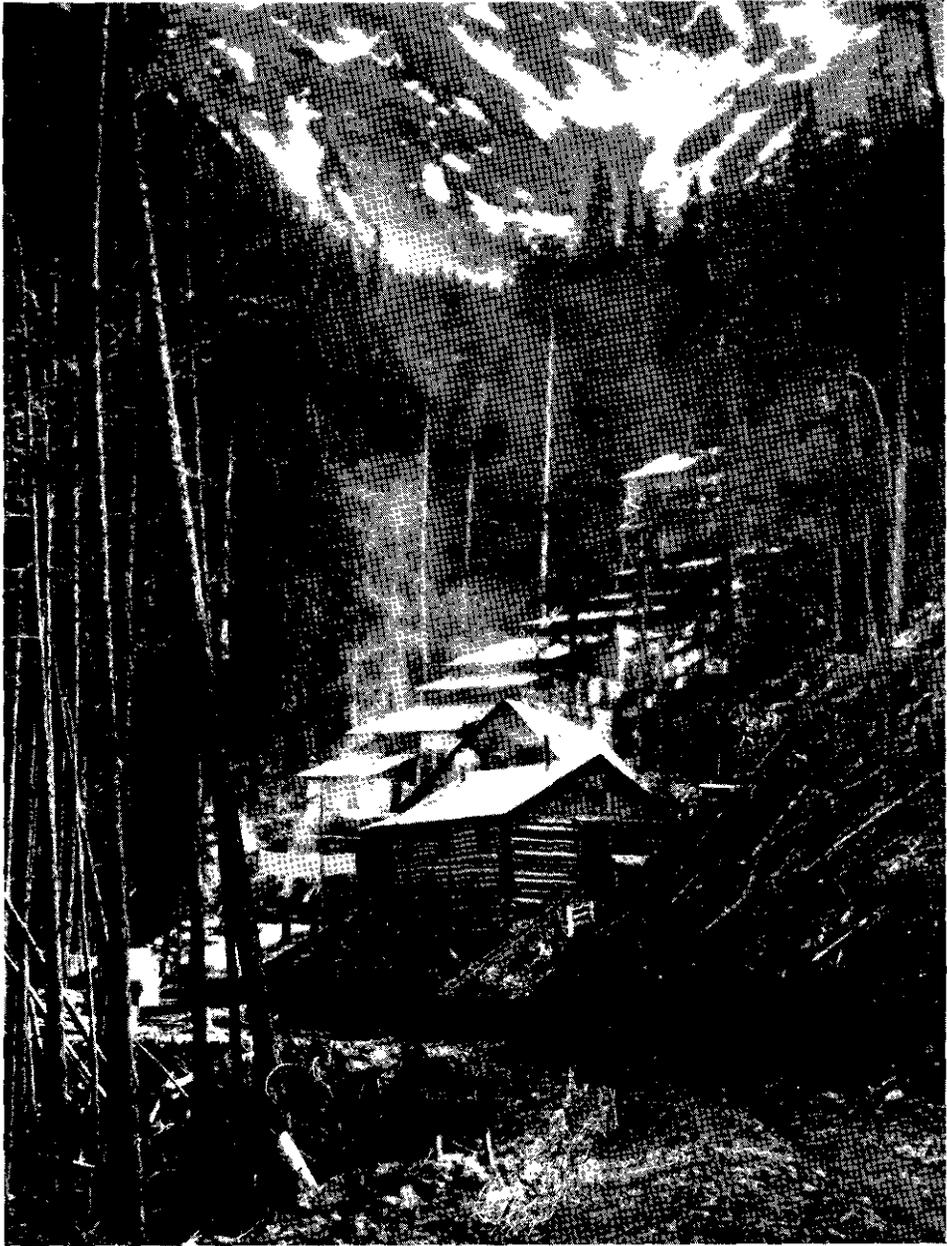
On the opposite side of the creek, and about 100 feet vertically above the above-described open-cut and some distance up-stream, the porphyritic volcanics are mineralized with bornite, chalcopyrite, and specularite. Quartz veinlets containing these minerals follow the jointing-planes of the volcanics. A tunnel 15 feet in length followed by a winze 15 feet in depth sunk at an angle of 35° has been run in the canyon-wall on a bearing S. 60° W. (mag.). The mineralization seems to improve towards the bottom of the winze. This tunnel and winze were evidently run some years ago, but it is clear that an attempt was made to hand-sort this ore to shipping grade, with some degree of success. A small dump showing some nice bornite lies close to the portal of the tunnel. A selected sample of this assayed: Gold, trace; silver, 6.2 oz. to the ton; copper, 19.5 per cent.

From the exposures in evidence it is difficult to ascertain if there is any definite trend to this mineralization, and it is not possible to form an opinion as to commercial significance until more work has been done. It would, however, certainly seem advisable to continue the tunnel in the direction in which it has been commenced, as proof is as yet wanting that the hanging-wall of the winze is the hanging-wall of the ore.

It will be noted that the aplite dyke exposed on the east side of the creek does not apparently occur on the west side. The mineralization on the latter side would seem to be due to the intrusion of granodiorite.

The showings on this property clearly merit some development, in view of the nearness to transportation. Refer also to the Annual Report for 1916 under "*Diamond* group."

Grotto. This group, owned by George Alger, is situated on Hardscrabble creek, somewhat over 1 mile from the Canadian National Railway track. In the immediate vicinity of an intrusion of granodiorite in the andesitic volcanic country-rock occur some quartz-filled shear-zones, mineralized with pyrite and chalcopyrite.



Silver Cup Mine—MHI at Nine-mile Mountain, Omneca M.D.



Finlay Forks. Finlay (Left) and Parsnip (Right), forming Peace River (Top).

These are exposed on both sides of Hardscabble creek, and on two of them short adit-tunnels 20 feet in length have been run. These veins strike about N. 10° E. (mag.) and dip north-west. The greatest observed mineralized width was 10 inches. A sample of selected portions of the best mineralized vein assayed: Gold, 0.30 oz. to the ton; silver, 14.5 oz. to the ton; copper, 5 per cent. The mineral shows fair precious-metal values and it would seem advisable to prospect the surface further in the hope of discovering larger veins.

Legate Creek.

M. & K.* This group, owned by M. Orr and partners, has been under option to the Consolidated Mining and Smelting Company of Canada, Limited, for the past two seasons, but it is understood that this company has relinquished its option. Development-work has been confined to the "Upper Showings" and consists of an adit-tunnel at elevation 4,640 feet, which has been driven on a bearing N. 50° E. for a distance of 74 feet, from which point branches have been driven S. 50° E. for 50 feet and N. 30° W. for 90 feet respectively. Very little mineralized matter was found in the branches, but the main tunnel carries disseminated chalcopyrite and bornite through most of its length. Another tunnel, elevation 4,240 feet and approximately parallel to the upper one, has been driven for a distance of 70 feet, about 50 feet of which was on fairly well-mineralized matter. Refer also to the Annual Reports for the years 1916, 1917, 1919, 1925, and 1928; also to Geological Survey of Canada, Summary Report, 1925, Part A, page 111.

M. & M. This group, owned by R. Moore, has been under option to the Consolidated Mining and Smelting Company of Canada, Limited, during the last two seasons, but it is understood that this company has since relinquished its option. An adit crosscut at elevation 4,200 feet has been driven for a distance of 70 feet to cut the vein under the main outcrop, but at the date of inspection (September 20th) it had not been continued far enough to reach its objective. Refer also to the Annual Reports for the years 1917, 1925, and 1928; also to Geological Survey of Canada, Summary Report, 1925, Part A, page 112.

Seven Sisters Mountain.

Seven Sisters.* This group, owned by Steve Young, has been operated during the year by the Consolidated Mining and Smelting Company of Canada, Limited. A considerable amount of work was done during the season, but it is understood that the results were disappointing. The vein, although large in places, appears to be low grade, most of the mineralization consisting of pyrrhotite and zinc-blende, carrying negligible values in precious metals.

The best surface showing is on the *Cordilleran* claim, where there is a mass of almost solid pyrrhotite up to 15 feet thick, but open-cuts on both sides failed to show any continuation. Refer also to the Annual Reports for the years 1925, 1926, 1927 (map), and 1928.

Hughie. Work was done during the year on a shear-zone and at the time of inspection (March 18th) an open-cut had been run a distance of 40 feet and an adit-drift had been commenced. The face of the drift showed a width of 18 inches of mixed galena, zinc-blende, chalcopyrite, and pyrite in a shear-zone between 4 and 5 feet in width. The mineral was stronger in the back of the tunnel than it was in the bottom, but about 75 feet ahead of this point, and about 25 feet vertically above it, promising mineral is exposed in the outcrop. The shear-zone strikes approximately S. 75° E. and dips south-west at a steep angle. The enclosing argillitic country-rock strikes N. 50° E. and dips south-east at a steep angle. A little native copper occurs in the gangue.

A sample taken across the above-mentioned width of 18 inches of mineral assayed: Gold, trace; silver, 4 oz. to the ton; copper, 8 per cent.; lead, 4.6 per cent.; zinc, 5 per cent. Refer also to the Annual Reports for 1925, 1927, and 1928.

Waverley.* This group, one of the discoveries made this year, is situated on the west slope of the main ridge of Seven Sisters mountain, to the south of the *Seven Sisters* group. It is owned by M. Orr, H. Macdonald, and associates and consists of eight claims. The main showing is situated in a shallow basin, well above timber-line, at elevation 5,200 feet, under the main ridge of the mountain. It consists of a large vein striking N. 10° W. and dipping steeply to the west. It is very well mineralized with galena, zinc-blende, and pyrrhotite. At the date of inspection it had been partially stripped along the

strike for a distance of 30 feet; only one wall was exposed and about 4 feet of vein; but it is understood on good authority that it has since been uncovered right across and is up to 15 feet wide. A grab sample from the material which had just been blasted out at the time of inspection assayed: Gold, trace; silver, 39 oz. to the ton; copper, trace; lead, 23.2 per cent.; zinc, 9.2 per cent.

A shallow lake covered a large part of the basin, but this has been partially drained and trenches were being cut across the strike to trace the vein, which appears to have been located in several places over a length of several hundred feet. The work is difficult, as bed-rock is covered by a considerable amount of talus and the water-level will only allow of shallow trenching.

Farther south, over a small saddle, there is a sloping trench-like depression, with a small sandstone and conglomerate bluff forming its western rim. Outcropping along this bluff is a well-defined vein striking S. 18° E. and dipping steeply to the west. It may possibly be a continuation of the vein described above. It is very strongly iron-stained and well mineralized with zinc-blende and galena. The width varies from 2 to 4 feet and it can readily be traced on the surface for a distance of 600 feet. Very little work has been done on it.

This group is situated about half a mile to the north of Big Oliver creek and 1 mile to the west of Lead creek, and, extending north, adjoins the *Waverley* group. It consists of eight claims and is owned by Frank McLean, F. Burk, and Walter Moberley, of Cedarvale. The showing, which is at an elevation of 2,900 feet, consists of a strongly oxidized zone, 7 or 8 feet wide, in a series of sandstones and argillites. The strike is north-south and the dip is at a very flat angle into the hill, apparently conforming to the dip of the sedimentaries. A sample taken over 12 inches of vein-matter slightly mineralized with pyrite gave, upon assay, traces of gold and silver and no copper.

Another showing about 300 feet to the west, also containing a little pyrite, was sampled. The assay indicated traces only of gold and silver.

This group, consisting of ten claims, is owned by Frank McLean, Fred Burk, **Big Oliver.** Walter Moberley, and Ben Bright and is situated above Big Oliver creek, a quarter of a mile east of Lead creek. The main showing, at an elevation of 2,300 feet, consists of a shear-zone cutting across the bedding-planes of the sandstone and striking N. 55° E., with a dip of 40° to the south-east. The vein-filling consists of brecciated country-rock with quartz-filling in the fissures. A small cut has exposed a width of 6 inches of quartz and limonite sparsely mineralized with pyrite.

About 25 feet above the showing the sandstones are overlaid by conglomerates and there is a bed of hard argillites about 6 feet below. The showing was said to contain nickel, but a selected sample yielded upon assay the following results: Gold, trace; nickel, none.

About 50 feet farther east there is another small showing about 18 inches wide, consisting of quartz very sparsely mineralized with zinc-blende and chalcopyrite. Very little work has been done on either of these showings.

Woodcock.

This claim, owned by A. S. Gray, is situated on the left bank of Wilson creek, **Sunset.** which flows into the Skeena river on the north side, about 3 miles west of Woodcock. It is distant about 2 miles from the railway-line and lies at an elevation of 1,200 feet. The showings appear to be shear-zones in argillites and sandstones and are somewhat sparsely mineralized with chalcopyrite and pyrite. A cut has been made for a short distance on a vein striking N. 40° W. and dipping 80° south-west. The filling consists mainly of quartz, calcite, and a little pyrite. There occurs a small carbonaceous seam on the foot-wall.

At about 100 feet to the south-east and 30 feet lower down a tunnel has been run a distance of about 10 feet on a flat stringer 6 inches wide, striking N. 80° E. and dipping at about 20° to the north. The same stringer shows on the surface about 40 feet west of the tunnel portal and contains some irregular patches of chalcopyrite.

This group of three claims, owned by D. C. McGregor, is situated about 2 miles **Morning Star.** north-east of Woodcock, a station on the Canadian National Railway, 6 miles east of Cedarvale. The mode of mineral occurrence at this property is that of a mineralized stock of batholithic rock, which intrudes sedimentary rocks. The phases of batholithic rock are granodiorite, granodiorite porphyry, and alaskite, and the sedimentary

rocks are conglomerate, sandstones, quartzites, and argillites. Minerals observed are galena, zinc-blende, pyrite, arsenopyrite, chalcopyrite, and molybdenite. Mineralization occurs in shear-zones in the batholithic rock, in small quartz-seams, and also in the form of a dissemination in the latter. Workings inspected in 1927 are described in the Annual Report for that year.

Further work was done by the owner during the year. About 150 feet east of the original exposure some open-cuts in alaskite show a good mineralization of pyrite and arsenopyrite. A sample, however, upon assay, showed only traces of gold, copper, lead, and zinc, and 0.24 oz. silver to the ton.

About 200 feet west of the above, three open-cuts show a fine-grained alaskite, in which pyrite and zinc-blende occur as a dissemination. A sample at this point showed upon assay: Lead, trace; zinc, 5.6 per cent; but no gold, silver, or copper values. Refer also to the Annual Report for 1927.

Rosalea. This claim, owned by W. C. Little and David Wilson, is situated immediately east of Woodcock Station, within 900 feet of the railway-track, and on the north side of the latter and about 35 feet above it. An open-cut exposes sandstone-beds striking N. 30° E. (mag.) and dipping north-west at about 40°. A transverse shear or fault plane, striking N. 50° W. and dipping at a steep angle to the south-west, is occupied by a quartz-seam lenticular in form of an average width of 18 inches. It is sparsely mineralized with pyrite and a very little galena. In places quartz follows the bedding-planes of the sandstone. A sample of the mineralized quartz disclosed upon assay no gold, silver, or lead values.

Kitwanga.

Two Laddie. This group, owned by D. Lamont, is situated about 1 mile east of Kitwanga, the showings being only a few hundred feet above and a few hundred yards from the railway-track. On the showing described in the 1925 Annual Report (under *Laddie*) the owner has driven an adit-drift, which at the time of inspection (June 21st) was 63 feet in length, the bearing being N. 58° W. (mag.). This tunnel follows a shear-zone dipping south-west at about 55°. This shows on the foot-wall a width of between 1 and 1½ feet of fairly solid zinc-blende and pyrite, with in places a very little chalcopyrite and galena. A sample across 1 foot close to the face of the tunnel assayed: Gold, trace; silver, 2 oz. to the ton; lead, *nil*; zinc, 30 per cent.

About 250 feet east of the above tunnel, and at about the same elevation, the owner discovered another shear-zone during the year. This is exposed by open-cuts over a length of 50 feet. The strike is N. 35° W. and dip 45° to the south-west. Mineralization consisting of zinc-blende with copper-stain is confined to a maximum width of 8 inches. A sample taken across a width of 4 inches assayed: Gold, trace; silver, 0.5 oz. to the ton; lead, *nil*; zinc, 48.8 per cent.

A few hundred feet north of the last-mentioned shear-zone occurs an outcrop of granodiorite porphyry, which intrudes the quartzite country-rock. Refer also to the Annual Reports for 1925 and 1928.

HAZELTON SECTION.

The chief event to chronicle in this section was the commencement of milling operations at the *Silver Cup* by the Silver Cup (Hazelton) Mining Company, Limited, on May 4th, followed by cessation of the same on December 7th, mining operations being suspended on November 23rd.

Rocher Déboulé Mountain.

Rocher Deboule. Obtaining an option on this property, Aurimont Mines, Limited, continued the operations commenced at the close of 1928. An effort was made to ship hand-sorted ore at a profit. After shipping a few cars of ore operations were suspended. W. S. Harris was in charge of this work.

Comeau. This group (formerly *Cap*), owned by D. Comeau, G. Beirnes, and Oscar Moore, is situated on the lower western slopes of Rocher Déboulé mountain and is distant about 2 miles from Carnaby flag-station on the Canadian National Railway. The *Rocher Déboulé* aerial tram-line passed over the property, but this tram has now been dismantled.

On this property occur two veins about 220 feet apart, striking north-easterly and dipping north-westerly. Attention has been confined practically entirely to the more westerly vein.

The latter varies in width from 2 to 5 feet and on it a considerable amount of work was done some years ago. Operations were resumed this year by the owners. A shipment of 29 tons of copper ore was made in 1917.

On the west vein some years ago a shaft was sunk at elevation 2,250 feet to a depth of about 60 feet. To intercept the downward continuation of this vein an adit-crosscut 76 feet in length was run at elevation 2,210 feet, and from the end of the crosscut drifts were run in both directions. The length of the south-west drift is 27 feet, at which point it connects with the shaft. The face of this drift shows a vein-width of 4 feet, of which a width of 1.5 feet is ore. A sample across this width assayed: Gold, 0.02 oz. to the ton; silver, 8.4 oz. to the ton; copper, 3 per cent. The shaft is full of water to the level of this drift, but is said to be in good ore 20 feet below this point. The length of the north-east drift is 67 feet. At 27 feet from the crosscut a fault was struck which dislocated the vein a few feet to the east. The face of this drift shows a width of 1.5 feet of well-mineralized vein-matter. An average sample of 20 tons of ore resulting from the running of the south-west drift, and taken in 1917 by the then Resident Engineer, assayed: Gold, 0.03 oz. to the ton; silver, 10 oz. to the ton; copper, 8 per cent. This vein is exposed by an open-cut at a point about 200 feet south-west of the shaft, at elevation 2,230 feet, where very fair mineralization 3 feet in width shows. The outcrop also contains a considerable amount of siderite and rhodonite. A sample taken at this point across 3 feet assayed: Gold, 0.02 oz. to the ton; silver, 21 oz. to the ton; copper, 0.6 per cent.; zinc, trace.

Several hundred feet south-west of this open-cut, at elevation 2,060 feet, an adit-tunnel has been run a distance of 203 feet on a bearing very nearly coincident with the strike of the vein. The last 25 feet of this tunnel shows a little mineral, but it is doubtful if this is the vein under investigation in the upper workings. This tunnel was an unfortunate piece of work. It is obviously hazardous to run a crosscut tunnel in practically the same direction as a vein, and, moreover, the objective at this property is obviously the region in the more immediate vicinity of the shaft from which the portal of the adit-tunnel is hundreds of feet distant. The topography in the vicinity of the shaft is particularly favourable for crosscutting from the surface at right angles to the vein, and very considerable depth can be gained in this region with a relatively short crosscut.

Distant from the above-described vein about 220 feet in an easterly direction, another vein is exposed by open-cut at elevation 2,330 feet. This strikes N. 52° E., dipping steeply to the north-west. A width of 3.5 feet shows a little zinc-blende, chalcopyrite, and pyrite.

A sample taken across this width assayed: Gold, trace; silver, 1.8 oz. to the ton; copper, *nil*; zinc, 6.4 per cent. This vein strikes somewhat more easterly than the first vein described, the strike of the latter being about N. 35° E. (mag.).

This property exhibits promise and further work to probe the region immediately below the shaft seems warranted. Refer also to the Annual Reports for 1914, 1916, and 1917, under "*Cap.*"

Nine-mile Mountain.

Silver Cup. Various difficulties were encountered by Silver Cup (Hazelton) Mining Company, Limited (formerly the Duke Mining Company), in getting its milling and power plants into successful operation, in consequence of which it was not found possible to start milling operations before May 4th. It subsequently developed that the ore was not by any means an easy one to treat by flotation, and time was necessarily occupied in arriving at a satisfactory flow-sheet. To G. L. Kvist, superintendent, credit is due for working out a flow-sheet, which resulted in a saving of about 90 per cent. of the lead and silver values and, generally speaking, met the situation satisfactorily. Only one concentrate was made, assaying from 25 to 30 per cent. lead and from 16 to 18 per cent. zinc. When the mill was "tuned up" it became evident that its capacity was in excess of the productive power of the mine with existing equipment. It is understood that it also became evident that it was doubtful if a profit could be earned under existing conditions. At any rate, mining operations were stopped on November 23rd and the mill was shut down on December 7th.

On December 29th and 30th this property was again inspected by the Resident Engineer, in company with an examining engineer, and G. L. Kvist, superintendent, at the request of both these gentlemen.

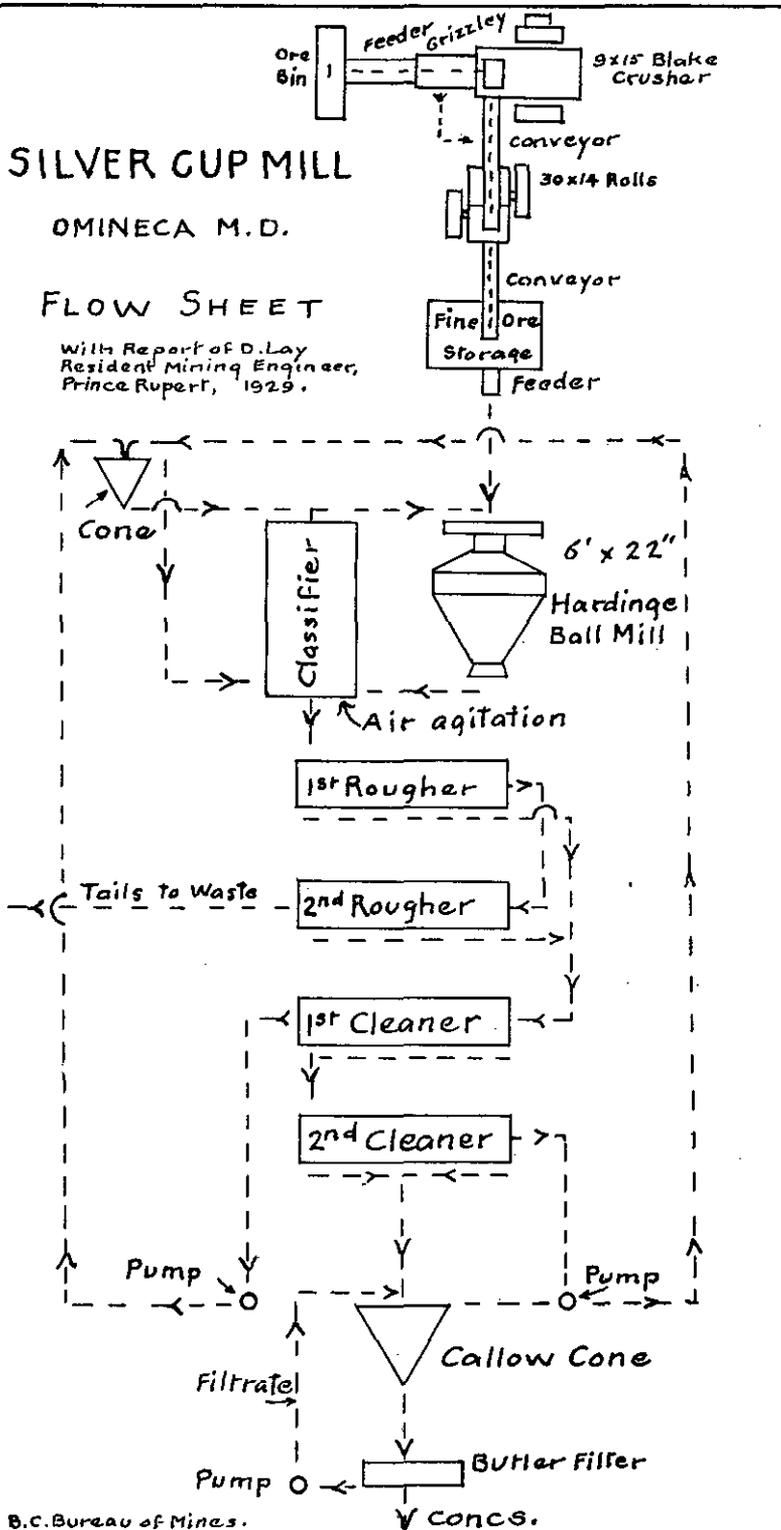
Levels 4 and 3 have been advanced to points approximately 275 and 260 feet respectively distant from the main raise between these levels. Level 4 at 100 feet south of the main raise

SILVER CUP MILL

OMINECA M.D.

FLOW SHEET

With Report of D. Lay
Resident Mining Engineer,
Prince Rupert, 1929.



encountered a fold or interruption in the vein, and shortly afterwards ran into granodiorite which shows in the present face and which contains some mineralized quartz-seams, but the original vein has not been identified beyond the point mentioned. Level 3 ran into the intrusive batholithic rock at about 210 feet south of the main raise, and at this point the intrusive forms both walls of the vein, which shows as a narrow mineralized fissure a few inches in width only. At the face the intrusive shows on the hanging-wall of the vein, the foot-wall being the sedimentary tuff. The intrusive where exposed on level 3 is a more acidic type than encountered on level 4, being porphyritic and of alaskite type. In both cases the intrusives are in all probability tongues of the stock of granodiorite which is known to occur in the near vicinity. The intrusive on both levels 4 and 3 is mineralized with galena and zinc-blende. On level 3 the vein has been easier to follow than on level 4, although on the former level for the last 100 feet beyond the region at which stopes have been started it shows as a narrow mineralized stringer only. Unfortunately the survey of the mine has not been kept up to date; consequently the relative positions of levels 4 and 3 south of the main raise is not known. From a Brunton survey of the individual levels it seems probable that level 4 leaves the course of the vein just south of the main raise and may have followed a branch vein from this point onwards; consequently the main vein might be discovered on this level by crosscutting west. Before any intelligent opinion can be given on this point, however, an accurate transit survey of these levels is quite essential, and such should obviously precede any further work on either level.

The faces of levels 1 and 2 were inaccessible on the date of inspection, but it is stated that the face of level 1 at 10 feet south of the main raise shows a width of 14 inches of good ore, and that the face of level 2 at 20 feet south of the main raise shows a width of 8 inches of good ore. The main raise has reached a point approximately 22 feet below level 1, and at this point some ore shows in the back on the south side, and about 20 feet north of this point the face of the stope shows a width of between 2 and 3 feet of good ore. Prospects therefore for the continuation of ore southwards at or about the horizon of level 1 are favourable.

The following flotation reagents were in use at the *Silver Cup* mill: Soda-ash, 4 lb. a ton of ore added to ball-mill; oil mixture (1 part water-gas tar and 2 parts cresylic acid), 0.45 lb. a ton of ore added to ball-mill; aerofloat, 0.05 lb. a ton added to ball-mill; pine-oil, 0.3 lb. a ton added to classifier; cresylic acid and pine-oil mixture (equal parts of each), 0.6 lb. a ton added to second rougher-cell; xanthate, 0.25 lb. a ton added to second rougher-cell.

The following are the averages of the respective returns for the periods indicated and illustrate the results attained:—

Months of September and October, 1929.

Description.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Per Cent.	Per Cent.
Feed.....	14.70	3.35	4.00
Concentrates.....	128.40	25.60	16.90
Tailings.....	1.29	0.38	2.39

Month of November and Part of December, 1929.

Feed.....	19.60	3.96	6.85
Concentrates.....	152.60	27.60	16.00
Tailings.....	1.44	0.38	3.74

These indicate, it will be noted, an improvement latterly.

The total tonnage of concentrates made was 571 tons and the total tonnage of feed treated approximately 5,710 tons. Shrinkage-mining methods were followed.

Refer also to the Annual Reports for 1914, 1927, and 1928 for full accounts. The property is briefly referred to in Annual Reports for years 1918, 1919, and 1920.

Small-scale operations were continued at this property throughout the year.

Mohawk. While no ore-shoot of material size was encountered, development-work yielded about 30 tons of ore, which quantity was shipped, and promise was indicated at several points.

No. 2 raise was continued through to the surface, but encountered no mineral beyond a point 40 feet up. It was in any case run up at a steep angle to shorten the distance. The drift below this raise was advanced a distance of approximately 450 feet north-west of the raise to a point approximately vertically below the Kinman shaft. In this region a fault was encountered and a crosscut was run, following the fault northwards for a distance of 57 feet, in the hope of recovering the vein, but without success. The ore struck in the drift below No. 2 raise was not found to extend more than a short distance, but from this region the shipment of hand-sorted ore mentioned above was made. The drift north-west of the raise encountered no material amount of ore, although it is stated that it showed frequently small amounts of mineral. A winze was started immediately below No. 2 raise, and a grab sample of hand-sorted ore from this winze assayed: Gold, 0.04 oz. to the ton; silver, 137.5 oz. to the ton; lead, 17.4 per cent.; zinc, 21 per cent.

This vein was followed by a drift south-west of the crosscut between the two veins for a distance of 145 feet. At 57 feet from the crosscut a little mineral was struck, which subsequently materially improved, it is stated, offering considerable promise at one point, but the present face does not look as well as formerly. When inspected on November 13th the face had reached a point 75 feet from the crosscut, and a winze had been started at 57 feet from the crosscut. A sample taken across 1.5 feet on the hanging-wall just beyond the winze assayed: Gold, trace; silver, 16.6 oz. to the ton; lead, trace; zinc, 6.6 per cent.

With regard to development on this level to date: Appearances in most places suggest that this level may be at the top of the ore-bearing zone; consequently it would seem advisable to continue prospect-winzes started for a short distance to ascertain if this is the case. It would also seem advisable to continue further the drift on the more northerly of the two veins met with on this level. Inasmuch as ore was found in the more southerly vein by No. 2 raise, it is a reasonable expectation that ore will be found in this region in the more northerly vein also in this region.

Operations during the year were carried on under the direction of H. A. Harris. Refer also to the Annual Reports for the years 1914 and 1920 (under "Erie group"), 1925, 1927, and 1928.

A full description of this property will be found in the Annual Report for 1928.

Comet. This property was under small-scale operation during the summer by Bulkley Mines, Limited, the company incorporated for this purpose. R. Curnow was in charge of the work. About 95 feet of drifting was carried out in the tunnel at 1,210 feet elevation, but nothing of importance was disclosed. In the 1928 Annual Report it was recommended for several reasons that the vein in the sedimentary tuffs should be followed. It is stated that the shaft at elevation 1,580 feet was cleaned out, in addition to the work mentioned above.

Thoen Basin.

At the head of 31-Mile creek, a southerly-flowing tributary of the Suskwa river, approximately 31 miles from Hazelton, is situated a large mountain. On the south side of the latter are the True Fissure and Thoen basins and behind these on the north side of the mountain are the Copper and Bergsten basins. This mountain consists of sedimentary rocks (argillites, quartzites, and tuffs) of the Hazelton series, intruded in numerous places by granodiorite in the form of small stocks and dykes. Although no mineral occurrence of obvious commercial significance has yet been disclosed, nevertheless the region is of considerable geologic promise and justifies prospecting.

A considerable amount of prospecting and surface work was carried out during the year by J. A. Rutherford at his *True Fissure* and *O.K.* groups, on which showings of silver-lead-zinc ore and also of copper ore have been discovered. These groups are known locally as "The Suskwa Mines." A further account of this region will be found in the Annual Reports for 1921 and 1927.

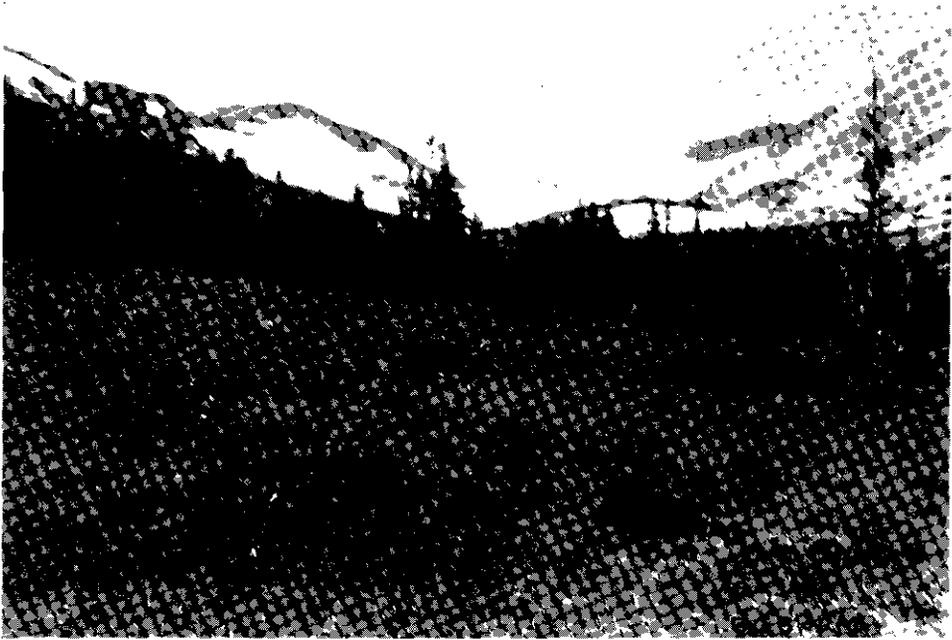
True Fissure. This group is situated in the True Fissure basin immediately west of Thoen basin on the south side of the mountain. Since 1927 the tunnel at 5,170 feet elevation has been advanced to a point 30 feet from the portal, following the vein, striking S. 35° W. (mag.) and dipping south-east at 60°. The vein varies from 10 to 12 inches in width and is well mineralized with galena, zinc-blende, and pyrite. An assay is given in the 1927 Annual Report. At 170 feet vertically above this point another tunnel has just been

started on this vein and shows a good mineralization of galena, zinc-blende, and pyrite between $1\frac{1}{2}$ and $2\frac{1}{2}$ feet in width. The gangue shows a considerable amount of rhodonite.

This group is situated in Thoen basin in part and in part in the Bergsten basin, the claims comprising the group extending over the divide between these two basins. In Thoen basin, at several points between elevations 5,385 and 5,560 feet, several small seams of galena and zinc-blende follow the bedding-planes of the sedimentaries, dipping at flat angles into the mountain, and are exposed by open-cuts and one short tunnel. These seem to continue for considerable distances. At 6,300 feet elevation, near the summit of the mountain and west of the pass between Thoen and Bergsten basins, in the near vicinity of an intrusion of granodiorite, a small tongue of the latter in the sedimentaries is mineralized with copper pyrites and copper-stain. A sample across the best showing, 2 feet in width, assayed: Gold, 0.30 oz. to the ton; silver, 11 oz. to the ton; copper, 2.1 per cent.



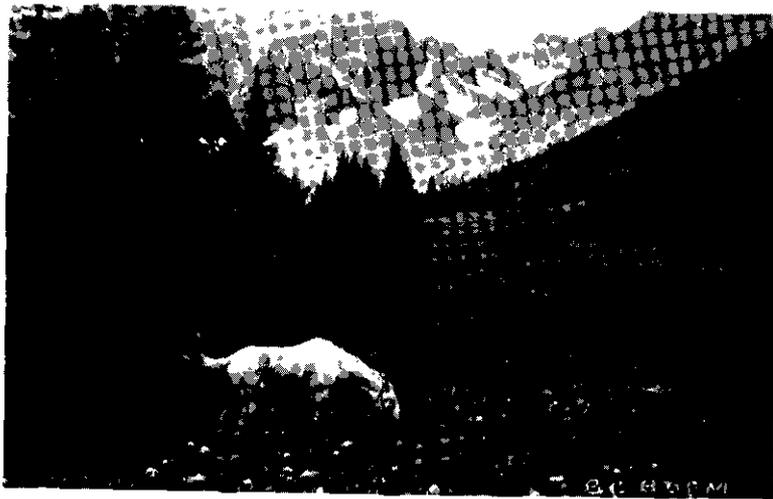
A good trail leads from Thoen basin to Bergsten basin through a pass at 5,660 feet elevation. In the Bergsten basin, on the east wall, granodiorite tongues intrude the quartzites, and the former are slightly mineralized at several different points with small amounts of chalcopyrite. In the centre of the basin, at elevation 5,060 feet, a shear-zone 6 feet in width shows a width of 1 foot of mixed galena, zinc-blende, arsenopyrite, and pyrite. The shear-zone strikes S. 27° W. (mag.) and dips north-west. Above this point and on the west side of the basin, within a width of 20 feet, there is exposed in quartzite by open-cutting three different strike seams of compact galena and zinc-blende, each seam being several inches in width. These strike S. 18° W. (mag.) and dip south-east. Much rhodonite accompanies the minerals mentioned.



Harloworth Group, Omineca M.D.



Emerald Group, Omineca M.D.



Waverley Group, Omineca M.D.



Thoen Basin, Omineca M.D.

A sample of selected portions assayed: Gold, 0.02 oz. to the ton; silver, 8.4 oz. to the ton; lead, 4.8 per cent.; zinc, 5.5 per cent. Further work by the owner at this point seems warranted.

Copper basin is reached from Thoen basin by a pass at elevation 6,460 feet. In this basin the sedimentaries are intruded at several points by small stocks of granodiorite and finely crystalline granodiorite dykes. The latter are sheared in a direction N. 20° E. (mag.) and in places are mineralized with chalcopyrite in the form of a dissemination, but there is no indication of appreciable continuity. One such dyke on the east side of the basin at elevation 5,660 feet is mineralized across a width of 5 feet, of which a width of 2 feet is well mineralized. A sample at this point across 2 feet assayed: Gold, 0.05 oz. to the ton; silver, 1.4 oz. to the ton; copper, 7.1 per cent. Refer also to the Annual Reports for 1921 and 1927.

Babine River.

Red Canyon. This group, owned by C. Cox, T. Hanna, and T. Creighton, is situated on Clifford creek, a north-flowing tributary of the Babine river, and is distant about 10 miles from Kisgagas or 58 miles from Hazelton. The owners report having done work on their property during the year, but time did not permit of inspection.

SMITHERS SECTION.

Noteworthy events in this section during the year were the resumption of milling operations on June 1st by Duthie Mines, Limited; the new strikes of ore at the *Cronin* property; the optioning of the *Silver Lake* group by W. R. Wilson & Sons; and an interesting discovery of bismuth minerals at the *Glacier Gulch* group by the owners of that property.

Hudson Bay Mountain.

Henderson. In accordance with the programme announced at the close of 1928, Duthie Mines, Limited, completed its power plant, installed a sorting-belt and other improvements at the mill, completed a new boarding-house and bunk-house and other surface buildings, and carried out extensive mine development. Towards the end of the year the adjoining *Humming Bird* and *Canary* claims were purchased.

At the time the property was last inspected (November 10th) the management estimated that the development footage for the year would total about 4,900 feet. This comprised sinking a 3-compartment vertical shaft from the mill tunnel level to the 600-foot level (a vertical distance of 100 feet), crosscutting to and drifting on the various members of the vein system at this horizon, crosscutting to the Ashman vein on the 500-foot level and drifting on this and the Fault Plane vein on this level, drifting on the Ashman vein on the McPherson level, and crosscutting to this vein on the Compressor level.

Generally speaking, development to date on the 600-foot level disclosed narrow seams of ore in the Henderson, Fault Plane, and Big Stranger veins, with the exception that at the time of inspection on November 10th the drift on the Henderson vein was running into considerably wider ore than had hitherto been encountered on this level. The Little Stranger vein had not been found. In view of the ore met with on the 500-foot level it would seem reasonable to anticipate productive stopes on both the Henderson and Fault Plane veins above the 600-foot level. On the 500-foot level the Ashman vein has yielded productive stopes, but the ore from this vein, while showing a gratifying improvement in silver grade in depth it is stated, is lower in this respect than that of the Henderson vein.

Surface and internal geology has been closely studied by the staff, as a result of which it is stated that about 200 feet east of the Fault Plane a new vein known as the Gill has been discovered on the surface, and a crosscut to it from the Compressor level is contemplated.

Milling operations were resumed on June 1st and since then a daily tonnage of about 50 tons has been milled, mill-feed being composed of ore resulting from development, together with such tonnage from shrinkage stoping as has been found necessary to reach the above total. The tonnage mined during the year was 12,500 tons, of which 10,370 tons was milled.

A description of the sorting plant installed during the year is of interest: From the mine-run storage-bin ore is fed to a screen with 1-inch round holes and is thoroughly washed at this point by a stream of water. Oversize passes to a picking-belt 87 feet long by 30 inches wide, delivering to the mill-feed bin. Undersize with all wash-water passes to a drag classifier in the mill, which delivers all coarse material direct to the ball-mill. The overflow from this classifier

passes to two settling-tanks in series, in sizes 14 by 6 by 4 feet and 8 by 8 by 4 feet respectively, and is returned by a centrifugal pump to the sorting-belt house, being used as wash-water. Material settling in the tanks mentioned is fed by hand to a Dorr classifier running in closed circuit with the ball-mill, the tanks being emptied periodically for this purpose.

The milling results obtained at this plant have reached a high degree of excellence. For example, lead and silver savings range from 95 to 98 per cent. and the zinc saving is about 85 per cent. Lead concentrates range from 50 to 60 per cent. lead in a concentrate carrying from 5 to 10 oz. silver to the unit of lead. Zinc concentrates range from 50 to 60 per cent. zinc in a concentrate carrying somewhat under 1 oz. silver to the unit of zinc. Such results reflect credit upon all concerned. Flotation reagents in use are the following: Soda-ash, 0.15 lb. a ton of ore to the ball-mill and 0.17 lb. a ton to the zinc-ump; lime, 3 lb. a ton to the lead circuit and 3.4 lb. a ton to the zinc circuit; sodium cyanide, 0.35 lb. a ton to the ball-mill; zinc sulphate, 0.37 lb. a ton to the ball-mill; xanthate of potash, 0.08 lb. a ton to the lead circuit and 0.06 lb. a ton to the zinc circuit; copper sulphate, 0.87 lb. a ton to the zinc circuit; pine-oil, G.N.S. No. 5, 0.09 lb. a ton to the lead circuit and occasionally a little to the zinc circuit; Barrett No. 4, 0.1 lb. a ton to the ball-mill.

It is quite evident that every phase of this company's operations receives skilled and searching scrutiny, and while the final outcome is necessarily dependent upon future developments, everything possible is being done to put this property on a profit-earning basis.

The recent purchase of the *Humming Bird* and *Canary* claims will greatly increase the scope and possibilities of this company's operations, as will be seen by referring to the map on page 108 of the 1922 Annual Report and perusal of the following report on these claims.

This group, consisting of the *Humming Bird* and *Canary* claims, is situated **Humming Bird.*** on the south-west slope of Hudson Bay mountain and adjoins the *Henderson*. (Refer to map in 1922 Annual Report). Formerly owned by George Chariton, of Telkwa, and the estates of William Hanna and George R. Holbrook, it was purchased at the close of the year by Duthie Mines, Limited. At the date of inspection work was being done on a promising-looking vein, striking N. 65° E., on the *Canary* claim of this group. It was being opened up over an approximate length of 500 feet by a succession of closely-spaced trenches and cuts.

On the lower 220 feet the vein seems to be small, but it was not possible to estimate its width, as many of the cuts were full of water, but a certain amount of mineral was observed on the dumps. In the next 280 feet the vein opens out up to a width of 2 feet in places and is well mineralized with galena and zinc-blende. At the northern extremity the vein has been stripped for a length of 40 feet, where in one place it reached a width of 3 feet. A sample from here over 2 feet assayed: Gold, 0.24 oz. to the ton; silver, 21.4 oz. to the ton; lead, 15 per cent.; zinc, 25.6 per cent.

This group, owned by Stanley B. Rutland and associates, consists of seven **Mayflower.*** claims—namely, *Mayflower*, *Jessie M.*, *Bessie*, *Marriner*, *Upland*, *Mamie Fraction*, and *Canary Fraction*. It is situated on the south-west slope of Hudson Bay mountain, immediately adjoining the *Canary* claim of the *Humming Bird* group on the north-east. It is reached by following the motor-road from Smithers to the Duthie Mines, Limited, camp, a distance of 15 miles, and from thence a further mile or so by foot-trail, and lies at an elevation of from 4,000 to 5,000 feet.

The showings, which are mostly above timber-line, consist of a series of approximately parallel shear-zone replacements in andesitic volcanics, striking between north-south and N. 15° E. and standing nearly vertical, or with a slight dip to the west. Mineralization consists chiefly of pyrrhotite, a little galena, pyrite, and arsenopyrite.

The most important showings are as follows: On the *Mayflower* claim, at an elevation of 5,300 feet, a cut has been made on vein-matter 4 feet wide, between well-defined walls, for a distance of 40 feet. Filling consists of country-rock, with 18 inches of well-mineralized vein-matter in the centre, 12 inches of which is nearly all pyrrhotite. Other minerals in lesser quantity are galena, arsenopyrite, pyrite, and a little chalcopyrite. A sample taken over the 18 inches assayed: Gold, 0.02 oz. to the ton; silver, 5 oz. to the ton. This vein can be traced on the surface up the hill for a distance of 300 feet.

About 200 feet to the south-east of the above, on the *Upland* claim, a cut has exposed a parallel vein which is sparsely mineralized with pyrrhotite and pyrite. It appears to be of

minor importance. At a further 500 feet to the south-east, and still on the *Upland* claim, an adit-drift has been run north for a distance of 25 feet on vein-matter 4 feet wide, having a slight dip to the west. The face shows 18 inches of almost solid pyrrhotite; a sample across this width assayed: Gold, 0.04 oz. to the ton; silver, 1.7 oz. to the ton.

The two main veins mentioned above appear to merit further exploration and their course should be traced down the hill. They are both strong-looking, well-defined veins, with every indication of permanence. Their location, which is to the north-east of the *Henderson* claim of Duthie Mines, Limited, and more or less on the projected strike of the latter's veins, is distinctly favourable. Another important factor is that at the time of inspection a distinctly promising vein was being opened up on the *Canary* claim of the *Humming Bird* group, where a width up to 3 feet, well mineralized with galena and zinc-blende, carrying gold and silver values was exposed. (Refer to *Humming Bird* in this report.) The strike of this vein would take it into the *Canary Fraction* of the *Mayflower* group in the course of a few hundred feet, where an attempt should be made to locate it and trace it up the hill, as it may be identical with one of the veins on the *Upland* and *Mayflower* claims.

The property is very favourably situated as regards transportation, as a motor-road down to the *Henderson* could easily be constructed and the distance, allowing for a reasonable grade, should not exceed 2 or 3 miles.

This group is situated on the south-west slope of Hudson Bay mountain, adjoining the *Upland* and *Jessie M.* claims of the *Mayflower* group on the south, being situated between elevations 3,500 and 5,400 feet. It consists of the following six claims: *Alice*, *Manitoba*, *New Nee pawa*, *Nee*, *Pa*, and *Wa*, and is owned by L. S. McGill and associates.

The main showing is situated well above timber-line on the *Alice* claim, at an elevation of 5,500 feet, and consists of a vein which can be traced on the surface for over 1,000 feet. It has been trenched across in various places and, at about half-way down, has been drifted on for a distance of 36 feet. The strike is N. 18° E. and dip 85° west. A width of 3 feet of vein-matter containing a fair proportion of disseminated arsenopyrite is showing in the face. A sample from this place across 3 feet next the foot-wall showed upon assay traces only of gold and silver.

Approximately 1,000 feet down the hill on the *Manitoba* claim, at an elevation of 5,040 feet, on the same line of strike, a trench has uncovered what may be the continuation of the above vein, but not enough work has been done to form any very definite opinion on the matter. It is fairly well mineralized with zinc-blende, arsenopyrite, and some galena. A sample of selected ore from the dump assayed: Gold, 0.38 oz. to the ton; silver, 3.8 oz. to the ton; zinc, 6.2 per cent.

A further 2,000 feet down the hill on the *Nee* claim, at an elevation of 4,450 feet, there is a shaft 20 feet deep said to have been sunk in 1912. A long cut was put in subsequently towards the shaft and about 30 feet beneath it. An examination of the dump showed rather sparse mineralization, but with a larger percentage of galena than in the upper showings. The strike is N. 15° E.

There were several minor showings on the *Pa* and *Wa* claims, but not enough work has been done to enable an opinion to be formed as to these. More work should be done on the showings on the *Manitoba* claim, as this appears to be the most promising, and an attempt made to trace the vein up to the *Alice* claim.

This group of eight claims is owned by G. Raymond, P. Berg, and H. C. Wade and is situated on the eastern slopes of Hudson Bay mountain. It is reached by a branch trail from the *Empire*, the distance from Smithers being about 4½ miles. The showing consists of a replacement fracture in andesitic volcanics, mineralized with pyrite, galena, zinc-blende, and some grey copper.

A short crosscut adit-tunnel at elevation 4,450 feet has been driven for a distance of 20 feet and has cut a lens of galena with grey copper, 10 inches wide. The strike is N. 40° W. and dip 80° south-west. A sample from this place assayed: Gold, 0.10 oz. to the ton; silver, 122 oz. to the ton; copper, 1 per cent.; lead, 11.4 per cent. Another crosscut has been started from a point about 200 feet to the south-east to try and cut the fracture at a higher level. At the date of inspection it had advanced about 20 feet. In view of the high silver contents this prospect seems to have possibilities and merits further work. Refer also to the Annual Report for 1928.

Empire.* This group, owned by D. C. Simpson, is situated on the South fork of Simpson creek and consists of four claims. A good trail leads to it from Smithers, which is distant about 6 miles. The drift from the crosscut at elevation 4,735 feet has been continued on the vein for a total distance of 63 feet on a bearing S. 45° E. (mag.) and dip 75° south-west. The vein varies in width from a stringer to 14 inches and is well mineralized with galena, zinc-blende, and pyrite. A sample from the vein in the face, across 9 inches, assayed: Gold, 0.04 oz. to the ton; silver, 12 oz. to the ton; lead, 7.6 per cent.; zinc, 8.2 per cent.

Another showing at elevation 5,200 feet, at the head of the basin, consists of a wide zone in volcanics striking north-south and dipping west, mineralized with galena and zinc-blende. Very little work has been done, but the zone can be traced on the surface for a considerable distance, and it is claimed that there are good showings farther up the mountain, but at the date of inspection the higher levels were under recent snow, so were not visited. A sample from a small cut across 24 inches of mineralized vein-matter assayed: Gold, 0.30 oz. to the ton; silver, 6 oz. to the ton; copper, 1 per cent.; lead, 25.2 per cent. Another sample from a small cut about 700 feet north across a stringer 5 inches wide assayed: Gold, 0.76 oz. to the ton; silver, 7 oz. to the ton; copper, 1 per cent.; zinc, 23.4 per cent. This zone appears to merit further exploration. Refer also to Annual Reports for the years 1925 and 1928; also Geological Survey of Canada, Summary Report, 1925, Part A.

Yukon.* This group is owned by A. Chisholm and associates and consists of the following eight claims: *McRae, Yukon, Red Cap, Crazy Sue, Wireless, August, Pictou, and Beaver*. It is situated on the north side of the North fork of Simpson creek. On the upper part of the shear-zone referred to in the Annual Report for 1928 the vein has been exposed by a series of cuts and trenches, and at elevation 4,400 feet a tunnel known as No. 1 has been driven for a distance of 20 feet. At elevation 4,320 feet another tunnel, known as No. 2, has been driven for a distance of 50 feet on a bearing N. 40° W. The vein averages about 5½ feet in width and is somewhat sparsely mineralized with arsenopyrite, pyrite, pyrrhotite, and zinc-blende. A sample from the face of No. 2 tunnel, across 36 inches, showed upon assay only traces of the precious metals. A selected sample from the dump, showing arsenopyrite, assayed: Gold, 0.16 oz. to the ton; silver, 0.04 oz. to the ton.

At elevation 4,350 feet and about 70 feet north-west of No. 2 tunnel a shaft has been sunk to a depth of 8 feet. A selected sample from this point assayed: Gold, 0.20 oz. to the ton; silver, 0.2 oz. to the ton. Refer also to the Annual Reports for years 1925 and 1928; also to Geological Survey of Canada, Summary Report, 1925, Part A, page 137.

Glacier Gulch. The owners of this property, S. F. Campbell, Grover Loveless, and Wesley Banta, are taking out a shipment of ore, stoping from the shaft sunk last year by F. H. Taylor, and on November 10th reported that they had about 15 tons sacked. This portion of the workings is fully described in the Annual Reports for the years 1926, 1927, and 1928.

This property was also the scene of an interesting discovery of bismuth minerals by the owners during the year, first identified by the Bureau of Mines. This occurs on the opposite side of the glacial cirque to that on which the silver-lead-zinc showings are situated and in close proximity to the Lake Kathlyn coalfield. Argillites are here intruded by a tongue of fine-grained granodiorite, and the bismuth minerals—sulphide and telluride—occur in a white rock, which is probably the tip of the igneous tongue mentioned. The white rock has the following chemical analysis: Silica, 54.5 per cent.; alumina, 26.5 per cent.; ferric oxide, 0.3 per cent.; calcium carbonate, 10.7 per cent.; the remainder being composed of bismuth minerals. The enclosing rocks are argillites striking N. 50° W. (mag.) and dipping at about 50° south-west. The white dyke containing the bismuth minerals where exposed is of irregular width, varying from a maximum of 5 feet 6 inches to about 1 foot. Its length has likewise not been exposed for any material distance. Bismuth minerals are, at the point of exposure, present over a width of 5 feet, of which a width of 26 inches was found to assay 0.34 oz. gold to the ton, 0.1 oz. silver to the ton, and 8 per cent. bismuth. The tongue of fine-grained granodiorite previously referred to occurs a short distance above this exposure and is pyritized, but the white rock appears to contain only bismuth minerals. Exposures are inadequate to form an opinion as yet as to the commercial significance of this discovery, which is of undoubted interest. The exposure is situated at elevation 3,265 feet, close to the head of the cirque, and about 650 feet above the floor of the latter.

Silver Lake. This group, owned by L. S. McGill and P. Schufer, was optioned during the latter part of the year by W. R. Wilson & Sons. A survey of the group was made during the year, as a result of which, it is understood, it transpired that the discovery supposedly made on the adjoining *Trade Dollar* in 1928 actually lies within the *Silver Lake* boundary. This discovery was described in the Annual Report for 1928 and is mentioned as being close to the boundary-line between these two groups. A description of the *Silver Lake* group will be found in the Annual Reports for 1926 and 1928.

Owing to the high elevation of this property the option was acquired too late in the season to enable actual mining operations to be commenced during the present year, consequently nothing was done beyond making the survey mentioned.

Smithers Copper. This group, situated on the south-eastern slope of Hudson Bay mountain, is owned by R. C. Mutch, S. F. Campbell, and G. E. Loveless. It is distant about 1½ miles from Smithers, from which it is reached by a wagon-road. It lies a short distance north of the *Canadian Citizen* and is apparently a relocation of older stakings.

The mineral occurrence exhibited is that of a sparse copper mineralization, the minerals being chalcopyrite, bornite, malachite, and azurite, which follows the bedding and jointing planes of the purple andesite country-rock.

At 1,975 feet elevation a few open-cuts expose a sparse mineralization of the described character in the andesitic volcanics. Presumably to probe this a tunnel was run in former years 90 feet vertically below this point on a bearing N. 25° W. (mag.) for a distance of 145 feet, without disclosing anything of importance. About 150 feet west of this tunnel and 190 feet vertically above it a tunnel 20 feet in length has been run, which shows a slight copper mineralization following the bedding-planes of the country-rock. A sample of pieces of selected mineral from various exposures assayed: Gold, trace; silver, 3.6 oz. to the ton; copper, 1.8 per cent.

Babine Mountains.

Harvey.* This group, owned by C. G. Harvey and associates, was under option during the year to the Consolidated Mining and Smelting Company of Canada, Limited, but the option has been relinquished. The crosscut tunnel was continued in an easterly direction to a total distance of 392 feet from the portal. At a point 264 feet from the portal a small seam containing some slight mineralization was encountered. This was followed for 70 feet to the north-east and a short raise put up from the end, but without finding the continuation of the surface showings. At the time the option was relinquished the crosscut tunnel was in a light-coloured, almost white, phase of andesite carrying thin layers of pyrite in the fissures and with appreciable gold values.

The tunnel has since been continued by the owners and at the date of inspection a raise had been started. It is possible that the vein is dipping at a flatter angle than anticipated. If so, a vertical raise from the end of the crosscut should quickly prove it. Refer also to the Annual Reports for the years 1918, 1921, 1925, 1926, and 1928; also to Geological Survey of Canada, Summary Report, 1924, Part A, page 34.

Rainbow.* This group is owned by Jas. Wright and partners and consists of three claims —*Rainbow No. 1, Rainbow No. 2, and Bird.* The exact location is shown on the map on page 166 of the 1928 Annual Report. It is distant about 14 miles from Smithers and the Driftwood Creek road leads to it. At elevation 4,000 feet a cut 20 feet long, direction S. 60° E., has been made on broken-up vein-filling containing lumps of chalcopyrite and bornite. The walls, which are intact, are about 4 feet apart. A sample of selected ore from this point assayed: Gold, 1.52 oz. to the ton; silver, 30 oz. to the ton; copper, 8 per cent. Below this point, at elevation 3,850 feet, a tunnel has been driven for a distance of 54 feet on a bearing S. 65° E., and a branch was driven to the north-east for a further 27 feet, without, however, finding the continuation of the showing above. Another tunnel has been run at a point approximately 600 feet to the east, at elevation 3,920 feet, for a distance of 50 feet on a bearing S. 70° E. Here also no ore-body was found.

More work should have been done at the surface open-cut, where the gold values are good, and an attempt should have been made to follow the walls into the solid.

Silver King. On this property, at the head of Driftwood creek, owned by the Babine Silver King Mining Company, Limited, some further work was done during the year, but no extensive development has taken place since that recorded in the Annual Report for 1926.

The Main vein has been traced on the surface by open-cuts at intervals for a distance of upwards of 3,000 feet, covering a vertical range of about 600 feet. But it is not to be inferred that mineralization is necessarily continuous for this distance. In this vein in former years an adit-tunnel about 170 feet in length, starting as a crosscut, was run at elevation 5,150 feet, which disclosed promising mineral, as did the workings at somewhat lower points in the vicinity. It is to this region at a depth of approximately 300 feet that the crosscut is directed at elevation 4,850 feet. The strike of the Main vein is N. 12° W. (mag.) and the dip north-easterly at about 70°, while the crosscut is being run on a bearing S. 42° E. (mag.).

The West vein is exposed by open-cut at elevation 5,000 feet, and the strike is N. 30° W. (mag.) and dip south-west. A new and good cabin has been constructed on the right bank of Higgins creek at a convenient point at elevation 4,690 feet. To facilitate development of this property the owning company has, with the aid of the Department of Mines, constructed a new trail from the Cronin road up Little Joe creek.

Iriquois. This group, owned by P. McPhee, is situated on the mountain between the head of Ganokwa creek and the head of the East fork of Driftwood creek.

The chief mineral occurrence on this property is a well-defined shear-zone in andesitic volcanics of varying width up to a maximum observed width of 4 feet 9 inches. It is well mineralized in places and extends for a considerable distance up the south-eastern and down the north-eastern slopes of the mountain mentioned, being traceable over the summit of the mountain.

Workings are confined to the south-east slope of the mountain and comprise two adit-drifts, at elevations 6,170 and 6,225 feet respectively, and of respective lengths 100 and 75 feet. Mineralization consists mainly of bornite, some chalcopyrite, and much malachite and azurite. As shown by the adits, the vein has a strike varying from N. 40° W. (mag.) to N. 50° W. (mag.) and a dip of from 50° to 57° to the north-east.

The upper adit shows mineral fairly continuous throughout its length. The maximum width is 3 feet, and a sample across this width at the best ore-exposure assayed: Gold, trace; silver, 2.6 oz. to the ton; copper, 13.5 per cent. A sample of selected mineral from the floor of the tunnel assayed 31.2 per cent. copper, but showed only traces of gold and silver. The lower adit-tunnel shows no appreciable amount of mineral.

About 20 feet above the upper adit an open-cut shows a well-mineralized vein 4 feet 9 inches in width. At 6,280 feet, the summit of the mountain and where the vein apexes, the mineralization is not so marked. At lower points on the south-eastern slope of the mountain two other converging shear-zones, very sparsely mineralized, are developed by a tunnel 27 feet long and various open-cuts.

Three small lakes situated at the base of the mountain at elevation 5,150 feet afford a convenient camp-site for the owner. Refer to Annual Report for 1918 (under "Social group") and 1922 (under "Iriquois group").

Lakeview. This property is situated about half a mile east of the *Iriquois*. At elevation of 6,000 feet a strong, well-mineralized shear-zone 5 feet in width is exposed by a shaft about 16 feet deep and drifts from the bottom of the latter for a length of about 35 feet. The strike is N. 45° E. (mag.) and the dip at 69° south-east. The face of the south-west drift shows a width of 18 inches of mixed bornite, quartz, and country-rock.

It is stated that some years ago a shipment of ore was made from this property, further work on which seems justified in view of the strength exhibited. The topography is favourable for obtaining depth by tunnelling.

Silver Saddle. This group is owned by A. T. Harrer and B. F. Messner and is situated to the north of the *Victoria* group on the south-eastern spur of Mount Hyland, the extension of which forms the wide flat ridge between Higgins and Cronin creeks. The chief exposure consists of a well-mineralized quartz vein which varies in width from a few inches to 2 feet, exposed by open-cuts on the north slope of the spur mentioned about 200 feet below the summit. This strikes N. 30° E. (mag.) and dips north-west at a flat angle. Appearances rather suggest that erosion has removed the portion of the vein below this point, and that the apex of this vein is an outcrop exposed on the summit of the spur at elevation 6,650 feet, 200 feet above the open-cuts. The quartz is well mineralized with galena and copper-stains. A selected sample of the mineral assayed: Gold, 1.40 oz. to the ton; silver, 35 oz. to

the ton; copper, 0.5 per cent.; lead, 20 per cent. A few other smaller mineralized quartz veins outcrop on this property.

A description of this property will be found in the Annual Reports for 1925 and 1926. During the year a crosscut tunnel west of the former workings was started at elevation 5,450 feet, and advanced 27 feet on a bearing N. 45° W., of which the first 15 feet is open-cutting.

Little Joe. This group, owned by E. Simpson and J. C. K. Sealey, is situated on the right bank of Higgins creek, about 1 mile below the *Victoria*. At elevation 5,360 feet, about 1,000 feet above the creek on the steep mountain-slope, there is exposed a band of rhyolite which is irregularly mineralized with malachite. At the best mineralized point the width is 25 feet. A sample across this width assayed traces of gold and silver and 0.4 per cent. copper. The owners did not accompany the Resident Engineer on the occasion of this inspection and there may be possibly other showings which were not found. Refer also to Annual Report for 1918 under "*Simpson property*."

Fisher. This group, owned by R. L. Gale and H. C. Lifton, consists of the following claims: *Peacehaven, Happy Home, Fairhaven, Sanctuary Fraction, Pleasant Valley, Enchanted Vale, and Triangle Fraction*. It is situated immediately east of the *Harvey* group and its position is shown on the map on page 166 of the 1928 Annual Report. The property is reached by following a branch trail which leaves the Driftwood Creek road a short distance beyond B. Nelson's ranch. It is distant about 2½ miles from Driftwood creek. The showings lie at elevations from 4,675 to 5,025 feet.

This property is of interest because the mode of mineral occurrence presents many somewhat striking analogies to that of the *Richfield* group (Topley-Richfield Mining Company), and is a great aid to study of the latter, even although there is no mineral-exposure on the *Home* group at present of obvious commercial significance.

The mineral occurrence consists of a shear-zone in porphyritic andesite in the near vicinity of an intrusion of granodiorite. The shear-zone is between 4 and 4½ feet in width and can be traced for many hundreds of feet along its strike of N. 10° W. (mag.). The dip is to the south-west at 63°. The gangue is quartz and country-rock, sparsely mineralized with copper pyrites, galena, zinc-blende, and copper-stain. The country-rock on the hanging-wall side of the vein is altered for a width of from 50 to 75 feet, somewhat resembling "topleyite," although alteration and shearing in this case have not been as intense as at the *Richfield* group. In this case, however, the causative influence, the granodiorite, is exposed, and study of this property is one of the reasons why in the report on the *Richfield* group the view is expressed that mineralization is due to a deep-seated intrusion of granodiorite.

The shear-zone on the *Home* group has been exposed by various pits along the strike and by two shafts 600 feet apart, one of which is 20 feet deep and the other 6 feet deep. A sample of selected mineral from the first-mentioned shaft assayed: Gold, trace; silver, 0.4 oz. to the ton; zinc, 4.5 per cent. On the north-east side of this shear-zone at various points up to elevation 5,025 feet are exposed some other veins consisting largely of quartz, sparingly mineralized with small amounts of galena, zinc-blende, and chalcopyrite.

Babine Bonanza Co. Babine Bonanza Metals, Limited, was incorporated on May 15th, 1929, under Dominion charter, for the purpose of acquiring, among other things, the control of the Babine Bonanza Mining and Milling Company, Limited, which owns the Cronin property. Hand-mining operations were carried on during the year with a small force of men and important ore strikes were made. Complete descriptions of this property are contained in the Annual Reports for the years 1917 and 1920 (containing map) and the Geological Survey of Canada, Summary Report, 1924, Part A. Descriptive matter contained in these reports will not be repeated herein.

The property was inspected on August 19th and 20th. As then viewed the new strikes were on vein No. 2. Tunnel C had been advanced a distance of 72 feet in continuous ore, connecting with tunnel No. 1. The vein-width in this area approaches 7 feet and the width of ore is about 5 feet. A sample taken across this width in the back of the tunnel at what seemed to be the best point assayed: Gold, 0.08 oz. to the ton; silver, 32 oz. to the ton; lead, 22 per cent.; zinc, 18 per cent. Prospects below this region, between tunnel C and tunnel No. 2, a vertical distance of 225 feet, are undoubtedly highly favourable for ore, although proof of continuity can only be afforded by a raise between the levels.

Tunnel B at the time of inspection had been advanced 60 feet on No. 2 vein, of which the first 30 feet showed continuous ore between $4\frac{1}{2}$ and 5 feet in width. The vein appeared to be interrupted by a rhyolitic intrusion where the ore pinched out, and for the remaining distance driven the tunnel swings to the north. Near the face, ore seemed to be coming in again and the prospects generally encouraging. In tunnel No. 1 prospects on No. 2 vein south-west of the crosscut to this vein from No. 1 vein appear favourable. Indeed, it seems not unlikely that No. 2 vein crosses tunnel No. 1 at or near the face.

It is understood that the management is proceeding with the installation of an air-compressor and the operation of the property on a larger scale than recently. The appearance of the mine affords ample warrant for a campaign of active development. The advisability of further development prior to the erection of a mill is clearly indicated. It is apparent that under present metal-market conditions it is most unlikely that any profit can be made from the zinc content of this ore. For example, a 50-per-cent, flotation zinc concentrate containing 8 oz. silver to the ton at market prices of December 31st, 1929 (London zinc, £19.625; New York silver, 46 $\frac{3}{4}$ cents), is worth at Trail \$10.29 a ton. This amount is less, by several dollars a ton, than the cost of transporting this concentrate from the mine to the Trail smelter.

During the year shipments of hand-sorted ore were made, which it is understood are to be continued during the winter.

Assistance has been rendered by the Department of Mines in improving the road to this property from Telkwa and making it passable for winter traffic, but a large additional expenditure is necessary to render this road fit for motor-trucking at all seasons of the year.

TELKWA SECTION.

Features of the year's developments were: The interest shown in the coal areas adjacent to Telkwa; the active prospecting at the headwaters of the Telkwa river; and the cessation of operations at the *Duchess* and *Contention* groups by the Consolidated Mining and Smelting Company of Canada, Limited.

Howson Basin.

Duchess and Contention.—A considerable amount of work was carried on under option at these properties by the Consolidated Mining and Smelting Company, Limited, throughout the year, but this company relinquished its option in the fall.

Grouse Mountain.

Further work has been done on this property by the owner, W. Skelhorne, **Hidden Treasure.** during the year. It is now apparent that the mineral occurrence is a mineralized shear-zone about 6 feet in width striking S. 30° W. to S. 60° W. (mag.), dipping south-east, which intersects a pre-mineral felsite dyke of similar strike, $4\frac{1}{2}$ feet in width, but which dips in the opposite direction at a flat angle. The shear-zone is well mineralized in places; the dyke is sparsely mineralized, doubtless because, although involved in the stresses which produced shearing, it did not fracture so readily as the enclosing country-rock, and so afford such good avenues for mineralizing solutions. By fortuitous chance the owner drove the adit-tunnel, described in the 1928 Annual Report, just at the intersection of shear-zone and dyke, so that as good results could not have been expected as might have been the case had the tunnel been run wholly in the shear-zone. However, the adit, which has advanced a distance of 52 feet (to date September 3rd), gives promise of leaving the dyke at the face, the upper portion at this point being wholly in the shear-zone and showing a mineralized width of $2\frac{1}{2}$ feet. Mineralization consists of galena, zinc-blende, and chalcopyrite. On the surface, about 40 feet above the adit, the shear-zone is well mineralized, but shearing does not appear to extend above this point—not on the same strike, at any rate—and such mineral as exists appears to have a tendency to follow a bedding-plane in the enclosing country-rock. Refer also to the Annual Report for 1928.

Cornu Copia.—It is stated that 40 feet of crosscutting was performed at this property by the owner, J. Oakes.

For further information on properties on Grouse mountain refer to the Annual Reports for the years 1914, 1916, 1923, 1925, 1926, 1927, and 1928.

Dome Mountain Camp.

Bulkley. This group, owned by P. Powers and E. Wilson, is situated about 6 miles south-west of Dome mountain and is distant about 18 miles from Telkwa.

A branch trail about 1 mile in length leads to it from the Dome Mountain road. The mode of mineral occurrence exhibited is that of a sheared and mineralized belt of volcanic rocks, 20 to 40 feet in width, exposed by three open-cuts in a length of about 500 feet. Mineralization consists of pyrite with smaller amounts of magnetite, and a little zinc-blende and small amounts of copper minerals. While at one point the sulphide mineralization is quite heavy, unfortunately assays of samples taken failed to disclose other than traces of precious metals and copper and only small amounts of zinc. Mineralization is in part a dissemination and in part a replacement following the bedding-planes of the country-rock. The general trend is N. 65° E. (mag.).

At elevation 4,200 feet on the left bank of a small unnamed creek open-cuts and a very short tunnel show the character of mineralization extending over a width of not less than 20 feet, and possibly the full width is greater than this. This strikes N. 65° E. (mag.), and about 200 feet distant in this direction on the right bank of the same creek a large open-cut exposes a very heavy mineralization of pyrite, with lesser amounts of magnetite and zinc-blende and slight copper-staining. At this point there is marked shearing in a direction N. 80° E. and dipping north-west at about 60°. The bedding-planes of the enclosing volcanic country-rock strike S. 50° E. and dip 25° to the south-west. The mineralization here is mainly a replacement following the bedding-planes, which are crossed by the shearing. Inasmuch as one bed may be richer than others, a tunnel following the shear cutting across the bedding-planes would cut such rich bed if present.

A sample taken across a width of 6 feet of practically solid sulphide at this point assayed traces only of gold, silver, and copper, and 1.2 per cent. zinc. Distant about 300 feet in the direction of the shear an open-cut discloses what is probably the continuation of the same mineral-zone.

About 150 feet down-stream from this point another smaller open-cut exposes somewhat similar mineralization, possibly a parallel zone. A little further work at this point would seem advisable. A sample was also taken of selected mineral from the first exposure above mentioned, which showed upon assay traces of gold and silver and 2.2 per cent. zinc. About 1,000 feet in a direction N. 40° W. (mag.) from these exposures is an outcrop of slightly mineralized diorite.

Deep Creek.

It is understood that a considerable amount of work was done on the *Ivanhoe* group by Alex. Chisholm, but time did not permit of inspection.

Telkwa River.

At the headwaters of the Telkwa river occurs the eastern contact-zone of the Coast Range batholith with the volcanic rocks of the interior. As exemplified by the *Big Four*, *Kitchener*, and *Grandview* groups, the mode of mineral occurrence is essentially that of flat-dipping gold-quartz veins mineralized with galena, zinc-blende, and chalcopryrite. It would seem that such veins characterize an east and west belt of country extending west of the Telkwa River headwaters to the region in the vicinity of Usk and Terrace. It is to be noted, however, that the *Grandview* vein system differs from that of the *Big Four* and *Kitchener* in containing good silver values to the unit of base metal present.

Grandview. This group, owned by T. Riley and associates, is situated on the east side of Milk creek, at the headwaters of the Telkwa river, and is distant about 35 miles from Telkwa. It is reached by following the Telkwa River trail (of which the first 17 miles from Telkwa is a motor-road) to Milk creek, from which a branch trail leads up the left bank to the property. It is in part, at any rate, a relocation of the old *Surprise* group, on which additional veins were found during the year.

The showings are above timber-line at elevations of between 5,300 and 5,900 feet and consist of a number of quartz veins, varying in width from a few inches up to 5 feet, with flat dips (in the neighbourhood of 30°). These are mineralized with galena, grey copper, chalcopryrite, pyrite, arsenopryrite, and copper carbonates. While mineralization is not heavy, silver values to the unit of base metal present are encouraging. Low gold values are also present. The

country-rock is volcanic (Hazelton series) intruded by granodiorite. The old showings on this property are fully described on page 91 of the 1920 Annual Report under "*Surprise*."

During the year further quartz veins were discovered on the Milk Creek slope of the mountain, of which the most important is a vein between 4 and 5 feet wide at elevation 5,300 feet. This strikes N. 30° W. (mag.) and dips north-east into the hill at a flat angle. Exposure is by natural agencies. Mineralization is sparse and mainly confined to a seam of galena about 3 to 4 inches in width in the centre of the vein. A sample taken across the full exposed width of the vein assayed: Gold, 0.1 oz. to the ton; silver, 15.6 oz. to the ton; lead, 1.8 per cent. Another sample, taken across the galena-seam only, assayed: Gold, 0.12 oz. to the ton; silver, 57.6 oz. to the ton; lead, 20.1 per cent. This exposure is close to the point of intersection of another smaller vein with that described. It is understood that since inspection (June 28th) another vein has been discovered.

Big Four. This group, owned by Alex. Chisholm, is situated about 2 miles by trail from the point at which the Telkwa River trail crosses Milk creek. It lies west of Clear creek and the showings, situated at elevations of about 3,500 feet, overlook the Telkwa River valley. There are several strong outcrops of quartz mineralized with galena, chalcopyrite, zinc-blende, and pyrite occurring within a small area at about 3,500 feet elevation in timber.

On each of two veins, about 750 feet apart, a shaft has been sunk, one of which seems to be about 60 feet deep and the other 15 feet, but neither could be inspected owing to water at the date of visit (June 29th). Between these two veins are other strong outcrops which appear to hold more promise than those on which the shafts have been sunk and on which some further work might be done to better expose them. A sample of selected mineral from one such assayed: Gold, trace; silver, 1.8 oz. to the ton; copper, 0.3 per cent.; lead, 19.8 per cent.; zinc, 1.3 per cent. Refer also to the Annual Reports for 1914, 1917, 1920, and 1926.

Kitchener.—An account of this property will be found in the Annual Report for 1925. Some further work was done by the owners during the year.

Hunter Basin.

A full description of this basin will be found in the Annual Report for 1914 and further mention in the 1925 Annual Report (with map). Some further work was done during the year by O. A. Riegler on his properties, the *Hunter* and *Riegler* groups.

HOUSTON SECTION.

Chief interest in this section has been centred in the operations of the Owen Lake Mining and Development Company, Limited, an interest in which was acquired by Noah H. Timmins, of the Hollinger Consolidated Mines, in June. This operation had the effect of inducing much prospecting in the surrounding area.

With the aid of the Departments of Mines and Public Works, the Owen Lake Mining and Development Company, Limited, constructed a road to its property from Houston, following the Morice river and Owen creek. The grade is excellent, but much remains to be done before this road can be used for motor-trucking, except in winter. This road also forms one of the links in the route from Kimsquit, on the Dean channel, via the Sakumtha pass to Canadian National Railway points.

Owen Lake.

The most important holdings of this company are the options on the *Silver Owen Lake Mining Queen*, *Diamond Belle*, and *Midnight* groups; neighbouring claims are held and Development in part by staking and in part by option. Persistent development has been carried out during the year. Preliminary investigation consisted in sinking the shaft on the *Diamond Belle* to a depth of 85 feet and drifting from the bottom east and west for a total distance of 120 feet. These workings were full of water at the time of inspection, but results obtained are stated to have been satisfactory. After this preliminary work attention was mainly focused on running a 6- by 8-foot crosscut tunnel at elevation 2,636 feet (175 feet above Owen lake) to penetrate the *Silver Queen* and *Diamond Belle* vein systems at depth. This tunnel is 284 feet vertically below the adit-drift on the *Silver Queen* No. 4 vein and approximately 514 feet below the collar of the *Diamond Belle* shaft. It is run on a bearing N. 58° E. for the first 2,200 feet, at which point it was diverted to the left

McKay

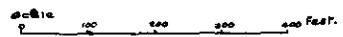
Wrinch
Elev. 2920'

Wrinch
Creek

OWEN LAKE MINING AND DEVELOPMENT CO., LTD.

OWEN LAKE, OMINECA MINING DIVISION.

With Report of D. Lay, 1929.
Resident Mining Engineer
Hazelton, B.C.



To Owen Lake

Powder Magazine

Road
To Hazelton

Fuel Oil

Water

Compressor

Black
Smith

Waste

Portal El. 2636'

Assay
Office

Fuse
House

One Bin

One dump

Powder House

Owen Lake 1/4 mile Elev. 2460'

on a bearing N. 4° E. in order to cut the *Silver Queen* vein system (this system is referred to by the mine management as the "Wrinch" system) nearer the ore exposed on that property than would have been the case had the original bearing been continued. Besides running this crosscut tunnel, a considerable amount of drifting was carried out on the veins penetrated by it and exploratory work in connection therewith.

When inspected on November 7th and 8th the main crosscut had reached a point 2,330 feet from the portal and had penetrated eleven veins (numbered from No. 1 to No. 11 in the order in which they were encountered), all virgin possibilities. By December 31st this tunnel had reached a point 2,765 feet from the portal and had penetrated two additional veins, members of the *Silver Queen* system—No. 12 at 2,665 feet, presumed to be No. 2 vein of the *Silver Queen* system, and No. 13 at 2,760 feet, presumed to be No. 3 of the same system. The identification of the veins struck in the crosscut with the respective members of the *Silver Queen* system cannot as yet be regarded as positive.

The property was again visited on February 9th and 10th, 1930, for the purpose of inspecting the recently penetrated veins, Nos. 12 and 13. At this time the face of the crosscut had advanced a distance of 170 feet from the foot-wall of No. 13 vein, or a total approximate distance of 2,930 feet. The face of the tunnel gave every indication of nearness to another vein. This is the point at which No. 4 *Silver Queen* vein is expected.

Veins Nos. 1 to 11.—The exact position of the first eleven veins encountered is shown on the accompanying plan (except No. 8, which does not seem important). Of these, Nos. 1, 3, 4, 7, 9, and 11 are the most important. The first three mentioned were followed east of the crosscut and at a comparatively short distance from the latter exhibited very nice exposures of ore, especially No. 1, so much so as to justify high hopes as to continuity on this level. Unfortunately these hopes were not realized and a somewhat complicated fault system was encountered within but a short distance of the main crosscut, which terminated very fine exposures of ore in an easterly direction. A considerable amount of investigation was carried out in this region, but no further ore of importance was subsequently met with. It would, however, seem advisable to continue the foot-wall drift on No. 1 vein a little farther east. The very fine exposures of ore in this region warrant exploration at depth by winze or by diamond-drilling.

These veins vary in width from 4 to about 11 feet. The character of the mineralization is that of lenses of chalcopryite, with quite subordinate amounts of sphalerite and galena. The silver-carrier appears to be chalcopryite and not the sphalerite or galena. A sample of selected chalcopryite taken from No. 1 vein assayed: Gold, 0.5 oz. to the ton; silver, 140 oz. to the ton; copper, 21 per cent. On the other hand, a sample of selected sphalerite showing galena from the same region assayed: Gold, 0.04 oz. to the ton; silver, 2.6 oz. to the ton; lead, 1 per cent.; zinc, 21 per cent. Gangue-minerals are siderite, quartz, country-rock, rhodochrosite, rhodonite, and chalcedony. While these veins are typical shear-zone replacements, banded structure is frequent. This character of ore lends itself to hand-sorting (although strictly of a type that requires beneficiation by milling), and when these veins were first discovered ore-sorting operations were started with a view to making a shipment. Hopes in this direction were frustrated by pinching-out of ore in the drifts.

Vein No. 7 showed in the crosscut as a strong fracture 4 to 5 feet wide and fairly well mineralized with chalcopryite, but the result of following it eastward for 115 feet was not promising. Vein No. 9 shows as a narrow but well-mineralized fracture up to 18 inches in width and has been followed mainly east of the crosscut. Vein No. 11 shows persistent mineralization up to 18 inches in width and was followed west of the crosscut for about 215 feet. A feldspar-porphry dyke was passed through and mineralization picked up beyond, but no great promise was shown by this drift.

Silver Queen Vein System.—No. 12 vein strikes N. 70° W., dips north-east at about 65°, and is 9 feet wide where penetrated by the crosscut. As shown by an east drift 15 feet long and by a west drive 35 feet long, this vein shows a marked tendency to narrow eastwards and widen westwards. In the west drift the width of the vein is probably not less than 13 feet and it is well mineralized with sphalerite and a little galena, and to a lesser extent with chalcopryite, the cupriferous portion being next the hanging-wall. In the west drift the walls are seen to be diverging. The vein is a characteristic shear-zone replacement. The gangue-minerals are siderite, rhodochrosite, and some quartz, besides country-rock. There are numerous small cavities in the vein. While copper and silver values are low on the average, the vein exhibits

great strength and well merits following westwards in anticipation of finding a higher copper and silver content.

A chip sample taken from the west drift, more or less representative of a width of 10 feet, assayed: Gold, 0.08 oz. to the ton; silver, 6 oz. to the ton; lead, *nil*; zinc, 9.6 per cent; copper, *nil*. A composite sample resulting from milled samples taken by the company, more or less representative of the vein in the west drift from foot-wall to hanging-wall, assayed: Gold, 0.03 oz. to the ton; silver, 4.4 oz. to the ton; lead, *nil*; zinc, 8.5 per cent.; copper, *nil*. Although assays do not show copper or lead, these metals are undoubtedly present in small amounts.

No. 13 vein is 17 feet in width where penetrated by the crosscut, but mineralization is almost entirely confined to a width of about 3.6 feet on the foot-wall and consists of sulphides of iron, zinc, and copper. This portion of the vein has received the minimum of shearing and is composed of silicified volcanic rock and is intensely hard and free from cavities. The remaining portion of the vein consists of a breccia, unmineralized, save for slight pyritization, containing many cavities, large and small. While locally the fragments are well cemented with silica, there are so many large cavities that the crosscut required timbering in the region occupied by this vein. The strike is N. 25° W. and dip north-east. Had slowly-circulating carbonated magmatic waters containing sulphides in solution, which have clearly originated the type of mineral-deposit on this property, found a channel in No. 13 vein at this point, the mode of mineral occurrence would have been identical with that exhibited by No. 12 vein. A sample taken by the mine staff across the mineralized portion of this vein across a width of 3.6 feet assayed: Gold, 0.08 oz. to the ton; silver, 1.13 oz. to the ton; copper, 1.79 per cent.

The geology of this region and the vein system of this particular property were the subject of detailed study by George Hanson and A. H. Lang, of the Geological Survey, whose report will be awaited with much interest. It may, however, be stated that the country-rock passed through by the crosscut appears to be mainly porphyritic volcanics of andesitic type, although some are more basic than this and some distinctly more acid. The rock in the vicinity of the present face is a highly siliceous fragmental volcanic of possibly tuffaceous origin. These rocks are intruded in places by gabbro or a gabbroid rock and by numerous feldspar-porphphyry dykes.

The veins are typical shear-zone fissures, which are offset by many faults, pre- and post-mineral. Very little as yet is known of any of the veins save those of the *Silver Queen* system, and in this case the evidence is rather meagre. But there is reason to anticipate that the veins of this system are likely to persist for considerable distances, and while they are likely to follow a zigzag course due to minor faulting, the strike as a whole remains fairly regular. A marked characteristic of the mineralization is the rhodochrosite content of the gangue. Siderite is also present. It would seem that the manganese content has been derived, by circulation of carbonated magmatic waters, from the ferro-magnesian silicates present in the batholithic intrusive. The possible influence of manganese on the precious-metal grade in depth is a matter of great interest. The sulphides present are chalcopyrite, sphalerite, galena, and pyrite. Precious-metal values, essentially silver, apparently are carried almost entirely by the chalcopyrite. From the widespread occurrence of the siderite-manganese gangue-minerals, the invariable concomitants of the sulphides, it is inferred that the latter are also likely to extend for considerable distances within the veins, but the commercial extent can only be ascertained by development. For example, No. 12 vein is well mineralized where cut by the main crosscut at a point about 500 feet east and about 250 feet vertically below its point of exposure on the *Silver Queen*.

The following points regarding this property appear worth bearing in mind:—

(1.) One of the main objectives which warranted development of this property—namely, the *Silver Queen* vein system—has now been reached. Broadly speaking, it is penetrated by the main crosscut at a point 300 feet east of the most easterly exposure of ore in the adit-drift on the *Silver Queen*, and about 300 feet vertically below this point, which is in itself about 250 feet below the apex of the vein. The behaviour of a vein system in depth cannot be fully gauged by the mere point penetration of the crosscut. A considerable amount of drifting, at any rate, on the more promising members will naturally be required before an intelligent opinion can be formed as to commercial possibilities. The results obtained to date respecting the *Silver Queen* vein system are far from discouraging. No. 12 vein is a large, strong, well-mineralized vein and clearly warrants development.

(2.) Known exposures of ore in the *Silver Queen* system being west of the crosscut tunnel, naturally in the absence of some clear reason to the contrary, drifting west of the crosscut would

first be carried out. There is, however, another reason for westerly driving. In view of the fact that Wrinch creek appears to follow a major fault-zone it would seem advisable finally to ascertain the behaviour of the system west of this.

(3.) While development of the veins met with in the main crosscut, apart from those of the *Silver Queen* system, has so far proved disappointing, these are issues which are quite distinct from and in addition to those concerning the objectives which originally warranted development of this property. Further, it must be borne in mind that development of these veins has only been at one horizon. The fine exposures of ore in No. 1 vein certainly warrant probing in depth.

(4.) The manganese content of the veins is such as to raise the question of commercial possibilities. In the installation of efficient plant, and conduct of operations generally, there is reflected competent technical direction, and much has been accomplished at this property in a comparatively short time and in the face of transportation difficulties. Refer also to the Annual Report for 1928, in which also will be found references to all reports in which the *Silver Queen*, *Diamond Belle*, and *Midnight* groups are mentioned.

This group, owned by F. H. Taylor, P. Pouport, and C. Hansen, is situated in the pass between Nadina mountain and a mountain lying to the north of the latter and is distant about 7 miles in a direct line north-west of the camp of the Owen Lake Mining and Development Company, Limited. It was discovered during the year by P. Pouport while prospecting for F. H. Taylor. A good trail leads to it, about 8 miles in length, from a point about a quarter of a mile below Owen lake, crossing Owen creek at this point.

Exposures which lie at elevations of about 4,100 feet exhibit two different types of mineralization. At one point there occurs a dissemination of pyrrhotite and chalcopyrite in volcanic breccia and at another point a shear-zone 10 feet in width shows copper-stain and a small amount of molybdenite. These both occur within 300 feet of an intrusion of diorite in interbedded volcanics and sedimentaries.

At elevation 4,140 feet open-cuts expose interbedded volcanic breccia and quartzite. The former are well mineralized over a width of between 40 and 50 feet with pyrrhotite and chalcopyrite; exposure is by open-cuts at intervals across this width. A sample taken at this point across 45 feet assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, 0.4 per cent. About 125 feet north of this the volcanic breccia outcrops and is also seen to be mineralized similarly at one point. About 350 feet in a direction due east (mag.) of this point occurs an outcrop of medium-grained diorite. About 300 feet in a direction S. 70° E. (mag.) from the latter, at elevation 4,185 feet, two large open-cuts expose a shear-zone about 10 feet in width in rhyolite and quartzite beds. The shear-zone strikes N. 15° E. (mag.) and dips south-east, and is mineralized with azurite and malachite, some pyrite, and a little molybdenite. While there is evidence of intense shearing at this point, proof of continuity is not shown on the surface. Further work at this point is well warranted, however. A sample taken across a width of 10 feet at this point assayed: Gold, trace; silver, 6.8 oz. to the ton; copper, 0.9 per cent.

Peacock Creek.

Peacock creek is a northerly-flowing tributary of the Morice river, which is crossed by the Owen Lake road about 7 miles from Houston. Some years ago a considerable amount of work was done by C. P. Price (better known as "Kid" Price) on some copper-showings on the upper reaches of this creek, and this area was this year again the scene of considerable prospecting and staking by J. Quinn, M. Morrison, J. Fraser, and E. G. Bellicini. Groups staked were the *Copper King*, *Morrison*, *Peacock*, and *Puro Argenta*. No showing of obvious commercial significance was seen, although Price's earlier efforts were directed to mining a narrow quartz vein well mineralized with copper sulphides carrying high silver values.

The region lies in a direct line about 10 miles south-west of Houston and is reached by a very fair trail branching off the Houston-Wistaria road at a point 2 miles from Houston. The distance from Houston by trail is about 12 miles. At the end of the trail is a cabin built originally by Price which serves as headquarters for prospectors.

This group covers the original location of "Kid" Price and is owned by **Peacock.** J. Fraser. On the right bank of Peacock creek, at elevation 3,950 feet, there is exposed a narrow seam of quartz and copper sulphides a few inches in width, striking N. 65° E. (mag.) diagonally across the creek. On the left bank of the creek on

the line of strike a shaft was sunk in former years by Price, who evidently went to some pains to flume the creek round the collar of the shaft, which is now full of water.

A sample of a small pile of mineral lying close to the collar of the shaft assayed: Gold, 0.06 oz. to the ton; silver, 166 oz. to the ton; copper, 10.1 per cent. The country-rock is an andesitic volcanic, but a short distance down the creek from the shaft graphitic argillites are exposed.

Copper King. This group, owned by J. Quinn and M. Morrison, adjoins the *Peacock* upstream. About a quarter of a mile above the shaft sunk by "Kid" Price volcanic rocks are exposed on the left bank of the creek which in places are slightly pyritized. A sample taken at the best-mineralized place across a width of 15 feet assayed: Gold, trace; silver, 0.2 oz. to the ton; copper, *nil*. About a quarter of a mile higher up the creek, close to the junction of a tributary creek, there is exposed a quartz stringer 6 inches in width showing copper pyrites. A sample across this width assayed: Gold, trace; silver, 0.8 oz. to the ton; copper, 0.5 per cent.

Region North of Houston.

B.C. Leader. This group, owned by Paul Tickolees, is situated on the mountains, the characteristic of which is maturity of relief, lying between the Bulkley valley and the valley to the north through which the Government telegraph-line passes. The elevation of the summit of this range is about 4,100 feet. The property is reached by a trail which leaves the main road about 4 miles east of Houston.

The mode of mineral occurrence exhibited is that of a dissemination of the minerals, galena, zinc-blende, copper pyrites, and iron pyrites in volcanic porphyritic breccia country-rock. On the whole, mineralization is somewhat sparse, although more promise is exhibited at one or two points. This type of mineralization is exposed by various open-cuts on the north slope facing the valley through which the Government telegraph-line passes; and at a point about 1 mile distant in a south-westerly direction on the south slope, by a short tunnel and open-cuts.

The open-cuts on the north slope are situated between elevations 3,500 and 3,685 feet. Open-cut known as No. 5 at elevation 3,500 feet shows a somewhat sparse disseminated mineralization of the described minerals. Distant about 300 feet from this in a south-westerly direction, at 3,585 feet elevation, open-cut No. 4 shows a narrow seam of galena and zinc-blende in country-rock in which the disseminated mineralization occurs. A sample of this narrow seam assayed: Gold, 0.09 oz. to the ton; silver, 3.8 oz. to the ton; lead, 20.8 per cent; zinc, 40.4 per cent. Open-cut No. 3A at 3,660 feet elevation shows a good mineralization of malachite, azurite, and a little galena and zinc-blende. Manganese minerals are also in evidence. A sample of selected pieces from this cut assayed: Gold, trace; silver, 5.2 oz. to the ton; copper, 1.8 per cent. Open-cut No. 3 at 3,685 feet elevation and about 175 feet west of cut 3A shows a better mineralization of zinc-blende and galena, no copper, and manganese minerals. A sample of selected ore from this cut assayed: Gold, trace; silver, 0.5 oz. to the ton; lead, 1.2 per cent.; zinc, 17 per cent.

About 1 mile south-west of the above-described showings, on the south slope, at elevation 3,820 feet, a tunnel is run 22 feet on a bearing N. 35° W. (mag.), showing a sparsely disseminated mineralization in the volcanic country-rock.

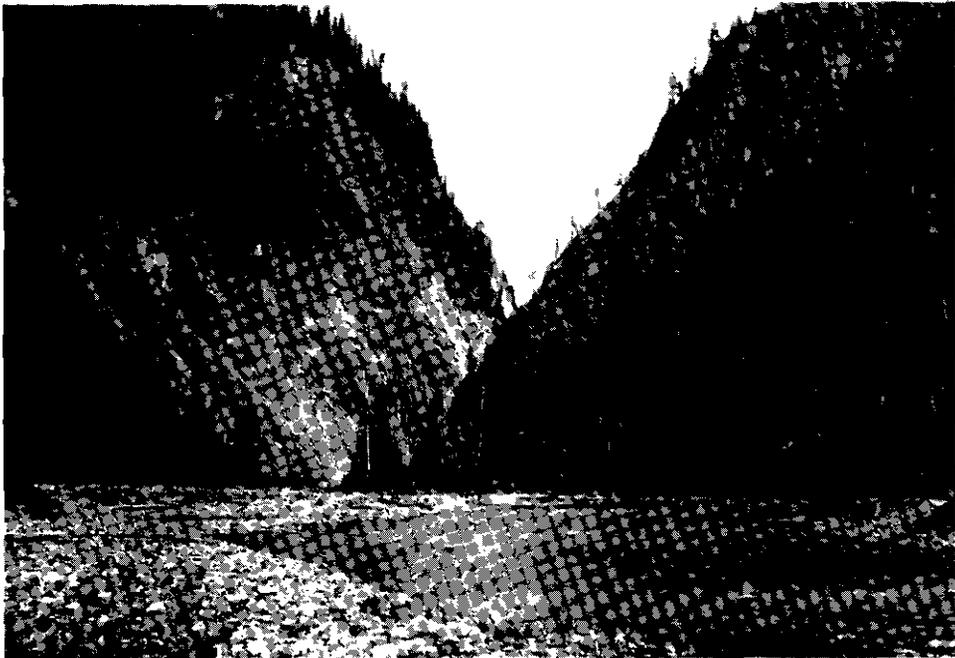
Mikado. This group is also owned by Paul Tickolees and adjoins the *B.C. Leader*. It is situated on the Bulkley Valley slope. At elevation 3,785 feet various open-cuts on the steep hillside show a little chalcopyrite, bornite, and malachite in the cracks and jointing-planes of the volcanic country-rock. Mineralization appears to trend N. 45° W. The width cannot be ascertained from exposures, but the mineralization is not heavy. A sample across 2½ feet at the best exposure assayed: Gold, trace; silver, 1.1 oz. to the ton; copper, 0.4 per cent. Paul Tickolees, the owner of these properties, has, single-handed, accomplished much work.

Morice Lake.

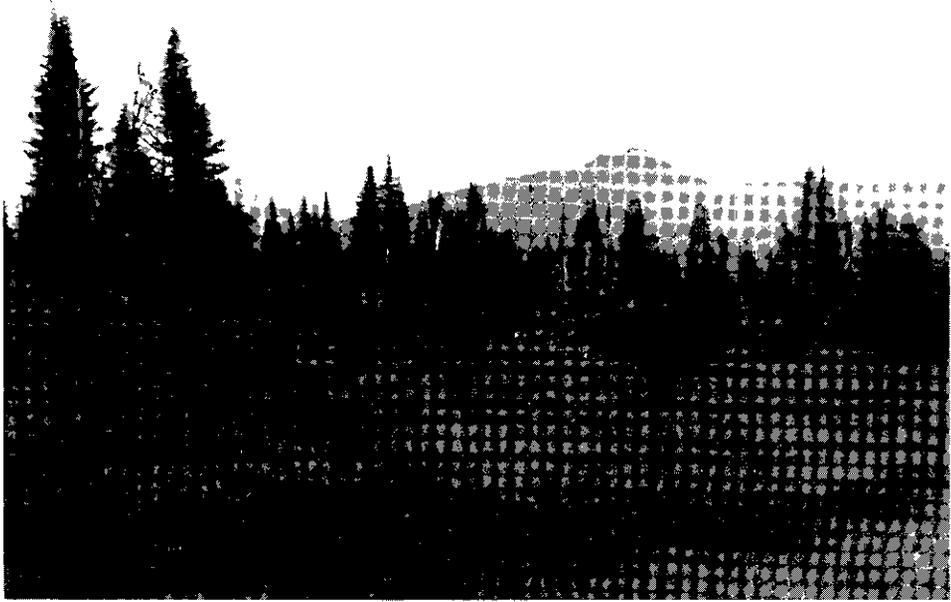
To inspect certain reported showings of coal and mineral and for purposes of general reconnaissance a trip was made in July through the area between Morice lake and the South fork of the Zymoetz river. This region, on the eastern fringe of the Coast Range batholith and previously known to be of general geologic promise, had not hitherto been visited by the Resident Engineer.



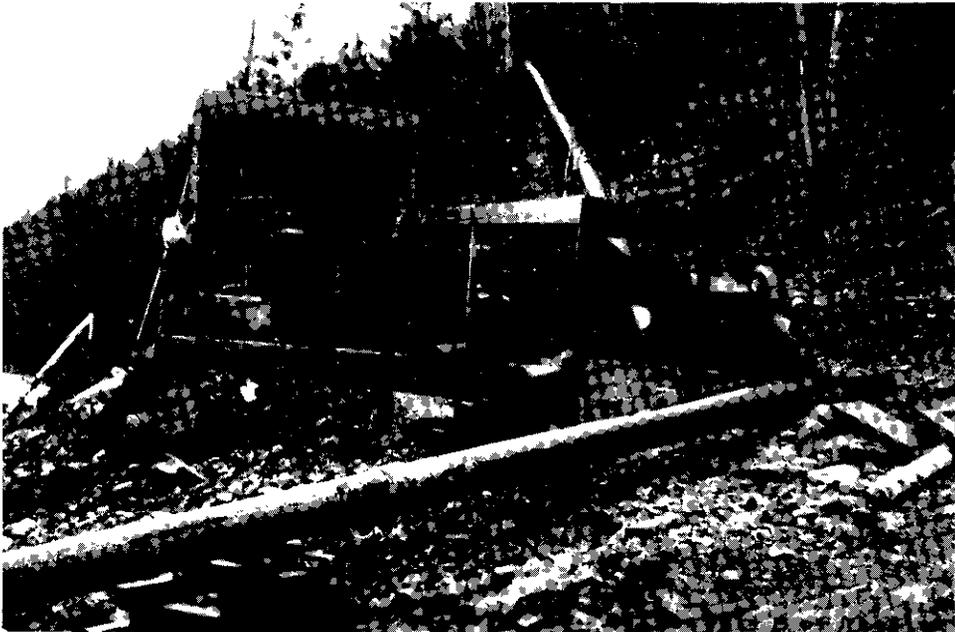
Zymoetz River, South Fork.



Zymoetz River and Birnie Creek.



Snowshoe Plateau, Omineca M.D.



Placer Pump Hydraulic Mine.

While it is possible for expert rivermen to navigate the Bulkley and Morice rivers in small craft powered by outboard motor, and to reach Morice lake from Houston by this means, this method of travel was not possible at the time the trip was undertaken, no motor-boat being available.

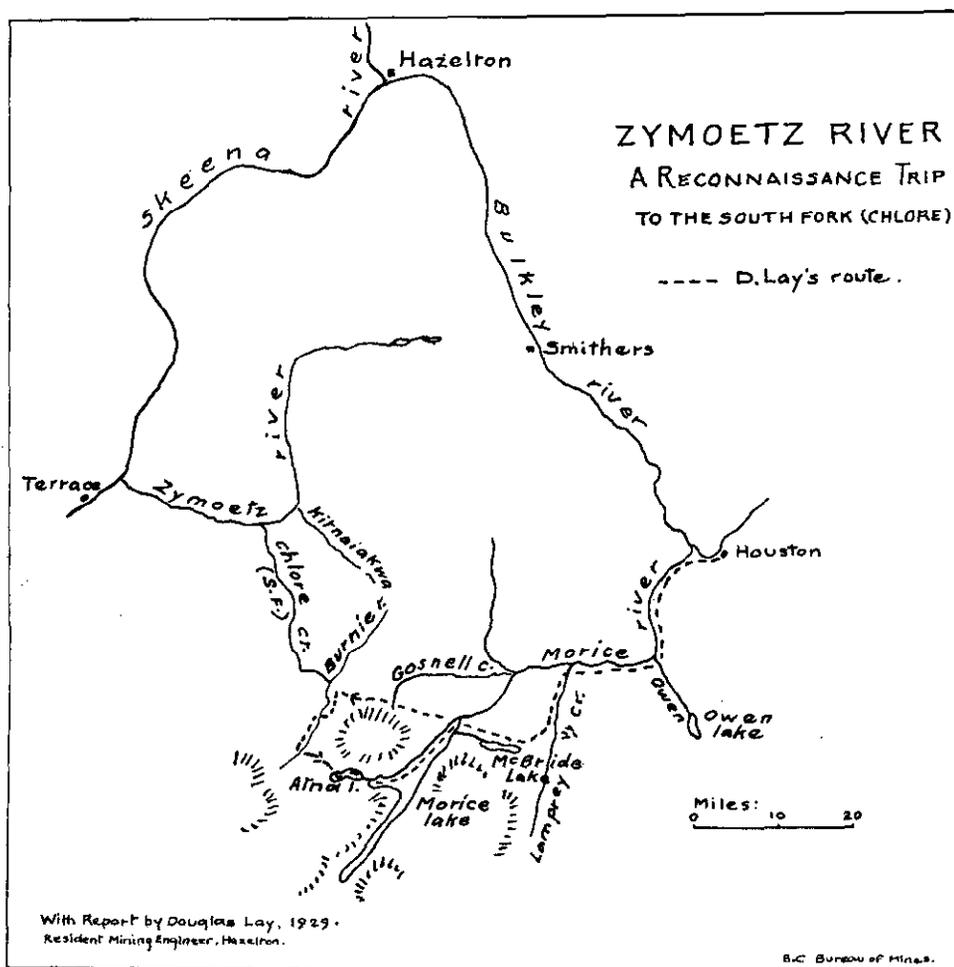
The route followed from Houston to Morice lake was via the Morice River trail, with pack-horses, to the north-east shore of Morice lake, a distance of about 55 miles, occupying two days. It might be mentioned that completion of the Houston-Owen Lake road will enable a car to be taken to Owen creek, a distance of about 20 miles from Houston, and render the Morice Lake region much more accessible. The Morice Lake trail crosses Owen creek at the junction of that creek with the Morice river, thence follows the right bank of the Morice river as far as Lamprey creek. The trail then crosses this creek and follows it up to the headwaters, swinging westward at this point and following along the north shore of McBride lake (known locally as Long lake) to a camping-ground on the east shore of Morice lake close to the north end. There is very fair feed at this spot for horses. The grade of the trail from Owen creek onwards is excellent, through comparatively flat country with good meadows en route for camping. Although there is not a great deal of travel over this trail, it is in fair condition save in spots, and an expenditure of \$500 would put it in first-class condition.

Pack-horses were left, together with food-supplies, at a base camp on the north-east shore of Morice lake in charge of one man, S. N. Long, and the other members of the party, comprising H. McLean (whose local geographical knowledge is excellent and skill in the backwoodsman's craft proverbial), J. R. Reynolds (also a skilled backwoodsman), and the Resident Engineer, continued on the journey. Morice lake was crossed by raft, and from the north-west shore of the lake a direct line was as nearly as possible followed across the congeries of mountains which occupy the region to the junction of the Birnie and South fork of the Zymoetz rivers. This route proved arduous and the objective was not reached until the third day from the start. The deeply dissected country in which flow Gosnell creek and its tributaries makes travel very difficult. It is apparent that Gosnell creek, which drains a large watershed and is a large stream, is in reality the West fork of the Morice river, and that even although Morice lake were dammed at the east end to divert the waters to the Pacific coast, much water would continue via Gosnell creek on its present course to the Bulkley river.

At the junction of the Birnie and South fork of the Zymoetz rivers there is exhibited the remarkable natural phenomenon of a "head-on" collision, so to speak, between two rivers. Both these rivers occupy precisely the same valley; there is hardly a foot difference in the alignment of their respective banks; the former flows south-west and the latter north-east. After meeting they flow at right angles to their former direction through the canyon, which is of considerable length and known as the South Fork canyon.

Coal.

It is in the immediate vicinity of the junction of the Birnie and South Fork rivers that the existence of coal was reported, the investigation of which formed one of the specific purposes of this trip. The so-called coal-measures extend for a distance of some 4 miles up the South fork from its junction with the Birnie river, and are also said to extend down the South fork in the canyon for some distance from the junction. These rivers cannot be crossed at this point, so that rocks could only be examined on the right bank of the South fork, where they were inspected at intervals for a distance of about 4 miles. Rocks of the same character were also viewed from a distance, which form the right wall of the canyon just at the junction of the rivers. No exposures of true coal, or even a close approach to it, were seen. An examination of the rocks in the area shows clearly that volcanic rocks and sedimentaries, mainly graphitic shales and sandstones, are interbedded; that is to say, there have been alternate periods of vulcanism and sedimentation. In places volcanic dykes are seen cutting the formation. Beds of sheared graphitic shale (some of which contain included large fragments of volcanic rock) are of frequent occurrence; and it is apparently these beds which were either mistaken for coal or thought to indicate the likelihood of the existence of such. It is quite possible that there may exist seams of coaly material more nearly resembling true coal than those seen. On the other hand, it must be apparent from the description of this region that it lacks the essential features of a good coalfield.



After examining the above-described region the South fork was followed to a point about 5 miles above its junction with the Birnie river, and a crossing was effected on foot to the north side for the purpose of examining some copper-exposures reported on the summit of a mountain in this region. It might be here remarked that this river can only be crossed on foot at certain seasons of the year, and then only in the morning, when the water is at its lowest. At best the crossing is dangerous, as the river is swift. The party came close to disaster at this point, as H. McLean, who was in the lead at the crossing, came within an ace of being swept away, and to avoid this had to throw his pack into the river. With characteristic agility he scrambled out and, running down the bank of the river, managed to regain his pack, and in doing so discovered a safer place where the party finally crossed the river.

Lode-mineral.

A showing was reported as occurring on the summit of a mountain situated immediately north of the South fork at a point about 5 miles south-west of the junction of this river with the Birnie river. Upon climbing to the spot, however, at an elevation of somewhat over 6,000 feet, the showing was found to be covered with many feet of snow. Some pieces of float were found, which assayed: Gold, 0.005 oz. to the ton; silver, 0.6 oz. to the ton; copper, 1.6 per cent. The formation exposed above timber-line on this mountain was seen to be wholly volcanic. On the lower slopes of this mountain some slight evidence of copper-staining was noted.

After examination of the above-mentioned mountain the return journey to the base camp was commenced. The route followed a survey trail and was along the north side of the South fork to a point about 12 miles above the South Fork canyon. The South fork was crossed to the south side at this point and thence to Atna lake, on which a raft was constructed, by which means the lower end of the lake was reached. Between this and the West arm of Morice lake there is only a short portage. Another raft was built on Morice lake and the return to the base camp so effected. It might be added that the latter route from Morice lake to the South fork of the Zymoetz river is far easier than that followed on the outward journey, although the trail is little more than a blazed line and difficult to follow in places. But it cannot be followed on the outward journey unless some more seaworthy craft than a raft is available on Morice lake, on which the prevailing wind is westerly, against which no headway can be made with a raft. Moreover, on the occasion of this trip it was desirable to cover as much country as possible.

Geological Notes.

From Houston up to the point at which the trail leaves the Morice river all rock-exposures observed were volcanics of the Hazelton series. Between the Morice river and the east end of McBride lake there are few exposures. In the vicinity of McBride lake there are frequent outcrops of sandstone. Along the route followed north of Morice lake the mountains appear to consist almost wholly of volcanics of the Hazelton series. Doubtless there are intrusions of batholithic rock in this region, but torrential rain and lack of time prevented any detailed investigation along the route. In the vicinity of the South Fork canyon sediments and volcanics are interbedded. North of the South fork in this region the formation is largely volcanic. In the vicinity of Atna lake, at the west end, there is a large intrusion of granodiorite. Intrusions of this rock also occur on the north shore of Morice lake at the entrance to the West arm and at a few miles north-east of this point. The opinion formed as a result of this reconnaissance trip was that prospecting should first be confined to the mountains sloping into Morice lake, which are of undoubted general geologic promise, readily accessible, and offer less difficulty regarding transportation than the more distant points.

TOPLEY SECTION.

Important events in this section during the year were the cessation of operations at the *Richfield* by Topley-Richfield Mining Company, Limited, in October; and simultaneous with this, new and apparently important strikes of ore on the neighbouring *Golden Eagle* group, the option on which, held by Topley Silver, Limited, had been relinquished earlier in the year after considerable development and diamond-drilling.

The following is excerpted from a statement issued by the directors of the **Richfield.** Topley-Richfield Mining Company, Limited, to the shareholders in December:

"The resolution which led to the closing-down of operations at the company's property, known as the Topley-Richfield mine, was passed at a directors' meeting in Smithers on October 12th. That decision was only reached after the most careful consideration had been given the interests of the shareholders, and followed the expressed opinions of several mining experts of repute that further work on this property was not justified."

A full description was published in Bulletin No. 1, 1929, of the condition of the property shortly before cessation of operations, but before any diamond-drilling had been undertaken to probe the region below level No. 2. It was pointed out in that report that exploration below level No. 2 was justified. Such exploration was subsequently carried out by diamond-drilling. The results of this are given in the following terms in the above-mentioned statement issued by the directors to shareholders: "Extensive diamond-drilling below the 200-foot level was carried out, with practically negligible results. Instead of showing the improvement below that level which appearances indicated, the opposite proved to be the case." This being the case, the decision to suspend operations is deemed wise. The company appears to be in a healthy condition financially and well equipped to acquire another property. It has already acquired an option on the *Three Star* group, Boo mountain, 10 miles west of Burns Lake, on which preliminary investigation was commenced in the fall.

This group, owned by C. Matheson and D. Heenan, has been under option to **Golden Eagle.*** Topley Silver, Limited, which company constructed camp buildings, installed compressor and pump, and carried out the development recorded in the 1928

Annual Report. After sinking one shaft to a depth of 140 feet a diamond-drilling campaign was undertaken in 1929, and the company subsequently relinquished its option. Since then the owners have done a considerable amount of useful work and have discovered a more or less parallel vein, which strikes N. 55° W. (true). It lies about 70 feet to the south-west of the original vein and on the opposite side to that on which diamond-drilling was done. Since inspection the owners report further important discoveries.

This new vein has been exposed in three places by means of pits over an approximate distance of 250 feet. Pit No. 1 is 8 feet deep and there is exposed in the bottom on the foot-wall 9 inches of well-mineralized vein-matter consisting of zinc-blende and some galena and grey copper. A sample over this width assayed: Gold, 0.20 oz. to the ton; silver, 374 oz. to the ton; copper, 1.8 per cent.; lead, 10 per cent.; zinc, 30 per cent.

Pit No. 2 is 7 feet deep. The vein in the bottom is about 24 inches wide, with 6 inches of almost solid grey copper and galena on the foot-wall. A sample from here over 18 inches assayed: Gold, 0.14 oz. to the ton; silver, 288 oz. to the ton; copper, 1.2 per cent.; lead, 25 per cent.; antimony, 0.5 per cent.

Pit No. 3 is about 8 feet deep on decomposed vein-matter, with unaltered sulphides beginning to come in at the bottom. A sample of selected ore from the dump assayed: Gold, 0.08 oz. to the ton; silver, 212 oz. to the ton; lead, 22.2 per cent.; zinc, 9.2 per cent.

Owing to the flat nature of the ground and its deep covering of loose material, a considerable amount of work has to be done to get down to the solid; and there is also water to contend with, so that tracing the veins is a laborious process. Great credit is due the owners for this discovery. Refer also to the 1927 and 1928 Annual Reports.

This group, owned by E. Hoops and associates, is situated north-west of the *Sheila*. *Golden Eagle* group on the north slopes of Finlay creek. Its exact position will be seen by referring to the map on page 175 of the 1928 Annual Report.

At elevation 3,780 feet a shaft was sunk to a depth of 20 feet, following a mineralized seam in the porphyry-breccia volcanic rock, but the shaft was full of water at the time of inspection. The seam was said to show considerable promise in places. Samples of mineral at the collar of the shaft assayed: Gold, 0.16 oz. to the ton; silver, 1.08 oz. to the ton; lead, *nil*; zinc, 5 per cent.

At the time of inspection a tunnel was being run at elevation 3,525 feet on the right bank of Finlay creek, following from the surface a quartz vein stained with manganese dioxide, the width of which at the face of the tunnel was 10 inches. The tunnel had been run a distance of 15 feet on a bearing N. 64° W. (mag.). A sample of the quartz vein assayed traces of gold and silver.

It would seem advisable to thoroughly prospect the surface of this property in the hope of finding high-grade silver veins. On the adjoining *Cup* group there is some evidence of the possible continuation of the *Golden Eagle* vein system, which would afford justification for continuing the search on the *Sheila*.

This group, owned by C. D. Haven, is situated at the northern end of Black mountain. A tunnel has been run a distance of 40 feet on a bearing S. 40° E. at right angles to a sheared band of porphyry breccia, without disclosing any hopeful mineralization.

Babine Lake.

A description of this property will be found in the Annual Report for 1927. **Richmond.*** It is owned by H. J. Macdonald and associates and is under option to the Consolidated Mining and Smelting Company of Canada, Limited. A campaign of diamond-drilling has been carried on during the year, and although operations were suspended in the fall, it is understood that they are to be resumed next spring.

The following statement regarding this property is contained in the annual report for 1929 of the Consolidated Company:—

“On the *Richmond* group, Babine lake, Omineca district, which was optioned in May, diamond-drilling indicated approximately 8,000,000 tons of ore in one body, assaying approximately 0.01 oz. in gold, 0.15 oz. in silver, and 0.8 per cent. copper. The copper values occurred as chalcopyrite and bornite disseminated through and in fractures in diorite porphyry and quartz-diorite porphyry. In addition to the above minerals, pyrite, magnetite, galena, and



Windsor Lake, Nanaimo B.C.



Producers Sand and Gravel Co. (1929), Ltd., Victoria B.C.

Babine Lake.

Venture. This group is situated on the north side of the lake, about 1 mile east of Marble point. It was formerly known as the "Boling property." Some work was carried on at this property by the Silver Island Mining Company under the direction of H. J. Macdonald, but time did not permit of inspection.

Endako.

Stella.* This molybdenite prospect consists of eleven claims—*Snowbird Nos. 1 to 5, Stella Nos. 1 to 4, and Pineridge Nos. 1 and 2.* A considerable amount of work has been done during the season, but owing to the depth of shattered rock on the surface the work of tracing the veins has proved extremely laborious. The showings, which consist of several quartz veins impregnated with molybdenite and occurring in granite, were as follows: No. 1 vein on the *Stella No. 2* claim at elevation 3,400 feet, where the vein has been cut across and fully exposed. The strike is N. 75° E. and dip 55° south. The foot-wall is granite, followed by 2 feet of quartz well impregnated with molybdenite; then 15 inches of granite inclusion, followed by 30 inches of siliceous granite containing a fair amount of molybdenite; and finally 20 feet of granite containing a little. This vein has been exposed in about five places over a distance of about 250 feet.

About 60 feet south of the big exposure, what appears to be a parallel vein has been exposed for a width of 18 inches in one place.

Another showing, possibly 700 feet to the west on *Stella No. 1* claim, consists of a mass of broken-up granite rock, with sections of quartz impregnated with molybdenite up to 2 feet thick and bearing the same characteristics as the Nos. 1 and 2 showings. If not in place, it must be nearly so.

No. 3 showing occurs about 200 feet south-east of No. 1 and consists of three parallel stringers of quartz, 4 to 6 inches wide, mineralized with molybdenite.

No. 4, which is on the *Stella No. 3* claim, at elevation 3,200 feet, has been exposed by several cuts over a distance of 200 feet. Its strike is the same as that of the others, N. 75° E., but it dips north into the hill and has an average width of about 6 inches.

Good work has been done by the owners during the year in tracing the veins on this prospect. Refer also to the Annual Reports for the years 1927 and 1928.

Fraser Lake.

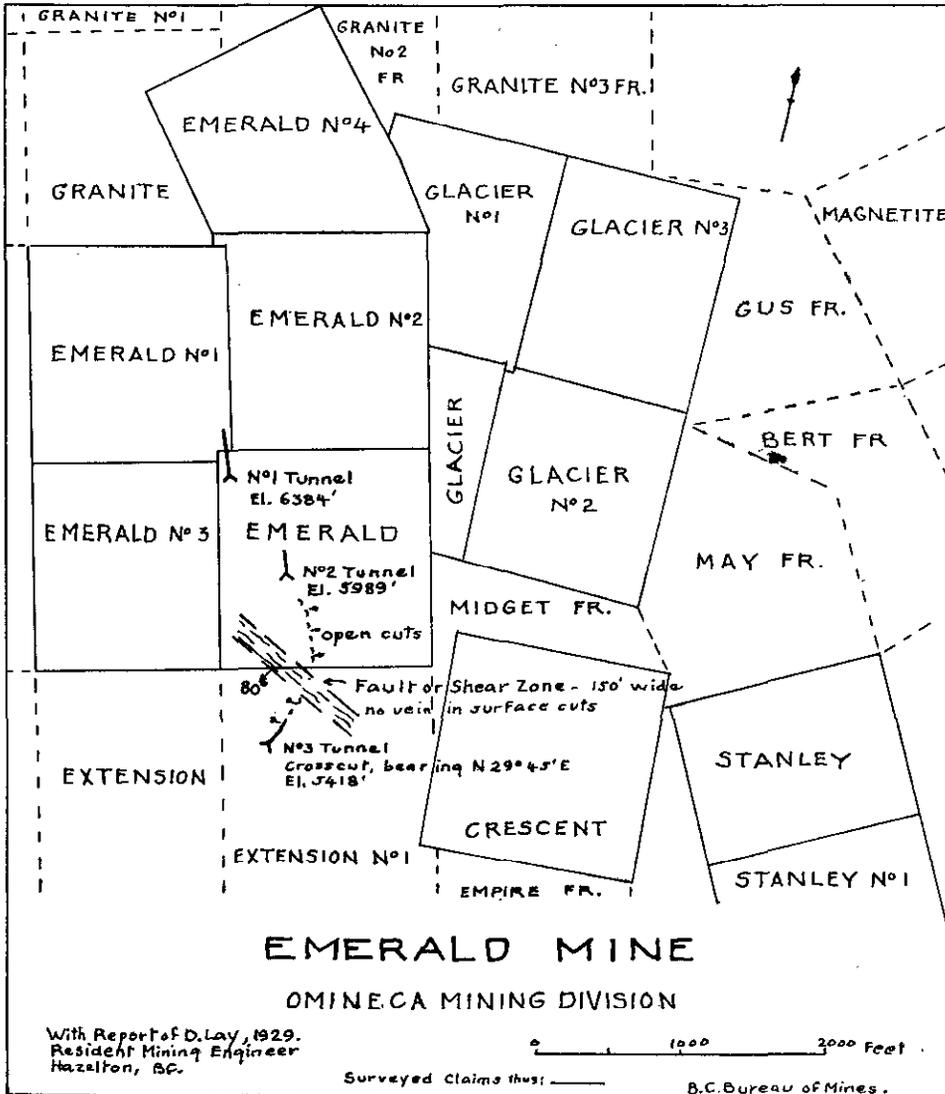
Nechako. A description of this group, owned by Arthur Goodwin, will be found in the Annual Report for 1928. Further work was done during the year. This consisted in sinking a shaft to a depth of 37 feet, following a shear-zone in granodiorite striking N. 35° W. (mag.) and dipping south-west at 65°. The mineralization is not heavy and consists of small seams of chalcopyrite with a little malachite. A sample of selected mineral from the seams assayed: Gold, trace; silver, 1 oz. to the ton; copper, 4 per cent. This shaft is distant about 600 yards in a direction N. 25° W. (mag.) from the open-cut made last year and about 80 feet vertically above the latter. The elevation of the collar of the shaft is 2,680 feet.

Copper-showings South of Fort Fraser.—Some showings were also inspected on the hills immediately south of Fort Fraser Station at the request of Arthur Goodwin. These consisted of small fractures in granodiorite mineralized with chalcopyrite, azurite, and malachite, but did not hold out hopeful commercial possibilities. A sample taken of selected mineral from these fractures assayed: Gold, trace; silver, 1.2 oz. to the ton; copper, 2.5 per cent.

SIBOLA SECTION.

Chief activities in this section during the year were the operations of the Consolidated Mining and Smelting Company of Canada, Limited, at the *Emerald* group; those of the Tahtsa Mining Company, Limited, at the *Swannell* group; and those of H. H. Logan and associates at the *Harloworth* group. The navigation of the Tahtsa river has been very greatly improved during the year by the Dominion Government by systematic clearance of obstructions. The work was in charge of D. L. McGibbon. Some work was also done on the Whitesail river, but this river requires further clearing. The trail into this section, which is being constructed from Kimsquit, on the Dean channel, was completed during the year to Tesla lake.

Emerald. On this group, situated on Sweeny mountain and owned by W. J. Sweeney and associates, much work was carried out during the year by the Consolidated Mining and Smelting Company of Canada, Limited, the optionees. Permanent camps were established at the landing on the Tahtsa river and at the mine; the trail between these two camps was widened and improved so as to enable supplies to be hauled up to the mine on a small cart with a team of horses; and a Sullivan portable air-compressor (330 cubic feet a minute capacity) operated by a 50-horse-power Buda gasoline-engine has been installed. In addition to this, the development-work described below was carried out.



No. 1 Tunnel (Elevation 6,385 Feet).—This is the adit-drift originally run by J. Cronin a distance of 120 feet. Shortly after the resumption of this tunnel last year ore was struck and has since been continuous for a distance of 220 feet. The total distance driven in this tunnel to September 26th is 335 feet and the advance during the year was 55 feet. Minerals present are mainly galena and zinc-blende, with a noticeable amount of chalcopyrite. Rhodochrosite is also present in the gangue. Towards the face of the tunnel there is a preponderance of zinc-blende. The average mineralized width of the shear-zone would seem to be about 6 feet,

although at one point it is 13 feet, and possibly crosscutting at other points might show greater widths than the tunnel reveals. Mineral seems to be mainly confined to a width of about 4 feet, of which the following assay is more or less representative of the more leady portions: Gold, trace; silver, 15.7 oz. to the ton; lead, 21.8 per cent.; zinc, 9 per cent. A sample taken from the dump of pieces showing the maximum amount of chalcopyrite (to ascertain the possible influence of this mineral on silver values) assayed: Gold, trace; silver, 24.5 oz. to the ton; copper, 11.1 per cent.; lead, 18.2 per cent.; zinc, 19.6 per cent. It will be noted that the silver ratio to the unit of base metals present is 0.5, practically identical with that indicated by the representative sample above cited.

No. 2 Tunnel (Elevation 5,989 Feet).—This tunnel starts as an adit-drift on the shear-zone, which had been traced down on the surface by open-cuts from No. 1 tunnel. To September 26th the total advance from the portal was 220 feet, of which 196 feet had been driven during the year. At about 108 feet from the portal, galena and zinc-blende began to appear in the filling and the face exhibits promise.

No. 3 Tunnel (Elevation 5,418 Feet).—This tunnel starts south of a sheared or faulted zone about 150 feet in width, the strike and dip of which are shown on the accompanying map, and in which open-cuts on the surface failed to reveal the vein, although, it is stated, it has been traced above and below this shear. To September 26th the tunnel had advanced a distance of 78 feet. It is a crosscut run on a bearing N. 29° 45' E. and it is estimated that it will require a distance of 800 feet to penetrate the vein. The elevation of this tunnel is about the maximum practicable for a main working-tunnel at this property, and to this tunnel will be confined operations during the present winter. At the portal is situated the compressor and about 75 feet or so vertically below is the mine camp just above timber-line in scrub balsam-brush. Refer also to the Annual Reports for the years 1916, 1917, 1919, 1924, 1925, 1926, 1927, and 1928.

Good progress has been made during the year at this property by the Tahtsa Swannell Mining Company, Limited, with a small force of men (about nine) under the direction of C. L. Copp, managing director. A river camp has been constructed on a backwater of the Tahtsa river a few miles below the *Emerald* landing, also a mine camp at elevation 4,245 feet in timber. The two camps are connected by a good pack-trail about 3½ miles in length.

At elevation 4,895 feet a tunnel had been run a distance of 154 feet to September 27th to develop at a vertical depth of 100 feet the original discovery of mineral on the surface. For the first 84 feet the tunnel crosscuts the formation, encounters the vein at this point, and follows it for the remaining distance. It is stated that a seam of mineral about 3 inches in width was continuous on the hanging-wall for a distance of about 60 feet. A sample of this mineral taken from the floor of the tunnel assayed: Gold, trace; silver, 23 oz. to the ton; lead, *nil*; zinc, trace. The assay disclosed the presence of a large amount of arsenic. The mineral is grey-black in colour and may be arsenopyrite. The face shows a shear-zone 6½ feet in width, slightly mineralized throughout with small amounts of galena and zinc-blende. In another 40 feet this tunnel will be immediately below the surface showing. This shear-zone outcrops on the surface at a point 165 feet vertically below the tunnel and is well mineralized at this point, where a width of 10 inches of mixed galena and zinc-blende shows. A sample of this assayed: Gold, 0.01 oz. to the ton; silver, 95 oz. to the ton; lead, 19.5 per cent.; zinc, 10.6 per cent.; copper, trace. It is stated that another parallel shear-zone was discovered during the year at a point about 750 feet east of that under development, which is very similar to the latter. Refer also to the Annual Reports for the years 1927 and 1928.

This group was discovered during the year and is owned by H. H. Logan, Harloworth. B. R. Harrison, and J. Worth, by whom surface work has been carried out with a small force of men. It is situated on a north-eastern spur of Mount Irma, between Little Whitesail and Whitesail lakes, at the head of a small creek flowing into the west end of the former. From the last-mentioned point a trail leads from the beach to the property, the distance being about 4 miles. Showings lie mainly at the lower extremities of glaciers between elevations 4,800 and 5,500 feet.

There are several more or less parallel quartz veins, mineralized somewhat sparsely with galena, zinc-blende, and pyrite, with low precious-metal values. The country-rock is argillite and quartzite overlain by volcanics, intruded in places by granodiorite and granitic dykes. In general the veins appear to follow in strike and dip the bedding-planes of the sedimentaries,

which trend N. 55° E. (mag.) and dip south-east at about 35°. There is local variation from this in the vicinity of igneous intrusions, as at the chief exposure. While evidence of the existence of quartz veins has been obtained at three points within a distance of about 5,000 feet along the line of general trend, there is no evidence that any particular vein is continuous for any material distance.

At the time of inspection on September 30th and October 1st, attention was focused on open-cutting two parallel veins at elevation 4,815 feet at the foot of a glacier. Where exposed one of these was 6 feet in width and the other 4 feet, the distance between the veins being 35 feet. The country-rock is quartzite at this point, intruded at a point within 40 feet of the open-cuts by a granitic dyke 10 feet in width which cuts across the bedding-planes. Mineralization in the veins is not heavy and consists of galena, zinc-blende, and pyrite. A selected sample of the most heavily mineralized exposure assayed: Gold, trace; silver, 2 oz. to the ton; lead, 0.2 per cent.; zinc, 1.4 per cent.

About 2,000 feet in a direction N. 32° E. (mag.) from the last-mentioned exposure, at the foot of another glacier, a quartz vein about 2 feet in width is exposed, similarly mineralized. A sample of selected mineral from this point assayed: Gold, 0.05 oz. to the ton; silver, 4.4 oz. to the ton; lead, 2 per cent.; zinc, 9.5 per cent.

About 3,000 feet N. 32° E. (mag.) from the last-mentioned exposure at elevation 5,535 feet, an open-cut shows mineralized quartz-seams ribboned through the country-rock. More work is required to determine width at this point. A sample of selected mineral assayed: Gold, trace; silver, 1.9 oz. to the ton; lead, 0.6 per cent.; zinc, 4.2 per cent.

About 50 feet west of the last-mentioned open-cut, and somewhat higher up, a more clearly defined quartz vein 2½ feet in width is exposed, but it is sparsely mineralized. At the summit of this spur, elevation 5,635 feet, a noteworthy feature is the occurrence of several large unfilled fissures.

Red Bird.—B. R. Harrison and J. Worth report another discovery during the year, near Bone lake, about 4 miles distant from Eutsuk lake. This is staked as the *Red Bird*. Inspection of this was not possible.

MANSON SECTION.

It was not found possible to examine any lode-mineral showings in the Manson section proper this year, available time being devoted to the region immediately adjacent to Takla, Trembleur, and Stuart lakes, a description of which appears below. In the Manson section proper considerable activity was manifested on Lost and Boulder creeks, where T. Rush and associates have been working on their claims. J. Ferguson was also prospecting in this vicinity. W. F. Paquette was working on his claims on Blackjack mountain.

Takla, Trembleur, and Stuart Lakes.

The region immediately west of the northern portion of Takla lake was the scene of considerable prospecting during the year, and claims were staked in two localities:—

(1.) About 14 miles north of Takla lake, west of the Driftwood river, by Neil McMillan for Angus W. Davis. This is a copper mineralization.

(2.) At the head of Ankwill creek, about 20 miles south-east of the foregoing, a few miles west of Takla lake, by A. Michell and Frank Martin; also a copper mineralization.

It is believed that work will be done on both these discoveries during 1930.

While an inspection of Takla lake was made early in June, this was prior to receipt of report as to the above-mentioned discoveries and they were not visited. The inspection trip mentioned was undertaken for the specific purpose of examining certain conglomerate beds on the shores of Takla lake, reported as being auriferous, and also for purposes of general reconnaissance.

The trip was by motor-boat from Fort St. James (readily reached by good motor-road 40 miles in length from Vanderhoof, on the Canadian National Railway) via Stuart lake, Tachie river, Trembleur lake, and Middle river. This is an excellent waterway navigable for craft of appreciable size and gives ready access to properties in the region tributary thereto. The distance from Fort St. James to Takla Landing on the east shore of Takla lake is about 108 miles; to the head of the lake it is another 20 miles.

From the outcrops of batholithic rock observed, the region tributary to this waterway is considered of general geologic promise and warrants close prospecting.

The geology is thus described by Charles Camsell in the Geological Survey of Canada Summary Report for 1915:—

“Rocks which have been classed by McConnell as Cretaceous occupy part of the western side and the whole of the northern end of Takla lake. They embrace a volcanic as well as a sedimentary series, which are conformable, and to a certain extent interbedded with each other.

“The volcanic portion of this series occupies the west shore of Takla lake, on either side of the narrows, and extends several miles up the North-west arm. It consists of soft green andesites, mottled tuffs and breccias, and some rhyolites and porphyries, all showing more or less evidence of metamorphism. The series rests unconformably on granite or the Carboniferous rocks, with a conglomerate member at the base.

“A prominent red bluff, situated 4 miles north of Takla Landing on the east side of the lake, is made up of rhyolite belonging to this series of rocks. Whether the rhyolite is intrusive into the adjacent conglomerates or interbedded with them is not quite clear.

“The sedimentary portion rests conformably on the volcanic and consists of conglomerate, sandstone, shale, and some coal. The beds dip at high angles and strike diagonally across the lake in a north-and-south direction, apparently occupying an ancient depression with which the outlines of Takla lake do not now strictly conform. The conglomerate contains pebbles of quartz, cherty quartzite, slate, and granite embedded in a siliceous matrix. The shales contain a number of plant remains.

“Bodies of granite are exposed on Middle river, the North-west arm of Takla lake. It is intrusive into the Carboniferous rocks, but overlaid by the volcanics of Takla lake.

“Rocks of Carboniferous age extend along the shores of Stuart lake and northward beyond Trembleur lake. Another area occupies part of the west shore of Takla lake and extends eastwards to the Omineca placer-mining region.

“On Stuart lake the rocks consist of massive, blue limestone underlaid by cherty quartzites, argillites, and green schists, the last being probably altered volcanic rocks. The beds have been very much disturbed and metamorphosed and now dip at high angles with a general north-westerly strike. The age of these rocks has been determined as Carboniferous by G. M. Dawson. On Takla lake black and grey sandy slates predominate, with only small bands of dark-blue limestone.”

It might be added that on the north shore of the lake at Fort St. James occurs an intrusion of granodiorite porphyry, of which the new jetty is constructed.

McMullen. This group is situated on the west shore of Stuart lake, behind Beaver island, about 12 miles slightly north of due west of Fort St. James. The country-rock in this region consists of argillites and metamorphic rocks. A quartz vein, about 12 inches in width in a sheared zone, is well mineralized with stibnite and a little copper-stain (malachite). This strikes due east and west (mag.) and dips north at about 45°, and has been followed by a shaft 20 feet deep. A sample across 12 inches assayed: Gold, 0.16 oz. to the ton; silver, 0.4 oz. to the ton; lead, 0.9 per cent.; antimony, 20 per cent.

In the vicinity of this exposure is a green-stained metamorphic schistose rock. Green mineral present is not malachite, as an assay showed only a trace of copper, but is probably mariposite.

Takla. This group, owned by A. Hankin and D. L. Stewart, covers the exposures of conglomerates on Takla lake, which occur on both sides of Takla lake, somewhat north of Takla Landing, and also on the Manson trail on the west of the lake and about 4 miles distant from the ferry. These beds were examined and sampled at the point mentioned, which cover a length along the strike of about 8 miles. On the east side of the lake, about 4 miles north of Takla Landing, in the bay just north of the prominent red bluff of rhyolite, occurs one outcrop which is continuous for about three-quarters of a mile. In this region the various bays enable cross-sectional samples of great width to be taken and a total width of about 1,000 feet to be covered. The depth of the lake below the level of the terrain is about 75 feet at this point. These conglomerates strike about due north and south and dip to the north-east.

About due south of this point, on the opposite side of the lake, they are exposed about 1½ miles above the ferry at two points about half a mile apart. The conglomerates consist of well-worn pebbles, the maximum size of which is about that of a man's fist. Numerous quartz pebbles are present. These beds therefore appear to represent the bed of an ancient river, the

valley of which did not coincide with the present master-valley system. It is evident that the river cut through a quartz-vein terrain, and entirely logical to assume, therefore, that they *might* contain gold of alluvial origin, as is exemplified by the blanket rock of South Africa. In all, nine samples were taken—one at the outcrop on the Manson trail, three on the west side of the lake, and five on the east side of the lake. On the east side three samples were taken representing a total cross-sectional width of about 1,000 feet, one sample across 350 feet, another across 400 feet, and the third across 250 feet. Each of the nine samples taken assayed a trace of gold only. It is, of course, possible that by detailed sampling of very much smaller widths than were sampled on this occasion, portions of the beds might be found to contain higher values than those yielded by samples taken across such great widths. Time was not available for such a detailed investigation.

FORT GRAHAME SECTION.

It was not possible for the Resident Engineer to visit this section during the year. Prospecting and reconnaissance over a large area were particularly active both on the part of companies and private individuals, and the planes of Western Canada Airways, Limited, were freely used for transportation of men and supplies from Prince George, where an aeroplane base was established, to various points in the Northern Omineca.

New discoveries of copper are reported in the vicinity of Thutade lake and in the Akie mountains east of the Finlay river.

The *Ferguson* was operated throughout the year by Ingenika Mines, Limited.

Detailed information concerning this section will be found in the Annual Reports for 1926, 1927, and 1928; also in the Geological Survey of Canada, Summary Report, 1927, Part A.

PEACE RIVER MINING DIVISION.

The "Peace River" land block, which includes portions of the Omineca and Peace River Mining Divisions, was the subject of detailed field-study by R. W. Brock and staff during the year in connection with the survey of the resources of the blocks of land set aside for the Pacific Great Eastern Railway.

In response to the request of the Department of Mines, the Dominion Government carried out some work on the Finlay and Parle Pas rapids, greatly improving navigation on the Peace river above the Rocky Mountain canyon.

Detailed accounts of the Peace River Mining Division will be found in the Annual Reports for the years 1923, 1926, and 1928.

- COAL.

The output of coal for the year was 1,505 long tons, as compared with 1,668 long tons in 1928.

Considerable interest was shown during the year in the coal areas in the vicinity of Telkwa. Telkwa Collieries, Limited, the sole contributor to the coal-output, was operated for the usual number of months in the year. With reference to the activities of British Pacific Industries, Limited, mentioned in the 1928 Annual Report, the plans of this company do not seem as yet to have crystallized into any definite action.

Telkwa Collieries, Ltd.—Operations were carried on during the spring, fall, and winter with a force of about nine men in charge of Asa Robinson, foreman. The Main entry has been continued a distance of about 200 feet north-eastwards and levels run from this for about 250 feet eastwards, in the immediate vicinity of the boundary-line between Lots 223 and 401, the southern boundary of the property (refer to map in the 1926 Annual Report). Refer also to Annual Reports for 1926, 1927, and 1928.

New discoveries of coal near Cedarvale, near Evelyn, and on the South fork of the Zymoetz river were examined during the year. Commercial possibilities were not apparent in any of these.

Cedarvale Coal.—The occurrence of anthracite coal in the vicinity of Cedarvale was reported at the close of the season in 1928. Exposures were examined during the present year. Coal leases have been staked on both sides of the Skeena river near Cedarvale. Exposures and analysis indicate that this coal is a graphitic material which possesses some points of resemblance to that of the Lake Kathlyn coalfield, but which is of doubtful commercial value as a fuel.

Exposures on North Side of Skeena River.—One lease has been staked by P. Cravetto on Mill creek, flowing into the Skeena river about quarter of a mile below Cedarvale Station. Mill

creek cuts down fairly deeply and exposes well for a mile or more above its mouth interbedded shales and sandstones, which strike about N. 60° E. (mag.) and dip from 50° to 85° north-west. The lithology of those rocks suggests that their age is Cretaceous. Graphitic material is exposed at several points. The chief exposure is on the left bank of the creek at a point 110 feet vertically above Cedarvale. At this point a seam of graphitic material between 2½ and 3 feet in width is exposed by an open-cut and a very short tunnel. It strikes N. 60° E. (mag.) and dips at 52° north-west, conforming in strike and dip with the enclosing carbonaceous shale. A sample of selected pieces of this material gave the following analysis: Moisture, 3.5 per cent.; volatile combustible matter, 5.2 per cent.; fixed carbon, 21.3 per cent.; ash, 70 per cent.

Exposures on South Side of Skeena River.—Six coal leases were staked on Coyote creek by F. McLean and associates. These are distant about 2½ miles from Cedarvale Station. About 1 mile up Coyote creek from its mouth, at an elevation of 200 feet above Cedarvale, on the right bank of the creek, is exposed a seam of graphitic material 1½ feet in width, which conforms in strike and dip with the enclosing argillitic rock (carbonaceous), striking N. 85° W. (mag.) and dipping at a flat angle to the north-east. The full width of this seam is possibly not exposed. The chief exposure is at an elevation of 310 feet above Cedarvale on the ridge between the North and South forks of Coyote creek, immediately above the junction. This ridge is about 75 feet above the creek-level in height and about 200 feet in width at this point. The exposure of graphitic material is on the left bank of the North fork, 50 feet or so above the creek. Exposure is by open-cut which had caved at the time of inspection and the full width of the graphitic material was not exposed. The strike of the enclosing argillitic rocks is N. 50° E. (mag.) and dip north-west at 25°. The downward continuation of this seam is likely to be found on the right bank of the North fork of the creek, and not in the ridge. It is stated that the width of the best of this graphitic material was about 3 feet, with a total width of upwards of 6 feet. A sample of selected pieces of the best-looking material yielded the following analysis: Moisture, 6.8 per cent.; volatile combustible matter, 10.2 per cent.; fixed carbon, 61.9 per cent.; ash, 21.1 per cent.

Evelyn Coal.—A lease was staked in this vicinity by W. A. McMaster and Axel Peterson. The exposures are on the southern portion of Lot 3290, on an easterly-flowing tributary of Toboggan creek, and are distant about three-quarters of a mile from Mile 13 on the Canadian National Railway Line (Mile 13 is just 4 miles west of Evelyn Station and 3 miles east of Doughty Station). The distance of the exposures from the main highway is about 1¼ miles. At elevations between 1,600 and 1,700 feet above sea-level, at several points on the banks of the small creek mentioned, beds of feldspathic sandstone are exposed. These strike about N. 65° E. (mag.) and dip at angles of from 45° to 65° north-west, and enclose small seams of coal up to 9 inches in width. These small seams apparently recur at frequent intervals separated by seams of bone. The best exposure is an old pit about 8 feet deep, said to have been sunk during the construction of the Canadian National Railway. At this point a width of 8 feet of country-rock shows several alternating narrow seams of coal and bone. The widest seam of coal is about 9 inches. A sample of the best-looking material from this exposure yielded the following analysis: Moisture, 1.2 per cent.; volatile combustible matter, 22.2 per cent.; fixed carbon, 50.4 per cent.; ash, 26.2 per cent.

South Fork of the Zymoetz River.—These exposures are described under "Houston section" in this report.

CARIBOO MINING DIVISION.

The placer production of the Cariboo Mining Division for the year was \$38,845, as compared with \$38,879 in 1928.

Water conditions were in general favourable for the hydraulic mines. The chief contributor to the output was the Lowhee Mining Company, Limited (formerly John Hopp Mines), on Lowhee creek, the most important hydraulic mine at present in operation throughout the Cariboo and Quesnel Mining Divisions. The activities of the many smaller hydraulics in and about Barkerville, whose annual total contribution to the output is considerable, were much the same as usual.

Keystone-drilling operations were carried on by the Consolidated Mining and Smelting Company of Canada, Limited, on Swamp river.

The dredge formerly owned by the Kafue Copper Development Company, Limited, was sold to interests in the United States and was dismantled and shipped to Oregon during the year.

In lode-mining the chief activity was that of the Cariboo Gold Quartz Mining Company, Limited, where hopeful results were gained. A nice exposure of ore (auriferous galena) was uncovered at the *Hudson* group by I. E. Moore. A certain amount of work was carried out by Cariboo Lode Mines, Limited, on Hixon creek.

The report by C. W. Moore on placer properties in the Cariboo, Quesnel, and Omineca Mining Divisions, which was published in Bulletin No. 2, 1930, "Placer-mining in British Columbia," is reprinted in full at the end of the Resident Engineer's report, commencing on page 196.

LODE-MINING.

Longworth.

Bonanza.* This group, owned by Oscar Eden and Fred Peterson, is distant about 5½ miles from Longworth, a station on the Canadian National Railway, 66 miles east of Prince George. The property consists of ten claims—*Tomboy, Galena, and Bonanza Nos. 1 to 8.*

The showings consists of an irregular mineralized zone in a limestone-bed striking east-west and dipping steeply to the south. Mineralization consists of occasional patches of coarse-grained galena associated with quartz and barite. A considerable amount of trenching has been done by the owners and the zone traced for some distance, but so far without discovering anything with commercial possibilities.

About 1½ miles to the east, at elevation 3,425 feet, on the right bank of Clearwater creek, which runs in a deep gorge at this point, a tunnel has been advanced a further 32 feet, making a total of 65 feet, but with no change in the mineralization. Refer also to the Annual Report for 1928.

PRINCE GEORGE SECTION.

Hixon Creek.

Cariboo Lode Mines, Ltd. This company, the registered office of which is at Prince George, was incorporated during the year. It owns the *Cariboo Lode, P. D. Carr, T. L. Carr,* and *Millsite* groups, and has options on the *Cayenne* and *O.P.* groups, *Cottonwood* and *Fraction* claims, and on the property of the Quesnel Quartz Mining Company, Limited, consisting of Lots 52 to 56, inclusive. This last-mentioned property is situated approximately in the centre of the other mentioned groups, which surround it on both sides of Hixon creek.

Most of the workings of the Quesnel Quartz Mining Company, Limited, comprising shaft and tunnels therefrom, are under water, and it is understood to be the intention of Cariboo Lode Mines, Limited, to unwater these. This property was worked in the very early days and more recently in 1918, and it is quite unnecessary to repeat herein the full particulars given in the Annual Report for 1918, and also in Memoir 118 of the Geological Survey of Canada.

One of the old adit-tunnels on this property on the right bank of Hixon creek was cleared out and retimbered during the year. This for a distance of about 114 feet follows the schistosity planes of a decomposed schist on a bearing N. 42° W. (mag.). At 114 feet from the portal tunnels are run for a distance of 35 feet and 108 feet respectively north-east and south-west of the adit. The south-west tunnel cuts through various quartz veins. These were not sampled in detail, but a general grab sample across the more promising-looking quartz-exposures did not disclose values. It should be understood that early records indicate that good results were obtained from veins in the workings now under water and inaccessible.

Cayenne No. 2. On this claim an adit started in former years has been continued to a distance of approximately 175 feet from the portal on a bearing S. 35° E. (mag.) in a much-altered decomposed schist, which has broken down mainly to a red clay. This tunnel intersects one quartz vein from 2 to 4 feet in width and a number of quartz stringers. The decomposed schist appears to carry spotty gold values and the tunnel merits careful sampling. In 1926 a grab sample taken along one wall of the tunnel for a length of 135 feet yielded upon assay a trace of gold and silver. This year a grab sample taken of the last 40 feet of tunnel disclosed no gold values, while another grab sample taken along a length of 25 feet, between points 60 and 35 feet distant from the face, assayed: Gold, 0.24 oz. to the ton; silver, 0.4 oz. to the ton. Several careful moiled channel samples should be taken to ascertain values. This property merits close scrutiny to determine tonnage possibilities. Refer also to the Annual Reports for 1918 and 1926.

Stone Creek.

Stone Creek. This group, owned by W. West, is situated on Lot 4618. In this region Stone creek has cut down deeply and the steep canyon-like banks of the creek are some hundreds of feet in height. In the vicinity of the showings the country-rock consists chiefly of carbonaceous schist and a quartz-schist stained with a green mineral, which appears to be mariposite.

On the south side of the creek, at elevation 2,385 feet, some small mineralized quartz stringers are exposed by open-cut in quartz-schist. Assays of these failed to disclose gold or silver values. About 50 feet vertically below this exposure a tunnel is run on a bearing S. 8° E. (mag.) for a distance of 95 feet, but without disclosing anything of importance. East of this and at somewhat higher elevations there are exposed by natural agencies several irregular quartz veins in the carbonaceous schist country-rock. The width of these varies up to 4 feet. A sample at one point failed to disclose precious-metal values. On the north side of the creek, opposite the above-described showings, a tunnel has been run a distance of about 75 feet at a point about 50 feet above the creek. The objective could not be perceived.

BARKERVILLE SECTION.

Lightning Creek Gold Gravels and Drainage Co., Ltd.—This company, which has changed its name to the "Lightning Creek Gold Mines, Limited," was the subject of adverse comment in Bulletin No. 1, 1929. By public advertisement, attention has already been drawn by the Honourable the Minister of Mines to the misleading nature of the literature in circulation and issued by this company. Attention is again drawn to the fact that the sponsors of this company continue to circulate such misleading literature. Those interested are advised to read Bulletin No. 1, 1929, and also the 1923 Annual Report of the Minister of Mines.

Lowhee Creek.

**Cariboo Gold
Quartz Mining
Co., Ltd.** Small-scale operations were carried on at this property during the year, which yielded decidedly encouraging results. From the main crosscut, which has for its objective the penetration of the *Rainbow* vein system in depth, at approximately 270 feet from the portal, a branch crosscut has been run on a bearing S. 37° E. (mag.) to intercept in depth the *Pinkerton* vein system. This crosscut had at the date of inspection (October 9th) progressed a distance of approximately 250 feet. Just by the point of commencement it passed through a large cross-vein upwards of 10 feet in width and very heavily mineralized with pyrite. A sample taken across a width of 9 feet at this point assayed: Gold, 0.3 oz. to the ton; silver, 0.06 oz. to the ton. Owing to the soft caving nature of this vein the drive following it into the hill is being run on the foot-wall, with drill-holes put into the vein at frequent intervals, so that it is only at the one point mentioned that the vein is fully exposed. This vein strikes S. 18° W. (mag.) and dips north-west at a steep angle, whereas the formation strikes N. 70° W. (mag.) and dips north-east. The face of the drift following it had reached a point approximately 60 feet from the point of original crosscutting. This vein may be the same as one encountered at 200 feet from the portal of the main crosscut, this latter having a similar strike.

The branch crosscut to the *Pinkerton* vein system had on the day of inspection just reached another vein at 250 feet from the point of commencement, but had not passed through it.

Surface prospecting has disclosed a large body of quartz at a point about 1,100 feet south of the cabin on the *Rainbow*, from which other quartz veins appear to branch in different directions. The width of the main body of quartz appears to be between 40 and 50 feet. One sample taken across 7 feet assayed: Gold, 0.66 oz. to the ton; silver, 0.16 oz. to the ton. Another sample from a different place, not representing any definite width, assayed: Gold, 1.30 oz. to the ton; silver, 0.3 oz. to the ton. A third sample chipped from different points, at some of which a little galena showed, assayed: Gold, trace; silver, 4.8 oz. to the ton. While it is not to be inferred that gold values such as the two first-mentioned samples show will necessarily continue in depth, nevertheless such clearly warrant investigation and are encouraging. It is suggested that a survey of the underground workings and all surface exposures should be made, so that exact distances and relationship might be ascertained and underground development guided to the best advantage. Refer also to the Annual Reports for 1927 and 1928.

Cunningham Creek.

Hudson. The owner of this group, I. E. Moore, met with very encouraging results during the year. The property is situated at the head of Pearce gulch, a westward-flowing tributary of Cunningham creek near the headwaters of the latter. It is distant about 21 miles from Barkerville, of which the first 12 miles is motor-road and the remaining distance a good pack-trail.

A belt of schistose country-rock between 50 and 60 feet in width contains several mineralized quartz veins. These are exposed by various open-cuts on both sides of the Cunningham Creek-Harvey Creek divide, on which these veins outcrop. Time did not permit of the thorough examination of all the surface showings which this property merits, but the following is the most important:—

On the Pearce Gulch slope in the immediate vicinity of the intersection of two veins, one 5 feet in width striking S. 80° E. (mag.) and dipping north-east, and one 7 feet in width striking S. 30° E. (mag.), also dipping north-east, an adit-drift follows the larger vein from the surface for a distance of 48 feet on the hanging-wall. At 27 feet from the portal a width of 4 feet on the foot-wall is heavily mineralized with galena and some pyrite. A sample across 4 feet at this point assayed: Gold, 2.98 oz. to the ton; silver, 5.5 oz. to the ton; lead, 24 per cent. From this point onward the foot-wall is not exposed. A sample at the face, taken across a width of 3 feet, assayed: Gold, 0.54 oz. to the ton; silver, 1.26 oz. to the ton; lead, 7.6 per cent. The adit just described is only a short distance above the caved tunnel mentioned in the 1925 Annual Report. The former is about 100 feet vertically below the summit of the Cunningham Creek-Harvey Creek divide and a vertical depth of about 120 feet can be gained by an adit-drift from Pearce Gulch slope.

Noteworthy features of this property are the nice vein-widths exhibited; the fact that values are in primary sulphides; and the galena is auriferous rather than argentiferous. The last-mentioned feature is, in the experience of the writer, unique in the Cariboo and Quesnel Mining Divisions. Memoir 149 of the Geological Survey of Canada also records the presence of scheelite in these veins.

This property well merits thorough examination and development and is commended to the attention of examining engineers. Refer also to the Annual Report for 1925.

Homestake. This property, owned by J. H. Campbell and J. P. Delhanty, is situated on Cunningham creek, about 2½ miles down-stream from the *Hudson*. A full description of this property will be found in the 1925 Annual Report. Since last inspected a large open-cut has been made on the west side of the creek with a view to intercept the north-west continuation of the replacement zone at a point about 60 feet distant from the original exposure on the west bank of the creek. This cut shows only a stringer of galena. It is suggested that on the east side of the creek some further open-cutting or trenching is advisable on the down-stream side of the exposure. This deposit appears to be capped with a few feet of barren and unreplaced limestone in the region where exposed.

QUESNEL MINING DIVISION.

The placer production of the Quesnel Mining Division for the year was \$20,417, as compared with \$28,033 in 1928.

The chief hydraulic operations carried on during the year were those at the *Bullion* by Carinelle Placers, Limited, and at Cedar creek by B. Boe on the *Platt* and *Layne* leases.

Interesting new discoveries were made on Spanish creek by A. Sutherland and A. Anderson and in the Horsefly section by R. N. Campbell.

Keystone-drilling was carried out by the Central B.C. Mines Development Company in Beaver valley and by the New Era Mining Company north of the town of Horsefly, these operations being under the direction of B. F. Lundy. Distinctly promising results are reported in the case of the latter operation.

In lode-mining considerable activity was manifested on Yanks peak in the Keithley section and a small mill was being constructed at the *Yanks Peak* group towards the close of the year.

Approximately 175 tons of diatomite was shipped by the B.C. Refractories, Limited, from its quarry on Lot 1122. Much investigation at considerable expense has been carried out by this company with a view to determine the commercial possibilities offered by diatomite and other non-metallics in this and other districts. Of very considerable interest is the announce-

ment by this company of its intention to commence very shortly the construction at New Westminster of a plant to manufacture clay products, including bricks, tile, terra-cotta, and "diatite." The raw material, including diatomite, will be obtained from Quesnel, Williams Lake, and points in the Fraser valley.

The completion of the Fraser River bridge at Quesnel greatly facilitated operations in connection with the diatomite-deposits.

LODE-MINING.

Marguerite.

Full particulars of various copper-showings in the vicinity of Marguerite, on the Pacific Great Eastern Railway, will be found in the Annual Reports for the years 1925 and 1928.

This group, owned by C. Fuller and D. Haws, is situated south of and immediately adjoining the *Pollyanna* group (refer to 1925 and 1928 Annual Reports).

Copper Queen. Much patient and laborious surface work has been done during the year in exposing by trenches and open-cuts a slight copper mineralization, which recurs at intervals in the shear-planes of the enclosing granodiorite. At this group, as at the *Pollyanna*, the planes of shearing strike about N. 60° W. (mag.), dipping north-easterly. As observed at other points in the vicinity, the mineralization on this property consists of small amounts of chalcopryite, specularite, and malachite, which occur in the shear-planes; at one point there is exposed a large quartz gash-vein which is mineralized with a little chalcopryite and copper-stain and which also follows the direction of shearing. This occurs at elevation 3,800 feet and is exposed by natural agencies over a continuous length of 100 feet and at intervals over a length of about 300 feet. The strike is N. 60° W. (mag.) and the dip north-easterly. Mineralization with chalcopryite and malachite is very sparse.

About 1,000 feet north of this, at elevation 3,700 feet, is a large trench approximately at right angles to the direction of shearing, which shows slight copper mineralization in the shear-planes of the granodiorite. At successive intervals of 125 feet, 350 feet, and 175 feet occur other trenches. One of these shows a width of 18 feet more or less stained with malachite, but mineralization is not heavy. A sample taken at this point across a width of 9 feet, representing the most heavily mineralized portion, assayed: Gold, trace; silver, trace; copper, 0.4 per cent. A sample of the best portions from this place assayed: Gold, trace; silver, 0.2 oz. to the ton; copper, 0.8 per cent. A sample of specularite only assayed: Gold, trace; silver, trace.

KEITHLEY SECTION.

Yanks Peak.

A week was spent in the examination of various properties on Yanks peak and the adjoining Snowshoe plateau. The country-rock where exposed is either schist or quartzite, and the prevailing strike of the bedding is about N. 50° W. (mag.), with south-westerly dip. As is the case in the Barkerville area, the veins are of two kinds—namely, those which cross the formation and those that strike more or less with it. But in this case the findings of Memoir 149 of the Geological Survey of Canada would seem not to be capable of too close application. The vein system of Yanks peak exhibits some cross-veins which are very large and apparently barren, a feature which was also observed on Cariboo mountain to the west. At the *Jane* group one cross-vein shows no appreciable values, while the vein following more or less the strike of the formation, from which the former branches, carries gold values. It is true that at the *Yanks Peak* and *Midas* groups cross-veins carry on the surface high, although spotty values, but no generalization seems applicable as in the Barkerville area. The quartz veins where exposed on the surface or at shallow depth are all more or less oxidized. The amount of sulphides present, chiefly pyrite, does not appear to be very great. Practically all the veins are bleached white on the surface, even although at a depth of a few inches they may be highly oxidized. This is presumably due to reducing agents present in surface waters. As might be expected, surface values, where high, are very spotty and vary from a few ounces of gold to the ton to nothing within a distance of a few feet.

This group, owned by H. Talbot and J. Larson, was at the time of inspection
Yanks Peak. (October 14th) under option to a private syndicate consisting of C. R. Henderson, Douglas B. Sterrett, C. Wilkinson, C. Hatton, J. A. Dowding, J. Norquay, J. M. Smith, and associates; but a company was incorporated in January, 1930, for its operation,

known as the Yanks Peak Mining Company, Limited. At the time of inspection ten men and a cook were employed, some of the optionees being included in the employees.

On this property occur a large number of quartz veins, some of which show high but spotty gold values; others show no appreciable values. The country-rock is schist, the planes of schistosity striking N. 50° W. (mag.) and dipping south-west.

Attention at present focuses on a zone about 100 feet or so in width, in which occur possibly five parallel oxidized quartz veins, varying in width from 1½ to 3½ feet, which cross the formation. Of these, three are more clearly defined than the rest and have been exposed by open-cuts and short tunnels. These outcrop on a hillside the slope of which does not exceed 20° at a maximum, and while all can be developed by adit-drift, cover is not gained very rapidly. The strike of the veins is about N. 35° E. (mag.), with steep dip to the south-east. On the most westerly of these an adit-drift which was started in 1925 has been run a distance of about 84 feet, the quartz vein being terminated by a fault apparently at 69 feet from the portal. Trenching on the surface north of this point would doubtless throw some light on the matter. A sample taken from this tunnel at 69 feet from the portal across 1.6 feet assayed: Gold, 4.24 oz. to the ton; silver, 0.72 oz. to the ton. A sample taken across 3½ feet, 51 feet from the portal, assayed: Gold, *nil*; silver, *nil*.

About 155 feet in a south-westerly direction and about 40 feet vertically below the tunnel a shaft is sunk on this vein to a depth of 12 feet. A sample from this shaft taken in 1925 showed good gold values. About 25 feet vertically below the shaft and 120 feet from it a small-sized tunnel is driven in a distance of 105 feet, but does not disclose anything of importance, being apparently off this vein. A sample taken across 2¼ feet from an open-cut on a well-defined vein about 30 feet east of this tunnel showed no values. On the most easterly of the veins a tunnel is run 131 feet, about 120 feet vertically below the top tunnel above mentioned and about 375 feet from it, but only the last 36 feet of this working is actually on the vein, the tunnel being a crosscut up to this point. A sample across the vein in the face of the tunnel, 1½ feet in width, showed no gold or silver values. A sample taken from this same vein across 2 feet where it is exposed by an open-cut somewhat below the top tunnel assayed: Gold, 0.24 oz. to the ton; silver, 0.06 oz. to the ton. A sample taken from another open-cut just above the top tunnel on a vein east of the tunnel vein showed upon assay no gold or silver values. It is quite evident from samples taken this year and in 1925 that, as might be expected, values vary widely within a distance of a few feet, from nothing to quite good values.

It is understood to be the intention to advance the lowest tunnel to a point about 100 feet vertically below the surface and then to crosscut to the other veins. Such a general scheme of development appears sound, but it would seem advisable to pick out the best vein on which to run this adit. While the foregoing samples are not sufficiently numerous to be conclusive, they indicate the most easterly vein as being distinctly better than the others. Further sampling to check this point would seem advisable.

About 1,500 feet in a north-westerly direction from these workings are numerous exposures of other quartz veins, all somewhat oxidized. Samples taken from two of these showed in one case traces only of gold and silver and in the other case no values.

At the time of inspection camp buildings had been erected at a point about a quarter of a mile from the lowest tunnel and about 300 feet vertically below it. A small mill building was also under construction and machinery for a 25-ton-daily capacity mill had in part arrived at Keithley. Any question of milling at the present time is regarded as quite premature, but the property merits development.

This group, owned by O. J. Pickering, J. Glover, H. G. Heisterman, and E. L. Midas. Tait, is situated about 1½ miles north-east of the workings on the *Yanks Peak* group, on the flat-topped ridge which separates French Snowshoe from Little Snowshoe creek. Present operations consist of running a crosscut tunnel to develop at a depth of 130 feet a strong quartz vein of an average width of about 4 feet, striking N. 33° W. (mag.) and dipping north-east at 60°. This vein is exposed by open-cut over a length of about 90 feet at elevation 5,730 feet. At the north end of the open-cut a width of 7 feet of quartz is exposed, possibly due to the junction of a branch vein at this point. A sample across 7 feet at this point assayed: Gold, 2.24 oz. to the ton; silver, 0.64 oz. to the ton. A sample taken from the main vein across 2½ feet, somewhat south of the foregoing, assayed: Gold, trace; silver, trace. A sample taken 40 feet from the south end of the open-cut across 3 feet 10 inches assayed: Gold, 0.08 oz. to the ton; silver, 0.02 oz. to the ton.

At the south end of the open-cut a branch vein $1\frac{1}{2}$ feet wide diverges from the main vein. A sample taken from this branch vein across $1\frac{1}{2}$ feet assayed: Gold 3.34 oz. to the ton; silver, 0.5 oz. to the ton. A sample taken from the main vein, just north of this branch vein, across $2\frac{1}{2}$ feet assayed: Gold, 0.88 oz. to the ton; silver, 0.36 oz. to the ton.

The horizontal distance from the portal of the crosscut tunnel to a point vertically below the north end of the open-cut is about 436 feet. The tunnel has advanced a distance of 191 feet and is being run on a bearing S. 50° E. (mag.), the last 35 feet being deflected somewhat to the left. Samples taken from the surface exposure of the main vein are not sufficiently numerous to form a definite opinion, but rather suggest that high values may occur in the main vein where influenced by branch veins, but not elsewhere. The owners, however, state that the many samples taken by them do not indicate this. Samples would require to be taken at intervals of 5 feet to enable a definite opinion to be formed. The face of the crosscut tunnel shows small stringers of quartz carrying pyrite. A sample of these stringers assayed: Gold, 0.07 oz. to the ton; silver, 0.02 oz. to the ton. Some pyrrhotite was also noted in quartz-seams in this tunnel.

On the foot-wall of the main vein the country-rock is a carbonaceous schist and on the hanging-wall it is a buff-coloured quartz-schist. The crosscut tunnel is being run from the Little Snowshoe slope.

About 750 feet north-east of the above-described vein is another prominent parallel vein outcropping at two or three points, and 175 feet north-east of this again are exposed two cross-veins about 125 feet apart. One strikes S. 75° W. (mag.) and a sample across 20 inches assayed: Gold, 0.94 oz. to the ton; silver, 0.2 oz. to the ton. The other cross-vein strikes S. 45° W. (mag.) and a sample of it across 18 inches assayed: Gold, 0.96 oz. to the ton; silver, 1.4 oz. to the ton. Between these two veins there is exposed a large quartz vein striking N. 45° W. (mag.), dipping north-east at 60° . A sample across 8 feet assayed: Gold, 0.24 oz. to the ton; silver, 0.72 oz. to the ton. These values merit further investigation. Generally speaking, the owners of this property are making a commendable and intelligent effort to develop it at depth.

This group, owned by R. Reinhold and associates, is situated at the head of Jane. Little Snowshoe creek, about 1 mile west of the *Midas* group. The workings include two tunnels, known as the "Heywood tunnels," which were driven many years ago, at which time an arrastra was erected on the property to recover gold from the quartz veins. These two tunnels are now known as No. 1 and No. 2. A third tunnel, No. 3, has been driven by the present ownership. The two first-mentioned tunnels are in places tightly lagged, so that inspection of these at all points was not possible.

No. 1 tunnel, at elevation 5,390 feet, follows for 27 feet a quartz vein about 5 feet in width, striking N. 30° W. (mag.) and dipping north-east at 60° . At this point the quartz narrows and the drift swings to the right or north for the remaining distance of a few feet. The face shows a width of 5 feet of decomposed schist and quartz. A sample across this width assayed: Gold, 0.44 oz. to the ton; silver, 0.2 oz. to the ton. On the hanging-wall near the face a width of 10 inches of brecciated quartz much oxidized assayed: Gold, 0.26 oz. to the ton; silver, 0.03 oz. to the ton. The schist country-rock strikes N. 50° W. (mag.) and dips south-west.

No. 2 tunnel, at elevation 5,350 feet, follows more than one vein in its course, and one of these is probably the downward continuation of the vein followed by No. 1 tunnel. For the first 50 feet the tunnel follows a vein striking N. 25° W. (mag.), dipping north-east at 60° . At about 50 feet from the portal the width of quartz is very considerable, possibly 20 feet, which may be due to the junction of another vein of more northerly strike. A sample at this point across a width of $8\frac{1}{2}$ feet assayed: Gold, 0.16 oz. to the ton; silver, 0.02 oz. to the ton. This sample was taken from a short raise on the west side of the tunnel. From this point onwards the tunnel follows a vein striking about due north (mag.) for a distance of 33 feet, at which point a cross-vein branches off on a bearing N. 35° E., and another vein parallel to that originally followed is continuous in the main drift to the face, 15 feet from the junction. The face of the main drift shows a width of 4 feet 9 inches of quartz slightly mineralized with pyrite. A sample across this width assayed: Gold, 0.10 oz. to the ton; silver, 0.02 oz. to the ton.

The cross-vein was followed by a branch drift for a distance of 70 feet, but the vein narrows rapidly to the north-east, pinching out practically entirely at 36 feet from the junction-point, although the width is 4 feet near the junction. A sample showed no gold or silver values. The face of the branch drift shows only a few small seams of quartz in the country-rock.

No. 3 tunnel, at elevation 5,230 feet, is run on a bearing N. 10° W. (mag.) for a distance of 36 feet. It is said that a small high-grade stringer was met with, but this would hardly seem sufficient warrant for continuing in country-rock; and it is considered far preferable to confine work to Nos. 1 and 2 tunnels, following the veins known to carry some values. Frequent assays are of course quite imperative to guide progress with any intelligence.

This group, owned by J. C. Holsclaw, is situated on the Snowshoe plateau, **Big Yank.** a remarkable park-like, sparsely timbered area several square miles in extent at the headwaters of French Snowshoe creek, lying between elevations of 5,700 feet and 6,300 feet; excellent feed for horses grows on this plateau.

At one point on this group within an area of about 100 yards by 200 yards there is a remarkable development of quartz veins, some of which are highly oxidized. The country-rock is quartzite, or quartz-schist, striking N. 50° W. (mag.) and dipping south-west at about 45°. The veins vary in width from mere stringers up to 20 feet. In general they either follow the schistosity planes or cut across these more or less at right angles. The largest veins are those which cross the formation and many of these are highly oxidized.

Three samples were taken, one of a quartz vein 3 feet in width where it seemed that the owner had been working, another was a general grab sample of oxidized quartz from a large number of veins, and the third was a sample across a highly oxidized cross-vein 20 feet in width. The first- and last-mentioned samples showed upon assay no gold or silver and the second only traces. It is not necessarily to be inferred from these assays that all of the veins on this property are barren or nearly so, but rather that some of the veins at points showing much oxidation carry no appreciable values. A large number of samples would be required to thoroughly test this property.

HORSEFLY SECTION.

This group, owned by E. T. Creighton and E. Matthew, is situated about 2 miles north-east of Bunting lake and is reached by a branch road and trail from the Williams Lake-Horsefly road. The mode of mineral occurrence exhibited is that of an intrusion of felsite in serpentine. In the latter there is a development of several quartz veins, large and small. These are probably dykes rather than veins and samples taken showed no gold or silver values. The felsite intrusive contains a small amount of garnierite and selected portions assayed 0.1 per cent. nickel. This rock is described by the Bureau of Mines as "a hard compact felsite containing much ankerite, but no lime."

Volcanic Ash.—Within a very short distance of the Black Creek road, a few miles from Horsefly, there are exposed on the banks of the Horsefly river, beds of volcanic ash. Time only permitted of a brief examination, but it is evident that the deposit merits attention.

CARIBOO, QUESNEL, AND OMINECA MINING DIVISIONS.

REPORT BY C. W. MOORE.

INTRODUCTION.

During the season of 1929 considerable activity was shown in placer-mining in this district, particularly in the Cariboo Division. The production for the year is estimated at \$38,845 and the total for the North-eastern District at \$63,342.

Water conditions were in general favourable for the hydraulic mines. The major hydraulics in operation were Lowhee Mining Company, Limited (formerly John Hopp Mines), on Lowhee creek, which continued in virgin ground; Carinelle Placers, Limited, operating the *Bullion*; and B. Boe, operating the *Platt* and *Lyne* leases on Cedar creek. The activities of the many smaller hydraulics in and about Barkerville, whose annual total contribution to the output is considerable, were much the same as usual.

Interesting new discoveries were made on Spanish creek by A. Sutherland and A. Anderson, and in the Horsefly section by R. N. Campbell.

Keystone-drilling operations were carried on by the Consolidated Mining and Smelting Company of Canada, Limited, on Swamp river, and by Central B.C. Mines Development, Limited, in Beaver valley, in the Horsefly section.

The dredge formerly owned by the Kafue Copper Development Company, Limited, has been sold to interests in the United States and has been dismantled and shipped to Oregon.

From August to November I examined a number of placer areas in the Cariboo, Quesnel, and Omineca Divisions, with the object of ascertaining the possibilities of stimulating and reviving activity in placer-mining. In the following report the description of properties is divided under the three Mining Divisions of Cariboo, Quesnel, and Omineca.

SUMMARY AND CONCLUSIONS.

There are signs of a revival of interest in placer-mining in the Cariboo district, which has undoubtedly been stimulated by the action of the Department of Mines in actively aiding the industry. All indications point to a great deal of drilling and other methods of prospecting during the year. Not only will there be more prospecting, but, should the ground warrant, there is capital available to equip it and bring it into production. There are companies prepared to finance any undertaking big enough to show promise of a fair return on the money invested. It is to be hoped that these companies will tackle the problem in a businesslike way with the best geologists and engineers obtainable. This shows a healthy condition and we may look forward, confidently, to excellent results.

I would emphasize that practically all the placer-mining done in the Cariboo Division during the past fifteen years has been done within a radius of 12 miles from Barkerville. Geologists and engineers all recognize that if the industry is to be revived we must look for placer-fields outside this small area. This is what is now being done and with good results.

The cause of this new interest generally and more particularly in the Cariboo is easily accounted for: The Government has been supporting the placer industry, particularly in the matter of more and better trails. In some sections it started and practically completed a system of trail-building. These trails will make it possible for prospectors and engineers to take pack-horses to or near any area which they may wish to prospect or examine. In doing this work the Government has shown confidence in the future of the country, and by doing so has encouraged the capitalist to proceed with the work of investigation.

The Cariboo has the advantage of having good trunk roads to all its centres. The Omineca is not so fortunate in this respect. However, upon the completion of the road from Fort St. James to Manson Creek, we can look for improvement in that section.

Another reason is that the results obtained from testing by the Central B.C. Mines Development, Limited, and the New Era Mining Company, under the management of B. F. Lundy, have encouraged other interests to proceed with development-work.

The great need of the Cariboo is a good topographical map, linking up Horsefly, Quesnel river, and the Barkerville areas, extending north to the Fraser river and easterly to a point which would take in the whole of the Stony Lake area. This map should be on a scale of not

more than 4 miles to the inch. Such a map would be of undoubted assistance in helping to trace out the old drainage systems and connecting up different sections of channels still in existence.

This section of the country has been well treated during the past year in so far as roads and trails are concerned. In every instance where assistance was recommended by the Resident Engineer the money has been granted by the Department of Mines. There has been more trail-building during the past year than there was during the preceding five years.

The Department of Mines and the Public Works Department have shown evidence of co-operation in trail-building which has resulted in a definite system of trail-building. For a comparatively small amount the whole country could be made accessible.

From the Horsefly river to Prince George, and from the Fraser river easterly as far as there appears any promising placer-ground, trails should be cut, over which pack-horses could be taken close to any desired location. Such trails would not only provide transportation facilities for prospectors and engineers who wish to examine any specific section of the country, but would also be of much assistance to the Forest Branch of the Government in the matter of fire-protection.

The population of the Manson Creek section (Omineca Division) at the time of my examination consisted of six white men and six Chinamen actually engaged in placer operations. Scattered through the district there were four men moving machinery to Germansen creek, four prospectors looking for quartz-showings, a Deputy Mining Recorder, and two or three trappers.

There are many reasons why this district is so depopulated. The main one is probably the condition, or perhaps I should say lack of condition, of the trails. This fact has been recognized for some time by the Department of Mines, but lack of funds has prevented as much trail-work as would have been desirable. During the season of 1929 a start was made on a road from Fort St. James to Manson Creek, and generally the Department of Mines is fully alive to the necessity of building roads and trails in this section.

Upon completion of the road now under construction from Fort St. James to Manson Creek, it will be possible to get heavy drills into the country, and thus encourage capital to drill the larger areas. It will also provide the individual prospector with an opportunity to earn a grub-stake without having to travel hundreds of miles to do so. I would suggest that this road be completed with all possible dispatch.

There are several small creeks in this section which are well worth prospecting and some larger areas which are sufficiently attractive to warrant examination with a view to dredging. It requires a Keystone drill to prove the ground, and until there is a good road into the country a drill of this type cannot be taken in, except at an almost prohibitive cost. The few light drills which have been taken in have demonstrated that their usefulness is confined to a very limited amount of scout drilling.

In the Cariboo, Quesnel, and Omineca Mining Divisions there are without doubt many excellent opportunities, other than those mentioned in this report. It will, however, require considerable time and investigation to secure sufficient data to present a comprehensive description of the many points of interest to the mining industry.

Owing to the interest being taken in placer-mining at the present time, it is more than likely that advantage will be taken of the many opportunities which, upon investigation, should offer every prospect of satisfactory remuneration for both the prospector and operator, and will in all probability enable the Cariboo to regain its former place as a large placer-gold producing district.

As an instance of the possibilities, there is a high channel paralleling the Horsefly river on the north which probably has never had a pick in it. There is another channel running from Little Swift river to an outlet on Lightning creek, about 2½ miles below Wingdam, which is cut by numerous creeks and is quite likely to prove the source of the gold, found above the clay, on Peters creek and Lightning creek.

There are miles of old channels in the Cariboo in which there has never been a hole drilled to bed-rock. As a matter of fact, detail knowledge of the Cariboo and Omineca is limited to certain areas.

The excellent report of W. A. Johnston and W. L. Uglow (Memoir 149, Geological Survey of Canada) covers but a very small area in the vicinity of Barkerville. It is, however, a valuable report as it is a key to the placer geology of a much larger area.

As a result of my examinations I have reached the following conclusions:—

(1.) That there are large areas in Cariboo and Omineca which can be worked by dredging and hydraulicking.

(2.) The indications are that there are sufficient values, if properly managed, to pay handsome returns on money invested.

(3.) That every consideration should be given capital, during the next few years, in order that the greatest possible activity will take place, to the end that the industry will be placed on a firm and permanent foundation.

(4.) That the building of roads and trails for mining purposes should be continued and in a systematic way.

(5.) That the "Placer Act" should be revised, and particularly that the provisions dealing with free miners' certificates should be made much less drastic than at the present time.

(6.) That a good topographical map of the Cariboo district should be made as soon as possible.

CARIBOO MINING DIVISION.

PRINCE GEORGE SECTION.

Government Creek.

The Government Creek Hydraulic Gold Mining Company has had a geologist in the field all summer making an investigation, and I believe some very valuable work has been done. This company has also washed a considerable quantity of surface gravels, but as no report was made to the Resident Engineer, I am unable to make any definite statement as to what success was obtained.

Hixon Creek.

H. Brisco interested some Victoria people in the spring of 1929 who have examined the property, but I was unable to learn with just what results. For some years E. Hann and J. Strbac have been the principal producers on this creek. During the summer of 1929 they did some ground-sluicing and also worked on some quartz-showings on the creek.

Tertiary Channel.

D. D. Fraser and James McHardy have been prospecting the Tertiary channel at Canyon creek, about 38 miles north of the town of Quesnel. The Quesnel-Prince George highway runs through the leases, giving them good transportation. At Cottonwood canyon on the Fraser river, where the channel is between 800 and 900 feet wide, the ground has been worked intermittently for twenty years without any great success. D. D. Fraser claims that due to bed-rock conditions existing at this point the concentration action was poor and that the recovery of gold was only 13 per cent. of the total bed-rock values. They are now attacking the channel 20 miles north of the old workings, where they expect higher values as well as improvement in the bed-rock conditions. If this proves correct as to values and they are able to recover 50 per cent. of the gold they should have a paying proposition. The drilling will give them valuable information which will be of benefit when prospecting other Tertiary channels. They have sunk a shaft to a depth of 85 feet, and from the bottom of the shaft sunk a 5-inch drill-hole to a total depth of 175 feet. They claim to have had rim-rock at that depth and are now making arrangements to drill a section of holes the full width of the channel.

BARKERVILLE SECTION.

Antler Creek.

The only work being carried on at present in this vicinity is on California creek. Pete McLanders has a small hydraulic plant and at present is endeavouring to get up the creek beyond the point where the old-timers drifted. He is recovering some coarse gold on the rim and hopes to get good "pay" when he arrives beyond the old workings.

There is an old channel of the creek which starts somewhere near the lower end of Maloney flat. This parallels the present creek-channel on the west and joins it between the wagon-road and the lower end of the old China Creek hydraulic pit. About three-quarters of a mile below Sawmill flat a section of this channel has slid away, and I believe that this accounts for the very rich ground found at Antler Creek discovery. About 2½ miles of the old channel is still intact, although the lower half-mile may have been eroded by a local glacier. This channel is located in one of the richest sections of the Cariboo and is one of the major possibilities of the whole district. The cost of proving the ground is small, as there is a good wagon-road to Sawmill flat, over which drills could be taken, reaching to a point within half a mile of the upper end of the old channel. There is another road up Wolf creek, over which drills could be taken to within about 500 feet of the lower end.

Sawmill Flat.

This flat offers another possibility in the vicinity. At one time it was the drainage system for Victoria gulch and Nugget gulch, as well as part of the area now drained by upper Antler creek. At present about 1½ miles of this flat drains to Antler creek and the remainder to Swift river. The flat will average about 500 feet in width. There are no big boulders in sight, but there are a few big slide-rocks. This location should be sufficiently attractive, to any one seeking dredging-ground, to drill at least two sections of holes. This will give all preliminary information required regarding values, depth, bed-rock, etc.

Cunningham Creek.

Trehouse Hydraulic Mining Syndicate.—A description of this property is given in the Annual Report for 1928. The roads to the property have been greatly improved during the past year and autos and trucks can proceed right up to the camp. This work was done jointly by the Departments of Mines and Public Works.

This is one of the most promising properties in the Cariboo. The old channel parallels the present channel of Cunningham creek, with both rims well defined. There has not been sufficient prospecting done below the present operations to give any idea as to how far the channel will extend down-stream before it is cut by the present channel of the creek. It is quite possible that it will extend down-stream approximately 2 miles.

There is sufficient water available in Cunningham creek to work this property twenty-four hours a day for three months, and to work twelve hours a day for the remaining three months of the season. The present ditch is so small that during the very hot weather, which causes heavy evaporation, it is impossible to get sufficient water to the penstock to supply a 3-inch nozzle with a 150-foot head.

Eight-mile Lake.

The road from Barkerville to this lake has been so greatly improved during the summer that automobiles and trucks can easily be driven to the lake.

M. McComish and Morris Anderson have been working all summer on the old Eight-mile Lake property, lowering the flume to enable them to get out some of the rich gravels still left in these leases. This property was one of the most spectacular finds in the latter days of the Cariboo. The pay-dirt was found on the top of hard boulder-clay. Due to the lack of sufficient grade and a limited supply of water this became a very expensive operation. When the ground was worked back from the lake, which was used for dumping purposes, the grade of the flume gradually rose above the clay, which made it impossible to secure the values, and consequently the work was discontinued for a time. There is known to be rich pay-dirt under the bank, where the previous operations ended, and it is this ground which the present owners are trying to recover.

Other Creeks.

R. D. Rees is working his leases on Shepherd creek. John Roddick is working a lease on Pine creek. John Chouse is working a lease on the right limit of Summit creek.

Willow River.

This river drains the largest area of rich placer-ground in the Cariboo. Williams creek is the headwaters of the East fork of this river, while Jack of Clubs creek and Slough creek form the West fork. The two forks converge at the north side of Island mountain, about 10 miles north-west of Barkerville. Practically all of the creeks draining into the river have been worked.

The Willow River Mining Company endeavoured to work the river itself just below the junction with Mosquito creek, but with little or no success, due, principally, to the depth and cost of pumping water. It did, however, prove that there were good values on the bottom, as some of the ground went as high as \$7 to the square foot of bed-rock. Apparently the deep ground does not extend any very great distance down-stream, as the river flows over bed-rock 6 miles below the mining company's works. The rim-rock shows at several points above Valley (Big Valley) creek. Between Dragon creek and Valley creek, a distance of about 16 miles, there is some of the most promising ground for dredging operations in the Cariboo.

From where Valley creek empties into the Willow river to a point about 5 miles north, the valley is very wide and is probably an old lake-bottom. From this point for about 45 miles

(as the river flows) there are excellent possibilities of finding dredging-ground. In the early days of the Cariboo there was considerable rocking done on the bars of this section.

There is an old channel, the source of which is very problematical, but which crosses Dragon creek about half a mile from the mouth. It runs almost parallel with Willow river, although in a slightly more westerly direction, for some miles, turns easterly, and joins Willow river about 16 miles from Dragon creek. Mr. Ford, of Dragon Creek, believes that this is the old channel of Lost creek, which is very likely correct. The channel is so deeply covered with glacial drift that it is impossible to determine its source.

From knowledge gained at the Dragon Creek exposure and from other evidence, I believe that it crosses Tregillus creek about $4\frac{1}{2}$ miles from its mouth and is quite likely to be the source of the gold found in Rushon and Baldhead creeks, as well as the rich spots found on the right limit of Tregillus creek. From this point to about 10 miles north, where it empties into the Willow river, as a hanging valley, the old channel is well defined. Deadwood creek, which empties into the Willow river about 2 miles north of Tregillus creek, cuts the old channel and was worked from this point to its mouth. Canyon creek, which empties into the Willow river from the same side, about 2 miles farther north, did not cut the channel and carried no values. Archer creek, north of Canyon creek, cut the channel, and from this point to its mouth was worked with success. Willow river, below the mouth of Tregillus creek, was wing-dammed and the ground also worked with success. With this evidence it is natural to conclude that the source of the gold was in the old channel and that there should be values in Willow river. All creeks emptying into Willow river on the east side carried gold. There is a good trail from Beaver Pass House to the mouth of Tregillus creek and from there up Willow river to Sugar creek and down-stream to Big Valley creek. There is a good trail from Ahbau lake to Willow river.

AHBAU LAKE SECTION.

There is a good pack-trail from Cottonwood House on the Quesnel-Barkerville road to the lower end of Ahbau lake. From here a good trail follows the easterly side of the lake for about 4 miles and then running almost due east to Willow river. Another trail follows the westerly side of the lake to Ahbau House, Hay lake, Lodi lake, Willow river, and Stony lake. Lodi lake is the head of the drainage system of the Little Cottonwood river, which flows in a westerly direction to the Fraser river.

Ahbau creek, between Lodi lake and Ahbau lake, has produced considerable gold. The chief producer was a Chinaman, for whom the creek was named. His workings were about half a mile below Alder gulch, which comes in on the west side of the creek. About half a mile up Alder gulch from Ahbau creek there is an old shaft about 80 feet deep. I was unable to secure much information about this work. However, Robert Cresswell (an old-timer known as Mountain Bob, now deceased) was credited with the statement that had the property been rightly managed it would have proven successful. The property was abandoned after a small amount of drifting. This shaft is of interest, inasmuch as all the gravel worked on Ahbau creek was from 4 to 12 feet deep. This Chinaman, Ahbau, had ground about 5 feet deep, to where the rock pitched to the west. His "pay" was close to the right limit, and as the gold was coarser than that found on any other part of the creek he was very probably working on the east rim of the deep channel found on Alder gulch. This deep channel shows that the old drainage-channel of this area was much deeper than the present one, likely with a reversed gradient north-westerly to Canyon creek. All the creeks, including Alder gulch, draining from the west into Ahbau creek have been worked on the surface and are reported to have paid better than wages.

In looking over this section during the summer I was impressed with its possibilities and consider it one of the best places in the Cariboo for a man to take out a grub-stake. The low cost of transporting supplies, the abundance of rainbow trout in the lakes, and the great number of deer, moose, black and grizzly bear in the vicinity tend to reduce the cost of living to a minimum in this section. This district was practically depopulated during the war and has remained so ever since.

Lower Swift River.

In the year 1922 a group of leases on this river were drilled by the Gold Dredging Syndicate, of Vancouver. M. M. Kerr was the secretary-treasurer of the company as well as manager in charge of field operations. The ground was drilled by G. A. Dunlop and the following results were reported: 5,000,000 cubic yards with an average value of 40 cents a yard. In my opinion,

the yardage that would be dredged is much smaller than this and that the values claimed are much too high.

In 1924 this company installed a suction-jet dredge, but for some unknown reason did not operate this dredge until 1926. After about two months' trial they found that it was useless, as are all other contraptions of a similar type. This operation had one very serious aspect, inasmuch as those who were not familiar with the situation were led to believe that as the undertaking was not a success the ground could not be profitably dredged. Careful investigation has established an entirely different view, and with a modern dredge the ground would be found very easy to dig. It is regrettable that in a placer-mining country there is nothing to prevent the formation of companies whose sole effort, apparently, is to dispose of stock in what purports to be a gold-dredging company, when the equipment or methods used are so absolutely useless that its mining efforts are doomed to failure almost before their inception. I believe that at least two of the leases in this group warrant further investigation, to the extent, at any rate, of checking some six or eight of the holes drilled by G. A. Dunlop. The gold in this section is on, or just above, the boulder-clay, and the gravel would average something under 20 feet in depth and should be suitable for a small dredge of modern type. Should the investigation prove the area to have sufficient values to make modern dredging profitable, there would be available a large area under similar conditions, which would probably carry values about the same as these two leases.

On lower Swift river and on Lightning creek, as well as on the flats around Coldspring Ranch and Cottonwood House, there is a layer of gold-bearing gravels at a depth of from 8 to 20 feet on top of the clay. In the early days of the Cariboo, Chinamen worked large areas on the surface. In many instances the gravel was rich, as is proven by the records of the late John Boyd. The drilling on Swift river is the only work in this section which has tested the ground.

QUESNEL MINING DIVISION.

HORSEFLY SECTION.

On October 7th, in company with Douglas Lay, Resident Engineer for the North-eastern District, I visited this section. We examined the ancient channel where it is cut by Moffat creek and found the gravels to be overlain with volcanic rock. We also visited Triplet lake and inspected the work done last winter just east of the lake by J. R. Williams and Mikkelsen Bros. They had made two attempts to reach bed-rock by sinking shafts, but due to the great amount of water encountered were unsuccessful, although they did get below the lake-level. From the surface to the point at which they were compelled to stop they found Miocene gravels, with the exception of one stratum of lignite coal. This work is of value for the reason that it proves that the channel runs toward Star lake. To the south-east of Star lake they claim that the old channel can be traced. Since there appears no good reason for doubting this claim, then somewhere near Star lake the old channel may be found intact, and if so would be the proper place to start drilling.

I believe that the rich gravels found at Wards Horsefly originated from an old channel and that this old channel runs through Beaver valley to the Quesnel river. It then followed the course of the present Quesnel river for some distance and probably flowed west in the vicinity of Dragon mountain into the Fraser river, 7 miles below the town of Quesnel. It is believed this old channel was the source of the gold found at the well-known rich bar on the Fraser river at this point. It is to be hoped that some company will be sufficiently interested to test this channel in the vicinity of Star lake. Should such drilling prove the direction, then it could be followed and, if not too much disturbed with ice, would offer wonderful possibilities. Should the Central B.C. Mines Development, Limited, get to bed-rock at Beaver valley, it will be of very great assistance in helping to prove direction of this old channel.

New Era Mining Co.—About the first of December this company started drilling north of Horsefly, with the expectation of locating the extension of the rich "pay" found at Wards Horsefly hydraulic. It appears that they have succeeded. To date ten holes have been drilled. B. F. Lundy, the manager, reports the average result from drilling is about \$1 a cubic yard. The average depth is 36 feet, which is ideal for dredging. There is an area of about 50 acres at least, or about 3,000,000 cubic yards. The area worked at Wards Horsefly was less than 5 acres, with a reported production of about \$500,000. Mr. Lundy reports that the values are on and above hard blue clay, which acts as a false bed-rock.

The interesting feature of the discovery is that the gold found must have come from a higher level than the bed-rock under the clay. The gravels carrying the gold therefore must have been resorted from a higher level. The ancient channel near the mouth of Moffat creek shows signs of erosion and is quite likely the source of the gold. If this is the case the old channel at Triplet and Star lakes should offer good inducements for drilling.

Moffat Creek.

For further description see Annual Reports for 1927, page 180, and 1928, page 203. At the time of each of my two visits to this section the owners of the leases were away. The only portion of the creek examined was that below the falls. The following information on Moffat creek is from the report of Douglas Lay, Resident Engineer, in the Annual Report for 1928:—

"*Ancient River-channel cut by Moffat Creek.*—In the Annual Report for 1927, page 180, mention is made of the fact that Moffat creek apparently cuts through an ancient river-course. This was further investigated during the year. A short distance below the falls on Moffat creek there is exposed on both banks what appears to be an ancient river-channel. The gravel is residual and is composed almost entirely of well-worn quartz, closely resembling that from the deposit at Star and Triplet lakes, on which are the leases of J. Williams and G. Kuchan, and also that of the old *Miocene* property at Horsefly.

"Where intersected by Moffat creek the direction of this channel is N. 65° W. (mag.). The level of the bed of Moffat creek at this point is 235 feet vertically above Horsefly Post-office. On the left bank of Moffat creek at this point the gravel is overlain by volcanic lava-flow, but it is not certain whether the latter is in place. It is understood that some years ago a Keystone drill-hole was put down in this gravel at a point somewhat down-stream from this exposure, but bed-rock was not reached. This is obviously a point at which drilling should be carried out, because of the hydraulic possibilities which may exist, and which can only be proved by ascertaining the depth of the channel at this point as well as the values. Moffat creek would furnish a good supply of water for hydraulicking if the presence of the other conditions essential to success can be established by Keystone-drilling."

Antoine Creek.

This creek flows out of the eastern end of Beaver valley into the Horsefly river. It has never been properly tested and has been overlooked for years by prospectors. In 1928 R. N. and John Campbell staked ground on the creek and when doing their annual development-work last July found good "pay." R. N. Campbell reports good values in all their pits. In places the gravel went as high as \$3 a cubic yard.

On October 8th, while on the creek, the ground was panned at several different places over about 1½ miles of the creek, and while I did not get values as high as reported by Mr. Campbell, the gravels did show high values over a large area. Although the pits put down by Campbell Bros. were from 6 to 7 feet deep, there is nothing known about the actual depth to bed-rock; consequently it is not possible to make any accurate estimate of yardage. If the ground is 20 feet deep, with the values holding to that depth, it will make a good hydraulic property. Physical conditions are ideal for hydraulicking. There is unlimited room for tailings in Roberts lake (Anderson). There are no big rocks in sight, nor is there likely to be in the ground. The water-supply was not investigated. R. N. Campbell states that they will have sufficient water to supply a No. 6 hydraulic plant for a season of six months. Campbell Bros. were more fortunate than the average prospector with regard to financing. This was quickly arranged with B. F. Lundy, who in consideration of a one-half interest agreed to furnish material and complete certain stipulated work. They have their storage-dam completed and it is their intention to start work on the ditch as soon as the frost is out of the ground. The ditch will be short and, as they have a road to the mouth of the creek over which to transport plant and material, the cost of equipping the property will be small. With any kind of luck they should be piping in July.

Beaver Valley.

R. N. Campbell, of Horsefly, was successful in interesting B. F. Lundy in his leases in the valley, with the result that Mr. Lundy formed the Central B.C. Mines Development, Limited, which started drilling in July. Mr. Lundy reports that the results to date have been very satisfactory, but sufficient drilling has not yet been done to develop any extensive area. The company intends to start drilling again in the early spring.

Black Creek.

Black creek empties into the Horsefly river about 20 miles east of Horsefly Post-office, from which point there is a good motor-road to the mouth of the creek.

The MacKeracher leases were taken over about a year ago by the Rountree Mines, Limited, of Vancouver. About 1½ miles from the mouth of the creek there is a drop of about 200 feet. Above the falls the creek flows through a narrow rock canyon 280 feet long and the leases are located just above this canyon. There is no sign whatever of bed-rock, or rim-rock, for 1,000 feet. The company claims to have good prospects in the gravel in this portion of the creek. Since taking over the property this company has installed a good No. 4 hydraulic plant and built a storage-dam. It has also lowered the rock canyon to a depth of 20 feet at the upper end, putting in a flume on grade, all of which has entailed a considerable expenditure of time and money. In the rock-cuts, or canyon, a 2-compartment flume has been installed, each compartment 3 feet wide.

This work was not completed until near the end of July, at which time the water-supply was nearly exhausted. Sufficient piping was done, however, to show that the rock-cut was not deep enough to get the flume on bed-rock. It is claimed that bed-rock will be reached at from 40 to 50 feet from the mouth of the flume. Should this be correct, the flume should be on the rock within thirty days of the starting of operations in the spring. I have been advised by Mr. Arms, the manager, that the company intends to send three men to put down some pits in order to locate the bed-rock. At the present time there is a limited supply of water, but the company claims that it can secure an unlimited supply at a very small cost. In my opinion there is nothing to justify any further expenditure until more definite information is acquired as to the depth of rock. It is quite likely that the flume will have to be lowered to get bed-rock or find the old outlet to the creek.

QUESNEL SECTION.

Quesnel River.

One of the major possibilities of the Cariboo district is Drummond flat. The mouth of the flat is located 28 miles east of the town of Quesnel on the Quesnel river. A road which starts near the Quesnel River traffic-bridge runs across the ground, but it is not in a very good condition at the present time.

This property was prospected in the early nineties by Thomas Drummond, of Montreal, and would have been worked years ago had there been a sufficient supply of water available to justify the cost of constructing a ditch and flume. Physical conditions for hydraulicking are ideal. The Quesnel river is about 100 feet below the bed-rock in the channel, providing ample room for tailings. A certain amount of drilling is necessary to establish the exact yardage, but there should be about 40,000,000 cubic yards available.

The Quesnel Hydraulic Gold Mining Company discontinued operations on its property at Birrel creek (20-Mile creek) some years ago. This company had a water right on Swift river, but at the present time this water right is open to staking. The company also owns a ditch which carried the water from Swift river to Birrel creek. This ditch will carry 200 second-feet of water and the minimum flow in Swift river is above this amount. I believe that this ditch could be secured from the company at a very reasonable price. This water system could then be utilized to hydraulic the Drummond Flat deposit.

The valley of the Quesnel river is one of the warmest spots in the Cariboo district. The hydraulic season would be approximately nine months in the year, somewhat longer than at Barkerville. The gravels in this channel date back to a very early period, as a proof of which I have a section of a mammoth's tusk and a fragment of a molar tooth which were found in these gravels.

LIKELY SECTION.

Cedar Creek.

B. Boe was the only operator on Cedar creek and reports a successful year. An output of 500 oz. was made.

Kemp and Lackie did a small amount of work on their leases situated near the mouth of Poquette creek.

Spanish Creek.

*Leases of Alex. Sutherland and A. Anderson.**—The owners of these leases made an interesting discovery during the year, having obtained indications of an old gold-bearing channel in the left bank of Spanish creek, about 85 feet vertically above the present creek, at a point about 3 miles above Black Bear creek. At this point a tunnel has been run a distance of 30 feet into the bank, preceded by 20 feet of open-cut. In the near vicinity of the face of the tunnel, pits have been sunk a few feet in depth; and 50 feet from the portal of the tunnel, between the latter and Spanish creek, a shaft has been sunk to a depth of 18 feet. The face of the tunnel shows rim-rock up to a height of 3 feet, and above that, gravel. Encouraging values are being found, the owners stating that they are taking out sufficient gold to cover their wages.

While further work requires to be done before it can be determined whether or not this is an old channel of Spanish creek, the discovery is of interest in view of the fact that on this creek no material amount of gold was found above the mouth of Black Bear creek. A good cabin had been built by the owners of this property on the right bank of Spanish creek, a short distance from the workings.

North Fork of Quesnel River.

*Matthias Gold Mining Co.**—With reference to the 1928 Annual Report on this property, the owners state that at the time of examination (October 18th, 1928) sloughing at the face of the pit rendered it impossible to discern what was observed by them at the time of piping—namely, the fact that at the face of the pit bed-rock dipped into the hill, also that some gold was found at this point, and that the indications were that the face of the pit had *just* reached the *south* rim of a buried ancient channel running parallel to the North fork of the Quesnel river. The owners further state that an opening has been made on Wolverine creek, some 3,000 feet upstream from the above-mentioned point, which also indicates the existence of such buried ancient channel.

This exposure on Wolverine creek has not yet been inspected and this property will be further examined during 1930. It should, however, be borne in mind that, even assuming that there does exist a buried ancient channel on this property, the question of profitable gold values therein remains to be determined by careful and adequate testing—by Keystone-drilling, for example. Until such has been done no intelligent and reliable opinion can be expressed as to possibilities. Further, it seems evident that such testing should precede any capital outlay in connection with any scheme of actual mining operations.

South Fork of Quesnel River.

Nelson and Fular Leases.—These leases were not worked during the season. The owners, J. P. Nelson and E. B. Defue, are contemplating some improvements to their pumping plant for next spring.

Bullion.—This property is now being worked by Carinelle Placers, Limited. During the spring and summer operations were carried on, but were discontinued early in the fall. I am unable to state with what success, for the reason that no report has been made to the Resident Engineer.

KEITHLEY SECTION.

The Consolidated Mining and Smelting Company of Canada, Limited, discontinued drilling on Swamp river in August. It is understood that results were unsatisfactory. Chester and Thomas were prospecting on Keithley creek. H. DeLong had a small hydraulic plant on Weaver creek, a tributary of Keithley creek.

The Quesnel Gold Mining Company, Limited, operated during the summer and did considerable development-work, but with what results I do not know as there was no report available.

OMINECA MINING DIVISION.

HOUSTON SECTION.

Buck and Bob Creeks.

These two creeks are about 10 miles south of the town of Houston, on the Canadian National Railway. They can be reached by a fairly good auto-road from Houston. The leases are owned by W. A. Johnston, of Prince George.

* Report by Douglas Lay, Resident Mining Engineer.

There are small prospects on the surface and in the canyon just below the property. Some coarse gold has been taken out. The property extends over some 20 miles of creek-bottom and, while there has not been enough development-work done to prove values, it warrants at least three sections of drill-holes. The physical conditions are ideal for dredging.

MANSON SECTION.

The term "Manson section" is used to designate that portion of the Omineca Mining Division which in former years had some importance as a placer camp and which centred about the old town of Manson Creek. In recent years this section has been dormant, but signs of returning activity are apparent.

In Dawson's "Mineral Wealth of British Columbia," published in the Geological Survey of Canada Report for 1888, mention is made of the Omineca placer-field and some information given in regard to the early mining operations.

In 1894 McConnell made a trip up the Finlay and Omineca rivers and examined the Omineca placer-diggings. His report is Part C of Vol. VII. (1894) of the Geological Survey of Canada.

A month's trip was made into this area by Camsell in 1915. His report, entitled "Explorations in the Northern Interior of B.C.," is contained in the 1915 Summary Report of the Geological Survey of Canada.

The main routes of travel are from Hazelton and Fort St. James. The trail from Hazelton goes through the Babine range to the foot of Babine lake; thence to Takla lake, which is crossed by ferry; and thence 65 miles farther, easterly, to Manson Creek.

Another route which is now much used to get into this section is from Vanderhoof, on the Canadian National Railway, to Fort St. James, 40 miles by motor-road; then by boat or canoe to Takla Landing. This water route is via Stuart lake, Tachie river, Trembleur lake, and Middle river to Takla lake. Twenty-ton scows can be taken in this way and it is a feasible route for transporting heavy machinery. From Takla Landing the Hazelton-Manson trail is used to Manson. The construction of a sleigh-road from Takla Landing to Manson would in connection with this water route make a fair transportation system for mining in the Manson section.

There is also a pack-trail which goes directly from Fort St. James to Manson, a distance of about 125 miles. As the water route to Takla Landing is quicker, this old trail is not now much used. A road is now under construction from Fort St. James to Manson and it is planned to complete this.

Slate Creek.

Since 1924 the only real development-work done is the drilling of Slate creek by W. M. Ogilvie for the Consolidated Mining and Smelting Company of Canada. While in conversation with Mr. Ogilvie, although no very definite statements were made regarding yardage and values, I was given to understand that the values were high, but that there was not sufficient yardage to justify the expense of building a ditch and equipping the ground with an hydraulic plant.

Above the point where the present channel of Slate creek empties into Manson creek there are three distinct channels. These cut the divide between the two creeks and undoubtedly at different periods Slate creek flowed through these channels. This would probably account for the rich spots on Manson creek just below where these channels were cut by the creek, and it is quite possible, should the company prospect or drill these three channels, that it would increase the yardage to a point where it would justify them in installing a ditch and plant.

Manson Creek.

R. H. Fleming and partners have taken in a small pump to be operated by an Evinrude engine and had just started to prospect when I visited the creek.

Germanesen Creek.

Ah Lock had rather a poor year on account of the unusually dry season. McCorkell Bros. have acquired several leases on the upper end of the creek, above the point at which it was worked in the early days. About $1\frac{1}{2}$ miles of this ground should be good! The old-timers made several efforts to work the ground by wing-damming and shovelling into boxes, but their efforts

did not meet with any very great results, principally on account of the heavy and sudden rains which would wash out their wing-dams and sluices. McCorkell Bros. intend to install a drag-line scraper which works on a boom. Should it be possible to work the ground dry by this method, and if they have a proper washing-machine and some device for getting rid of the tailings, their operations may prove quite successful.

Vital Creek.

Lee Tong and associates are the only operators on this creek. Heretofore they have worked by ground-sluicing and a small hydraulic plant. Owing to the height of the clay-bank and the small amount of water available, their operations were not successful during the last year and they have devoted the summer of 1929 to getting ready to work the ground by drifting methods. They have taken as a partner Sing Cow, of Barkerville, who is a first-class underground man. Practically all summer was spent in doing dead-work in order to get the property in shape for drift-mining. No production was made during 1929.

On Tom creek W. McCormick is still looking for the outlet of the old channel. There was one other prospector prospecting for placer in the Omineca. As I failed to locate him, I cannot state whether he has met with any success.

NATION RIVER SECTION.

This section was not visited during the year. George Snell reports that he and his partners have half a mile on Philip creek and 3½ miles on Nation river which show exceptionally good values and claim that it could be dredged with every prospect of success. The transportation facilities in this section are very inadequate at present. The Fort St. James-Manson Creek road, now under construction, will cross the Nation river above these leases and will provide some relief for this section and will help in solving the difficulties of Snell and partners.

In the Annual Report for 1924, John D. Galloway (then Resident Engineer, No. 2 District) noted that there was a very considerable area in this section that would lend itself to dredging, providing that there were adequate means of transportation, in order that drills may be taken in for testing purposes. At the present time there is under construction a road from Fort St. James to Manson Creek, and until this road is completed there is very little prospect of securing capital for development-work in this district.

CENTRAL MINERAL SURVEY DISTRICT (No. 3).

BY H. G. NICHOLS, RESIDENT MINING ENGINEER.

INTRODUCTION.

GENERAL.

The Central Mineral Survey District covers the southern interior of British Columbia, with seven out of the forty-two Mining Divisions of the Province, and occupies about 12 per cent. of its total area. It includes all the country drained by the Thompson river, and by other tributaries of the Fraser river between Williams Lake and Hope, as well as the Okanagan valley down to the southern extremity of Okanagan lake and a section of the watershed of the Skagit river.

The district figured in the earliest history of mining in the Province, placer gold having been mined in the lower reaches of the Fraser river in 1858, while the *Eureka Victoria* silver-lead mine near Hope is credited with being the first Crown-granted lode mine that was operated in the country.

At a later date placer gold was found along the upper reaches of the Fraser river, above the canyon, and on the Bridge river, and the operations that ensued led to the discovery of the gold-quartz veins on Cadwallader creek, one of which, the *Pioneer*, is the premier producer of the district to-day.

In the year 1877, when the results of the first geological reconnaissance of this area were published,* about ten localities of placer gold and as many of lode-minerals were known, and discoveries have followed one another, year by year, until at the present time there is no considerable section of the district that is not known to be mineral-bearing.

The district, in general, presents unusual opportunities on the score of accessibility, the master valleys of the Fraser and Thompson rivers providing the means whereby both railway and highway transportation are available, while the plateau country which constitutes a large proportion of the entire area lends itself admirably to the construction of roads and trails.

The Interior Plateau country, levelled up by vast flows of Tertiary rocks, has not been affected by processes of erosion to a degree comparable with that which is evidenced in mountain-built areas, with the result that the surface has not been cut down to a depth sufficient to expose the cores of intrusive rocks, with which the mineralization of the Province is so largely associated. This feature is responsible, in large measure, for the fact that development of ore-bodies of economic importance has not proceeded more rapidly.

Stocks of such intrusives are exposed in more or less isolated positions throughout the plateau country and mineralization of one kind or another is identified with these surface occurrences, while a feature of even greater significance is the widespread character of mineralization in joint planes and fractures over areas in or near which underlying batholithic rocks occur.

These conditions point to deeper development than lies within the scope of average prospecting operations, as being a dominant requirement for the full realization of many of the mineral possibilities of the district, whose progress, therefore, depends greatly upon external influences affecting the work of exploration, such as the price of metals.

Up to the present time the development of base-metal resources has not been commensurate with the possibilities that are indicated, and in view of the lack of such attraction as would be afforded by the operation of a mine of outstanding magnitude, investment of capital in the exploration of the mineral resources of the district has been influenced by the precious-metal content of the ores, a fact which is reflected in the preponderance of production of gold and silver over that of other metals.

During recent years greater attention has been paid to the possibilities of production of base metals, and in particular during the past year investigations of low-grade copper-deposits were made by prominent operating companies as a result of the stimulus afforded by the higher market price of the metal. This factor, however, reacted later in a less favourable way upon the search for new ore-bodies by rendering available for extraction large reserves of mineral not previously of economic grade, already developed in existing mines.

* Dawson, G. M. Prelim. Report on Physical and Geological Features of the Southern Portion of the Interior of British Columbia. Geological Survey of Canada Report, 1877-78.

Another factor that militated against investment in exploration-work during the past year was in connection with the reaction following upon a period of wild speculation with which the year commenced.

Notwithstanding these retarding influences, a considerable amount of activity is to be recorded, and this is to be attributed to the attraction presented by the district in the range of possibilities embraced by the variety of its mineral occurrences.

The district is still largely undeveloped, and, while the possession of gold values is still largely the criterion of attraction, the improvements in transportation and the strenuous efforts that are being made by the Department of Mines to bring isolated areas within reach of the prospectors have resulted in a growing inclination to pay attention to the possibilities for base-metal production.

The work of the Geological Survey also, as individual map areas are correlated, affords strong encouragement to the belief in the existence of ore-bodies of greater importance than the known surface exposures might indicate.

The writer desires to express his thanks to the prospectors, operators, and mining men of the district for many courtesies extended.

GEOLOGIC AND MINERALOGIC FEATURES.

The following list of publications and authorities is arranged numerically and is referred to in the continuation of these general remarks dealing with the respective Mining Divisions and the distribution of mineral occurrences:—

Ref. No.	Publication.	Author.
1	G.S.C.: Report of Progress, 1877-78.....	G. M. Dawson.
2	G.S.C.: Annual Report, 1887-88.....	G. M. Dawson.
3	G.S.C.: Summary Report, 1894.....	J. McEvoy.
4	G.S.C.: Report, Kamloops Map Sheet, 1895.....	G. M. Dawson.
5	G.S.C.: Summary Report, 1908.....	C. Camsell.
6	G.S.C.: Summary Report, 1909.....	C. Camsell.
7	G.S.C.: Summary Report, 1911.....	C. Camsell, A. M. Bateman, and R. A. Daly.
8	G.S.C.: Summary Report, 1912.....	N. L. Bowen, C. W. Drysdale, and R. A. Daly.
9	G.S.C.: Memoir No. 38.....	R. A. Daly.
10	Mines Branch, No. 245.....	L. H. Cole.
11	G.S.C.: No. 59.....	R. A. Daly.
12	G.S.C.: No. 57.....	D. B. Dowling.
13	G.S.C.: Summary Report, 1915.....	C. W. Drysdale.
14	G.S.C.: Summary Report, 1916.....	C. W. Drysdale.
15	G.S.C.: Summary Report, 1917, Part B.....	C. Camsell.
16	G.S.C.: Summary Report, 1918, Part B.....	C. Camsell.
17	G.S.C.: Summary Report, 1919, Part B.....	C. Camsell.
18	Mun. Resources Commission Report, 1920.....	W. F. Ferrier, R. P. D. Graham, J. C. Gwillim, etc.
19	G.S.C.: Memoir 118.....	L. Reinecke.
20	G.S.C.: Summary Report, 1920, Part A.....	C. E. Cairnes and G. D. MacKenzie.
21	G.S.C.: Summary Report, 1921, Part A.....	W. L. Uglow.
22	G.S.C.: Memoir 130.....	W. S. McCann.
23	G.S.C.: Summary Report, 1922, Part A.....	C. E. Cairnes.
24	G.S.C.: Summary Report, 1923, Part A.....	C. E. Cairnes.
25	G.S.C.: Memoir 139.....	C. E. Cairnes.
26	G.S.C.: Summary Report, 1924, Part A.....	V. Dolmage and C. E. Cairnes.
27	Mines Branch, No. 592.....	V. L. Eardley-Wilmut.
28	G.S.C.: Summary Report, 1925, Part A.....	B. R. MacKay.
29	G.S.C.: Economic Geological Series No. 3.....	G. A. Young and W. L. Uglow.
30	G.S.C.: Summary Report, 1927, Part A.....	J. R. Marshall.
31	G.S.C.: Summary Report, 1928, Part A.....	V. Dolmage.

Kamloops Mining Division.

The Kamloops Mining Division is identified, for the greater part, with the watershed of the Thompson river and with Interior Plateau conditions. The northern boundary is marked by the divide between the headwaters of the North Thompson and Canoe rivers on the one side, and

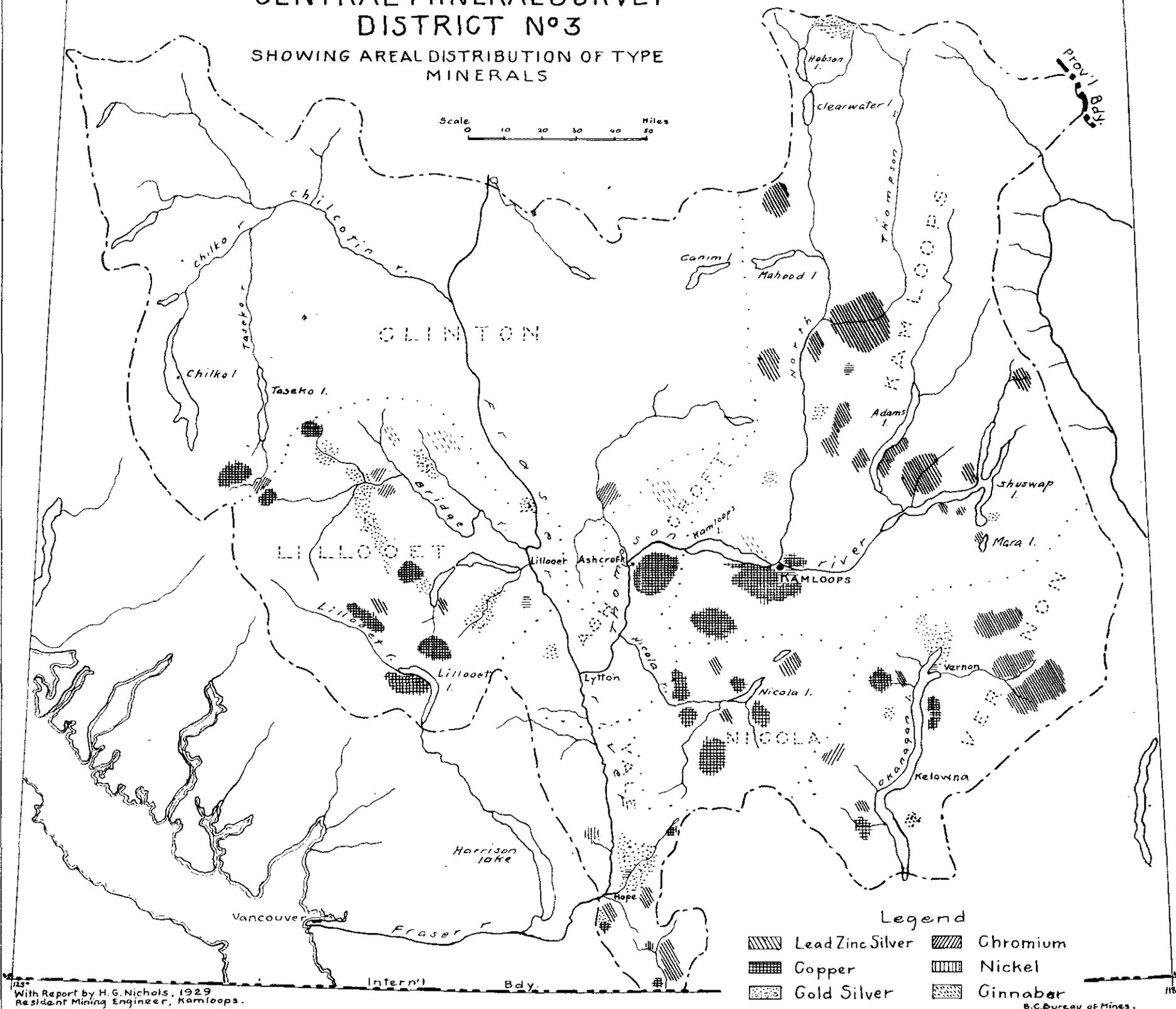
53° 25'

116° 53'

CENTRAL MINERAL SURVEY DISTRICT N°3

SHOWING AREAL DISTRIBUTION OF TYPE
MINERALS

Scale 0 10 20 30 40 50 Miles



With Report by H. G. Nichols, 1929
Resident Mining Engineer, Kamloops.

B.C. Bureau of Mines.

the tributaries of the Fraser river between Raush valley and the Yellowhead pass on the other side. On the west the dividing-line passes between the Clearwater and Quesnel Lake systems and crosses the Thompson river at the lower end of Kamloops lake. The southern boundary crosses the Nicola plateau and passes between the Shuswap and Okanagan Lake systems. On the east the Division is bounded by the divide between the Columbia River valley and the North and South Thompson watersheds.

A rough zonal arrangement is to be noted in the mineralization of the Division in a north-west and south-east direction. The north-eastern section is characterized principally by mineralization of the lead-zinc-silver type, while that lying to the south-west of an indefinite border-line of demarcation is mostly represented by copper mineralization.

In regard to this latter section, the geological features, which have been described in detail by the late G. M. Dawson in his memoir on the Kamloops Map Sheet, include to a notable extent isolated exposures of granitic stocks, intrusive into volcanic and sedimentary rocks, while a large proportion of the surface is overlain by more recent Tertiary rocks.

The copper mineralization occurs in shears and fractures in the granite as well as in the rocks intruded by it, and in the latter case the widespread character of the mineralization is to be remarked, mineral being found in several localities where no objective evidence of the relationship to an intrusive rock is to be found. These conditions, generally speaking, indicating as they do the existence of underlying bodies of intrusive rock with which the mineralization is genetically associated, point to conditions under which exploration at depth may be considered to be the prime requisite in the development of ore-bodies of economic importance.

The overlying Tertiary rocks, themselves, also have a value from the point of view of mineral deposition, more especially in the vicinity of the centres of this late vulcanism where deposition of copper minerals and also of cinnabar are found in the surrounding volcanic rocks of Triassic age. To these Tertiary rocks also are to be related many occurrences of non-metallic minerals such as sodium carbonate. These are found in the form of lake deposits, and the results of recent boring operations suggest the occurrence of underlying beds of the salt which would enhance materially the prospects for their economic utilization.

The lead-zinc-silver deposits of the north-eastern section of the Division are found in the crystalline schists and quartzites of the Pre-Cambrian belt that stretches along the eastern border of the Division, and in a zone adjacent to this old shore-line, in which the principal occurrences thus far discovered are found along the valley of the North Thompson river between Louis creek and Vavenby.

Placer-gold mining has not been active within the Division during recent years, although the stream-gravels of some of the smaller creeks have provided profitable occupation for individual operators in years gone by, notably on Tranquille creek, which flows into the South Thompson river below Kamloops; on Louis creek, tributary to the North Thompson river; and on Hobson creek, in the Clearwater area. Successive attempts have been made to work the bars in the main river and the benches flanking these streams, but no systematic testing-work has been carried out upon which prospects of success might be based.

The following is an areal classification of the known occurrences of minerals of potential economic importance within the Kamloops Division, with numerical references to bibliography as above:—

Shuswap Lake Section—

Galena, sphalerite, and chalcopyrite in association with crystalline limestone, north of Seymour arm (4, 9, 11).

Silica and graphite near Sicamous (4, 9, 11).

Gold and silver in association with galena, pyrite, and sphalerite in rocks of sil-sedimentary complex on Mara lake (7, 9, 11).

Gold and silver in veins in schist and quartzite near Salmon Arm (4, 9, 11, 18).

Chalcopyrite in phyllites of the Bastion formation near White lake (1, 4, 9, 11).

Bismuth in quartz veins on Little Shuswap lake (1).

Sphalerite and galena in schist at Blind bay (1, 4, 9, 11).

Tetrahedrite, galena, and sphalerite with associated gold values in flat-dipping micaceous-chloritic and calcareous schists on Adams plateau, east and west of Scotch creek (1, 4, 9, 11).

Galena, sphalerite, and chalcopyrite in greenstone on Adams lake (4, 9, 11).

Shuswap Lake Section—Continued.

Gold, argentite, ruby silver, galena, and sphalerite in association with barite in flat-dipping talcose-schist beds near Squaam bay (3, 4, 21).

North Thompson River Section—

Galena and sphalerite in quartzite and schist and in association with crystalline limestone, near Vavenby (9, 11).

Argentiferous galena, sphalerite, and manganese in chloritic schist near Birch island (9, 11, 18).

Gold and silver in quartz veins in quartzite near Birch island.

Fluorite near Birch island (18).

Chalcopyrite in greenstone and in granite south of Birch island (21).

Blende in greenstone near Black Pool (21).

Gold telluride in association with magnetite near Chu Chua (21).

Gold and silver associated with zones of alteration in greenstone near Chu Chua (21).

Chalcopyrite, tetrahedrite, galena, and sphalerite in chloritic schist west of Mount Olie (21.)

Galena and sphalerite in beds of replacement in flat-dipping phyllites, and argentiferous galena in association with quartz, west of Barriere river (21).

Galena and tetrahedrite in quartz veins related to fracturing in alternating beds of schist and limestone east of Barriere river (21).

Gold and silver in association with galena, pyrite, and arsenopyrite in quartzite area around head of North Thompson river (9, 11, 30).

Gold and silver in quartz veins in granite on Jamieson creek (2, 4, 21).

South Thompson River Section—

Chalcopyrite in greenstone, basalt, and in shears in granite around Kamloops (4).

Chalcopyrite and magnetite in joint-planes in diorite near Kamloops lake (1, 3, 4).

Cuprite and chalcopyrite in diabase porphyrite around Meadow creek (4).

Bornite, chalcopyrite, chalcocite, and tetrahedrite in granitic and basaltic rock in the Highland valley (4, 13).

Cinnabar in decomposed Tertiary eruptive and Triassic rocks near Kamloops lake (1, 3, 4, 8, 16).

Magnetite near Kamloops (4, 29).

Non-metallic Minerals—

Gypsum at Falkland (10).

Gypsum on North Thompson river (10).

Coal near Chu Chua (1, 2, 12).

Coal near Kamloops (1, 2, 4, 12, 21).

Mica in pegmatites in Shuswap Lake area (1).

Sodium sulphate near Kamloops.

Diatomaceous earth north of Kamloops lake (14).

Iceland spar reported near Chase.

Roofing-slate reported near Salmon Arm.

Placer gold on Hobson creek, Louis creek, Tranquille creek, and on Thompson river (1, 2, 4, 7).

Clinton Mining Division.

The Clinton Mining Division occupies the north-west corner of the district and is wholly covered by a portion of the watershed of the Fraser river with its tributary, the Chilcotin river. The northern boundary of the Division crosses the Cariboo road at the 150-Mile House and reaches away to the west to the headwaters of the Chilcotin river. The western boundary passes between Chilko and Tatlayoko lakes, while on the south the district is bounded by the divide between the Chilcotin and Bridge River systems; the divide between the Fraser and the Thompson River watersheds constituting the eastern limit.

A large portion of the Division is occupied by the Chilcotin plateau, an extensive range land at an elevation of approximately 4,000 feet above sea-level, in which rock-exposures are scarce and prospecting for minerals has not been carried on to any extent. The western section of the Division abuts upon the eastern flank of the Coast range, and here a mineralization that is more or less characteristic of batholithic conditions is found. The eastern section of the district is

also drift-covered to a certain extent, and with the exception of the high land bordering the boundary itself, prospecting for metallic minerals has been largely confined to the valleys of streams tributary to the Fraser river, along which placer-gold mining on a small scale has been carried on for many years.

In general, it may be said that the Division has been handicapped by the distance from transportation of the more favourable areas for metallic mineralization, such areas lying in the extreme south-western and north-eastern corners, although one exception is to be noted in the case of the small section around the lower reaches of the Bonaparte river, where both gold and base metals have been found in association with the Cache Creek rocks. Extensive beds of coal are also found in the valley of Hat creek.

Underlying rocks of this series as well as Tertiary basalts are responsible for a large number of deposits of non-metallic minerals in the area around Clinton, in the south-eastern portion of the district. There are here a number of saline lakes which are generally understood to owe their content to leaching agencies probably connected with springs by which the mineral constituents have been derived from these rocks. Such deposits include sodium carbonate, hydromagnesite, and Epsom salts, the two latter classes being particularly referable to the Cache Creek series.

The following is an areal classification of the known occurrences of minerals of potential economic importance within the Clinton Division, with numerical references to bibliography as above:—

Molybdenite, chalcopyrite, bornite, galena, and blende in quartz diorite on Timothy mountain (19, 27).

Stibnite on Watson Bar and Ward Bar creeks.

Gold in association with copper in zones of alteration and fracturing in quartz diorite near Taseko lake (7, 31).

Gold in tourmaline veins at head of Taseko river (26).

Limonite in upper Taseko valley (8, 20).

Chromium associated with serpentine in Bonaparte valley (4, 18, 19).

Gold and silver in quartz veins in fractured granite near Kelly creek (1, 2).

Coal on Hat creek (1, 2, 4, 12, 28).

Refractory clay near Williams Lake.

Gypsum on Kelly lake.

Sodium carbonate, sodium sulphate, hydromagnesite, and epsomite in lake deposits near Clinton (19).

Magnesite near Lac la Hache (15).

Placer gold on French Bar creek, Big Bar creek, Ward Bar creek, Watson Bar creek, and Fraser river (1, 2, 4).

Lillooet Mining Division.

The Lillooet Mining Division lies to the south of the Clinton Mining Division and embraces the entire watershed of the Bridge river, as well as that of the Lillooet river above Lillooet lake. The Division includes on its extreme eastern end the town of Lillooet, on the Fraser river, which represents the nearest point of railway transportation. The entire Division is occupied by mountainous country, the western half lying within the heart of the Coast range and, as might be anticipated as the result of the deep erosion by the glacial streams and rivers, a large number of natural exposures of bodies of mineral are found. This feature is reflected in the premier position that is occupied by this Division among the mineral-producing areas of the whole district.

The development of the gold-mines of this Division resulted from the pioneer work of placer-miners who followed up the trail of placer gold from the point upon the Fraser river at Lillooet where, in years gone by, a notable extraction of the metal was obtained from bars and bench-gravels below the mouth of the Bridge river. Following this development, the handicap of inaccessibility has been greatly reduced by the construction of roads and trails by means of which prospecting has been encouraged and a wide vista of possibilities for the discovery of ore-bodies is being opened up. In this connection it may be said that transportation and development are likely to be still further assisted with the completion of the scheme of hydro-electric power that is being carried out by the British Columbia Electric Railway Company on the Bridge river.

The following is an areal classification of the known occurrences of minerals of potential economic importance within the Lillooet Division, with numerical references to bibliography as above:—

- Gold in quartz veins in schist on Cayoosh creek (2).
- Sphalerite and galena in altered limestone near D'Arcy.
- Malachite and chalcopyrite in fractured zone in quartz diorite and in limestone on Owl creek (15, 26).
- Chalcopyrite in limestone-belt west and south of Lillooet lake (15, 26).
- Polybasite, argentiferous galena, sphalerite, and chalcopyrite in veins, and shears in volcanic and sedimentary rocks, at head of Tenquille creek (15, 26).
- Gold and silver in quartz veins on McGillivray and Cadwallader creeks (7.)
- Gold and silver in quartz veins in augite diorite on Cadwallader and Gun creeks (7, 8, 13, 14, 22).
- Gold and silver associated with arsenopyrite on Gun creek (31).
- Chalcopyrite in granodiorite at head of Gun creek (16, 31).
- Chromite in peridotite in Taylor basin (13, 22).
- Magnesite near Liza lake (13, 14, 22).
- Cinnabar in rhyolite on Tyaughton creek.
- Chromite in Bridge River area.
- Chalcopyrite in granite on upper Bridge river (31).
- Gold associated with pyrite on Shulap range.
- Stibnite in metabasalt on Bridge river (8, 13, 22).
- Gold and silver in quartz veins on Cayoosh creek (13).
- Native arsenic north of Lillooet (2).
- Tetrahedrite, azurite, malachite, and galena in quartz on contact between quartzite and serpentine, west of Anderson lake (8, 22).
- Galena and blende in altered limestone east of Anderson lake.
- Placer gold on Cayoosh creek, McGillivray creek, on all tributaries of Bridge river, and on Fraser river (1, 2, etc.).

Ashcroft Mining Division.

The Ashcroft Mining Division is interposed between the lower portion of the Kamloops Mining Division on the east and the Clinton and Lillooet Divisions on the west; it covers the valley of the Thompson river below Kamloops lake and the point of confluence between this river and the Fraser at Lytton, extending down to a point on the Fraser river a few miles above Keefers, on the Canadian Pacific Railway. At its south-east corner the Division abuts against the Nicola Mining Division, the boundary crossing the Nicola river a few miles north of Lower Nicola. The northern half of the Division is occupied very largely by volcanic and sedimentary rocks of Triassic age and by later flow-rocks, and the occurrences of metallic minerals that have been discovered up to the present time are represented chiefly by deposits of cinnabar in the Triassic rocks in the vicinity of centres of Tertiary vulcanism. There are certain deposits of non-metallic minerals in this section of the Division, including gypsum, and refractory clay. The southern half of the Division includes a large portion of the Highland Valley area, in which there is widely scattered copper mineralization in Triassic rocks, and in granite; and deposits of sodium carbonate are found in the valley of the Thompson river near Spences Bridge. On the west, precipitous country bordering the Fraser river lies within the mineral-zone identified with the eastern flank of the Coast range and the Cascade mountains, along which discoveries of gold, copper, lead, and zinc are being found all the way up from the International boundary to the north-western limits of the district. This corner of the Division, difficult of access as it is, represents an area holding considerable promise of mineral discovery.

The following is an areal classification of the known occurrences of minerals of potential economic importance within the Ashcroft Division, with numerical references to bibliography as above:—

- Cinnabar in Triassic rocks on Criss creek (4).
- Bornite, chalcopyrite, tetrahedrite, chrysocolla, azurite, malachite, in granite and basalt, in Highland valley (4, 13).
- Gold in quartz veins on Stein creek.

Molybdenite in granite at head of Texas creek (14, 18, 27).

Silver in quartz veins in argillites, and asbestos in serpentine formation, on Quoieek creek.

Hæmatite near Spatsum.

Magnesium sulphate and sodium sulphate on Thompson river.

Sodium carbonate near Spences Bridge.

Gypsum near Spatsum (10).

Placer gold on Thompson and Fraser rivers (1, 2, 4).

Yale Mining Division.

The Yale Mining Division represents the southernmost extension of the district; on the north it abuts on the Ashcroft Division and includes the watershed of the Fraser river down the length of its canyon as far as Hope, and, continuing beyond, it covers the watershed of the Skagit river down to the International boundary. The greater part of the section to the west of the Fraser river represents an extension towards the south of the mineral-zone above referred to in the Ashcroft Mining Division and is subject to the same difficulties of accessibility. This mineral-zone is intersected by the valley of the Coquihalla river, which represents, reasonably enough, the locus of greatest activity in the Division, interest being inspired by the discovery of exceptionally high-grade gold ore.

Farther to the south the mineralization, which in common with that of the area in general is related to the intrusion of dioritic rock into greenstone and sedimentaries, is represented by the base metals lead, zinc, and copper, and important ore-bodies due to replacement in limestone are found with associated gold and silver values.

The following is an areal classification of the known occurrences of minerals of potential economic importance within the Yale Division, with numerical references to bibliography as above:—

Gold in quartz veins in slates and in serpentine on Coquihalla river (1, 17, 20, 25).

Molybdenite in pegmatite on Coquihalla river (20, 25).

Sphalerite and galena with associated gold in greenstone, on Coquihalla river (25).

Chalcopyrite in granite porphyry on Coquihalla river (5, 6, 20, 25).

Nickel associated with pyrrhotite in basic intrusive rock on Emory creek (26).

Molybdenite in granite on Skagit river (1, 7, 25).

Argentiferous galena and sphalerite in fissures, in replacements associated with pyrrhotite in fractured greenstone, and in limestone on Skagit river (1, 7, 20, 23, 25).

Silver associated with chalcopyrite as replacement in limestone on Skagit river (1, 7, 25).

Nickel and tungsten associated with pyrrhotite in greenstone on Skagit river (7, 25).

Blende and galena in fractures of altered granodiorite near Green lake (24).

Gold in quartz veins in granodiorite on Silver creek (7).

Arsenopyrite and chalcopyrite in quartz diorite on Silver creek (20, 25).

Argentiferous tetrahedrite in conglomerate near Hope (1, 2, 20, 25).

Molybdenite west of Spuzzum (2).

Gold in quartz veins in slate on Hills Bar creek (24).

Gold in quartz veins on Siwash creek (7, 17).

Placer gold on Fraser river and tributaries (1, 2).

Nicola Mining Division.

The Nicola Mining Division is centred around the town of Merritt; it occupies a large portion of the Nicola plateau south of the Kamloops Mining Division and extends down to the low divide at the headwaters of the tributaries of the Tulameen river on the south. It is bounded on the west by the mountainous country of the Yale Division and on the east by the Okanagan valley.

The characteristic rocks of this Division are greenstones of Triassic age, referred to as the Nicola series, and there are also large exposures of granitic intrusive, as well as extensive areas covered by flow-rocks. The mineralization of the Division is represented chiefly by copper, although there are areas, as around Stump lake and in the immediate vicinity of the town of Merritt, where the characteristic minerals are of the lead-zinc-silver type. The Stump Lake area has received the greatest amount of attention and developments now under way give

promise of the establishment of a mining camp such as was visualized by the late G. M. Dawson many years ago.

The Division in general represents an area over which mineralization is widely spread in relation to fractures and joint-planes in the greenstone and many attractive bodies of ore have been discovered as the result of surface prospecting, for which, however, up to the present time, the amount of underground development necessary for the proof of continuity has been lacking.

The town of Merritt itself is situated in an important coal-basin from which there has been a steady production.

Deposits of non-metallic minerals such as gypsum are found in the western section of the Division. The area is largely occupied by plateau country which is valuable range land, but does not offer facilities for prospecting.

The following is an areal classification of the known occurrences of minerals of potential economic importance within the Nicola Division, with numerical references to bibliography as above:—

- Argentiferous galena, jamesonite, tetrahedrite, blende, and chalcopryrite with gold values in veins in diabase porphyrite around Stump lake (1, 2, 4, 17).
- Jamesonite, tetrahedrite, galena, and sphalerite in altered limestone on Nicola plateau.
- Bornite and chalcopryrite in quartz vein in altered granite near Nicola.
- Galena and hæmatite in andesite on Iron mountain (1, 4).
- Chalcopryrite associated with hæmatite near Merritt.
- Chalcoite and bornite in shears in granite on 10-Mile creek.
- Native copper, cuprite, malachite, and chalcopryrite in greenstone and basaltic rock at Aspen Grove.
- Specular hæmatite near Merritt (29).
- Chromite in serpentine south-east of Douglas lake.
- Coal at Merritt (1, 2, 4, 12).
- Gypsum near Canford (10).

Vernon Mining Division.

The Vernon Mining Division occupies the extreme south-east corner of the district, covering the entire Okanagan valley as far south as Penticton. In years gone by (1859 and on) this Division attracted a considerable amount of attention by reason of the occurrences of placer gold which were found in the streams heading out of the divide between the Okanagan watershed and that of the Kettle river. In particular, the bench-gravels on Cherry creek, a tributary of the Shuswap river in the north-eastern section of the Division, were responsible for placer-mining activity as long ago as the year 1874, which has never completely died out. Placer-gold workings have also been conducted on streams flowing into Okanagan lake from the west.

Conditions in regard to lode-mining vary considerably; on the east there is a section of territory in which pebble conglomerates, quartzites, and schists of Pre-Cambrian age afford some evidences of a workable zinc content with associated gold and silver values. Towards the centre of the Division silver-lead ore-bodies are found in rocks of Triassic age, while farther to the west higher temperature minerals are found in association with stocks of intrusive rocks of varying composition. This section of the country has been very little prospected and has not been mapped by the Geological Survey of Canada. There are good prospects for the development of copper ore, and chromium, has been discovered in association with serpentine areas on the western side of the lake.

The following is an areal classification of the known occurrences of minerals of potential economic importance within the Vernon Division, with numerical references to bibliography as above:—

- Jamesonite, galena, and sphalerite on contact of porphyry and argillites on Monashee mountain.
- Freibergite with galena and blende, in argillites, on Cherry creek (2).
- Zinc in crystalline schist on Shuswap river.
- Argentiferous galena associated with amphibolites in area of Triassic rocks on Aberdeen mountain.
- Chalcopryrite and chalcoite in altered limestone on Siwash creek.
- Argentiferous galena in quartz vein in argillites on Deep creek.

Free gold in quartz veins north of Vernon.
 Sphalerite and chalcopryrite in shears in schist formation and associated with beds of limestone east of Okanagan lake.
 Gold-bismuth-telluride associated with pyrrhotite, in body of quartz in granitic area, west of Ewings Landing.
 Chalcopryrite and chalcocite in fractures of greenstone west of Peachland.
 Chromium associated with serpentine south-west of Peachland.
 Tetrahedrite and galena north of Summerland.
 Gold and silver associated with pyrite and sphalerite on Mission creek (1).
 Potash near Penticton.
 Coal west of Okanagan Lake.
 Placer gold on Cherry creek, Siwash creek, and Mission creek (1, 2).

PROSPECTING.

The remarks under this head refer to work carried on in search of new ore-bodies and in attempts to determine economic possibilities in regard to mineral-deposits already discovered, whether such work is performed at the instance of operating companies or of the individual prospector. The amount of such work carried out during the year was in general fully up to the average, while in certain areas a record of activity was established.

Chief among the operating companies to conduct investigations of the mineral resources of the district was the Consolidated Mining and Smelting Company of Canada, Limited, by whose engineers a great number of prospects have been examined, with prospects for development-work being initiated in certain cases. This company also carried out a programme of exploration by diamond-drilling upon the low-grade copper area near Kamloops, and as a considerable amount of interest has been taken in the possibilities of this field for many years past, and as this work represents the first attempt at testing by exploration at any depth, too much credit cannot be given to the company for its action in providing the owner of the property with full details of the results achieved. A summary of these results is included in the section of this report dealing with the description of operations.

Under this heading also may be mentioned the activities of B.C. Nickel Mines, Limited, in the Yale Division, this company having commenced the diamond-drilling work by which the estimation of value of the nickel-bearing deposit at the head of Emory creek may be estimated.

The Coquihalla area of the Yale Division was the site of intense activity during the year on the part of exploration syndicates and prospectors who have been engaged in searching for further occurrences of gold-deposits similar to those discovered upon the property of Aurum Mines, Limited, and adjacent properties. The Skagit valley was the scene also of much exploratory work.

A notable example of the part taken by outside capital in exploratory work is found in the attempt that was made during the year to open up the mineralized area at the head of the North Thompson river. Heavy expenditure was incurred in the construction of a trail, with facilities for the establishment of permanent means of communication up the valley of the Raush river and over the Fraser-Thompson divide, a distance of approximately 65 miles. The attraction in this case rested upon the discovery of gold values in extensive zones of mineralization in this remote area.

In regard to the work of individual prospectors, in the Kamloops Division the Adams Plateau area and the Shuswap Lake section continued to receive attention on account of the favourable conditions that exist for mineralization, and the large number of occurrences of silver-lead deposits similar to that which was investigated in the year 1928 by the Granby Mining, Smelting, and Power Company.

In the Clinton Mining Division, despite the cessation of development-work by the Consolidated Mining and Smelting Company in the Taseko valley (Whitewater area), prospecting has been active.

There was also a considerable amount of interest taken in old properties, upon which new work was recorded, in different parts of the Division.

Assessment-work was also recorded on the old *Maggie* mine on the Cariboo road, between Ashcroft and Clinton, which stands in the name of J. C. Hocking, of Victoria, to whom and to J. B. Rowley, of Vancouver, mining leases have been issued to three of the reverted Crown-grant claims adjoining this property. Following the interest taken by the Consolidated Mining and

Smelting Company in the chrome-iron deposits of Scottie creek, H. Cargile recorded eighteen claims, known as the *Pine* and *Tree* groups, between Chrome and Ferguson creeks, and J. L. Burr did some open-cut work as assessment upon the five claims known as the *Golden Eagle*.

In the Lillooet Division a large amount of prospecting-work was carried out by syndicates and individual prospectors in the Bridge River area, including a total of about 400 feet of tunnel-workings. The Anderson Lake and Pemberton areas were also centres of considerable activity.

In the Ashcroft Mining Division the principal fields of activity were centred around the copper area of Highland valley; the mineralized belt on the west side of the Fraser river below Lytton, at the headwaters of the two forks of Quoieek creek; the chrome-iron ore deposits at Cache creek; and the hematite-deposits between Spatsum and Spences Bridge on the east side of the Thompson river.

In the Yale Division the Coquihalla gold-belt proved an exceptionally attractive field to both syndicates and individual prospectors and search parties were active over the neighbouring ranges, particularly in the Skagit valley.

In the Nicola Mining Division prospectors were active in the Stump Lake, Aspen Grove, Guichon Creek, Nicola, and Merritt areas.

In the Vernon Mining Division prospecting activities were for the greater part centred around the copper-deposits in the Okanagan valley, but exploration-work was also carried on upon gold-quartz properties north of Vernon and silver-lead-zinc properties along the valley of the Shuswap river and in the neighbourhood of Kelowna.

In the statistical figures for the year, which follow, it will be noted that an increase is shown of 13 per cent. in the number of claims and leases recorded and an increase of 55 per cent. in the number of certificates of work over those for the preceding year.

Mining Division.	CLAIMS AND LEASES RECORDED.		CERTIFICATES OF WORK.	
	1928.	1929.	1928.	1929.
Kamloops.....	269	334	423	388
Clinton.....	158	94	95	129
Lillooet.....	417	463	251	402
Ashcroft.....	89	106	58	79
Yale.....	692	878	253	686
Nicola.....	166	117	77	167
Vernon.....	131	171	91	126
Totals.....	1,913	2,168	1,248	1,927

The attention of prospectors and others interested is directed to the fact that the records of claims located and assessments filed in the offices of the Mining Recorders are available to any one, either by search of the books or by written application.

DISCOVERIES.

The outstanding discovery of the year was that of a body of copper-silver-zinc ore in the Skagit valley near the International boundary-line, to which reference is made in another section of this report. Further discoveries of silver-lead ore were found on Adams plateau in the Shuswap Lake area; of silver-lead-zinc ore on the Barriere river; and of mercury-deposits in the Bridge River area. Chrome-iron ore was discovered on the divide west of Okanagan lake, in the Vernon Division, and a surface deposit of manganese dioxide on Smuggler hill near Birch Island Station, in the Kamloops Division.

DEVELOPMENT.

Development of the *Pioneer*, in the Bridge River area, is of chief importance. The gold-quartz vein on this property has been opened up to a depth of 1,000 feet below surface, where it appears to maintain fully its average width and value.

On the adjoining property of the Lorne Gold Mines, Limited, the low-level tunnel development for the purpose of exploring the downward continuation of the system of gold-quartz veins was continued throughout the year, with the result that three of the known vein-fissures were

located and a considerable amount of drifting-work was carried out. On the *King* vein an ore-shoot was opened up for a distance of approximately 400 feet at a depth below the surface, on the dip of the vein, of approximately 1,000 feet, and a raise was commenced to connect with the surface workings and from which intermediate levels are to be driven. The width of the ore-body on the tunnel-level varies up to about 8 feet, with an average of 3 feet, and the average grade is said to be around \$20 a ton.

At the *Planet*, in the Nicola Mining Division, the crosscut tunnel intersected the *Enterprise* vein at a depth of approximately 320 feet, on the dip of the vein, below surface. Connection was made with the shaft, and drifts were carried in both directions, proving a continuous vein- fissure with a succession of ore-shoots up to 5 feet in width, with an average stoping-width of approximately 2 feet. The grade of this ore in gold, silver, lead, and copper values varies up to as high as \$60 a ton, with an average of around \$13 a ton. In the Merritt coalfield two new mines were opened up from the workings of Middlesboro Collieries, Limited.

PRODUCTION.

The following table* shows the lode-mineral production of No. 3 District:—

Mine.	Ore.	Gold.	Silver.	Copper.	Lead.
	Tons.	Oz.	Oz.	Lb.	Lb.
Kamloops Mining Division—					
Copper King.....	304	120	322	24,368	.....
Ford.....	30	.....	9	1,150	.....
Bonny Etta.....	33	8	25	6,056	.....
Lillooet Mining Division—					
Pioneer*.....	13,260	5,061	670	.....	.....
Nicola Mining Division—					
Planet.....	7,005	794	41,945	.....	448,400
Yale Mining Division—					
Silver Daisy.....	21	1	1,038	.....	2,243
Totals.....	20,653	5,984	44,009	31,574	450,643

* In compiling the total figures of metal production of the mines of the Province, an incorrect figure was used for the *Pioneer* mine. The mistake was not noticed in time to correct the entire figures throughout as the first part of the Annual Report had been printed. The figures in this table have therefore been left as compiled and corrections to Provincial metal totals will be made by crediting the extra production to the 1930 figures. The correct figures for the *Pioneer* are: 26,760 tons, of which 13,570 tons was tailings, producing bullion valued at \$185,303.90.

KAMLOOPS MINING DIVISION.

SHUSWAP LAKE SECTION.

Cotton Belt. No further operations were conducted during the past year upon this property, situated above the head of Seymour arm. It is understood that the activities of the company were concentrated upon developments elsewhere, and that the continuation of the work of exploration upon these low-grade lead-zinc properties is dependent upon provisions for the installation of machinery by which the requisite scope of the development-work may be made possible.

Copper Chief. This group of claims has been located by J. T. Lauthers and associates upon a shear-zone in schist of the Bastion formation in the neighbourhood of White lake, between Salmon Arm and Sorrento, on Shuswap lake. There is scattered mineralization with some chalcopryrite in seams within this zone of shearing. A crosscut tunnel was driven at a small depth below the surface. The average grade of the rock encountered was not commercial.

Copper Cup. This claim, owned by J. Rivers, of White Lake, adjoins the western boundary of the *Copper Chief* group. Some prospecting has been carried out on the same mineral-zone, an extension of which is found on the shores of the lake, about 3 miles distant and about 500 feet vertically below, where the mineralization is represented by sphalerite and galena.

Venus. This property is situated on Crowfoot mountain to the north of Shuswap lake, at Magna bay, at an elevation of approximately 5,500 feet. Bedded seams of silver-lead-zinc minerals are found in the schists of the Bastion formation,

in association with bands of limestone. Several of these seams have been opened up in a series of open-cuts and shallow workings, the work of prospecting being handicapped by the plateau-like character of the area. During 1929 some exposures of exceptionally high-grade silver-lead ore were made, but up to the present time information is lacking as to their continuity; in general, it may be said that the formation is fairly well undisturbed and that there are good chances for the finding of ore-bodies of economic importance in this area.

Metal Crest Mines, Ltd. A company of this name, with head office in Vancouver, has been formed, with the stated purpose of developing properties situated on Scotch creek, a stream which flows into Shuswap lake from the north, opposite Sorrento, on the Canadian Pacific Railway. The property includes claims which were originally staked many years ago and upon which some tunnelling and shaft-sinking was done. The mineral occurrences are represented by some erratic lead-zinc mineralization in a system of quartz veins traversing schists of the Bastion formation. These veins are well exposed in the bed of Scotch creek at a distance of about 8 miles from its mouth, and some galena was found in an open-cut on the hillside on the east side of the creek, about 40 feet above its bed; the principal working now available for inspection, that was carried out by the original operators, is a tunnel with some crosscutting, amounting in all to about 100 feet, that was driven into the hill below this prospect. No values appear to have been discovered in the quartz-seams that were followed in these workings.

There is also a shaft, said to be about 37 feet deep, on the top of a low ridge some 300 feet above. The position of this shaft would appear to be more or less on the same line of strike and some mineral is to be found on the dump. This shaft has not been unwatered and, with the exception of a small amount of stripping along the bank of the creek, which was unproductive of results of any commercial importance, no work has been carried out by the present company. The country is covered with brush and no trails have been constructed.

Elsie. A small amount of prospecting-work was carried out by H. McGillivray, who, with associates of Chase, owns this property, situated on the east side of Adams lake. The occurrences of mineral are similar to those on the *Venus*, but the proof of economic importance depends upon a greater amount of development-work than was carried out by the Granby Mining, Smelting, and Power Company, referred to in the Annual Report for 1928.

Homestake. Although there have been no new developments upon this silver-lead property, situated near Squaam bay on Adams lake, considerable interest attaches to possibilities in connection with its operation, on the basis of concentrating the ore on the ground. It will be remembered that ore to the value of \$129,000 was extracted from a high-grade shoot, in the process of which the workings were left in a condition which imposed some difficulty in the way of the development of the reserves of ore of milling grade that are indicated.

One of the principal features bearing upon the continuation of work from the existing tunnels has relation to the fact that these workings penetrate a faulted area, identified with the ravine of Falls creek, which has marked a boundary of the ore-seams towards the east. The ground here is much broken. A feature which is characteristic of this occurrence is the presence of bodies of barite carrying low values in silver, and indications observed on the surface point to the continuation of these conditions towards the west for some distance beyond the point to which underground workings have penetrated. Development in this section would open up a considerable area of virgin ground and would be removed from the handicaps of exploration and maintenance that are a feature of the old workings in the trouble area around Falls creek.

A rough survey of the ground indicates the possibility of reaching the mineralized seam by means of a crosscut tunnel from 700 to 800 feet in length, at a distance of approximately 350 feet west of the stoped area and at the lowest level yet obtained by the underground workings. Consideration of such a method of development, or of any means whereby the possibilities for the production of ore of milling grade might be investigated, is warranted fully by the past history of the property and by the results of successive examinations that have been made. The results of recent prospecting-work indicate a possibility of the same mineralized seam being found beyond the faulted area towards the east.

Treasure and Signet.—These claims are located on the east side of the *Homestake* and beyond the fault that has been recognized as bounding the ore occurrence in that direction.

It is understood that silver-lead-zinc mineral in association with barite has been exposed in open-cut and tunnel workings. The properties are held in the name of J. Tenford, of Squam Bay.

NORTH THOMPSON RIVER SECTION.

Blue Ice and Blue Lead. Under this name a group has been located at the head of Hobson creek, in the Clearwater area of the Kamloops Mining Division. These claims cover the locations originally made by Fred Wells and referred to under this name in the Annual Report for 1923. The present locations were made for J. Errington, of Toronto, who acquired options upon the properties owned by Angus Horne and associates, of Blue River, and of A. Anderson, near the headwaters of the Azure river, in the same area. As has been described in previous reports, this area may be reached from four different directions—by way of the North Thompson valley, by way of the Clearwater River valley, by way of Quesnel lake, and from the Fraser river. The area covers approximately 50 square miles, embracing the divide between the river systems of the North Thompson, the Fraser, and the Quesnel, and has been described by J. R. Marshall, of the Geological Survey,* as follows:—

“The area lies on the eastern border of the Interior plateau and is a highly dissected upland with broad rounded summits, having uniform elevation of 8,000 feet above sea-level and numerous isolated peaks rising 1,000 feet higher. To the north the upland merges abruptly into the rugged Alpine-Cariboo range with serrated peaks 9,000 to 10,000 feet above the sea-level. The streams occupy valleys 3,000 to 4,000 feet deep. Glaciers have carved many picturesque cirques. Timber-line ends abruptly 7,000 feet above sea-level. At the head of the North Thompson, Azure, and Rausch rivers, and between Azure river and Hobson lake, are extensive permanent snow and ice fields.”

There is a low pass over the divide between the Azure river, flowing to the south, and the Raush river, flowing to the north into the Fraser river, and, following a reconnaissance carried out last year by Angus Horne, it was decided to use the valley of the Raush river as a means of access and for hauling supplies for the purpose of the general prospecting of the properties held under option and located for the interests mentioned above. Heavy expenditure was entailed in the construction of a trail leading from the station of Raush Valley on the Canadian National Railway to the Azure River properties, a distance of approximately 65 miles. Substantial cabins and storehouses were erected along the road and several tons of material were transported by pack-horses with a view to the permanent establishment of this line of communication.

It is possible that this road might be utilized advantageously in connection with the properties of the eastern side of the area, but the difficulties attendant upon reaching the mineral locations at the head of Hobson creek on the western side were found to be so great as to discourage the continuation of the work of development that was initiated.

The mineral occurrences at the head of the North fork of Hobson creek are found in zones of fracturing, crossing the general formation at an oblique angle. This formation is composed of “metamorphosed quartzose sediments, including massive quartzite, quartz-pebble conglomerate, and quartz-sericite schist with interbeds of limestone and argillite.” The strike of the formation is S. 75° W. The zones of fracturing have a strike of N. 60° W. Included among the series of rocks mentioned above there are some extensive lenticular bodies of white quartz, and at points where these are intersected by the crossing fractures mineralization with pyrite, siderite, galena, and chalcopyrite is found with associated values in gold and silver. Quartz veins carrying the same minerals are found also in the crossing fractures themselves. There are three areas of mineralization coming within the above classification.

The eastern area lies at the highest elevation, approximately 8,000 feet above sea-level and immediately under the southern flank of the foot of the glacier, occupying the divide between Hobson creek and the pass on the head of the Azure river. There is here a zone about 250 feet wide intersected by a system of crossing fractures, with the development of a number of bodies of quartz aggregating approximately 24 feet in width. These quartz-lenses occur in a ridge exposed between the ice on the one side and morainal detritus on the other. The distance across this ridge before the seams would pass under the glacier is from 200 to 300 feet, but no individual body of quartz can be traced for this distance. There is erratic mineralization with

* Marshall, J. R.: Geol. Surv., Canada, Summary Report, 1927, Part A, page 43.

pyrite and a little galena, sphalerite, and chalcopyrite. A sample taken across 4 feet of quartz carrying galena assayed: Gold, 0.40 oz. to the ton; silver, 4 oz. to the ton; lead, 0.2 per cent. And a picked sample of quartz with sphalerite assayed: Gold, 0.01 oz. to the ton; silver, 6.2 oz. to the ton; lead, 7 per cent.; zinc, 10 per cent. On account of the erratic character of the quartz-seams that ramify throughout this zone, and to the fact that there appears to be no replacement of the country-rock outside these quartz-bodies, added to the practical difficulties of operation incidental to the location, it is difficult to visualize economic possibilities for this zone in its present state of development.

The west area lies below the toe of the glacier. There are here some extensive lenses of the quartz lying with the formation in contact with a band of a dark-coloured limestone, lying within the zone, approximately 80 feet wide, that is intersected by fractures belonging to an individual system which may be traced for several thousand feet across the hill towards the south-east. Within this zone a number of bodies of quartz have been developed which in part follow the direction of the fracturing and in part continue in conformity with the general formation. The quartz represents approximately about 20 per cent. of the whole width of the zone, and of this amount approximately 50 per cent. is mineralized with galena, sphalerite, chalcopyrite, and pyrite. The mineralization is confined to quartz-seams in the direction of the fracturing; the quartz, lying with the formation, being practically barren. A general chip sample of the mineralized quartz assayed: Gold, 0.09 oz. to the ton; silver, 2.8 oz. to the ton; lead, 0.4 per cent.; zinc, 3.2 per cent. The zone, which is bounded towards the south-west by the band of limestone above referred to and in which the fracturing is marked by seams of calcite, can be traced for about 150 feet towards the north-east, where it is covered by a mass of morainal detritus.

The south-east area lies at a distance of approximately three-quarters of a mile south of the eastern area and at about the same distance from the western area, being located on the same system of fracturing with which the latter area is identified.

In this case the mineralization is found in an individual fracture crossing the formation. There is here a quartz vein with notable content of pyrite and some chalcopyrite, which shows continuity for a distance of over 750 feet between horizons representing a vertical height of approximately 450 feet; this occurrence is situated on the *Blue Lead* group.

More work in the nature of open-cutting has been done upon this vein than upon any other part of the property, and this would appear to be justified by the greater degree of economic possibility that is indicated by the conditions of this occurrence. There is here an opportunity for development unhampered by the physical difficulties of operation presented by the glacier and its moraines. The average width of the vein is approximately 5 feet; open-cuts at the highest point yet explored at the south-east end expose a width of approximately 16 feet, but this is due partly to the intersection of the vein-fracture with a body of quartz lying with the formation. These open-cuts cover a distance of 75 feet on the vein, and a general chip sample of the exposures assayed: Gold, 0.06 oz. to the ton; silver, 3.5 oz. to the ton; copper, 1.2 per cent.; zinc, 3.4 per cent. A sample taken across 4 feet at the extreme south-east end of these open-cuts assayed: Gold, 0.16 oz. to the ton; silver, 4.6 oz. to the ton; while a sample taken across 3 feet 6 inches at the north-west end of the same section assayed: Gold, 0.04 oz. to the ton; silver, 7.8 oz. to the ton; copper, 2.1 per cent. At the bottom of the deepest of these cuts a body of soft disintegrated pyrite was exposed, of which a sample assayed: Gold, trace; silver, 1.5 oz. to the ton. At this point the greater part of the vein-filling is a blue quartz with a considerable content of pyrite. A sample of this quartz assayed: Gold, 0.8 oz. to the ton; silver, 1 oz. to the ton. At the lower or north-west end of the 750 feet of length covered by the open-cut work the vein is approximately 4 feet 6 inches wide; a sample taken across this width at this point assayed: Gold, trace; silver, 0.3 oz. to the ton; while a picked sample of the highly pyritized quartz assayed: Gold, 0.05 oz. to the ton; silver, 0.5 oz. to the ton. Two other quartz veins occur in the same fracture system, but no work has been done upon them and for the greater part the quartz appears to be barren.

Although the results of this sampling cannot be said to be encouraging, neither can it be regarded as entirely representative; and in view of the possibilities of continuity that are indicated in connection with the extension of this well-defined lead towards the south-east, in which direction backs would be obtained quickly by tunnelling into the hill away from the glacial moraine, the occurrence may be considered as an unproven prospect of some attraction.

The formation traversed by this vein-fracture for the entire distance over which it has been prospected is a pebble conglomerate.

This group, owned by Angus Horne and associates, of Blue River, was also under option to J. Errington, but very little work was done upon the claims.

Summit. The mineral occurrence has been referred to in previous reports (*see* Annual Report for 1927, page 192), and were described by J. R. Marshall,* following a survey in the same year, as follows:—

“This group consists of nine claims on the ridge between Azure river and Hobson creek and approximately 4½ miles south of the head of Azure river. The claims are owned by Angus Horne and G. W. Stewart, of Blue River.

“On the west side of Azure River valley, 600 feet above the valley-bottom, a tunnel has been driven north 40 feet on claim No. 3 of the group. At the portal the rock is a thinly foliated, rusty-weathering, quartz-sericite schist striking east and dipping 70° north; the schistosity strikes N. 80° E. The face of the tunnel is in dark green and grey quartz-sericite schist with thin bands of sheared quartzite. The tunnel crosses an irregular quartz-lens visible at the surface. The quartz in the tunnel is milky white, massive, and without apparent cross-fractures. In the tunnel the lens is 25 feet wide, strikes N. 55° E. across the strike of the schists, and dips 70° north. Massive and granular pyrite is freely distributed across the full width of the lens and is also sparingly disseminated in the schists for a distance of 1 foot from the walls of the quartz-body. A channel sample taken across the full width of the quartz-mass in the tunnel assayed \$2 a ton in gold.

“Five hundred feet north-west of the tunnel a small lens of milky-white quartz is exposed in an open pit. The weathered surface is coated with iron oxide, some of which was crushed and panned, but failed to show any colours. The interior of the quartz is honeycombed as the result of the leaching.

“Approximately 1,000 feet north-west of the tunnel three irregular quartz-masses outcrop within 200 feet of one another. The largest is 250 feet long, 20 feet wide, and strikes N. 40° E. Granular pyrite is sparingly disseminated at intervals through these masses. In the largest mass is a lenticular seam of pyrite 1 foot wide and 30 feet long paralleling the trend of the mass. A sample taken along the full length of this seam assayed \$31 in gold and \$3 in silver.

“Approximately 1½ miles north-west of the tunnel an irregular quartz-lens, 30 by 20 feet, and trending N. 15° W., outcrops in the bed of a small creek. One hundred feet west of this mass is a second, sericite-schists striking S. 80° E., dipping 70° north-east, from the country-rock. Pyrite is very sparingly disseminated through the quartz.”

This group was located by Angus Horne and covers the extension of the mineralized zone of the *Summit* group, towards the north-west, on the summit of the divide above the South fork of Hobson creek, at a distance of approximately 3 miles east of the *Blue Ice* group. The group consists of four claims, upon which several large bodies of quartz occur.

At the extreme west end one of these quartz-bodies is exposed along the north side of the hill flanking one of the tributary streams of the South fork of Hobson creek. With this quartz a considerable amount of siderite is associated, but no other mineral content is to be noted. This body of quartz lies conformably with the formation. Another seam of quartz about 2 feet wide, in which patches of solid galena are found, occupies a fracture running almost at right angles to the above. Towards the eastern end of the group of claims some trenching-work has exposed an 8-foot body of quartz lying conformably with the formation, which appears to be continuous for 200 or 300 feet; pyrite and some galena are found in this vein, but up to the present time the work that has been accomplished is insufficient upon which to base an opinion as to its economic value. In the direction of the continuation of this seam towards the west, at a distance of about 500 feet, the formation appears much broken and some seams with heavy lead content are exposed in open-cuts. At a distance of about 200 or 300 feet to the north from this seam another massive body of quartz is exposed which has an apparent strike of northwest-southeast for a distance of approximately 350 feet. At its lower end this quartz is 25 feet wide and some good work has been done in surface-trenching, exposing bands of fairly heavy mineralization with arsenopyrite and galena. A sample of selected material from these seams assayed: Gold, 0.17 oz. to the ton; silver, 4.6 oz. to the ton; lead, 7 per cent.; zinc, 1.6 per cent.

* Marshall, J. R.: Geol. Surv., Canada, Summary Report, 1927, Part A, page 45.

The two occurrences last named appear to present considerable encouragement for further prospecting. In the case of the latter this may be carried out readily and to advantage by crosscutting from points exposed in the small ravine along which the body of quartz occurs; in the case of the former, development-work is handicapped by the general flatness of the ground, but it is quite possible that sufficient information might be obtained by systematic trenching to warrant further exploration by means of diamond-drilling. The exposures on this group, however, give promise of response to development.

This group, owned by A. Anderson and associates, of Blue River, was also included in the options held by J. Errington. A tent camp was established and a considerable quantity of supplies were hauled up over the Raush Valley route during the early part of the summer, and some surface-stripping was carried out with a view to enabling a representative sampling of the ore occurrences at several points, as well as to determine the continuity of quartz veins indicated by bodies of quartz lying in a north-west-southeast direction. The results of this work were not held to be satisfactory, more particularly in regard to the continuity of the veins; several of the quartz bodies proved to be no more than float. Work upon these properties was suspended. A description of the mineral occurrences on this group, given by J. R. Marshall,* is as follows:—

"This group of six claims, owned by Adolf Anderson and Lewis Kuntson, of Albreda, is on the east side of Azure river, 4 miles from its source.

"On the east bank of the river a tunnel driven N. 30° E. for 20 feet intersects two quartz veins. At the portal of the tunnel is a vein of blue quartz 8 feet wide striking S. 60° E. and dipping 60° north-east. This vein can be traced for 50 feet along the strike. Pyrite, chalcoppyrite, sphalerite, and galena are disseminated across the full width of the vein. A sample taken across the vein assayed: Gold, \$1.50 a ton; silver, \$1 a ton.

"In the face of the tunnel the foot-wall of a second vein is exposed. The trend of this vein is about S. 35° E. It is sparingly mineralized with pyrite, chalcoppyrite, and galena. A sample assayed: Gold, trace; silver, trace. Two hundred feet east of and 400 feet above the tunnel is an irregular mass of bluish-white quartz measuring 60 by 25 feet. It is sparingly mineralized with pyrite, chalcoppyrite, and galena. In all three veins considerable siderite accompanies the quartz as gangue."

This property is situated on Hobson creek, which flows into Hobson lake, in Hobson (Cariboo) Kamloops Mining Division. It is reached by boat to the head of Quesnel lake from Likely, then by wagon-road 6 miles across the portage between Quesnel and Hobson lakes, then 5 miles by boat on Hobson lake to the mouth of Hobson creek, and finally by trail 1½ miles up Hobson creek to the property. During 1929 the company improved the wagon-road and trail serving the property.

The history of this property as told by some of the old-timers in that part of the country is as follows:—

In the summer of 1909 T. Drummond went in with a few men and built a dam and put the creek through a flume about 400 feet long in order to dry the creek-bed, which he did successfully. He then began to sluice, getting some coarse gold from below and under a very big boulder, some of the pieces being valued at \$5. Apparently this was all the work that was done, but from a financial standpoint it was not a success, so he discontinued work.

From all accounts, nothing further was done until thirteen years ago, when a tunnel was run under the bank on the east side of the creek about 300 feet below Drummond's dam, and a few feet above the rock where Drummond was supposed to have found the gold. Morris Davis was not at the property while I was there, but his son informed me that the tunnel was 118 feet long. Mr. Davis, whom I saw in Likely, says the gravel from the tunnel went 65 cents a cubic yard, and that a blind shaft was sunk 9 feet deep at the end that went \$6 a cubic yard. I could not make an estimate of the average values as they could not give the size of the tunnel or shaft. My aneroid reading showed 200 feet of glacial drift over the tunnel. This bank of drift has fallen down over the mouth of the tunnel, making it impossible to form an opinion as to a possibility of a channel being there.

In conversation with Mr. Davis before I left Likely for the property, he considered this was sufficient prospecting to justify the expense of building the road and putting on the hydraulic

* Marshall, J. R.: Clearwater Lake Map Area. Geol. Sur., Canada, Sum. Rep., 1927, page 46.

† Report by C. W. Moore.

plant and other equipment. Hobson creek is fed by numerous small glaciers, making it ideal for hydraulic mining during the dry season. It is claimed that 300 feet of pressure can be obtained with 3 miles of ditch. At the time a survey party was locating a ditch-line.

It is apparent that the Hobson Creek deposit is glacial and the concentration will likely be in spots. With the heavy grade and large flow of water, the fine gold, if any, will have been washed down to the delta at the mouth of the creek, leaving only the coarse gold or nuggets. It is difficult to say anything about the dump for the tailings until there is more information to be had on the depth of the supposed channel under the hill.

My opinion is that the Hobson Creek deposits are glacial and the concentration is local and in spots, also that there has not been sufficient prospecting done to justify the expenditure of \$6,000 in building a road to reach the property. Much further testing should be carried out before it can be assumed that the deposit will pay to work as an hydraulic.

The *Red Top No. 1* and *Red Top No. 2* claims are situated at a distance of about 10 miles north of Vavenby, on the Canadian National Railway, at an elevation of approximately 4,000 feet above sea-level. The locations cover a mineralized zone in typical Pre-Cambrian formation in which three parallel bedded seams occur over a width of about 30 feet. The continuity of these seams as exposed in a series of five open-cuts may be traced for a distance of approximately 600 feet. In one of these open-cuts a width of approximately 8 feet of lead-zinc mineralization is exposed in one seam, the other open-cuts showing less concentration of mineral, the aggregate width being approximately 4.5 feet. These exposures are found on the top of a ridge at a distance of about half a mile from a body of granite towards which the seams dip at an angle of about 35°. The strike of the ore-bodies is south-west by west and the dip is to the east.

The formation is intersected by a series of porphyry dykes which, however, do not appear to be genetically related to the mineralization. A sample taken across 8 feet of mineralized ground in the big open-cut above referred to assayed: Gold, trace; silver, 1.2 oz. to the ton; lead, trace; zinc, 8.6 per cent. A sample taken across 3 feet in another cut farther to the north assayed: Gold, trace; silver, 1 oz. to the ton; lead, 1 per cent.; zinc, trace. A sample taken across 2.5 feet in an open-cut at the south end of the ridge assayed: Gold, 0.02 oz. to the ton; silver, 1.4 oz. to the ton; lead, 2.4 per cent.; zinc, 12.2 per cent. And a sample taken across 4.5 feet of a foot-wall seam assayed: Gold, trace; silver, 1 oz. to the ton; lead, trace; zinc, 4 per cent.

These values are not particularly encouraging, but there are features of interest in the property. The formation is undisturbed and there are indications of further seams having a regular strike on the hillside, which slopes gently down towards the granite-contact. An excellent opportunity would be provided for exploring this ground by means of diamond-drilling from this eastern slope, and in view of the generally mineralized character of this area these features provide a favourable opportunity for some deeper development-work where structural conditions are favourable.

At a distance of about three-quarters of a mile to the west of this group, which is owned by W. E. Noble, of Birch Island, further exposures of lead-zinc mineralization are found on the *Snow* claim, where bands of crystalline limestone are included in the general quartzite and schist formation. Some patches of heavy lead mineralization are found upon this claim, but the formation is considerably disturbed, conditions being very similar to those found on the *Smuggler Hill* properties on the other side of the river and still farther to the west. A sample taken across one seam 12 inches wide assayed: Gold, 0.03 oz. to the ton; silver, 26.3 oz. to the ton; lead, 62.2 per cent.; zinc, 4 per cent. Two other samples taken from a long open-cut intersecting silicified bands with considerable pyrite mineralization assayed: Gold, 0.02 oz. to the ton; silver, 1.4 oz. to the ton; lead, trace; zinc, 3.6 per cent. And: Gold, trace; silver, 1.6 oz. to the ton; copper, 0.6 per cent.; lead, trace; zinc, 3.4 per cent.

Again to the south-west, where the granite-contact is approached, silicified bands, with heavy pyrrhotite mineralization and with some zinc content occur.

A considerable amount of work has been done at this end of the area, where original locations were made, in the way of tunnelling, open-cutting, and shaft-sinking, but no ore-bodies of economic importance have been proved up to the present time. The owners of these other properties, adjoining the *Red Top* group, are W. E. Noble and J. Beaton, of Vavenby.

Smuggler. Some further prospecting-work has been done by the local syndicate controlling this property, situated at Birch Island, on the North Thompson river. The general conditions of the mineralization on this hill were referred to in

the Annual Report for 1927, page 191. The promise of economic importance of this property as a producer of silver-lead mineral has been held to be in connection with the possible discovery of a vein-fissure or of fissures, for which a greater degree of persistence might be hoped than is the case with the irregular seams and bodies included within the dislocated schist formation that is characteristic of the lower slopes of the hill.

During the early part of the year a vein-fissure was discovered crossing the harder quartzite formation of the ridge of the hill and extending down towards an intermediate zone of alteration, in which there is evidence of silicification and wide distribution of scanty mineralization. This vein has a strike approximately north-south, with a steep dip towards the west. At the highest point at which it was exposed by open-cutting a sample taken across a width of 20 inches assayed: Gold, trace; silver, 0.6 oz. to the ton. A sample of selected ore from this cut assayed: Gold, 0.02 oz. to the ton; silver, 2.6 oz. to the ton; lead, 0.9 per cent.; zinc, trace.

At a vertical depth of about 200 feet below this point the same fissure has been exposed in a short tunnel, but the inclusion between the walls, about 3 feet in width, is represented by crushed rock with abundant development of crystals of fluorite, spar, and calcite. The alteration of the impure quartzite adjacent to the fissure is also a marked feature. A sample from the lower tunnel assayed: Gold, trace; silver, 0.1 oz. to the ton; while a sample from another open-cut about 60 feet above assayed: Gold, trace; silver, 1.4 oz. to the ton; lead, trace.

The failure to find values of any significance in this vein leaves the general position in regard to this property as a producer of silver-lead ore uncertain; meanwhile attention has been paid to an occurrence of manganese which is found over a wide area of the hill. Samples of wad which occurs as a subsoil deposit to a depth of from 3 to 8 feet assay as high as 53 per cent. manganese, although, for the greater part, a difficulty in the way of the practical utilization of the material may be found in the inclusion of soil and vegetable matter. A number of test pits and holes are being dug with a view to estimating the extent of the deposit.

At points on the hill above these slopes, where this deposit occurs, exposures are found in a zone of alteration of rock mineralized with pyrite and siderite, with minor quantities of mangano-siderite in association with calcite and quartz. It appears probable that a concentration of the manganese has been effected by surface waters acting on this material.

The crosscut tunnel on this property has been advanced by J. Schlichter to a total distance of 287 feet, a change in the formation being encountered near the face, with vertical fractures cutting across the tunnel. Work is being continued by the owner. There appear to be alternating bodies of considerable thickness of quartzite and schist in this area, and while irregular bodies of high-grade galena ore are found in the disturbed schist formation, as on the *Smuggler*, overlying the quartzite band which is the characteristic formation on the *Minnesota Girl*, there would appear grounds for anticipation that the more important mineralization would be found in an underlying band of schist exposed along the banks of Canyon creek. The work carried out by the owner upon this property represents a praiseworthy attempt in investigating the possibilities connected with the fracturing in the quartzite-band, with which lead-silver mineralization was found to be associated in the surface workings about 200 feet above the tunnel.

This property, which was the subject of considerable exploration some years ago, under the direction of engineers at that time associated with the operations of the Consolidated Mining and Smelting Company, is situated at a distance of 6.5 miles from Birch Island, up the valley of Canyon creek.

Scattered mineralization with copper minerals is found over a considerable area occupied by a fractured greenstone and schist in contact with a prominent porphyry dyke exposed on a precipitous hillside. Two tunnels were driven into the hill for a distance of over 700 feet. The lower tunnel, which is now caved, does not appear to have been driven upon or to have intersected any body of ore. The other tunnel, at no great distance from the summit of the bluff bordering the ravine on the west, followed an extremely circuitous course, having been deflected apparently in the attempt to follow a number of crossing seams and fractures. This tunnel was, in general, driven away from the contact with the porphyry dyke and but very little mineralization is to be seen beyond the first 100 feet of its length. In this 100 feet there are a number of seams of quartz carrying some chalcopryrite which appear to be identified with a zone of fracturing that is intersected obliquely. The property was the subject of examination during the past year by representatives of the Consolidated Mining and Smelting Company.

O.K. This property, including the *Anaconda* claim, to which reference has been made in previous Annual Reports, is situated on the north side of Berk creek, a tributary of the North fork of the Barriere river. The tunnel driven on the flat-dipping mineralized seam was extended to a total distance of 135 feet without, however, encountering any change in the character of the ground. Owing to the almost horizontal position of the strata, the amount of exploration achieved by this tunnel-working is limited to development in one seam, instead of exploring different horizons, as is required.

A discovery of some interest has been made upon this claim, adjoining the **King Pin No. 1. O.K.** and situated at some distance farther down the creek. It is owned by one of the partners of the group of prospectors by whom much of the work in this area has been carried out. Upon this claim a body of lead-zinc mineral has been discovered, indicating a zone of replacement by these minerals at a lower horizon than the tunnel-working on the *O.K.* and lying below the beds of pyritic replacement, of which mention has been made previously, as being exposed in the bed of Berk creek.

Gold Hill. Following the operations upon this property, situated near Chu Chua, on the North Thompson river, by the local syndicate referred to in the 1928 Annual Report, an interest in it was acquired by A. E. Day, of Kamloops, and further development was carried on by him. A total amount of approximately 550 feet of tunnelling-work was carried out in the attempt to establish a workable gold content in the mineralized zones traversing the property.

The geological features of this occurrence were investigated by the late W. L. Uglow, who reported upon it in the Summary Report of the Geological Survey of Canada, 1921, Part A, as follows:—

“The country-rock is the greenstone pillow lava of the Fennell formation. This rock is traversed in a general east-west direction by shear-zones which have been altered to cream- and buff-coloured masses of siliceous ferrodolomite, through which ramify veinlets and irregular masses of white quartz. In many cases the quartz is broken and the fragments are cemented by ferrodolomite. The contacts between the ferrodolomite and greenstone are, as a rule, transitional. The width of the main ferrodolomite zone varies up to 20 feet. The quartz stringers carry appreciable amounts of fine- and medium-grained galena, associated with less amounts of chalcopryrite, pyrite, and sphalerite. Free gold occurs scattered through these veinlets and seems to be associated with galena. Individual grains of gold were seen as large as pin-heads and a few the size of small peas. Much invisible gold is scattered through the quartz and also in the ferrodolomite. Small pieces of rusty quartz when panned produce a very decided yellow streak, due to fine particles of gold. The quartz is rather intimately impregnated with small grains and traversed by tiny veinlets of ankerite. The easy cleavage of this mineral makes the quartz very friable and produces by its oxidation a buff to brown colour in the zone. Limonite is abundant as an oxidation product of the ankerite and malachite and azurite as alteration products of the chalcopryrite.

“These ferrodolomite zones have irregular transitional contacts with the greenstone, and the evidence points to a replacement of the greenstone along broken or shear zones. The origin of the carbonate minerals is uncertain. Some of the material may be derived from the alteration of the ferromagnesian minerals of the original lavas by hydrothermal processes. The source of heat, and perhaps of some of the solutions, may have been the Baldie granite intrusive which outcrops about 2 miles to the east, but which may underlie the Fennell formation of Gold hill at a relatively shallow depth.

“No systematic sampling has been done to determine the values, but the presence of free gold scattered over such a length of deposit suggests that the zone might warrant careful investigation.”

Of the total amount of work accomplished under the late management, about 170 feet was represented by drifting and crosscutting on the No. 2 zone.

The work on the No. 1 zone was inspired by reports of values encountered in some diamond-drilling carried out some years ago by the Granby Mining and Smelting Company. This work failed to give any satisfactory results and the seam itself was found to die out in the fractured greenstone, which showed considerable movement towards the west.

The work on the No. 2 zone was carried out at three different horizons. The outcrop of the dolomite-zone was picked up towards the east at a distance of approximately 500 feet from the

original workings. At this point the zone appears to have a normal strike of S. 75° W. and a dip of 70° north, but the 50-foot tunnel that was started on the outcrop angled away from the zone and no satisfactory results as to values were obtained.

At an elevation of about 300 feet vertically above the original workings No. 3 tunnel was driven for a distance of about 250 feet, no general direction being followed. The ground here is very much disturbed and there is an absence of any continuous seam or zone. Fifty feet above this tunnel a well-defined seam, in which there is a quartz vein, was followed for approximately 50 feet. A sample taken across 22 inches of the hanging-wall side on the face of this tunnel assayed: Gold, 0.28 oz. to the ton; silver, 4.9 oz. to the ton. And a sample taken across 22 inches in the foot-wall side assayed: Gold, trace; silver, trace. The face of this tunnel (No. 4) is about 60 feet east of the point where good values are reported to have been found in an open-cut where the zone is intersected by crossing fractures. A 60-foot crosscut tunnel was driven to intersect the zone at this last-named point, at a depth of only a few feet below the surface. Two samples were taken from this tunnel, as follows: Across 20 inches on right-hand side of face: Gold, 0.1 oz. to the ton; silver, 1.6 oz. to the ton. Across 20 inches on the left-hand side of face: Gold, 0.68 oz. to the ton; silver, 3 oz. to the ton; lead, 9.2 per cent.

Some further work was done on the west slope of the hill, where originally some high-grade specimens showing free gold were obtained from a narrow seam.

The occurrence of crossing fractures having a general north and south direction, to which the occasional values have been thought to be related, is a feature of the apex of the hill and of the western slope; and the failure to discover appreciable gold or silver content at lower horizons on the eastern side is in support of this theory of the ore occurrence. Between the two sections there appears to have been a throw of the zone for a distance of about 50 feet to the north of its western end, and it would appear that the No. 3 tunnel lies within a faulted area.

A limited amount of work might be devoted to ascertaining whether any promising values are to be found in the lower section of the zone east of the faulted area; whether the occurrence in the No. 4 tunnel shows any sign of improvement in the next 50 feet; and whether any estimate of average values can be arrived at in connection with the outcrops on the western slope of the hill.

White Rock. Since this property was described in the 1928 Annual Report a crosscut tunnel has been driven for a distance of approximately 250 feet with the object of intersecting the quartz vein with silver-lead content that was exposed in open-cut workings at a point about 150 feet north and at a vertical height of about 100 feet above. No further work had been done in the open-cut workings, with the exception of putting in a few shots, breaking through the foot-wall face that was exposed, and upon which some good showings of galena occur as described in the last report. The result of this small amount of work indicated that the main body of the quartz vein was almost barren.

The new tunnel penetrated an area of crushed and fractured altered limestone with bands of schist in which there is evidence of considerable faulting movement. This whole area affords evidence of secondary action by aqueous solution, with the development of calcite and powdered silica.

At the point where the quartz vein which constituted the main objective of this work should have been struck, a zone of decomposed rock was encountered with mud-seams, calcite, and a small amount of quartz, and there was no encouragement for drifting. This appears most unlikely ground for the occurrences of a vein of any continuity; no such vein has been discovered and the net result of recent work is not encouraging to further expenditure upon development.

It may be pointed out, however, that towards the north and at surface where no indications of similar decomposition are to be seen, there are a great number of small quartz veins carrying notable quantities of both galena and grey copper, and these occurrences may provide an argument in favour of the suggestion that the full possibilities of the property as a speculative prospect have not been exhausted by the driving of the tunnel referred to, which may have been sited in an unfortunate position.

SOUTH THOMPSON RIVER SECTION.

Ajax and Monte Carlo. These groups, situated near Jacko lake, at a distance of about 6 miles south of Kamloops, were selected by the Consolidated Mining and Smelting Company for investigation of the conditions of low-grade copper mineralization that occur in this granite area. Diamond-drilling was carried on during the

greater part of the year and a series of bore-holes were put down over a distance of approximately 720 feet on the strike of the ore-bodies. A considerable amount of prospecting-work has been carried out during recent years by the owner of the property, G. J. Rogers, of Knutsford, including a tunnel on the *Ajax* claim, in which sampling indicated a width of 55 feet with an average copper content of 2.2 per cent., while in one higher-grade seam of oxidized mineral, upon which a winze was sunk to a depth of about 10 feet, certain associated values in gold were encountered. It was due in large measure to this indication of gold values that this particular zone was selected for the diamond-drilling operations.

The programme of the work was outlined more with a view to obtaining general information in regard to the extent of the mineralization than with the object of following up any individual seam of ore, and the results, so far as they have been carried, point to sparse sulphide mineralization in a zone having a width of approximately 250 feet passing through the *Ajax* group, the general trend of which is approximately N. 65° W., with a steep dip towards the north.

In the course of this work individual core samples were obtained with a copper content of over 8 per cent., but the general conclusion to be reached from a study of the diamond-drilling records is that no continuity is indicated for seams of any considerable width having an economic metallic content. The best proof of continuity in depth was obtained in drill-holes on a section passing through the tunnel-workings, where in hole No. 9 an average grade of 0.77 per cent. copper was obtained for a core-length of 109 feet penetrating to a vertical depth of approximately 260 feet below the surface; this would represent a width of zone approximately similar to that exposed in the tunnel above. A bore-hole put down at an intermediate horizon, while indicating mineralization over a similar width, revealed intervening bands of almost barren ground. A bore-hole approximately 25 feet to the east failed to pick up this zone. Similar non-continuous bands, ranging from 10 to 50 feet in width and with an average content of around 1 per cent. copper, were indicated in nine out of twelve diamond-drill holes put down on the *Ajax* group, two of these being within the wide zone of mineralization indicated by the surface workings.

It is possible that there are structural conditions affecting the mineralization such as systems of cross-fracturing which have not yet been determined; such an explanation is suggested particularly by the results obtained in the two diamond-drill holes at and near the western extremity of the area that was investigated. In these two holes, penetrating sections of a zone approximately 50 feet apart, core results were obtained that in point of width and average content—namely, around 40 feet and 0.85 per cent. copper—were sufficiently identical to warrant the belief that they represented two different sections on the same ore-body, but this would not be possible on the basis of the strike and dip generally recognized for the zonal structure, as above. A further argument in favour of possible influence by fracturing is found in the case of the work done upon the *Monte Carlo* group, adjoining the *Ajax* group on the east; on this group three diamond-drill holes were put down to intercept an ore-body that was assumed to extend between two surface workings in which particularly promising indications had been obtained, but without locating it as anticipated.

In general it may be said that, although this preliminary reconnaissance-work was not fortunate enough to afford encouraging evidence of value, its scope was in no sense final, and a degree of importance may be attached to the proof of a definite zone with sulphide mineralization extending to a depth of approximately 400 feet below surface.

In view of the general recognition of possibilities in connection with this area, in which several similar zones of copper mineralization occur, the following analysis of the results obtained in this first attempt at development is presented.

At the east end of the zone the tunnel and Nos. 9 and 10 bore-holes indicate mineralized ground with barren inclusions, from 60 to 120 feet wide, extending to a depth of about 280 feet below the surface on the foot-wall side of the zone.

At the west end of the zone Nos. 8 and 13 bore-holes may indicate similar conditions of mineralization over a width of approximately 170 feet and at a depth of from 200 to 380 feet below the surface; neither of these two holes is deep enough for definite proof.

Intermediate between the above two sections No. 1 bore-hole affords some indication of persistence for a distance of approximately 120 feet to the west of the eastern section, although the width of mineralized ground penetrated is only about 25 feet. Bore-holes Nos. 2 and 6 were put down on the dip of the seams, and it is possible that they passed through inclusions of barren

ground such as are indicated in bore-hole No. 10; the evidence of these two holes is not, therefore, to be accepted as entirely negative. Purely negative evidence as regards continuity is presented in bore-holes Nos. 7, 11, and 12, although in each of these bore-holes other mineralized seams are indicated farther towards the hanging-wall of the zone. From information supplied, it appears that a certain amount of doubt attaches to all of these three bore-holes; in the drilling of each, trouble was encountered on account of their being started in loose ground, and, admitting a possibility of deflection, there would still be room for assuming possible continuity for the foot-wall zone, indicated in the eastern and western sections, on upper and lower horizons respectively.

One further point of possible encouragement is to be found in the fact that, with the exception of assay results obtained in the *Ajax* tunnel, the best composite results of sampling were obtained from the lowest point of mineralization penetrated by any of the bore-holes—namely, at a depth of 400 feet below the surface in bore-hole No. 11.

Copper King. *Ajax*, was operated under lease by H. R. Graham, and four car-loads of ore was extracted from the old stopes and shipped to the Trail smelter, yielding a net return of approximately \$3,000; values are in copper and gold. A further shipment of four car-loads was made of ore from the old dump. Plans are under consideration for the continuation of development of this property in the coming year, following upon discoveries of ore that were made during the course of the stoping operations.

Ford. This group is situated on Meadow creek and bordering the road from Kamloops to Mamit lake at a distance of 32 miles from the city. A large open-cut was made some years ago on a small bluff of rock in which copper minerals were found, occupying joint planes and fractures in the prevailing diabase-porphry formation. The property was relocated recently, being acquired by a syndicate operating under the name of Meadow Creek Mines, and some further work was carried on in an attempt to trace the mineralization shown in the open-cut. Some good ore was obtained in these operations and a shipment of approximately 30 tons was made of this and of the material previously accumulated on the dump. Smelter returns from this shipment were: Copper, 2.14 per cent.; silver, 0.3 oz. to the ton; gold, trace. It is possible that the purple and green coloration of the diabase porphyry was responsible for some miscalculation in regard to the copper content and that by some careful sorting a considerably better grade of bornite ore could have been selected for shipment.

The occurrence is more or less typical of several points of mineralization in this area occupied for the greater part by the greenstone and diabase porphyry of the Nicola formation. At one of these points situated near Dupont lake, lying at a distance of about 5 miles south of the *Ford* group, the *Bertha* and *Molly* claims have also been located by the Meadow Creek Mines, and it is understood that the work of the syndicate is to be devoted chiefly to the ore-body upon which they have been located. An old shaft was sunk upon this ore-body, indicating a vein about 4 feet wide, from which some high-grade copper ore was extracted in past years, but apparently no attempt has been made to prove the continuity, on the surface, of this occurrence. It is stated that the plans of the syndicate provide for continuing work from this shaft by drifting in both directions on the ore-body.

Transvaal. This group is situated on Forge mountain, in that part of the Highland Valley area lying within the Kamloops Mining Division. A new camp has been constructed by the owner, George Novak, of Rossland, and tunnelling operations have been in progress with a view to opening up the extensive bodies of copper ore that are indicated by the numerous surface exposures. A considerable amount of development-work was carried out several years ago upon this property and adjoining groups, but results so far achieved have been inconclusive. The continuance of exploration is fully warranted in view of the widespread character of the mineralization, and it is understood that work is to be continued during the coming year.

Sugar Loaf. This property, owned by Edwin Smith and associates, of Grindrod, is situated about 1 mile south of the *Grandview*, between Grindrod and Salmon Arm, to which reference was made in the Annual Report for 1928, page 211. A tunnel approximately 60 feet in length has been driven upon a body of quartz about 7 feet wide occurring in the prevailing quartzite formation. This vein has a north-and-south strike and may be

traced for about 200 feet on the surface; it is bounded by fairly well-defined walls, having a steep dip towards the west. With the exception of some scanty mineralization with galena, there are no evidences of valuable content to warrant further underground work at the present time, but systematic open-cutting on the surface might result in more encouraging showings being found.

GYPSUM.

The production from the gypsum quarries at Falkland, owned by this company, was approximately 24,000 tons in 1929. The deposits have been opened up over an area extending about a quarter of a mile in one direction and approximately 300 feet in the other, and with the exception of a relatively small amount of material that may be classed as gypsite, the bulk of the deposit, the full extent of which has not yet been determined, is composed of fairly pure rock gypsum. Twenty-two men were employed at the quarries. The rock is transported to the company's works at Port Mann, where it is manufactured into plaster of Paris, plaster-board, and other products. The production for the year of this plant, which has a capacity of approximately 35,000 square feet of plaster-board a day, reached a total value of approximately \$250,000. Of the 24,000 tons handled during the year, approximately 18,000 tons was used in the production of plaster of Paris and allied products and 6,000 tons in the production of plaster-board.

CLINTON MINING DIVISION.

These properties, covering deposits of chromite, are situated on Scottie creek, at a distance of about 4 miles from the point where the creek enters the Bonaparte river. As described by L. Reinecke (Geological Survey of Canada, Memoir 118), the ore occurs in association with some magnetite, in serpentine, which outcrops on both sides of a small creek tributary to Scottie creek. The ore appears to be an essential part of the rock-mass in which it occurs and is found in nodules, lenses, and tabular sheets, some of them with quite definite borders, and is also disseminated through the serpentine. A sample taken from this deposit assayed 55.9 per cent. of chromium oxide, the content varying between 10 and 60 per cent.

The properties were bonded by the Consolidated Mining and Smelting Company, and 126 tons of the ore was shipped to the smelter at Trail with a view to finding an efficient method of concentration, by which the disadvantages attaching to the low-grade of run-of-mine ore that would be unavoidable in working upon a scale of any magnitude upon a deposit of this character might be minimized.

TIMOTHY MOUNTAIN.

Assessment-work upon nine claims in this area, about 40 miles north-east of Lac la Hache, was recorded by R. Cavanagh and T. H. Hamilton. The claims are divided into two groups, covering deposits of molybdenite, and gold and silver associated with copper, lead, and zinc, in quartz veins. The mineral occurrences were examined by L. Reinecke, Memoir 118, Geological Survey of Canada. The following notes, although not direct quotation, are taken from this report:—

“The molybdenite ores occur as a series of parallel quartz veins cutting quartz diorite. These veins vary in width from 1 inch to 3 feet and strike in directions varying from S. 52° E. to S. 38° E., with dips to the south-west of from 20° to vertical. The greatest proved width of the mineral-belt is about 75 feet and it has been opened up at intervals along its strike for a distance of 1,900 feet. The veins have, as a rule, well-defined walls and are composed of parallel bands of quartz and molybdenite.

“The copper veins occur at a distance of about 2 miles north-west of the molybdenite-zone as a number of parallel and branching veins, about 6 inches wide, striking N. 42° E., dipping steeply eastward, some of them apparently running together in depth. They have been opened up in a belt of sheared quartz diorite at intervals for a horizontal distance of about 700 feet. The width of this sheared zone is from 25 to 30 feet.”

These claims were examined by the Consolidated Mining and Smelting Company, to whom, it is understood, their ownership was transferred during the year.

This area was described by John D. Galloway in the 1917 Annual Report, page 134.

NON-METALLICS.

B.C. Chemical Co., Ltd. This company, with head office in Vancouver, acquired from the Lillooet Soda Company, properties lying about 12 miles west of the Cariboo road at 59-Mile, upon which there are two soda-lakes known as the "Last Chance" and "Rob and Nan." A description of these deposits is contained in the report of L. Reinecke, Memoir 118 of the Geological Survey of Canada. Previous attempts to utilize this source of soda have been met by difficulties in connection with dehydration of the sodium-carbonate crystals and with the elimination of impurities due to the admixture of mud with the salt. In connection with the question of dehydration it was found that the direct application of heat resulted in the formation of caked material which clogged up the apparatus employed for the purpose. The B.C. Chemical Company, after making a series of experiments upon a practical scale, has adopted a process developed by the vice-president of the company, and which is substantially an adaptation of that employed in the dessication of milk.

A plant capable of handling an estimated output of 1.5 tons an hour has been erected, the scheme of treatment being briefly as follows: The salt, which at the present time is being dug by hand from the encrusted surface of the dried-up lake, is delivered by an incline conveyor to a dissolving and cleaning tank. This tank is a steel punt-shaped receptacle 30 feet long and 5 feet 6 inches in diameter, in which a travelling link-belt is fitted. Heat is applied to the bottom of this receptacle by steam-coils by means of which the crystal is liquefied, and the suspended mud is withdrawn on the slowly-travelling belt, being elevated above the surface of the liquid. The clarified liquid is pumped to three storage-tanks, in which the temperature requisite for maintaining solution is maintained by exhaust steam, and is withdrawn by a high-pressure pump and delivered in an atomized condition through sprays into a cyclone-type evaporator. This evaporator is in the form of an asbestos-covered steel inverted cone having a maximum diameter of 30 feet and 28 feet in height.

Furnace gases from an oil-feed furnace adapted with Ray steam-turbine oil-feed are introduced through an annular passage at the top of the evaporator; a thorough admixture of the whole content, together with a swirling motion, is provided by a central exhaust through a pipe submerged to a depth of several feet in the apparatus.

The exhaust is maintained by a fan by which the gases and vapour are delivered to a second smaller evaporator which is introduced for the purpose of catching a proportion of the pulverized soda-ash which is carried off in the first operation.

The soda-ash which is dessicated and pulverized in the evaporator at a temperature of approximately 600° F. accumulates in the bottom of the cone and is withdrawn by a blower, and together with that recovered from the second evaporator is delivered to a storage-silo in marketable form.

Estimates of the content of sodium carbonate in the dried-up lake vary, ranging up to a maximum of about 200,000 tons. This figure would represent an amount of approximately 60,000 tons of soda-ash. Plans are in contemplation for the utilization of a further supply from a near-by lake in which the salt is still in solution.

As has been stated above, practical tests have demonstrated that the dehydration of the salt crystals containing 63 per cent. water can be carried out by this process with the production of clean pulverized soda-ash ready for the market. The plant is well designed and constructed and a good camp providing for winter operation has been provided; actual operations were, however, suspended until the spring. It is understood that approximately \$50,000 has already been expended upon this project. C. W. Austin, who was formerly chemist for the company operating the soda-deposits at Green lake on the Cariboo road, is in charge of operations.

Dominion Soda Producers, Ltd. This company, with head office in Vancouver, continued operations on the *Davidson Lake* group of four claims, covering soda-deposits about 3 miles west of the 70-Mile House on the Cariboo road. Approximately 2,500 tons of soda crystal was extracted for experimental and sales purposes. Several buildings were erected and it is understood that expenditure upon this project during the year amounted to about \$3,600. The company has also been conducting investigations upon the *Soda* group of three claims in the vicinity of Big Bar lake and upon soda-lakes at Coulson's Spur on the Pacific Great Eastern Railway, from which a considerable amount of soda crystal has been extracted and soda-ash produced by evaporation at the company's plant on the site, to which certain improvements are being made.

Royal Crown Soaps.—This company, with head office in Vancouver, has Crown-granted the *Lela* soda claim, situated about 3 miles west of the 70-Mile House on the Cariboo road.

Sallie No. 1, Gypsum Deposit.—Approximately 80 tons of gypsum, available for shipment, has been screened from the material of this deposit by L. Burley.

LILLOOET MINING DIVISION.

The most noteworthy feature of the operations by Pioneer Gold Mines of British Columbia, Limited, during 1929 was in connection with the satisfactory results obtained in the deep development of the mine. Owing to unavoidable delays in the prosecution of this work the opportunity for realizing the maximum utility of the all-cyaniding treatment plant was not reached, ore reserves being insufficient to provide for operation being maintained on mine ore alone, with the result that the grade of the heads of the mill was considerably lower than it would have been otherwise. Notwithstanding this set-back the year's record represents a highly encouraging performance, and with the mine opened up as it is, and with improvements in the treatment plant which have been effected, there is promise that the coming year will see a considerable increase in production.

The main scheme of treatment has not been changed since the new mill was started, but it was found that capacity was limited through insufficiency of settling area, and this has been practically doubled by the introduction of additional settling-tanks. The capacity of the mill before this alteration was made was from 75 to 80 tons a day and is now estimated at between 125 and 140 tons.

The mine development consisted of sinking the main vertical shaft from the 500- to the 1,000-foot level, with intermediate stations cut at the 625-, 750-, and 875-foot levels. Crosscuts were driven from all of these stations to intersect the vein and a total of approximately 1,000 feet of crosscutting and drifting was carried out on the 750-, 875-, and 1,000-foot levels. On the 500-foot level the ore-shoot had been developed over a total distance of about 600 feet, having an average width of 4 feet and a value of approximately \$15 a ton. On the 750-foot level, where up to the end of the year about 350 feet of drifting-work had been completed, the average width of the vein was found to be 5.5 feet, with an average value, over a width of 4 feet, of approximately \$16 50 a ton. Practically the same conditions were found on the 875-foot level with 200 feet of drifting, while on the 1,000-foot level 300 feet of drifting showed the vein to be 4.5 feet wide, with an average value of around \$20 a ton.

By the completion of this work in 1929 the situation in regard to ore-supply is changed entirely from that under which the property has been operated up to the present time, and by means of the active prosecution of lateral development, which is in progress, there would seem to be little likelihood of further shortage of ore-supply in the coming year.

During the year 15,190 tons was mined in stopes west of the shaft, between the Nos. 5 and 2 levels. Of this tonnage, 13,190 tons was milled, together with 13,570 tons of accumulated tailing from previous operations, representing a total amount of 26,760 tons of heads to the mill, having an average value of \$8.30 a ton.

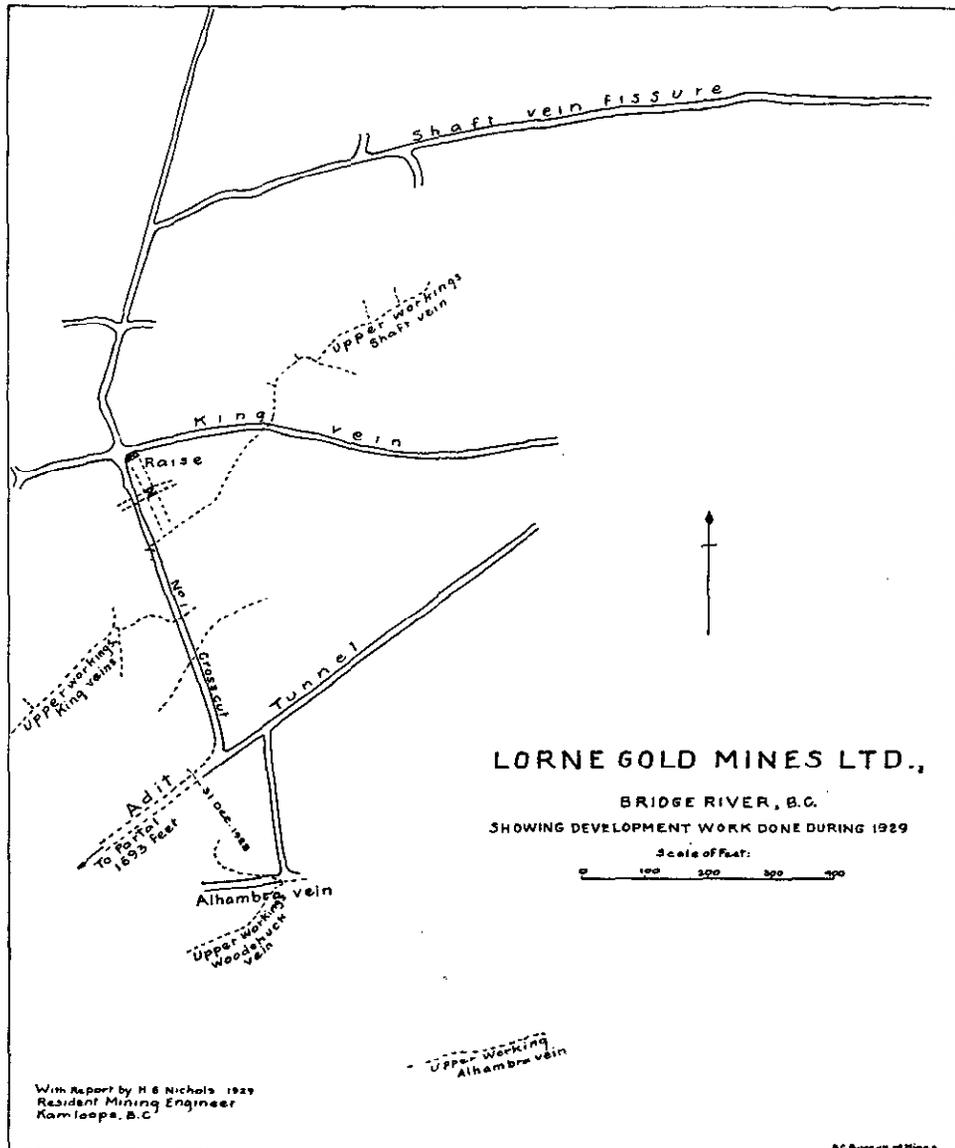
The grade of the mine ore was affected unfavourably by the cavy condition of the only stope that was available, due to the presence of local faulting above the 500-foot level. It is interesting to note that in the work carried out below this level during the year only one fault was encountered, showing a displacement of from 18 inches to 3 feet; this fault was met in the workings on the 750- and 875-foot levels, but was not found on the 1,000-foot level, a fact which encourages the belief that the vein on the lower levels of the mine may be less affected by fault movements and that mining conditions may be improved thereby to a considerable extent.

The mill ran for 360 days and the total value of the bullion produced was \$185,303.90 (correct figure, but see foot-note to production table on page 217). An average number of fifty men was employed during the year.

The property of this company lies to the north-west of that of the Pioneer Gold Mines on Cadwallader creek. Some forty-seven claims and fractional claims are included in the group, which represents a consolidation of the original *Lorne*, *Coronation*, *Blackbird*, *Ida May*, *Htram*, and *Copeland* claims, as well as a number of isolated claims and claim groups. The holdings occupy a length along the gold-belt of approximately 1,400 feet, the total area being about 1,200 acres.

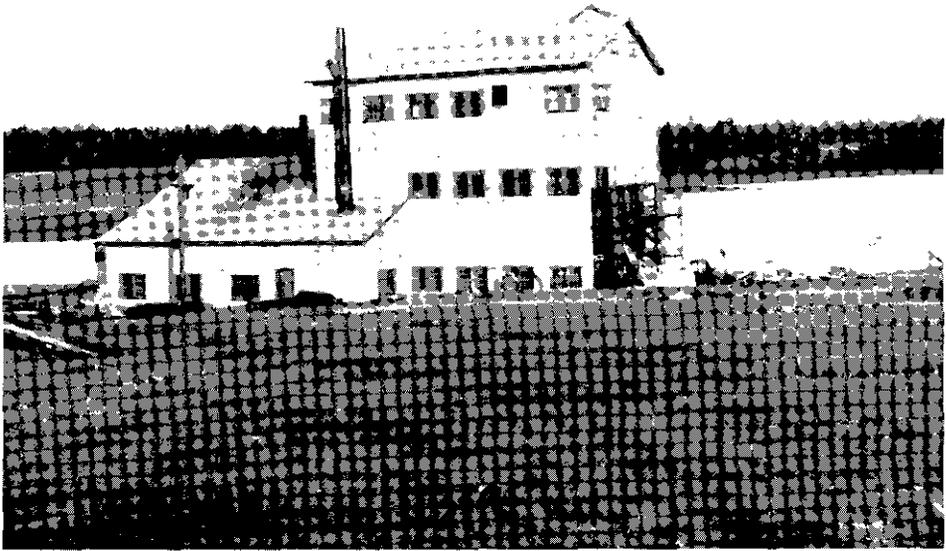
**Lorne Gold
Mines, Ltd.**

The projected work of development of the several veins occurring on the properties by means of a low-level adit was commenced in the year 1928. During 1929 5,054 feet of drifting and crosscutting and 264 feet of raising has been carried out. The adit-tunnel, which has been driven in at an elevation of approximately 3,500 feet, had for its immediate objective the intersection of four veins exposed at the surface at elevations ranging between 4,000 and 4,150 feet and known as the *Alhambra*, *Woodchuck*, *King*, and *Shaft* veins. Upon all of these veins



a certain amount of development-work had been carried out by drifting at short distances below the surface, and encouraging results had been obtained from this work.

The adit-tunnel penetrated the hill to a total distance of 2,390 feet from the portal in a direction roughly parallel to the strikes of the several veins. Two gold-bearing veins, having widths of 12 and 18 inches respectively, and several other stringers, having a strike approximately at right angles to that of the veins above mentioned, were intersected in the course of driving the adit.



B.C. Chemical Co., Ltd., Benverdam, Clinton M.D.



Lorne Mine Camp, 1929.



Hobson Creek, Kamloops M.D.—Glacier at Head.



Hobson Creek, Kamloops M.D.—Camp at Head.

The *Alhambra* vein-fissure was intersected in a south crosscut at a distance of 233 feet from the adit; this vein was drifted on for a distance of 153 feet, but is not particularly well defined, although widths of from 6 inches to 2 feet of quartz are found carrying values of from \$10 to \$15 a ton.

From a point in the adit 1,784 feet from the portal a north crosscut was driven for 1,259 feet; this crosscut failed apparently to intersect the downward continuation of the *Woodchuck* vein, but at a distance of 518 feet the *King* vein was struck in approximately the position calculated for it on its known strike and dip. This vein was drifted on for 150 feet to the west, at which point it was found to be cut off by a fault, and for a distance of approximately 700 feet to the east, an ore-shoot being opened up for a total length of about 450 feet, averaging about 3 feet in width, with a value of around \$20 a ton. A raise is being put up on this vein to connect with old tunnel-workings at a depth of about 350 feet below the outcrop where the vein had been followed for a distance of approximately 100 feet. The distance on the incline of the vein between the adit and these old tunnel-workings is approximately 650 feet, and as at December 31st, 1929, 264 feet of this distance had been completed. A crosscut driven from an intermediate level 160 feet above the adit showed the vein to be 6 feet wide at this point.

Two other veins and a small stringer were intersected by the north crosscut. The first of these occurs at a point 737 feet from the adit; this vein was 12 inches wide where it was intersected by the crosscut and carried good values, but the results of 199 feet of drifting were disappointing. At a distance of 886 feet from the adit a small fissure was cut in more or less the calculated position of the *Shaft* vein and a drift was carried on this fissure for a distance of about 1,200 feet to the east.

No ore-body of economic importance was developed in this working, although occasional spots of enrichment were encountered, some spectacularly rich gold quartz specimens being found at a point some 340 feet from the crosscut.

While the immediate results of this extensive development-work are limited to the evidence in connection with reserves of ore from the *King* vein, it is to be understood that a wide range of possibilities exists in relation to upper levels of the mine. In this connection the proof of continuity of the vein-fissures themselves to a depth represented by the adit-workings, and the occasional high values encountered, are not without encouragement; while facilities have been created for the economic development not only of the vein system above, referred to, but to possible reserves in connection with the occurrences on adjoining claims, such as the *Coronation*.

In addition to the underground work, several surface improvements were made and a length of 1.25 miles of wood-stave power pipe-line was laid in anticipation of the erection of a treatment plant during the coming year. In addition to well-appointed camp equipment, the plant includes three compressors with capacity totalling 1,350 cubic feet of air a minute, one 60-horse-power Diesel engine, and two water-wheels.

The work that has been done, both on the surface and underground, reflects high credit on the management. During the construction period in the middle of the summer over eighty men were on the pay-roll, but at the end of the year, with work confined to underground operations, this number had been reduced to twenty-six.

This company has acquired placer and lode-gold properties at McGillivray **McGillivray Gold** creek, which flows into Anderson lake close to the station of McGillivray on **Mines, Ltd.** the Pacific Great Eastern Railway. The lode-gold properties include those originally held by the Anderson Lake Mining and Milling Company and referred to in the Annual Report for 1922, page 137. At the time that this property was acquired by the present company there were three tunnels, totalling about 800 feet of drifting on a quartz vein, having a northwest-southeast strike and a steep dip. The width of this vein averages about 10 feet, varying from 5 to 20 feet.

During the past season a small amount of drifting and crosscutting has been done and sampling indicates occasional values up to \$10 a ton, the average content being considerably lower. It is stated that at the time of some past milling operations an average grade of \$6 a ton was maintained. The main object of the present operations is to ascertain whether ore-shoots may be expected to occur in this large quartz vein and to prospect the ground generally by surface-stripping. Certain open-cut work is said to have uncovered two other ledges, both of which are parallel with the main lead and from both of which free gold has been panned.

The placer-mining operations consist of hydraulic workings on bench-gravels lying below the site of the tunnels mentioned above. The following short summary of the season's work is supplied by H. H. Sutherland, superintendent of the company:—

"It was late in the season when we had our hydraulic plant installed and the water on the property. Before we could put in our sluice-boxes we had to pipe off a lot of overburden which carried no values. After the sluice-boxes were installed we made a short test run of approximately 1,500 to 2,000 cubic yards, with a recovery of 12 oz. Since then we have piped out approximately 14,000 cubic yards, which we have not yet cleaned up.

"Our hydraulic plant consists of 1,800 feet of pipe, starting from the penstock with 36 inches and gradually reducing down to 16 inches at the monitor, which has an 8-inch nozzle. We are now adding a second monitor with 4-inch nozzle to be used on our next season's work. We are also installing a small Ingersoll-Rand compressor, to be run by water-power, for drilling the larger boulders in the pit. We are hoping that next season will see the property on a paying basis."

Marion. This group is situated at a distance of 7.5 miles due north from a point on the Bridge River road, where the trail up Gun creek commences, at an elevation of approximately 6,500 feet above sea-level. There are some scattered exposures of cinnabar in seams in argillites and volcanic rocks exposed in a small draw near the summit of a long rolling upland, and a tunnel has been driven in for about 60 feet with the object of intersecting the most noteworthy of these seams, in which some good specimens of cinnabar are found in open-cut workings. The work has been carried out by Lillooet Mercury Mines (N.P.L.) under the direction of C. E. Cartwright, of Vancouver, and an excellently graded trail has been constructed to the property.

Some 22 tons of material, including that for a continuous feed-treatment plant, has been hauled on to the ground, but the latter material has not been assembled, the work of construction having been suspended.

In the same draw in which the cinnabar occurrences are found there is an exposure of a jasperoid material of a purplish colour, and it would appear that in the first instance the presence of this material gave rise to anticipation of a greater tonnage of mercury-bearing rock than has been found to exist as a result of the small amount of development that has been accomplished.

According to C. E. Cartwright, recent exploration in the open-cut workings has demonstrated the existence of two branches of a west-dipping quartz vein that was not intersected in the tunnel and to reach which a crosscut about 20 feet long would be required. It is stated that average samples taken from the two branches of this vein assay 0.4 per cent. mercury over an indicated width of 5 feet, without including certain higher-grade material occurring in knife-blade seams.

Cinnabar King. A group of eight claims has been located under this name by Grant White, of Bridge River, near the headwaters of Tyaughton creek, in the Bridge River area, at a distance of about 17 miles from the road. These claims lie at a distance of about 8 miles to the north-east from the *Marion* group. There is said to be a zone about 100 feet wide exposed on the side of a steep bluff, through which cinnabar is found to be disseminated, more or less uniformly. The zone may be traced for a distance of approximately 700 feet between vertical limits of approximately 400 feet. The formation appears to be an acid volcanic rock. Some small samples have been brought out, from which a mercury content of 3 per cent. has been obtained.

Griswold. The Consolidated Mining and Smelting Company of Canada, Limited, has completed the construction of a trail leading to this property, near the headwaters of Bridge river, from the auto-road, a distance of about 40 miles, and some prospecting-work has been done. It is understood that the further development of this property, upon which some attractive bodies of chalcopyrite have been found in a recently discovered area of granite of a younger age than the predominating batholith, will be proceeded with next year. In the Summary Report of the Geological Survey of Canada for 1928, Part A, V. Dolmage refers to this property as follows:—

"The *Griswold* showing, situated in a small canyon, is at the contact between the younger granite and the quartz diorite of the Coast Range batholith, is easily accessible; it is not more than 40 miles from the Bridge River road and can be reached by trail following an easy grade

up Bridge river. When the hydro-electric project now being carried out by the British Columbia Electric Railway Company is completed, a considerable part of this section of Bridge river will be converted by a dam into a long, navigable lake, which will facilitate communication and cheap power will be available for transportation, mining, and treatment operations. In view of these advantages, as well as the fact that the mineralized margin of the younger granite has been mapped, this newly discovered mineralized area appears to be worthy of attention."

This group of claims, owned by J. Jacks, of Pemberton, is situated on the **Copper Mound**, pass between the heads of Tenquille creek and Wolverine creek, in the Pemberton area, at an elevation of over 7,000 feet above sea-level. This property was examined by C. E. Cairnes, of the Geological Survey of Canada, extracts from whose report in the Summary Report for 1924, Part A, are as follows:—

"The peak of the hill is composed of a faulted series of volcanic and sedimentary rocks intersected by several quartz-porphyry sills and dykes and surrounded by quartz porphyry and more basic intrusive batholithic rocks. Viewed from hills to the south-east the centre of this peak appears to be traversed by a fault following a northwest-southeast direction along a nearly perpendicular plane.

"Mineralization is evident at a number of localities on Copper mound and especially so at certain showings on the slope overlooking the head of Wolverine creek and about 300 feet above the creek. Here a thick bed of limestone runs nearly parallel with Wolverine creek, and dips at a low angle to the north-east under a massive greenish rock resembling an andesite-flow, but possibly fragmental in origin. Within the limestone-belt and at three closely adjoining localities heavy ore mineralization has been exposed. The three showings cover a vertical range of about 75 feet and may represent a single broad zone of mineralization. At the upper showing and across a width of about 20 feet a deposit composed chiefly of pyrrhotite and magnetite and containing only a little gangue has been exposed over a length of several yards. The intermediate showing is of similar character, except that the percentage of magnetite is higher. The lower showing contains a considerable percentage of sphalerite as well as magnetite. A little chalcopyrite is present in all three showings. Veinlets of pyrite cut across the zinc and magnetite ore, and crystals of calamine were observed along fractures in the ore-body. A sample obtained by Davis from the lower showing gave an assay return of 8 per cent. in zinc. Low assays in gold and copper are said to have been obtained from these showings, but no systematic sampling has yet been attempted.

"At a number of smaller showings on this property, and chiefly as a result of the replacement of limestone, other ore-minerals—galena, arsenopyrite, pyrite, chalcopyrite—occur, but in none of these showings is the concentration of ore-minerals very pronounced. The hill as a whole is deserving of further prospecting and more careful sampling of such mineral-deposits as have been discovered."

A considerable amount of stripping and open-cut work was done on these claims during the past year and it is understood that further development-work, at the hands of a Vancouver syndicate that has acquired an interest in the property, will be carried out in the spring of 1930.

This group of claims, owned by C. Barbour, of Pemberton, to which reference **Gold King**, has been made in previous Annual Reports, has been bonded, it is understood, by A. B. Trites, of Vancouver. It is reported that diamond-drilling upon the strongly mineralized shear, which extends in length over four claims, will be commenced in the spring of 1930.

This company, with head offices in Vancouver, was formed for the purpose of **P.E. Gold Mines, Ltd.** prospecting and developing a group of claims known as the *Pioneer Extension* group, which adjoins the *Pioneer* on the south-east. Prospecting-work, following upon the discovery of rich gold float, resulted in the discovery of a well-defined vein carrying low gold values and further exploration-work is to be carried out in the coming year.

Wayside.—Further prospecting-work upon this property, situated on the Bridge river below the forks, was commenced in the early part of the year, but operations were suspended during the summer and no particular change in the outlook is to be recorded.

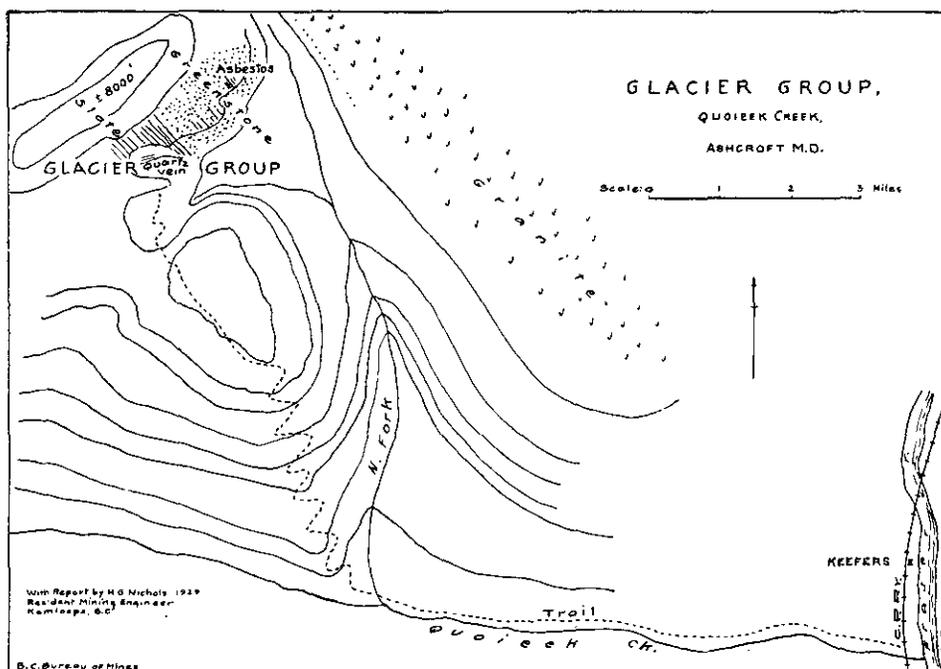
Golden Cache.—A lease upon this reverted Crown-granted claim, situated on Cayoosh creek, has been taken by A. F. Noel and W. C. Savage, of Vancouver, and it is understood that development-work will be commenced in the spring.

ASHCROFT MINING DIVISION.

Sharp. This group consists of fourteen claims, situated on Criss creek, at a distance of about 3 miles above the point where it enters the Deadman river. The claims, which lie at an elevation of about 3,000 feet above sea-level, cover deposits of cinnabar in fractured breccias of Triassic age, close to centres of Tertiary vulcanism. Cinnabar is found in a series of veins with varying strikes in a gangue of quartz and calcite. These occurrences have been prospected by a number of shallow shafts and open-cuts, the one of chief importance being opened up in a cut 12 feet long to a depth of 3 feet. A 2-foot vein is exposed in this working, in the centre of which there is a 10-inch streak of high-grade cinnabar ore.

The property was examined by V. Dolmage, who obtained a sample across the full width of the vein, which assayed 1.15 per cent. mercury. Evidence of continuity is not afforded by the existing surface workings. Several other cinnabar-bearing veins are exposed, which point to fairly widespread mineralization and afford encouragement for more systematic development.

Glacier. This group is situated at the head of the North fork of Quoieek creek, a stream which flows into the Fraser river from the west just below the flag-station of Keefers, on the Canadian Pacific Railway. The property comprises eight mineral claims and is owned by J. W. Murphy, of Lytton, and associates. The distance from the railway-track to the claims is approximately 15 miles, of which distance about 8 miles



is covered by a rough trail following the main stream to its forks, from which point it climbs a steep ridge between the North and South forks to an elevation of approximately 5,500 feet, after which a gradual ascent is made to the location of the claims above timber-line.

The area is occupied by slates and greenstone, intersected by acid dykes, related to a large body of granitic intrusive that is exposed on the east side of the North fork of the creek. The slaty argillites are in contact with the greenstone in a cirque-like area where the mineral occurrence is found and a high degree of schistosity is developed in both formations. The vein that has been the object of the prospecting-work upon the property occurs in the argillite formation, and may be traced over a distance of approximately 800 feet, lying conformably with the schistosity and being exposed at several points down the rock-strewn mountain-side, for a vertical distance of approximately 400 feet. In most of the exposures the vein appears to be about 2 feet wide, but there is a greater development of quartz at points where the dykes are intersected.

At a point near the summit of the mountain where the quartz vein appears to be about 2 feet wide a sample was taken which assayed: Gold, trace; silver, 0.4 oz. to the ton. From an open-cut about 150 feet below the highest exposure a sample was taken across 14 inches which assayed: Gold, 0.04 oz. to the ton; silver, 4.5 oz. to the ton. From an open-cut still farther down the hill a sample taken across a width of 2 feet assayed: Gold, trace; silver, 0.5 oz. to the ton.

Below this point there is another exposure where the vein appears to cross a body of dyke-matter and there is a considerable width of quartz. A sample taken across the vein at this point assayed: Gold, 0.04 oz. to the ton; silver, 13.2 oz. to the ton; while a sample of quartz in the vicinity of the vein assayed: Gold, 0.01 oz. to the ton; silver, 3.4 oz. to the ton.

Still farther below this point the vein appears to swing round towards the south-east in conformity with the schistosity, which appears to indicate an anticlinal structure; the dip is steeply towards the east, whereas in the higher exposures it lies towards the west. Some open-cutting at the point where this change of direction is first noticed exposes a width of quartz of about 4 feet; a sample taken across this width at this point assayed: Gold, 0.02 oz. to the ton; silver, 0.04 oz. to the ton. The vein is also found with well-defined walls in a short tunnel and open-cut some 50 feet below the point last mentioned. A sample taken across 3 feet 6 inches in this tunnel assayed: Gold, 0.16 oz. to the ton; silver, 0.08 oz. to the ton.

The predominance of gold over silver values in this south-east section of the vein occurrence is of interest, but with the small amount of work yet accomplished it is not possible to determine whether this is a separate vein or not; the evidence in general points to the explanation given above.

The occurrence is deserving of further investigation, although the facts thus far observable, in regard to the size and value of the single vein that has been discovered up to the present time, are not such as to indicate commercial importance, more particularly in view of the difficult location of the property.

The association of slates and greenstone near a granite-contact in this belt of country enhances the importance of the mineral discovery, and it may be suggested that further prospecting within this area would not be without promise. The greenstone lying to the east is greatly altered along shears and bodies of serpentine occur in which seams of asbestos are developed. These seams are narrow and irregular and, although some good fibre may be obtained, the deposits could hardly be considered as commercial assets under existing conditions.

Snow Storm.—This property, in the Highland Valley area, was restaked during the year and there has been renewed activity in prospecting the copper-deposits in this section.

Index.—This molybdenite property, at the head of Texas creek, has not been further developed, but continues to be of interest in view of the growing demand for molybdenum.

PLACER-MINING.

Some dredging-work on a small scale was carried out upon a bar on the Fraser river below Lytton, and an organization, entitled Mineral Sands, Limited, with head office in Vancouver, has been incorporated for the purpose of operating on the Thompson river near Spences Bridge. Some machinery has been put on the property, but heavy expenditure is not warranted until the ground has been tested.

YALE MINING DIVISION.

Aurum Mines, Ltd. Approximately 1,500 feet of underground work was done during the year in an attempt to open up ore reserves upon this property, situated near Jessica, on the Kettle Valley Railway. The greater part of this work was carried out on two levels, approximately 125 and 225 feet respectively below the No. 2 tunnel, where high-grade gold ore was discovered. This gold occurrence, which was identified with knife-blade shears, along the edge of a body of serpentine bordering the slate-greenstone contact, and also associated with arsenopyrite in kidneys of ore occurring within a limited section of crushed ground, at the point where the serpentine swung away from the contact in the No. 2 level workings, extended over a distance of approximately 60 feet. The No. 3 tunnel was driven with the object of exploring that section of the ground in which the downward continuation of a possible ore-shoot might be expected to be found below this occurrence, provided that the known conditions associated with the mineralization, as referred to above, were repeated at this horizon. During the latter part of the year a pocket of arsenopyrite, with heavy gold

content, was encountered in these tunnel-workings and a raise was started at a point where this ore was found; this raise failed to afford evidence of continuity and a second raise was started from a point 60 feet farther back in the tunnel and was carried up for a distance of 70 feet. Small amounts of gold in talc were found in this raise. Some stoping and raising was also started from the No. 2 tunnel, but here again the ore is reported to be very "bunchy." In regard to some work done on a level about 40 feet below the No. 2 tunnel, the superintendent reports as follows: "The intermediate level shows good indications, but, as in other places, very sparse."

About 500 feet of work was done on the level of No. 4 tunnel, but with the exception of the occasional finding of small flakes of gold in talc this work was unproductive of results. The results of this work have demonstrated the correctness of the surmise, both in regard to the irregular character of the bodies of serpentine and to the sporadic occurrence of gold along certain shears.

In view of these peculiar conditions of mineralization it is clear that the prospecting of this ground demands the closest attention to observable facts and careful survey of the workings as they are advanced, and it is to be regretted that no detailed survey has been made. On account of the severe winter and due to shortness of water, work was confined during the latter part of the year to prospecting by hand, four men only being employed.

Dalhousie Mining Co., Ltd.—Exploration-work was carried on by this company on the south-easterly extension of the same zone of mineralization in which the occurrences on the *Aurum* are found, but this work was suspended during the summer.

Reward Mining Co., Ltd.—This company secured a number of claims in the same area, but no work of importance was carried out.

Columbia Metals, Ltd.—An active campaign of exploration was launched by this company upon its properties, situated on the east side of the Coquihalla river, near Jessica, but with the exception of some occasional seams, in which a gold and silver content was found, in association with zinc, in shears within the greenstone, no ore-bodies of economic importance were developed during the season.

Several other individuals and organizations are engaged in the work of prospecting along this attractive mineralized zone.

Dawson Gold Mines, Ltd.—This company continued work upon the *Emancipation*, attention being devoted principally to developing possibilities in connection with the downward continuation of the shoot of high-grade gold ore in the *Dyke* vein.

The properties of this company are situated near the summit of a hill, at an elevation of about 5,000 feet, west of Iago, on the Kettle Valley Railway. There is here a wide belt in which a series of quartz veins associated with pegmatite occur in a granite area. There are said to be twenty-six veins within a zone approximately half a mile wide, carrying molybdenum in variable quantities. The continuity of these veins over a considerable distance is indicated, although more work will have to be done before this point can be established. Samples of an attractive character are obtained from many points within this vein system. The property is being developed by the above company, which has headquarters in Vancouver.

Home Gold Mines.—A few men were employed upon exploratory work on the *Pipestem* claim, at the head of the South fork of Ladner creek.

This company, with which A. B. Trites, of Vancouver, is identified, acquired an interest in mineral claims situated on 15-Mile creek, about 2 miles south of the property of Aurum Mines, Limited. The principal claims, originally located by W. S. Bradley and associates, of Hope, are the *Dundee*, *Dunwell*, *Lebred*, and *Reno*.

A wide belt of serpentine is exposed in the creek-bottom and ranging up the hillside for a distance of about 2,000 feet. On the south side of the creek a trench was cut to bed-rock by means of ground-sludging, in which occurrences of free gold were found in shears; one of these was along a contact of a diorite dyke traversing the belt in approximately an east-west direction; in three other cases the gold was markedly associated with a white rock that probably represents an ultimate product of alteration derived from the serpentine itself. In each of these occurrences the values were found to be confined to shears a few inches in width. Assays of samples from the material in the shears ranged from gold 0.02 oz. and silver trace to the ton to gold 0.42 oz. and silver 0.05 oz. to the ton. These values may only be looked upon as indications, as it is difficult to obtain representative samples from such seams carrying coarse visible gold.

It is understood that further trenching-work has demonstrated the continuity of some of these seams, and the occurrence is interesting as indicating that gold values are to be found within the mass of the serpentine bodies, and not confined to shears along their margins. The opportunity is here presented to explore the ground at depth by means of a crosscutting tunnel. Although the ground is soft and the work of driving will be comparatively small, such work, to be conclusive, would entail considerable footage, and it is understood that, as would appear advisable, further information is to be sought in the first place, as to the probable commercial aspect, by a continuation of surface operations. The whole mass of this body of serpentine exhibits marked shearing, and the confinement of gold content to certain definite shears in which a process of alteration is indicated is not without significance as pointing to the fallibility of the assumption that gold is to be looked for wherever there is serpentine, or even where there are shears in the serpentine.

This company, representing interests more or less identical with those associated with Pacific Mines, Limited, acquired an interest in a number of locations lying, for the greater part, to the south and west of the properties of Aurum Mines, Limited. A considerable amount of open-cut work was carried out with a view to locating bodies of serpentine and their contacts with the surrounding greenstone, and upon one claim located about 2 miles west of the *Aurum* workings two tunnels have been driven.

In the upper tunnel, which was driven in for a distance of about 100 feet, a seam was exposed in which visible gold occurs in a shear in serpentine. Following this seam the serpentine was found to die out and the shear persisted through the greenstone, but without indication of valuable content. The lower tunnel, about 150 feet below, penetrated a mass of serpentine which was found, by crosscutting, to have a considerable width and to be uniformly sheared. It is stated that a seam carrying visible gold was found along the one shear-plane that was followed in the upper tunnel.

On this property several occurrences of the alteration product of the serpentine similar to those observed on 15-Mile creek are to be found, and while the particular body of serpentine above referred to may not be continuous, several exposures of it as well as outcrops of diorite intrusive are to be found on the surface throughout the wide zone covered by the properties of this company. As a field for prospecting, therefore, this particular section is held to possess considerable attraction and presents scope for the exercise of the same principles of intelligent observation and prospecting that have been cited as the outstanding requirements in connection with the further development of this whole area.

This group, together with a number of other locations, covers an area over **Pride of Emory**, which bodies of nickel-bearing pyrrhotite occur at the head of Emory and Stulkawhits creeks, which enter the Fraser river from the west a few miles south of Yale. The properties, comprising seventy-four claims and fractional claims, have been acquired by B.C. Nickel Mines, Limited, with headquarters in Vancouver, and active steps have been taken towards their development.

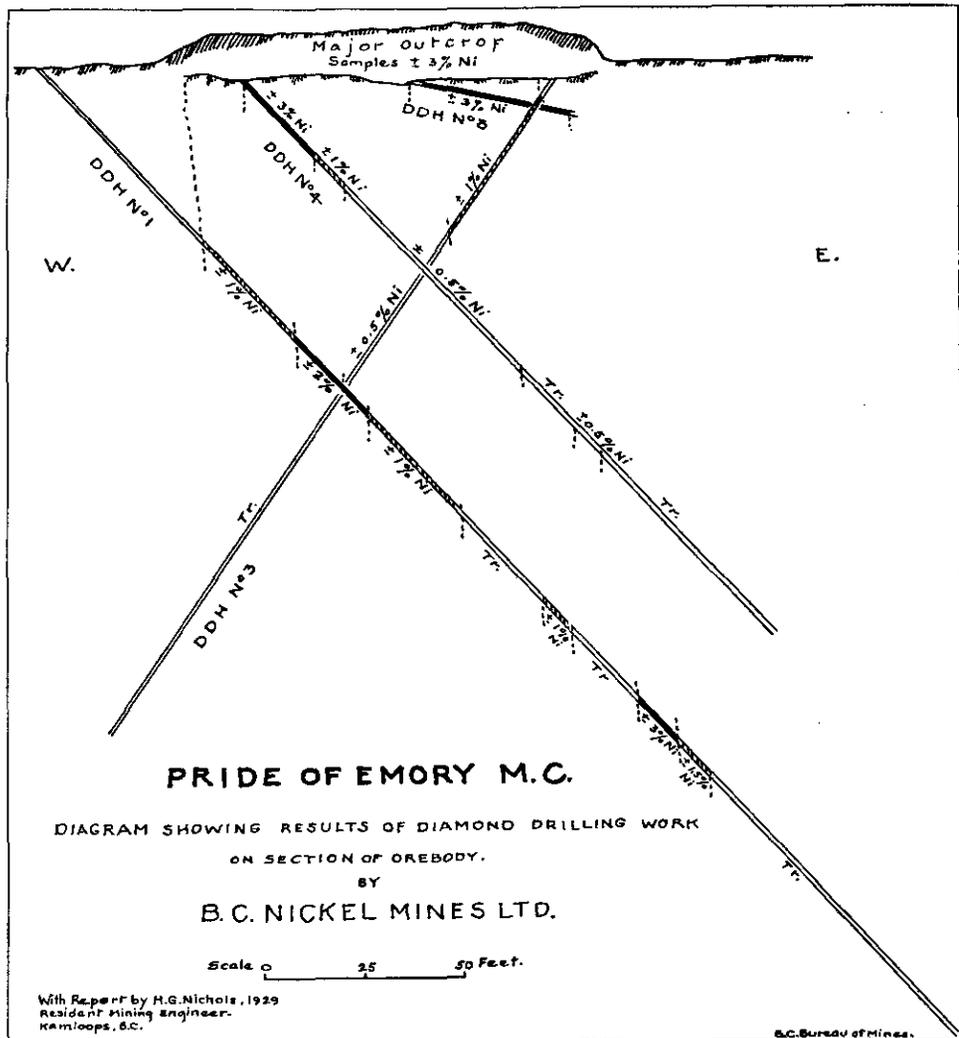
The area lies at elevations approximately between 3,500 and 5,000 feet above sea-level, at a distance of about 8 miles from the main line of the Canadian Pacific Railway and the Trans-Provincial highway. During the early part of the year a good pack-trail was constructed up the valley of Emory creek, a distance of approximately 10 miles, and two camps were constructed, and diamond-drilling operations commenced.

The geological features of the occurrence have been described by C. E. Cairnes (Geological Survey of Canada, Summary Report, 1924, Part A). At several points in a zone of pyroxenite rock in contact with granodiorite there are prominent outcrops of massive pyrrhotite with a nickel content. The principal natural exposure is found on the Emory Creek side of the divide, where an open-cut, to which reference has been made in former Annual Reports, offered opportunity for sampling. Samples from this cut yielded returns of approximately 3 per cent. nickel over a width of about 50 feet, higher content up to 5.5 per cent. nickel with some values in copper and gold having been reported in spots.

At five or six other points where open-cuts have been made evidence is afforded of a considerable extent of mineralization, solid pyrrhotite with nickel content varying from 0.17 to 1.5 per cent. having been found over a distance of about 1 mile on the strike of the pyroxenite-zone, which has been estimated roughly to have an average width of 900 feet.

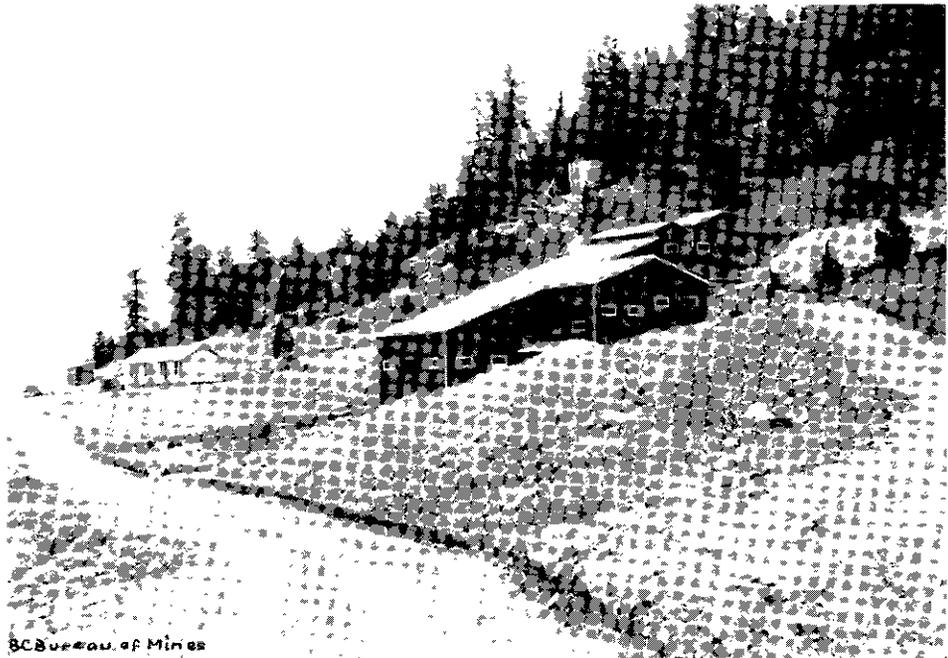
The work that was carried out during the year was devoted chiefly to prospecting the major outcrop on the Emory Creek slope by means of diamond-drilling. Four bore-holes were put down with a view to cross-sectioning the ore-body below the open-cut workings, and three other holes were drilled along the extension of the strike where pyrrhotite is exposed down the valley of the creek to a distance of about 600 feet.

The results of this work, beyond proving that this body of pyrrhotite, which is about 80 feet wide, carries a nickel content, are inconclusive as regards average grade. Sections of core of an average grade of around 3 per cent. nickel were obtained, and even higher results are indicated



by check assays, but no satisfactory degree of correlation of these results is afforded; thus bore-hole No. 3, passing through a section of ground in which some of the best results were obtained in bore-hole No. 1, failed to provide confirmation. A summary of the results achieved by the drilling of the four bore-holes on the section of ore-body passing through the open-cut workings is represented in the diagram accompanying this report, compiled from information supplied by courtesy of the company.

The three bore-holes referred to above that were put down to prospect the extension of the zone towards the south-west yielded negative results.



Planet Mine, Nicola M.D.



The Inn Mine, Nicola M.D.



Quoieek Creek, Ashcroft M.D.



Hope Mountains, West of Skagit River.

It is probable that a considerably greater scheme of development must be carried out before the economic aspect of this impressive mineral occurrence can be estimated, and it is understood that active prosecution of this work is to be taken in hand by the company.

Mammoth. This claim, in the 23-Mile Camp area, on the Hope-Princeton trail, owned by W. H. Robinson, of Hope, has been under option to Hope Holdings, Limited, but no further development has been carried out. A sample of the ore exposed in the open-cut workings, where scheelite is found in association with the pyrrhotite, was taken by the Provincial Mineralogist; this sample assayed: Gold, 0.01 oz. to the ton; silver, 0.8 oz. to the ton; nickel, 2.7 per cent. This deposit represents an interesting association of minerals, but, so far as present developments go, continuity of the occurrence has not been established.

Rainbow. This group was also under option to Hope Holdings, Limited. The property is situated on the same hillside, north of the Sumallo river, at a distance of approximately 1.5 miles east of the *Mammoth*. A compressor was installed with a view to driving a crosscut tunnel to intersect a body of ore thought to be indicated by a surface exposure in which some scanty mineralization is found. The operations on this property were, however, suspended pending further prospecting-work on the surface.

Silver Daisy. This property, situated on the east side of the Skagit river, just below its confluence with the Sumallo river, was also taken up by Hope Holdings, Limited, and operations have been carried out through the means of a subsidiary company, Silver Daisy Mines, Limited. A crosscut tunnel has been driven for a distance of between 250 and 350 feet for the purpose of intersecting a narrow silver-lead vein which crosses the creek at a vertical height of about 142 feet above the tunnel. This vein, which has a general north-south strike, with a dip of from 50° to 60° to the west, was drifted upon in both directions from the creek for a total distance of about 175 feet. The vein, which is about 6 inches wide, occupies a fissure which follows a sinuous course through a succession of joint-planes in greenstone. A shipment of 21 tons of ore obtained from this development-work contained: Gold, 1 oz.; silver, 1,038 oz.; lead, 2,243 lb.; with a total net value of \$372.54.

The development-work represented by the lower crosscut tunnel has not yet reached the downward continuation of this vein. A good camp has been established and a considerable amount of money expended upon the repair and maintenance of the truck-road leading from Hope, in addition to installation of power machinery. These workings represent an outlay disproportionate to the degree of commercial importance that is to be attached to the vein so far exposed in the upper workings; the development is understood to be based upon anticipations of greater width in depth.

Gold Coin, Waterfall, and Grandview. These groups are situated on a mountain rising to an elevation of about 5,000 feet lying to the north of Steamboat mountain, from which it is separated by the valley of 10-Mile creek, which flows into the Skagit river from the east; at a distance of about 9 miles below the *Silver Daisy* camp. Extensive bodies of pyrrhotite, similar to those at 23-Mile camp, occur in association with a joint system in the greenstone, which is here intersected by tongues and dykes of diorite; in certain of these occurrences lead, zinc, and copper minerals are found, with some associated values in gold and silver. There are also some zones in which arsenopyrite predominates. The following series of samples were taken from a number of exposures on these claims by the Provincial Mineralogist, and afford an idea of the general character of the metal content, as well as of the occasional occurrences of ore, carrying high values in silver:—

Claim.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. to Ton	Oz. to Ton.	Per Cent.	Per Cent.	Per Cent.
Gold Coin No. 2.....	0.14	0.5	Trace	Trace	5.7
Gold Point.....	Trace	0.2	.....	.....	.....
Gold Coin No. 6.....	Trace	0.1	.....	Trace	6.1
Gold Coin No. 5.....	Trace	1.2	Trace	Trace	7.2
Gold Coin No. 5.....	Trace	0.7	.....	Trace	4.7
Gold Coin No. 5.....	0.18	95.0	6.3	3.8	15.1
Grandview No. 1.....	0.61	0.9	*	.....	.....
Grandview No. 1.....	Trace	0.2	.....	.....	.....
Polar Bear.....	Trace	0.4	.....	.....	.....
Gold Coin.....	0.14	65.6	Trace	51.1	4.9
Ruby.....	0.10	0.9	*	.....	.....

* Nickel, trace.

A considerable amount of prospecting has been carried on by C. Howlett, of Hope. The greater part of this work has been devoted to the bodies of pyrrhotite which are in greater evidence at the lower horizons of the hill. Some narrow bodies of limestone are found in the greenstone, and in general it may be said that further prospecting is justified, with particular application to the occurrences of galena at the higher elevations.

These properties are situated on the Skagit river, close to the International boundary-line, at elevations ranging up to 6,000 feet above sea-level, and cover the location known originally as the Gibson property, having been staked several years ago by Luke Gibson, of Princeton, upon a deposit of silver-lead-zinc ore which is exposed on either side of an abrupt saw-tooth range, across which it passes in a north and south direction.

Sparse mineralization is found in an irregular sheared zone. The following samples were taken by the Provincial Mineralogist:—

Description.	Width.	Gold.	Silver.	Copper.	Lead.
		Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
Sample No. 1.....	20 in.	0.14	18.0	4	38.2
Sample No. 2.....	3½ ft.	0.04	6.0	N4	15.2
Sample No. 3.....	6 in.	0.06	15.5	N4	40.0

This group is situated in the Skagit valley, close to the International boundary-line, at a distance of 15 miles below 23-Mile camp, on the Hope-Princeton trail. The claims were located by A. Robinson, of Vancouver, upon a replacement ore-body in limestone, with copper and silver content. The group, which is situated at an elevation of 4,750 feet, consists of the *Silent Friend*, *Bannockburn*, *Muriel*, *Dominion*, and *Canada Fraction* claims. A trail has been constructed to the property and development-work is being carried on throughout the winter. The property was examined by the Provincial Mineralogist, from whose report the following extracts are taken:—

“The mineral occurrence on the property is on the side of a dry gulch and consists of a natural rocky outcrop sloping down the draw at about a 45° angle. The deposit is a typical contact-metamorphic ore-body in grey limestone, with a granitic intrusive rock distant some 400 to 600 feet easterly from the outcrop, the intervening distance being covered with drift and timber.

“The outcrop consists of bands of altered limestone irregularly mineralized and interbanded with unaltered limestone. The apparent strike is north and south (mag.) and a wide mineralized zone up to 100 feet is indicated. The sulphide minerals present are sphalerite, chalcopyrite, pyrite, galena, and possibly arsenopyrite. The gangue-minerals present are quartz, calcite, garnetite, lime silicate, epidote, chlorite, hornblende, specularite, and magnetite. No pyrrhotite was noted, but this sulphide may occur. Surface oxidation products consist of malachite, azurite, and limonite. The showing is an impressive one and is practically a natural exposure, as only a few shots have been put in it. Another showing is reported to occur between the one examined and the granitic intrusive, but this was not known at the time and was therefore not examined.

“In general the sulphide mineralization is disseminated, although bands of practically solid sphalerite up to 2 feet wide occur. Bands of clean magnetite and also specularite up to 1 foot in width were also noted.

“The principal values are in silver, copper, and zinc; a high zinc content occurs, but at present zinc prices this is of but small value. However, it is evident that the silver and copper values are sufficient to warrant thorough investigation of the property even though the zinc content is disregarded.

“The ore-body is partially oxidized at and near the surface, but this condition will only last for a few feet. It is noticeable, in places where the original outcrop was barren limestone, that on breaking into this, mineralization occurs beneath the barren outcrop. It is not to be expected that the entire zone will be mineralized across the full apparent width, but the surface indicates that a substantial portion of the zone should be well mineralized.

"As far as can be determined from the limited surface showings, the limestone has been fractured or sheared along a north-south direction, and along this shearing circulating solutions from the granitic magma have metasomatically replaced the limestone with sulphides and gangue-minerals.

"Totalling the results of all samples across the ore-body gives 45 feet 9 inches of width assaying \$14.75 a ton in silver, copper, and zinc; this would be reduced somewhat for a right-angle section, but it may be conservatively estimated that it shows at least 40 feet of width. This is the width sampled and an additional 10 feet in three intervening bands was not sampled. This 10 feet is slightly mineralized, but was considered to be too low grade to be commercial.

"The general average value for the 40 feet of width (sampled) in silver and copper is \$8.15 a ton.

"The outcrop gives such evidence of size and commercial values that the property is a decidedly attractive prospect and that it is well worth energetic and extensive exploration."

NICOLA MINING DIVISION.

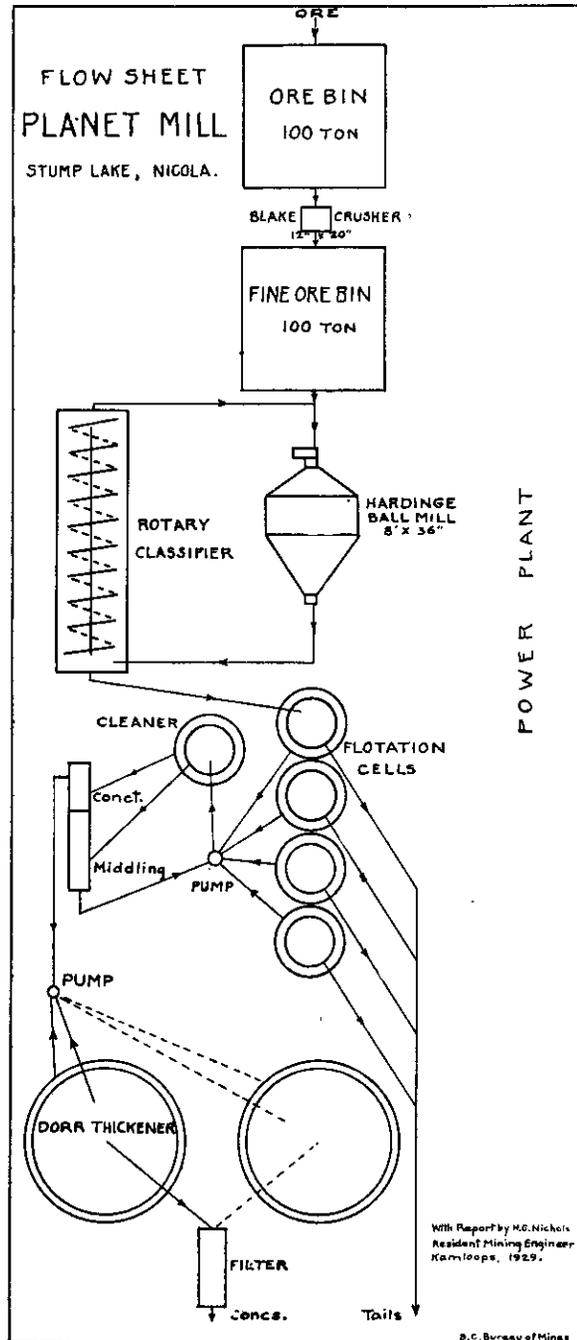
The operations of this company at Stump lake have continued during the year, **Planet Mining and Reduction Co. of Nicola, Ltd.** and good extraction of values from the gold-silver-lead ore of the *Enterprise* vein has been obtained in the flotation plant that was completed and put in operation during the early part of the year. The crosscut tunnel to intersect this vein at a level below the bottom of the incline shaft, from which operations have been conducted in the past, reached its immediate objective soon after commencement of milling, when the vein was encountered, having a width of 5 feet of ore of good grade. Prior to this ore being made available for extraction mill-feed was obtained from the dump from the old shaft-workings, and in this way an opportunity was afforded for tuning up the machinery, although from the point of view of production the results were not satisfactory.

Upon the vein being encountered, a combined effort of stoping and development was made with a view to overcoming the shortage of ore and to keep the mill in operation. A drift was run south from the adit and connection was made with the shaft, and in addition a drift was also run to the north. These workings have now been extended, the north drift having been continued for 145 feet on the vein and the south drift for a distance of approximately 300 feet. The vein-fissure has been found to continue for the whole of this distance, although the pinching and swelling which is characteristic of the vein system is strongly evidenced in these workings. Some seven shoots having a maximum width of about 4 feet and an average length of about 20 feet have been opened up over the entire distance so far developed, affording an average width of approximately 2 feet of continuous ore-body. The stopes are carried as narrow as possible and the ore, going to the mill, passes through a certain amount of sorting, but is still diluted with approximately 50 per cent. waste. The measure of success obtained in the operations is attributable in a large measure to the saving presence of gold values and to the high ratio of concentration that is obtained in the treatment plant.

The installation consists of a 12- by 20-inch Blake crusher, an 8-foot by 36-inch Hardinge ball-mill, a rotary-type classifier, five 4-foot Peterson flotation-cells, two 12-foot Dorr thickeners, and a 3-leaf American filter.

It has been found that a ratio of concentration of 25 to 1 can be obtained, and heads of a value of \$13 a ton can be treated with a production of concentrate of a gross value of approximately \$275 a ton, with tailing assaying \$1.40 a ton; the most important loss being in connection with the silver values. The principle employed in the treatment is to depress the iron and zinc. There is also a notable copper content in the concentrate. The capacity of the mill has been tested up to over 120 tons a day, but the average production, limited by power capacity and stoping facilities, has not averaged one-half of that amount; a maximum of about 60 tons a day may be looked for. The mill is well constructed, but is probably out of proportion to the tonnage. Cost of mining is stated to be around \$2.60 a ton, milling costs averaging \$1.40, and with freight and treatment charges amounting to around \$3 a ton of ore, a net operating profit is indicated of about \$5 a ton.

All the machinery is driven by a 250-horse-power Petter engine, power being distributed by belts and electric motors. Power-supply is a limiting factor in the operations. Water, amounting to 60 gallons a minute, is pumped by a small Petter engine from Stump lake. A 720-cubic-foot Ingersoll-Rand compressor supplies air for three machine-drills running on three shifts.



The consumption of fuel-oil amounts to 250 gallons a day. Supplies are hauled from Nicola, from which point on the branch line of the Kettle Valley Railway from Merritt the concentrate has been shipped to the Selby and Trail smelters. With regard to ore reserves, it may be said that approximately one-half of the ore blocked out up to the present time between the adit (320-foot) level and the 190-foot level above has already been extracted, but these reserves are being added to by continued lateral development, and in addition there is an area of probable ore above the 190-foot level. It is estimated that total reserves of ore above the adit-level amount to about 5,000 tons.

It is understood that plans for next year include the continuation of the main crosscut to intersect the other ore-bodies related to the general vein system of Mineral hill, as well as further development in depth. These plans would appear to be justified by the results of the work already achieved, and the profitable continuation of the operations is dependent upon adherence to such a policy of intensive development.

Work has been resumed by this company, with headquarters in Vancouver, upon the *Mary Reynolds* claim, situated near Stump lake. In previous operations a seam of high-grade silver ore was followed in tunnel-workings and a considerable amount of prospecting was carried out by means of shallow shafts and open-cuts along a zone in the greenstone formation, in which the continuity of the vein occurrences is indicated on surface.

A shaft was also sunk to connect with the main tunnel-workings at a depth of about 50 feet below the outcrop. Recent work has been devoted to exploring the ground intermediate between the surface and the tunnel-level by means of a north drift from the shaft at a depth of approximately 35 feet below surface. This drift has been carried for a distance of about 50 feet and vein-filling is found over a width of approximately 4 feet, with narrow seams from which assays up to 120 oz. silver to the ton have been obtained from selected samples. It is understood that plans are being made for the more extensive development of the mineralized zone.

This company, with head office in Seattle, Wash., was incorporated to acquire **Comstock of B.C., Ltd.** and develop properties situated on Iron mountain, south of the town of Merritt. Twenty-one claims are held by this company, including the *Leadville*, *Yellow Jacket*, *Hornet*, and *Comstock* groups. The entire area comprises about 1,000 acres, covering the summit of the mountain, which is about 5,280 feet above sea-level. This mountain derives its name from the occurrence of several veins of specular hæmatite which traverse altered volcanic rocks, which have been thought to indicate a centre of volcanic activity. Zones of lead mineralization also occur and it is with these that the present operations are concerned. A considerable amount of open-cut work has been done, but prospecting has been retarded by the heavy drift which covers the surface. At one point a vein was uncovered and a shaft has been sunk upon it to a depth of 100 feet. This vein has well-defined walls and is about 5 feet in average width.

Some high-grade ore carrying 65 per cent. lead was extracted from this shaft and there is an amount of about 370 tons of ore on the dump with an estimated average content of 15 per cent. lead; although occasionally high values in silver are found, the silver content is generally low. The vein was found to be displaced by a fault movement at the bottom of the shaft and, after some groping around, work was discontinued in favour of driving a crosscut tunnel at a lower horizon. It is planned to drive this crosscut to intersect the vein at a depth of 175 feet below the collar of the shaft, and it is estimated that this point can be reached with about 400 feet of tunnel-work.

For the purpose of this development-work a portable compressor is being put on the property and it is understood that operations will be continued throughout the winter. The company has constructed a permanent camp and with the assistance of the Department of Mines a truck-road has been constructed up the mountain.

Some copper is also found in association with hæmatite on other sections of the property and a programme of diamond-drilling to explore these deposits is planned for the spring of 1930.

This company, with headquarters in Vancouver, has been incorporated for the purpose of developing copper prospects in the Aspen Grove area, south of **Morgan Copper Mines, Ltd.** Merritt. This mineral field was referred to in the Annual Report for 1928, page 222. The company has acquired by purchase and location a total number of thirty-two claims, covering about 1,600 acres of this area, and known by the names of the

Shamrock, Slipper, Waverly, and Dunbar groups. Included within these holdings is the claim formerly known as the *Big Sioux*, situated towards the northern end of the mineral-zone.

One of the more attractive occurrences in the area is found upon this claim where a shaft had been sunk several years ago upon a zone of shearing and fracturing, from which high-grade ore had been extracted and is still to be seen on the dump. Exploratory work is being carried out at this point and this should prove of interest, as this particular occurrence appears to afford better promise of continuity than is to be found in the case of the majority of the prospects in this camp.

Thelma.

This property, owned by *Thelma Mines, Limited*, with head office in Vancouver, is situated on the Nicola plateau, at a distance of 9 miles north of the town of Nicola. Development has been continued from the *Thelma* shaft, which has been carried down to the depth of 200 feet on the incline, but with the exception of some narrow seams of zinc mineral no further ore was exposed below the 60-foot level, where the body of ore referred to in the last year's report was found in a crosscut. It appears that the shaft passed into the foot-wall of this ore-body, which occurred on the hanging-wall side of a feldspar-porphphy dyke, intrusive in the altered limestone formation. A short crosscut from the bottom of the shaft exposes a body of porphyry rock, and it is probable that this crosscut must be driven for a short distance into the hanging-wall before the downward continuation of the ore-body is reached. Plans for the commencement of this crosscutting-work have been made and the future prospects of the property will depend upon the results obtained therefrom.

Some further open-cut work has been done along the extension of the zone in which the bands of limestone occur that have afforded the loci of mineral replacement; this work appears to confirm the opinion previously expressed in regard to the intermittent character of these lenses of limestone and the irregular character of the mineralization.

The high silver content of ore previously exposed in the workings from both the *Thelma* and *Bernice* shafts is an encouraging feature. The camp equipment has been improved and a crew of about eight men has been employed steadily throughout the year.

Turlight Mines, Ltd.

This company, with head office in Merritt, was formed to acquire and operate properties situated about 5 miles north-east of the town of Nicola, on the east side of Mill creek. The claims, known as the *Turlight* group, are located at an elevation of about 3,000 feet on the Nicola plateau. Several scattered points of copper mineralization are found in a zone of an altered hornblende showing a gneissic structure, which borders a contact between greenstone and a granitic intrusive rock. Exposures are scarce in the drift-covered area and very little work has been done in the way of stripping the surface, by which some indications of continuity might be obtained. At one point where oxidized copper minerals were found a shaft was sunk, and at a depth of a few feet opened up a 5-foot body of quartz strongly mineralized with bornite and chalcopyrite. The shaft was carried down to a depth of 60 feet between two well-defined walls, dipping 65° to the north. An assay of a sample taken from this ore-body gave results as follows: Gold, 0.02 oz. to the ton; silver, 2.6 oz. to the ton; copper, 11.7 per cent.

There is no positive evidence on the surface, either to the east or the west, of the continuation of this ore-body, but in view of the insignificant surface exposure at the shaft this fact may not be of great importance, and drifts run from the bottom of the shaft would quickly determine this point. As the economic importance of the occurrence must depend upon proof of lateral extension, which must be considered to be in doubt until proved, it would appear that immediate development-work should be applied in this direction rather than in sinking the shaft to any greater depth. It is understood that the plans of the company include the performance of this work as well as a programme of diamond-drilling work.

There is an abundance of good timber on the hill and an easy approach by wagon-road, presenting favourable conditions for development.

COAL.

Middlesboro Collieries, Ltd.—During 1929 two new mines were opened up by this company in the Merritt coalfield, in the Nicola Mining Division. These mines are situated west of the No. 2 mine of the company. The seams of coal vary from 4 to 10 feet and the pitch is very irregular, but the coal is of good quality and the conditions for mining are fair.

VERNON MINING DIVISION.

**Okanagan
Copper Co.** The property of this company, known as the *Goodenough* group, is situated on Siwash creek, on the west side of the North arm of Okanagan lake, at an elevation of about 2,500 feet above the level of the lake. It is reached by auto-road for a distance of 23 miles from Vernon and trail for the remaining 2 miles. The mineralization is represented by chalcopyrite and calcocite in shatter-zones in volcanic and sedimentary formations, which, for the greater part, appear to consist of greenstone and a black argillite and in an altered limestone intruded by diorite.

The general trend of these zones is north-west and south-east and they have been prospected by a number of open-cuts and shafts, some of which represent work that was done many years ago. More recently about 250 feet of tunnelling and crosscutting work has been carried out, exposing a zone in which a shoot of ore occurs of better than the average grade; this zone has a north-and-south strike. It was intersected in the tunnel, which was driven as a crosscut to intercept another body of ore that is indicated in an open-cut some 80 feet above, but the tunnel has not yet reached this objective. The zone that was intersected passes across the tunnel at an oblique angle, and the drift that was driven at right angles to the tunnel passed out of this zone into a cherty argillite formation, in which calcite-seams are found with small inclusions of galena. The further development of this shoot was suspended in favour of some general prospecting of the ground, in view of the large number of exposures and the uncertainty in regard to their correlation.

Plans originally formulated included the driving of a long crosscut tunnel from the western slope of the hill to intersect the majority of the zones indicated on the surface. It is understood that, following upon the proposed acquisition of an interest in this property by the Consolidated Mining and Smelting Company, the prospects were in the first instance to be investigated by means of diamond-drilling; but these plans were not consummated.

The mineralization on most of the surface workings, higher up the hill, is represented by disseminated chalcopyrite. A sample of ore showing chalcocite, taken from the shoot exposed in the tunnel, assayed: Gold, trace; silver, trace; copper, 3.2 per cent. In general, the structural condition, the widespread mineralization, and the fact that the one shoot explored underground is found to carry ore of workable grade constitute factors of considerable attraction for this property and its further development will be watched with interest.

Pay Roll. This group of six claims is located on Deep creek, a stream which flows into the North arm of Okanagan lake from the west, a few miles above Siwash creek. The property stands in the name of H. Blurton and associates, of Vernon, by whom the discovery and location were made. The ore occurrence is in the nature of a quartz vein in an argillite formation, in which dykes of feldspar porphyry are intruded. The vein is found outcropping on the south bank of the creek and occupies an east-west fissure. A notable feature is the continuity of the vein as exposed at surface. The outcrop has been stripped at regular intervals for a horizontal distance of over 400 feet and greater distances have been indicated by exposures that have not been opened up. Work that has been done affords a good example of what a prospector's work should be; good faces of ore, available for sampling, being exposed in the open-cuts. The vein has a uniform width, wherever exposed, of between 2 and 3 feet. It has a dip of about 40° to the south. On the hanging-wall side there is a seam of lead carbonate, and galena is fairly well distributed throughout the whole width of the quartz, although the better samples are found nearer the hanging-wall side. The quartz appears to have been fractured, but it is not thought that the mineralization is secondary to the quartz-deposition. Ribbon structure is noted and in general the appearance of the vein affords encouragement to the belief that a payable content in lead, gold, and silver values may be fairly evenly distributed.

The work so far has been confined to prospecting the surface, and the results obtained are satisfactory, indicating as they do a persistent vein of an average workable width and grade and capable of being developed easily. From the lowest point to which the vein has been traced, at a vertical height of about 100 feet above the creek, a tunnel driven on the vein would give backs of about 140 feet in a distance of approximately 300 feet.

A sample taken across a width of 2 feet 6 inches in an open-cut at the highest elevation at which the outcrop has been exposed assayed: Gold, trace; silver, 6 oz. to the ton; lead, 1.6 per cent. A sample taken across a width of 2 feet at the lowest point assayed: Gold, trace; silver,

trace; lead, trace. A sample of selected ore from the hanging-wall side assayed: Gold, 0.04 oz. to the ton; silver, 35.5 oz. to the ton; lead, 40.4 per cent.

This is a property that is well worth a limited expenditure upon development. It is reported that similar vein occurrences have been found on the north side of the creek at a distance of 2,000 feet west of the location of the above-mentioned vein. The property lies at a distance of about half a mile from the auto-road to Penticton, on the west side of the Okanagan lake.

This property, near Ewings Landing, on the west side of the North arm of **White Elephant**. Okanagan lake, in which interest was aroused some years ago by the discovery of a high-grade gold-bismuth-telluride mineral in association with pyrrhotite, occurring in a massive body of quartz, is now under operation by the Pre-Cambrian Mines, Limited, with headquarters in Seattle, Wash. At the time of previous operations a vertical shaft had been put down from the open-cut workings, in which the rich ore had been found, to a depth of about 80 feet; this shaft passed through the band of pyrrhotite at a depth of approximately 35 feet below the surface.

A crosscut was driven from the bottom of this shaft to intersect the downward continuation of the pyrrhotite, in which the pocket of telluride ore had been found in the surface workings. These lower workings have been under water for some years and accounts vary as to the conditions that were found in the crosscut. During the past year Pre-Cambrian Mines, Limited, commenced operations on the 35-foot level, driving in on the body of pyrrhotite, which appears to be about 8 feet wide and massive.

In anticipation of inclusions of telluride similar to those which have been discovered above, a small flotation-mill was installed and has been in operation for the purpose of trying out the possibilities of concentration. This mill, which consists of a small crusher, ball-mill, classifier, and flotation-cells, driven by a 35-horse-power Petter engine, was calculated to handle from 25 to 50 tons a day, with a ratio of concentration of about 10 to 1. Milling operations were commenced about the beginning of June, but it was not found possible to keep the mill running steadily, and it is understood that the total amount of concentrate produced did not exceed the amount of about 30 tons.

The principle adopted in the treatment was to attempt a measure of selective flotation by depressing the iron, but success of this experiment would depend upon the variation in grade of the pyrrhotite due to the presence of associated minerals, and the evidences, ocular and otherwise, upon which such enrichment is based, would not appear to be conclusive. A sample of the concentrate which had been produced at the time of the inspection assayed: Gold, 0.60 oz. to the ton; silver, 1 oz. to the ton; iron, 42.7 per cent. A sample of the pyrrhotite taken from the open-cut close to the spot where the telluride ore was found assayed traces of gold and silver; and negative results were obtained from the assay of another sample that was picked out by a representative of the company as being typical of the better-grade ore.

The work of exploration is understood to be under guidance of a method of geophysical investigation, by which it is claimed that variations in value may be detected. About nine men have been employed during the season. The property lies at an elevation of about 4,000 feet and may be reached by an auto-road having a very steep grade for a distance of 3.5 miles from the road between Vernon and Penticton, on the west shore of Okanagan lake at Ewings Landing.

Some further exploratory work was carried out on this property by H. J. **Jumbo**. Blurton, of Vernon, but failed to afford satisfactory results and was abandoned. A shaft was sunk to a depth of 12 feet from a point in the open-cut referred to in the 1928 Annual Report, at a point where visible gold had been found at the surface, but the vein was found to terminate abruptly upon reaching the argillite formation. A short crosscut driven in from the bottom of this shallow shaft picked up another section of vein quartz, which was also found to be cut off by argillite and did not continue in depth. Prospecting-work has been encouraged by the presence of free gold in these seams, but it would appear that the bodies of quartz lack continuity. They apparently represent fillings of disjointed systems of fractures in an area of highly disturbed rock representing a marginal zone in a highly altered formation that is, probably, partly of volcanic and partly of eruptive origin, in contact with a dark argillite.

This property, located by H. Mills, of Kelowna, is situated on Mission creek at a distance of approximately 10 miles above Okanagan lake, south-east of Kelowna. It is stated that the section of the creek-canyon traversed by this location lies above all the old placer-workings, for which this creek was notable in past years,

and that no gold was found in the stream-gravel at any point above it. The formation cut through by the creek is composed of almost horizontal beds of crystalline schists and argillites, and in the deep gorge, where the mineral discovery was made, a series of vertical dykes intersect this formation, the immediate vicinity being characterized by a considerable degree of silicification, with the occurrence of pyrite, chalcopyrite, blende, and some molybdenite.

On account of the reported finding of some high gold values associated with this pyrite, a number of additional claims have been staked, but no other prospecting-work than that carried out along the canyon by the original locator has been done. The presence of zinc mineralization, indicated at certain horizons of the flat-dipping formation, is in many respects similar to that exposed along the Cherry range and Silver hills, as referred to in the Annual Report for 1926, page 200.

**Chrome
Vanadium.**

This group has been located by A. H. Raymer and associates, of Kelowna, on the high land bordering the divide between the Okanagan valley and the open country of the Nicola plateau on the west. The property is reached in a roundabout way at the present time, by way of Bear creek, which flows into Okanagan lake from the west, a short distance north of Kelowna, and thence across the summit, at an elevation of about 6,000 feet, the total distance being about 27 miles. Chrome-iron ore is found in association with peridotite and serpentine in a zone traversing an area occupied by slaty argillites and limestone between two granite stocks.

The chrome ore is found both in disseminated and in massive form. Owing to the distance from transportation, but little work has been done upon these properties, which were located during the latter part of the year, but with the construction of a new trail from Trepanege creek, south of Lambley creek, it is anticipated that further information in regard to this little-known area will be available during the coming year.

Copper King.

This group, comprised of the *Annable, Loon, Aunt Jane, Isabel, Bonanza, Fawn, Jack Pine, Bear Creek,* and *Bulldog* claims, has been located by M. J. Doran, of Lumby, around the shores of Swallowwell lake, at a distance of approximately 12 miles due east from Winfield, on the Vernon-Kelowna road. Due to certain operations in connection with irrigation, the level of this lake has been lowered by about 10 feet during recent years, with the result that a considerable area of shelving shore had been exposed. For the greater part this is occupied by mud and fragmentary lava, but there are also exposures of schists probably of Pre-Cambrian age. These schists are greatly contorted and afford evidence of intense recent disturbance. In some foliated seams and in fractures there are traces of copper mineralization and specks of native copper occur. The area over which this mineralization extends is probably of considerable extent, but up to the present time the available information does not point to the possibility of delimiting zones of commercial importance or to continuity in any particular direction.

COAL.

Coal-seams occur on Shorts creek, near Fintry, on Okanagan lake, and it is understood that a Kelowna syndicate has been organized for the purpose of prospecting and development.

SOUTHERN MINERAL SURVEY DISTRICT (No. 4).

BY PHILIP B. FREELAND, RESIDENT MINING ENGINEER.

INTRODUCTION.

The Southern Mineral Survey District (No. 4), comprising four Mining Divisions—Grand Forks, Greenwood, Osoyoos, and Similkameen—is situated in the extreme south centre of the Province, and is bounded on the south by the International boundary-line, on the east by the height of land controlling western-flowing streams, on the north by the watershed of southern-flowing streams, and on the west by waters flowing east from the Coquihalla range.

Tonnage production figures again show an increase over last year, due chiefly to the steady operations of the Granby Consolidated Mining, Smelting, and Power Company, Limited, at Copper mountain, and, in a smaller way, from the mines on Wallace mountain near Beaverdell. Because of water-shortage there was a decrease in tonnage mined and milled by the Hedley Gold Mining Company, Limited.

The steady price of copper and persistent inquiries for large deposits containing this metal has stimulated prospecting, especially in the region of Copper mountain, where recent developments have outlined larger and higher-grade lenses of ore at depth. The drop in the price of silver has worked a hardship on some of the silver-producers, but this is being offset to some extent by a larger production. Prospecting was again confined chiefly to the better-known mineralized areas and many reverted Crown-granted claims were leased.

Some very preliminary Radiore surveying has been done at Beaverdell and near Camp McKinney, and in the case of Beaverdell excellent results were obtained. Without the best geological assistance any type of electrical prospecting is at a disadvantage, and employers of this system will be well advised to have the geology mapped first.

Although the district is well provided generally with roads and trails, which are detailed later, much assistance was given by the Department of Mines in road-building, especially on Wallace mountain, Beaverdell, at Lightning peak, and in the region of Princeton and Tulameen. The results of these expenditures are already being felt in increased production. The outstanding departmental work is being done on a trunk trail from Copper mountain, near Princeton, south to the Pasayten river and from thence to the Ashnola river. This trail is filling a long-felt want and will be of great service to hunters as well as prospectors.

Continuous forest fires were not only a menace to nearly every mining operation, but also a hindrance, as crews of men were requisitioned to fight fire, which curtailed production in many cases.

SUMMARY BY MINING DIVISIONS.

GRAND FORKS MINING DIVISION.

The coming into production of the *Union*, under the ownership of the Hecla Mining Company, is the outstanding operation in this Division. Developments in the mine have been such that a 125-ton oil-flotation concentrator and necessary crushing machinery were installed and the camp constructed to accommodate about fifty employees. Regular shipments of concentrates may be looked for from this mine.

Next in importance was the operation of the *Rock Candy* by the Consolidated Mining and Smelting Company during the greater part of the year.

The option on the old Granby smelter-site at Grand Forks has been dropped by the Hercules Mining, Smelting, and Power Company, and nothing was done except the sampling of the old slag-piles and furnace-flue dust.

GREENWOOD MINING DIVISION.

The Beaverdell mines continued to be the bright spot in this Division during the year and practically all production can be placed to the credit of the mines there.

In the Phoenix area insufficient work was done on the *Stemwinder-Brooklyn* group to prove anything, but some attractive mineralization was discovered.

Many reverted Crown-granted claims in the *Oro Denoro* camp have been leased, and it appears to be the intention of the lessees to thoroughly prospect the mineral-outcrops, and if

justified an electrical survey will follow. This area warrants the attention of capital. The same may be said of the Deadwood basin, Copper camp, and the area stretching south to Midway.

OSOYOOS MINING DIVISION.

The Hedley Gold Mining Company's operations continued to be the major feature in this Division, and the advice from the management is that there is a likelihood of prolonged life for the mine.

A Radiore survey of the *Oregon* group, 4 miles below Hedley, registered a continued mineralization on each side of the workings.

SIMILKAMEEN MINING DIVISION.

There were no outstanding discoveries made in this Division in spite of intense activity, especially around Princeton. The outlook for the district has improved immensely, chiefly on account of attractive deep developments and ideal geological conditions for finding ore. The coal-mines have taken a spurt and increased production may be expected. Developments at Summit camp, Tulameen river, have outlined minable ore-bodies, and with the installation of a reduction plant a higher-grade product can be shipped.

The copper mineralization in the schists near the granodiorite contact in the region of Lawless creek and Rabbit mountain are attractive in a general way and should be studied as such.

The placer production was small in comparison to the amount of money invested in plant, etc. The high benches are attractive and may produce paying quantities of gold and platinum to any one who understands the vital necessity of churn-drilling before plant-installation.

GENERAL REMARKS.

TRANSPORTATION FEATURES.

The main trunk motor-road passes through Cascade, Grand Forks, Greenwood, Midway, Rock Creek, Bridesville, Osoyoos, Keremeos, Hedley, Princeton, Tulameen, and Merritt. Branch roads fork from Cascade and traverse Christina lake and up McRae creek to Paulson and to the old *Inland Empire* group, 4 miles beyond. A road from Grand Forks traversing the Granby river to Franklin camp, a distance of 48 miles, has been improved. Another road follows the Kettle River from Rock Creek to Christian valley, with a branch up the Westkettle river to Beaverdell and Carmi. The Camp McKinney road leaves the main thoroughfare between the Rock Creek crossings and goes direct to Oliver. From 2 miles beyond Osoyoos a road follows Osoyoos lake to Oliver and Penticton, with a branch from Fairview, which joins the Penticton road at Dog Lake. There is another road from Penticton to Keremeos, with a branch running up to the *Nickel Plate* mine and another branch to White lake. Four roads branch from Princeton; one follows the Similkameen river for 12 miles, another goes up Allison creek to Merritt, another up Hayes creek to Osprey lake, and the fourth follows Summers creek to Missoula lake. From Tulameen a new road has been built up the Tulameen river to Summit camp, a distance of 21 miles, with trails in many directions. A narrow road follows the Hope trail up Whipsaw creek for 13 miles beyond 9-Mile bridge. A tractor-road has been built from the Edgewood-Vernon road, commencing at the "Crossing" and following a maximum 8-per-cent. grade up to Lightning peak, a distance of about 18 miles. New branch roads have been built on Wallace mountain, Beaverdell, and the main road widened out and resurfaced.

The main trails traverse the country between the Edgewood-Vernon road, Lightning Peak camp, and Rendell creek. Another trail leaves Carmi and crosses the Kettle River divide into Penticton. Commencing at a point about 8 miles above Keremeos, an old wagon-road and trail follows the Ashnola river to the International boundary-line. The Dewdney trail leaves the wagon-road 9 miles south of Princeton and crosses the summit to Hope. Numerous trails which branch from the wagon-roads and main trails give access to nearly every part of the district. The West Kootenay Power and Light Company's line passes through the district from Cascade to Princeton and affords cheap power for mine operation.

In addition, the Kettle Valley Railway traverses the district between Farron, Grand Forks, Penticton, Summerland, Princeton, and Brookmere, with branch lines running from Grand Forks to Archibald, about 20 miles up the Granby river, and from Penticton to Oliver, about 22 miles

down the Okanagan river. The old trails traversing the Pasayten river from its junction with the Similkameen river (Roche) to the International boundary-line and the trail up Chuwanten creek from its confluence with the Similkameen have been cut by the Forestry Department. It is possible to take horses over the trail cut out between Cambie Creek bridge, at the junction of the Little Muddy creek and the Similkameen river (Cambie), and the Hope trail via the Nicomen Ridge trail. The trail is rough and there is a good deal of dead timber and it is necessary to pack a good axe. Another old trail between the South fork of Granite creek and the Hope trail was cut out. Another trail has been started up Thynne creek and the Otter Creek road near Tulameen by the Forestry Department. The trail running from the Lawless Creek road to the *Independence* on the Coquihalla has been cut out. A new trunk trail has been built by the Mines Department from Copper mountain in a general southerly direction to near the junction of the Similkameen and Pasayten rivers. This trail will be continued to connect with the South fork of the Ashnola river and will open up for prospecting a most interesting geological belt, especially close to the International boundary-line.

BIBLIOGRAPHY.

A list of the important reports on the mineral occurrences and mineral properties in the district was given in the Annual Report for 1928. Topographical maps covering part of the district can be obtained from the Surveyor-General, Parliament Buildings, Victoria, B.C. A list of these follows: Nos. 8T277, 3T277, 3T220, 7T263, 25L21, and Princeton-Tulameen area not numbered, all by G. J. Jackson; Nos. 21L21, 7L1, 2T128, 1T241, 22L21, and Brookmere-Summers Creek area not numbered, all by R. D. McCaw. These maps will be found very useful to any one prospecting the area included.

PROSPECTING.

The following brief outline of favourable prospecting areas and opportunities for mining development is again published:—

Grand Forks Mining Division.—In the Paulson section gold, silver, and lead are found, with occurrences of platinum associated with pyrite, in the Burnt basin. This is an old mining district, but is worthy of more intense prospecting and perhaps closer examination of some of the semi-developed mines.

In the Cascade area the dunite rocks contain chromite which has been only partially developed.

In the vicinity of the Granby river (North fork of Kettle river) there are several prospects of silver, lead, zinc, and copper, whilst at Franklin camp the gold and copper ores command attention, especially in the pyroxenite rocks, which contain a percentage of platinum where the copper sulphides are massive.

At the headwaters of the Granby river, named Lightning Peak camp, the silver-lead deposits are worthy of development.

A belt of serpentinized dunite rocks occurs at intervals between Grand Forks and Phoenix, and a certain amount of platinum is associated with the copper ores found near the contact of these rocks and sedimentaries.

Greenwood Mining Division.—Further intensive prospecting and development of some of the old silver-lead mines near Greenwood is warranted, as well as a closer study of the copper occurrences at Copper camp beyond Deadwood and to the north.

Between Rock creek and Bridesville there are silver-lead deposits which have merit, and if the market price justifies it the chromite prospects in the same belt might be developed successfully.

The silver-lead deposits on Wallace mountain at Beavertell still present opportunities.

The country north and east, lying between the Kettle river and Westkettle river, is worthy of closer study, especially along the contact of the quartz monzonite and in the quartz diorite; also the gold-bearing arsenopyrite on Horseshoe mountain, which is now being developed.

Osoyoos Mining Division.—The belt of schistose rocks predominating north of Osoyoos lake and between the Okanagan and Similkameen rivers contains many gold-bearing quartz veins which might be prospected.

The whole section of country lying within the curve of the Similkameen river between Princeton and Similkameen Station and north of the International boundary has not been

thoroughly prospected. The geology of the part of the country reported upon by R. A. Daly in the 49th parallel survey is sufficiently interesting to be followed up by closer inspection, especially on the contacts of the sedimentaries and igneous rocks. Native arsenic, tungsten, and strontianite have been found in the vicinity of the Ashnola river, which drains this part of the country to the north.

Similkameen Mining Division.—A continuation of the last-named area extends west as far as the Coquihalla and has been reported upon in sections by C. E. Cairnes, of the Geological Survey of Canada, Summary Report, 1922, Part A. Prospects of coal, silver-lead, and zinc have been found east and south of the Similkameen and Pasayten rivers. The belt of pyroxenite and peridotite rocks extends from Olivine mountain on the Tulameen river in a south-easterly direction to the International boundary, and along the contact of these rocks in the weathered zones good prospects of platinum have been panned. Transportation facilities throughout the district are good and a great assistance to prospecting.

In addition to this, the demand for chromite is greater and the dunite rocks mentioned are especially attractive for finding this mineral. Undeveloped prospects of chromite occur about 3 miles north of Rock Creek village on the Westbridge road. Prices of this mineral are quoted at \$22.50 a long ton for 45 to 50 per cent. Cr₂O₃. In the area adjacent to the Similkameen river, Whipsaw creek, and especially near the junction of the Similkameen and Pasayten rivers, the schistose rocks are worth investigating for their copper, lead, zinc, and gold contents. On the falls of Coldwater creek, flowing into the Similkameen (Cambie) river from the south about 6 miles from its source, the pyroxenite rocks invade the sedimentaries and are worth exploring.

ROAD AND TRAIL CONSTRUCTION.

Much assistance was given towards roads and trails by the Department of Mines to operating companies, syndicates, and prospectors, providing the prospect of future development warranted it. Further requests were received from operating mines and others to keep the snow ploughed off the roads, and this request has been fulfilled to a great extent.

Many thanks are due to all mine operators and prospectors whose claims were visited, for their kindness and hospitality.

PRODUCTION.

The following table shows the mineral production of No. 4 District:—

Division.	Ore.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.
Grand Forks.....	.....	.....	.....	.....	.....	.....
Greenwood.....	2,494	141	444,429	.....	187,390	112,681
Osoyoos.....	71,565	14,217	226	.....	100	.....
Similkameen.....	927,992	5,924	187,040	22,539,798	32,640	16,229
Totals, 1929.....	1,002,051	20,282	611,695	22,539,798	240,130	128,910
Totals, 1928.....	937,183	17,242	641,921	21,389,756	182,749	6,366

Division.	Arsenic.	Coal.	Limestone.	Brick.	Fluorspar.	Platinum.
	Tons.	Tons.	Tons.	\$	Tons.	\$
Grand Forks.....	.....	.....	21,726	15,000*	17,800	.....
Greenwood.....	.....	.....	.....	.....	.....	.....
Osoyoos.....	743	.....	371	.....	.....	.....
Similkameen.....	.....	198,478	.....	.....	.....	1,699
Totals, 1929.....	743	198,478	22,097	15,000	17,800	1,699
Totals, 1928.....	659	201,332	25,791	14,000	.....	2,743

* Estimated.

GRAND FORKS MINING DIVISION.

In the 1928 Annual Report part of the economic geology by C. W. Drysdale* was incorporated. This geological report was made before much development had been done in Franklin camp. On the *Glouster* group segregations of nearly solid chalcopyrite were found in the

* Memoir No. 56, G.S.C.

greenstone. Diamond-drilling later proved that these mineral-zones were entirely cut off a few feet below the surface by the granodiorite batholith. In the shonkinite-pyroxenite more segregations of chalcopyrite and bornite carrying small percentages of platinum were developed. Insufficient work was done to prove the extent of these deposits. It seems likely, however, that the ore-deposition was contemporaneous with the intrusion of the pyroxenite. On the contact of the pyroxenite on the *Maple Leaf* claim chalcopyrite containing platinum is found in the greenstone. A general sample of chalcopyrite from this zone assayed as high as 0.45 oz. to the ton in platinum. On the *McKinley* group at the south end of the camp and the *Copper No. 2* claims near the old Franklin Camp, copper-deposits have been found near the limestone-granodiorite contact. In several areas to the south and south-east intrusions of pyroxenite are to be found containing segregations of chalcopyrite. No deep development-work has been done in the basic rocks.

In the *Union* the surface ores were chiefly galena, sphalerite, with a little chalcopyrite and pyrargyrite in a quartz gangue. In the lower levels the galena, sphalerite, and pyrargyrite have been to a great extent replaced by fine-grained pyrite. The highest values are found associated with siderite and hæmatite.

The *Union* group, which was bonded two years ago by the Hecla Mining Company, has been steadily developed on the second, third, and fourth levels. In the upper levels the ore-body varies in width from 5 to 12 feet and is mineralized chiefly with pyrite, containing gold and silver in a gangue of quartz and greenstone. Numerous block-faults displace the vein a few feet. There are no commercial walls to this fissure and the size of the vein can be determined only by close sampling and assaying. The country-rock, a greenstone, adjacent to the vein is to all appearances similar to the ore; so that extreme care will have to be exercised when mining. It is understood that every round either in the stopes or levels will be sampled and assayed before being sent to the mill. In the fourth or lowest level, only disintegrated pieces of ore have been found up to the present. The country-rock and ore has the appearance of recemented fragments. This condition may be due to the dyke intrusive or to the proximity of the batholith. Upraises have been driven connecting No. 4, No. 3, and No. 2 levels, and the mine generally developed so that production may commence.

Construction in 1929 consisted of a two-story bunk-house, 24 by 72 feet, two men in a room and to accommodate forty-two men, hot and cold water, electric lighting; two four-room dwelling-houses; assay office; a 24- by 70-foot addition to the compressor-house and dry; a four-car garage; four 10,000-gallon crude-oil tanks and a buried 600-gallon gas-tank. Water is supplied by a 5½- by 6-inch Smith-Vaille triplex pump installed on the Granby river. A 240-horse-power Fairbanks-Morse engine coupled with a 250-kw. generator has been added to the power system.

Machinery at the mill consists of a 9 by 15 Blake crusher, a 30 by 14 set of rolls, a 6-foot-diameter Denver Engineering Works ball-mill, a 54 by 18 Dorr duplex classifier, one 10-cell M.S. 18-inch sub A flotation-machine, and a South Western filter. About fifty men have been employed under the superintendence of Paul H. Schultz.

This mine, located on Kennedy creek, about 18 miles north of Grand Forks, was operated during the summer and autumn by the Consolidated Mining and Smelting Company, of Trail. Seventeen thousand eight hundred tons of fluorspar was shipped. About forty men were employed under the management of Dan Matheson. The fluorspar is separated from the siliceous gangue by flotation at Trail.

This group was bonded early this year by R. Crowe-Swords, director and Western representative of the Hercules Consolidated Mining, Smelting, and Power Company. During the early part of the year a winze was sunk about 10 feet close to the porphyry dyke in the *Bonanza Fraction* tunnel and a crosscut driven south-east for 25 feet. A similar type of ore was found in the crosscut to that already developed in the older workings; i.e., galena, pyrite, and sphalerite. Segregations of high-grade galena carrying good values in silver were found. The continuation of this crosscut may be recommended to determine the limits of the ore-body in a south-easterly direction. When this is accomplished a more favourable location may be found for developing this ore-body at depth. This bond was forfeited late in the year.

Humming Bird Fraction and Mamie. These two Crown-granted claims, situated about 10 miles up the Granby river, are leased by Carl Andersen, of Grand Forks. Numerous open-cuts and a short tunnel have been driven on a zinc-pyrite mineral-zone in the limestone-beds about 100 feet in elevation above the old workings. The ore occurs in beds conforming to the dip of the limestone and varies in width from 2 to 10 inches. Samples of this ore vary from \$10 to \$20 in gold to the ton. More work will have to be done to prove the extent and value of this deposit.

Clara Charlotte Mining Co.—This company, with headquarters in Wenatchee, Wash., did nothing but assessment-work on the *Blacktail Fraction* group during 1929.

Alpha and Myrtle Fraction. These claims, situated on Hardy mountain, were leased by Ab. Fee and F. Fritz, of Grand Forks. Numerous open-cuts were excavated in the fragmentary volcanic rocks, containing segregations and veins of pyrite and chalcopyrite in a siliceous gangue, over an area of about 500 feet square. On the west of this discovery the volcanics are intruded by a dense dark-grey porphyry dyke about 100 feet wide. To the west of the dyke much-disturbed and tilted limestone-beds occur, also containing pyrite, chalcopyrite, and specks of galena. A general sample of the largest open-cut adjoining the dyke assayed: Gold, 0.02 oz. to the ton; silver, 0.80 oz. to the ton; copper, 1.7 per cent. A sample taken from a shallow cut across 2 feet of vein-matter assayed: Gold, trace; silver, 0.82 oz. to the ton; copper, 2.4 per cent. The deposit is interesting and warrants more development.

SUMMIT CAMP.

This camp is one of the oldest producers of copper ore in the Boundary. No active operations have taken place for ten years. This section, covered to a great extent by overburden and lavas, is an interesting one geologically and contains the porphyritic tuffs and limestone which have produced most of the ore in the Boundary. The intrusive rock is granodiorite and there are many varieties of porphyry dykes, including pulaskite. The old *B.C.* mine in this area produced some of the highest-grade copper ore ever mined in British Columbia and there still remains an opportunity to find more ore of a similar type. There are several diamond-drill holes bored from the underground workings. All these except three are drilled along the ore horizon instead of at right angles to it. In the deeper workings the bodies are lying nearly flat, so that this method of prospecting may have missed a considerable amount of ore. The *Emma* mine also produced several thousand tons of ore, and there is still ore in the vicinity. It seems likely that geophysical prospecting may be advantageously applied to this section. R. A. Brock's geological survey map made in 1905 covers the area in a general way and will be found extremely useful in guiding those who are interested.

Granby Smelter-site (Old).—Since the optioning of this site and slag-dumps in the autumn of 1928 by R. Crowe-Swords, director and Western representative of the Hercules Consolidated Mining, Smelting, and Power Company, nothing has been done except some sampling.

PAULSON SECTION.

Molly Gibson. This group, situated about 4 miles south-west of Paulson, consists of six claims and is owned by the Molly Gibson (Burnt Basin) Mining Company, Rossland (*see* 1928 Annual Report). Assessment-work this year uncovered extensions of the mineral-zones and has added to the possibilities of this property.

Mont Rose. This claim, owned by J. T. James, Trill, is located at a lower elevation in Burat basin than the *Molly Gibson*. A considerable amount of development-work has been done on a mineralized fissure, in the limestone, containing galena, pyrite, and sphalerite, the latter predominating. The vein varies from 18 inches to 4 feet in width and strikes in a northerly and southerly direction. An open-cut 8 feet long shows a continuation of the vein about 300 feet south.

Halifax.—A continuation of the ore-body mentioned in the 1927-28 Annual Report was discovered by Henry and Geo. Jackson, Paulson.

LIGHTNING PEAK SECTION.

This company was incorporated during the summer with a capitalization of 1,500,000 shares of no par value. The directors are as follows: C. M. Kingston, M.L.A., Grand Forks; J. A. Rendell, Trill; Robert Leroy Clothier, Victoria; J. C. Kennedy, Vancouver; A. McNicoll, Penticton. The company

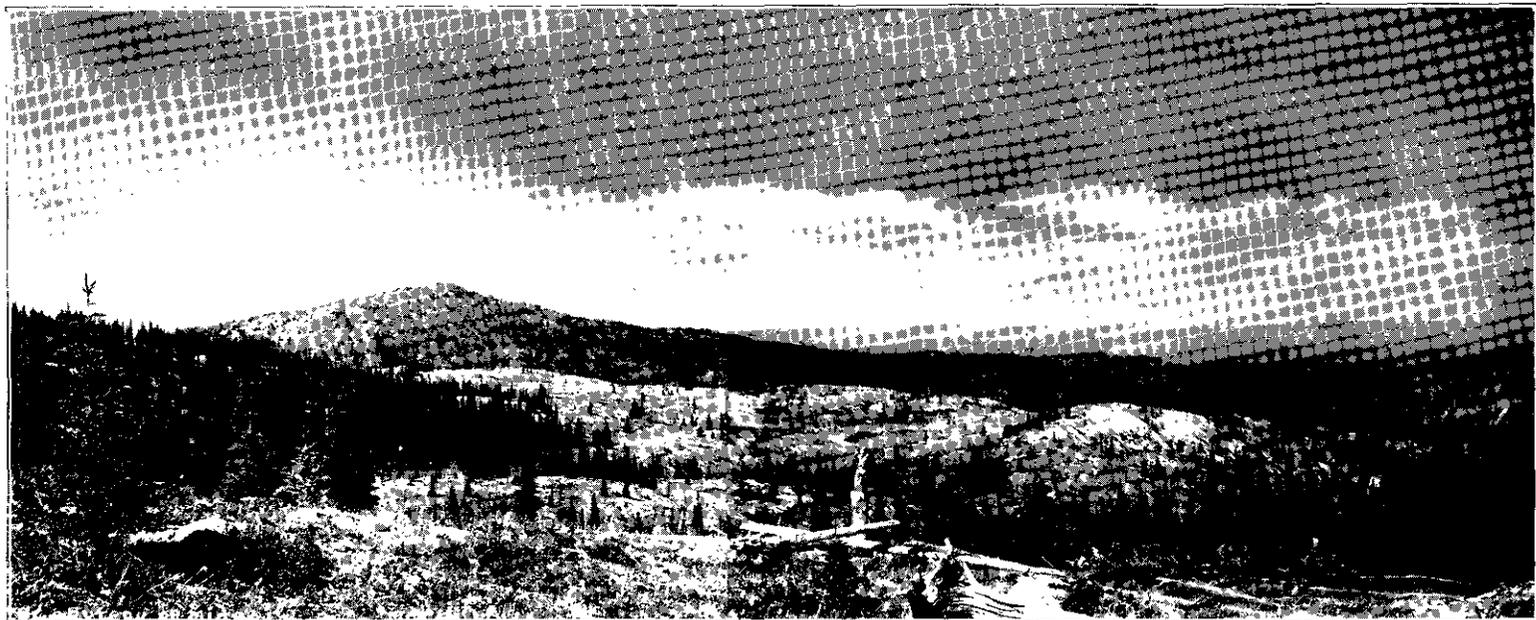
has obtained options to purchase, in consideration for the issue of fully paid-up shares of the company, the following mineral claims: *Waterloo No. 3, Silver King, Silver Cup No. 2, Silver Spot No. 1, Silver Spot No. 2, Silver Spot No. 3, Silver Spot No. 4, Silver Spot No. 5, A.U., Gold Coin, Gold Plate, Gold Bullion, Golden Fleece, Golden Rod, Golden Hair, Golden Sunshine, Golden Rule, Golden Morning, Golden Treasure*, and has obtained an option to purchase the *Silver Spot* mineral claim for cash, the payments being spread out over the term of five years. All of these claims are situated in close proximity, one to the other, and form a compact group for the purpose of a comprehensive scheme of operation. Copies of the option agreements covering the above-mentioned claims are on file at the registered office of the company at Penticton, and particulars thereof are contained in the statutory information contained therein.

This group has been reported upon from time to time in the Annual Reports. There are numerous fissure-veins which strike across as well as conform to the strike of the schistose rocks that form the toe of Lightning peak. The intersection of these veins is deeply covered with gravel and ordinary tools have proved inadequate when attempting to prospect the vein extensions. This company proposes to install a small air-compressor and to mine the *Waterloo* vein, which has been developed by two tunnels, also to ship ore from the dump to the smelter. A tractor-road has been built from a point about 24 miles from Edgewood, on the Vernon-Edgewood road, to the *Waterloo* mine, a distance of about 18 miles. The ore will be sacked and probably hauled out over the snow. Some very high-grade silver ore has been found in the *Waterloo* vein which varies from 4 to 8 inches in width. In the face of the No. 1 tunnel more ore of this quality was discovered in 1929. Until more development-work is done by cross-cutting it is impossible to estimate the width of the mineral-zone. In the present workings it varies from 4 to 6 feet, with a possibility of larger dimensions. A log camp, office, assay office, and bunkers have been built at the mine. R. L. Clothier is in charge.

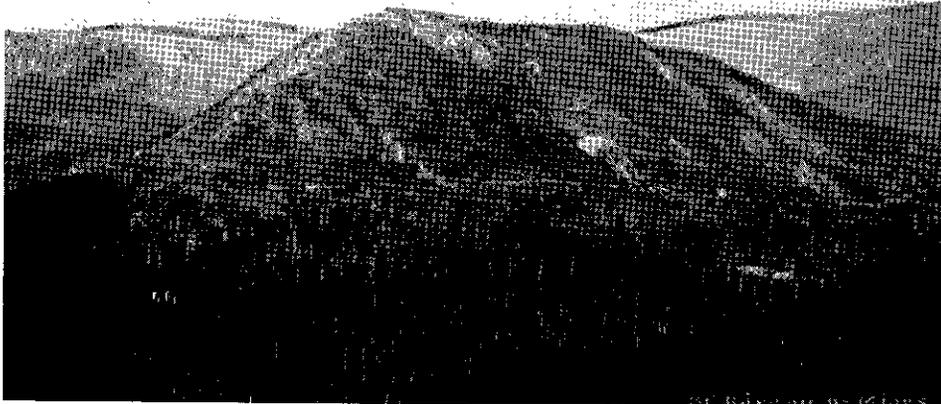
Pay Day. This group, owned by Walter B. Johnstone, A. Williams, *et al.*, of Edgewood, comprises the following claims: *Joyce J., Pay Day, Goodenough, Big Bend, At-a-Boy, Fritz the Hun, Ron the Rigger, Maria Jane, William Henry, and Eileen J.* Development consists of numerous open-cuts along a mineral-zone 600 feet in length, which measures 2 feet across in the narrowest and 6 feet in the widest part. The ore-minerals are pyrite, sphalerite, galena, and specks of chalcopryrite in a siliceous gangue. At an elevation of about 30 feet below, a crosscut tunnel has been driven which intersected the vein. The width at this elevation measured about 17 feet and the face was still mineralized. A 10-foot sample of the more solid sulphides assayed: Gold, trace; silver, 30 oz. to the ton; copper, 4.2 per cent.; lead, *nil*; zinc, 12 per cent.; nickel, *nil*; arsenic, *nil*; bismuth, trace. The galena has been replaced to a great extent at this depth by chalcopryrite. Towards the face or hanging-wall of the tunnel solid veins of pyrite containing specks of chalcopryrite occur, separated by a siliceous gangue. The hanging-wall rock is schist and to all appearances the ore-minerals have replaced a limestone-bed folded on the contact. A heavy covering of soil prohibits an intelligent classification of the rocks at this point. To the south-west the limestone is exposed, and prospecting in this section uncovered mineralized rock which assayed: Gold, 0.70 oz. to the ton; silver, 480 oz. to the ton. Prospecting is difficult owing to the heavy overburden, but these assays are very attractive and warrant intensive work.

First Chance. This group has been worked for some time by W. A. Calder, of Edgewood, and a lower tunnel driven in an easterly direction for 685 feet along the strike of the vein. In this tunnel the ground has been badly faulted and sheared and only small segments of ore were found. The face of this tunnel is about 150 feet lower in elevation and within 50 feet of the downward extension of the vein found in the old shaft at the east end of the property. Some high-grade ore was mined and shipped from this section in former years.

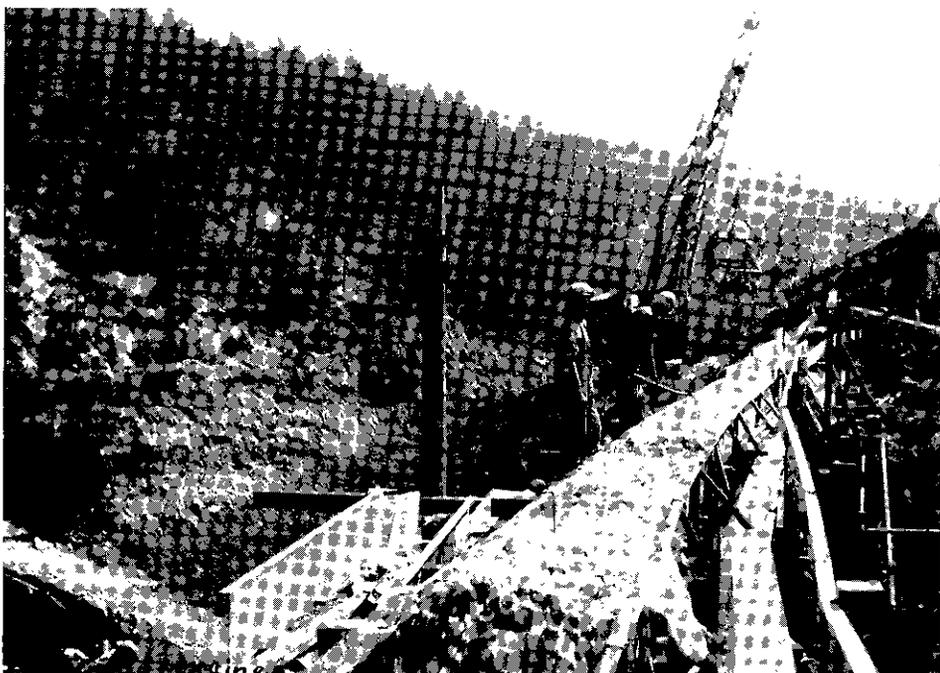
Killarney. This claim is owned by W. J. Banting, of Edgewood. A 21-foot crosscut was driven under the upper open-cut on the slope of the creek and the vein drifted on for 44 feet. At the vein intersection massive galena, sphalerite, and pyrite 10 inches wide was struck. To the south-west, in the drift, the vein pinched and became siliceous. The strike, S. 70° W. (mag.), carries this vein into the hill, where a greater depth can be developed. It seems likely that other well-mineralized ore-shoots may be found in this direction and more work is justified.



Lightning Peak, Grand Forks M.D.



Treasure Mountain, Tulameen River.



Guest Placer Mine, Tulameen River.

GREENWOOD MINING DIVISION.

PHOENIX SECTION.

A description of the economic geology of Phoenix camp by O. E. LeRoy* was incorporated in the 1928 Annual Report. During the year a small amount of development uncovered what appears to be the extension of the *Stemwinder* ore-body alongside and under the main road. Unfortunately those interested were not financially able to continue the work, so that no definite information was obtained. This find may not materialize into a commercial ore-body, but it corroborates the theory that there are opportunities of finding more ore in these favourable geological formations.

It is not generally understood that the Granby Mining and Smelting Company did not own the *Brooklyn-Stemwinder* group of claims and therefore intensive prospecting was not conducted by this company. Also, geophysical prospecting was not in use during the period of the Phoenix operations. A good deal of diamond-drilling was done more or less blindly, but this method of exploration is too expensive without a preliminary location of mineral concentration. On the Granby Company's ground, between the *Grey Eagle* and *Gold Drop* claims, systematic drilling discovered deeply buried ore-bodies of commercial value several hundred feet away from the main workings.

Stemwinder. This claim, owned by R. Forshaw, Greenwood, was taken over from the Pacific Tidewater Mines, Limited, which has withdrawn from the camp, by R. Crowe-Swords, representative of the Hercules Consolidated Mining, Smelting, and Power Company, and a crosscut tunnel driven 75 feet long under the main road. Near the mouth and at the face of this tunnel highly altered fragmentary volcanics containing pyrite and chalcopyrite were found. The intermediate rock is porphyry. It seems advisable to extend this working to ascertain the width and value of the mineral-zone, which has been stripped about 25 feet in elevation above, and between 75 and 100 feet north. A trench dug for about 100 feet along the strike of this zone is slightly mineralized with pyrite, chalcopyrite, and malachite. The option on this claim has been dropped by the Hercules Company.

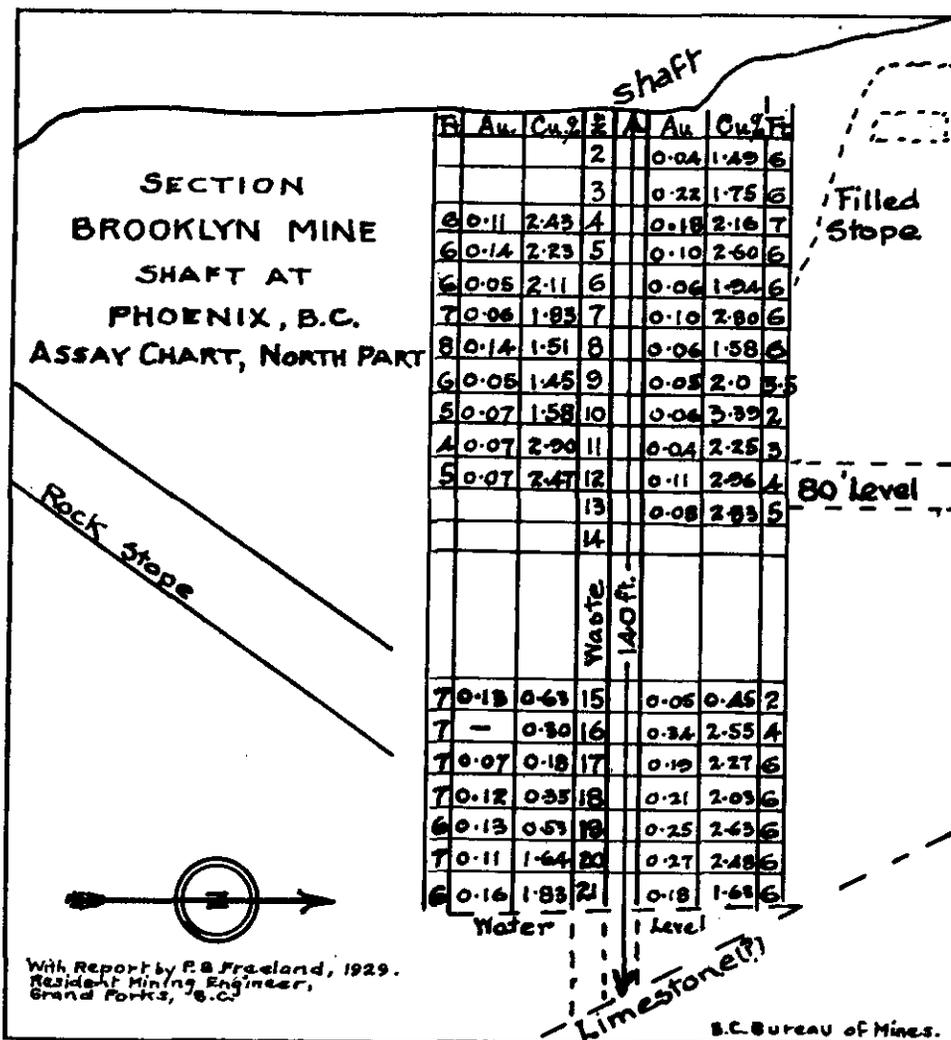
Brooklyn. This old mine, owned by R. Forshaw, together with the surrounding group of claims, was also taken over by the Hercules Company. A few shallow open-cuts were excavated to the north of the *Brooklyn* glory-hole which showed the mineralized extension of this ore-zone. There are several thousand tons of low-grade copper ore left on the foot-wall of the glory-hole and an assay chart and map of the shaft is appended. The comparatively high gold values are noticeable in this class of ore. The amount of ore in this shaft is not known, but enough was left to safeguard hoisting operations. This mine option was also dropped by the Hercules Company without any material development-work being done or any effort made to ascertain amounts of possible tonnage. A log camp was partly constructed on the north extension of this group in Deadman's gulch, and it was the intention of the management to drive a long crosscut tunnel from the gulch to develop the lower horizons of the *Brooklyn-Stemwinder* group. No diamond-drilling was done by this company on any of the claims to ascertain the location or depth of any ore-bodies that may occur in this area.

GREENWOOD SECTION.

On the *Greyhound* and *Ah There* claims in the Deadwood basin a few diamond-drill holes were bored many years ago by the B.C. Copper Company. Copper ore was found in some of these drill-holes, but it was not fully outlined by further development. This is another instance of buried ore-bodies. On the *Big Copper*, *Enterprise*, and *King Solomon* claims in Copper camp some remarkably high-grade copper ore was found and mined, spasmodically. Due chiefly to the high prices asked for these properties, very little exploration has been done upon them of late. The geology of this area can be seen on R. A. Brock's geological map, 1905, of the Boundary Creek mining district.

Providence. Nothing has been done on this property, except keeping the mine pumped out, since the early summer, when the Providence Mining and Leasing Company, of Wallace, Idaho, worked in the south shaft. One hundred tons of ore was shipped to the smelter. The vein in the south end did not carry the high-grade silver values found

* The Geology and Ore Deposits of Phoenix Boundary District, B.C. Memoir 21, Geol. Sur. of Can. O. E. LeRoy.



in the old workings and a large part of the ore could not be shipped direct. A sample of the culled ore assayed: Gold, 0.80 oz. to the ton; silver, 74 oz. to the ton; copper, *nil*; lead, 1.5 per cent.; zinc, 0.9 per cent. This material is quite high enough grade for milling purposes and, if a sufficient tonnage can be found, would justify a small plant. In the older workings in the north end of the mine the vein persists for some distance on the floor of the 500-foot level, and there is also some high-grade ore left in one of the stopes. There is also supposed to be ore on the 600-foot level, but this was still under water and could not be examined. It is almost impossible to estimate probable tonnage left in the old workings without a considerable amount of cleaning-up. The ore apparently was cut off by a porphyry dyke and has not yet been found beyond the dyke. This interference is not serious and should not offer any serious mining problem after a complete survey has been made. A small compressor, hoist, and pump electrically driven are installed at the mine ready for work.

This claim has been worked by J. Wichser, of Greenwood, and a 400-foot crosscut tunnel driven under a mineralized zone containing copper. Several quartz veins carrying pyrite and occasional specks of galena were found, but no minable ore discovered to date. To the south-east several open-cuts uncovered copper carbonates in the fractures of the volcanics near the contact of a porphyry dyke. More work is being done on this outcrop.

Vendela.

CAMP MCKINNEY.

Waterloo-Fontenoy.—These claims were leased by Chas. F. Law, Vancouver, and the old shaft unwatered and partly retimbered. It is understood that the lower levels of the shaft were filled with waste from former operations and this was not removed. Nothing more has been done.

Le Roi and War Eagle.—This group was optioned by A. Thomas and a preliminary Radiore survey made in the vicinity of the main workings only. According to the map, there is a mineral-zone about 1,000 feet long extending both ways from the old shaft. It is understood that a shaft will be sunk on the strength of these indications.

KETTLE RIVER SECTION.

Several prospectors have brought in attractive-looking silver-lead samples from this section, but according to reports insufficient work has been done to prove the value of these discoveries. The country-rock in which the ore occurs is quartz diorite and some degree of permanency may be expected. In the greenstone and tuffs mineralization is scattered and difficult to follow.

According to the prospectus of the Mogul Mining Company, Limited, it is proposed to acquire, develop, and mine the *Mogul, Utopia, Gold Rock, Keystone Fraction, Messinger Fraction, Silver Dollar, Seven Thirty, Rambler, Denver, Champion, Mamie, Highland Mary, Boston, Houston, Lillie May, Mayflower, Hard-to-Beat, Riverside, Maldoon, Idaho, Fourth of July, Kingston, and Coin Fraction* claims, situated on Horseshoe mountain, Greenwood Mining Division. The first development was to consist of extending the drift on the *Silver Dollar* and blocking out the ore developed. The company proposes to issue 250,000 shares for cash and 1,250,000 shares for other considerations for the purpose of carrying out the objects specified under clause 1. The directors are: Arthur F. Thomas, Westbridge; Horace W. Bier, Victoria; Herbert E. Hunnings, Victoria; Kenneth M. Chadwick, Victoria; and Percy A. Bodkin, Sidney.

In 1929 the company drove a tunnel about 35 feet from the bottom of the shaft on the *Silver Dollar* to tap the possible downward extension of the ore found in the shaft above. According to A. Gaul, manager, when operations ceased in October no ore had been discovered in this tunnel. Near the bottom of the shaft the contact of the augite-syenite porphyry dyke and the greenstone, in which the ore occurs, was struck. The drift was driven in a semicircle in the porphyry and was continued until it extended a short distance into the greenstone. The ore-bodies found in this area in the greenstone are, as a rule, lenticular in shape and often disconnected; therefore it seems advisable to continue this development either by an upraise to the ore already found above or by crosscutting farther to ascertain definitely whether or not there is any downward extension. A log bunk and cook house were constructed and a narrow road built $3\frac{3}{4}$ miles long to connect the camp with the main valley road. The *Mogul* shaft-workings were not examined on account of water.

This claim, situated near Rhone Station on the Westkettle river, is owned by J. F. Worthington *et al.*, Westbridge. At an elevation of about 450 feet above the road a crosscut tunnel has been driven for 15 feet, and a drift from the crosscut 40 feet long on a 12-inch quartz vein. A shallow winze was sunk on the vein in the drift. The ore-minerals are pyrite and chalcopyrite. A sample of this ore across 12 inches assayed: Gold, 0.20 oz. to the ton; silver, 2 oz. to the ton; copper, 1.5 per cent. Above this tunnel, about 50 feet in elevation, numerous open-cuts expose two veins striking N. 05° W. (mag.) and N. 28° (mag.). A porphyry dyke striking N. 10° E. (mag.) cuts and displaces the vein on the surface. A crosscut 85 feet lower than No. 1 has been driven for 115 feet and a winze sunk at the vein intersection. A drift follows the vein from this tunnel for 85 feet in a north-westerly direction, and a further 21 feet, where it bends sharply in a north-easterly direction. A crosscut 60 feet long has also been driven N. 70° E. (mag.), 25 feet from the winze. The vein in this tunnel has been badly displaced and fractured. The ore-minerals are chiefly pyrite with specks of chalcopyrite in a quartz gangue. A sample of the sorted ore on the dump assayed: Gold, trace; silver, 0.40 oz. to the ton; copper, 0.7 per cent.

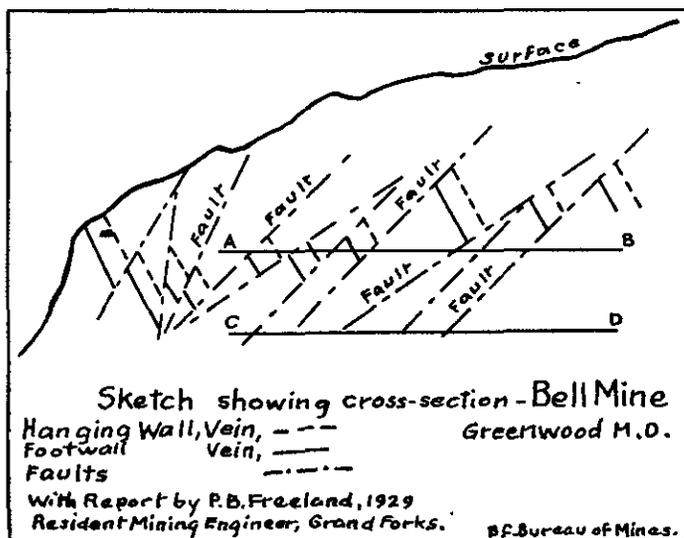
This mine, mentioned in the 1928 Annual Report and under option to W. E. Johnston and R. C. Draggio, of Yakima, has been closed down and the plant sold. The lower crosscut was driven 530 feet at an elevation of about 125 feet below the collar of the shaft. In this tunnel numerous faults and slips were encountered filled

to a great extent by calcite, specks of galena, zinc-blende, and marcasite. The management insisted that samples of this material, assayed in the United States, gave: Gold, \$12 to the ton; platinum, \$40 to the ton; and mercury, 7 per cent. A check sample assayed: Gold, trace; platinum, *nil*; mercury, *nil*. No drifting was done in these faults. In the shaft, which was sunk about 15 feet, a vein varying from 2 to 6 inches wide was followed. On the strength of this mineralization a camp was built, a small compressor and engine installed, and the crosscut driven.

WALLACE MOUNTAIN SECTION.

The outlook for the mines on Wallace mountain, in spite of the lower value of silver, is without doubt more attractive than formerly. Operators in general realize the vital necessity of surveying and mapping the shear-zones and faults in the workings, so that comprehensive development may eliminate to a great extent as much dead-work as possible. In the past a great deal of money won has been expended in searching for other shear-zones, which often resulted in failure, so that the option or bond had to be forfeited. The likelihood of long life for these mines appears to be excellent.

An excerpt from an interesting sketch written by Henry Lee, part owner in the *Bell*, follows; also a cross-section showing the attitude of some of the faulting: "In 1916 Robert Perry held an option to purchase the *Bell* mineral claim. Duncan McIntosh, with whom was associated the late F. Buckless, acquired this option



from the Buckless interests and later on P. E. Crane followed Oliver. Crane retired in 1925 and the partnership of Duncan McIntosh and Henry Lee was then formed, and still continues. Mr. McIntosh successfully opened up and operated the mine. Too much credit cannot be given him for this achievement. The success of the *Bell* is to be attributed to his skill and persistence in mastering the complicated faulting. The revival of interest in other claims on Wallace mountain is largely due to the profitable operation of the *Bell* mine.

"L. Reinecke, in Canadian Geological Survey Memoir No. 79, 1915, states that the geology consists of: The Wallace group of volcanic rocks—with subordinate sediments, schists, and coarse-grained intrusives—largely andesites and tuffs; overly and intruded by the West Fork quartz diorite, which contains the ore. This in turn overlies and is intruded by the Beaverdell quartz monzonite, to which the origin of the ore is attributed. Conditions, therefore, offer an almost ideal example of ore-deposits related to igneous rocks.

"The ore occurs in what were originally shear-zones in the quartz diorite. These zones, on the *Bell*, strike north-easterly and dip to the south-east. Subsequent to mineralization local

folding and faulting took place; and final faulting of irregularly spaced normal movements to the west, along strikes varying from a few degrees west of north to a few degrees east of north, accompanied by a multitude of intermediate minor faults, left the ore-bodies in their present greatly complicated form. Outcrops are inconspicuous and would, ordinarily, receive little notice, owing to the fact that, in most cases, the points only of faulted segments of veins show, or an oxidized streak appears where the decomposition of sulphides has been followed by the sloughing of wall-rock. Float is scarce. Several of such innocent-looking surface exposures have yielded thousands of dollars from small surface workings and shallow shafts, but, in general, on most parts of Wallace mountain, no serious and systematic attempt has been made to find ore beyond faults.

"The veins vary in width from a few inches to 4 feet. In places the 'vein' consists of a number of parallel or intersecting ore-streaks. The ore consists of iron pyrite, zinc-blende, galena, grey copper, ruby silver, polybasite, argentite, and native silver in a sparse gangue of quartz, with some calcite and green fluorite. It is not believed that secondary enrichment is greatly responsible for the high silver content of the ore. The veins appear to be persistent on strike and, as far as mined, in dip, with but little, if any, alteration in the silver content. The cross-section sketch attached illustrates some of the eccentricities attendant on the simpler faulting. A crosscut on horizon A-B would find the 'hanging-wall vein' to the foot-wall of the 'foot-wall vein,' and also would prove that the deeper the veins were mined the higher the ore became. In other words, the lower part of a vein would have to be raised to, in this instance, instead of sunk for, as in unfaulted deposits. At point X the segments of the two veins coincide. A crosscut on horizon C-D would be unproductive. A force of about eighteen men is usually employed, working day shift only, six days a week. The power plant is a Diesel engine driving the usual type of air-compressor, with an older-type oil-engine and compressor as a stand-by. Output consists of about 100 tons of roughly hand-sorted ore per month. This is shipped direct to the smelter, being hauled to the railroad by motor-truck most of the year, or by sleigh when snow is on the ground. An assay of average shipped ore would be, per dry ton: Gold, 0.03 oz.; silver, 200 oz.; lead, 6 per cent.; zinc, 7 per cent.; silica, 42 per cent.; iron, 13 per cent.; lime, 1 per cent. Gross production from the *Bell* to date exceeds \$1,000,000.

"In the extraction of such faulted veins, mining methods as used in more regular ore-deposits have to be applied in unconventional ways. It is impossible to either speed up production or to develop ahead to any great extent.

"The two veins now being mined give promise of long life, and there are others. The *Bell*, despite this being its fourteenth year of profitable operation, has apparently many more years of productive activity ahead of it."

About the same tonnage was shipped from the mine in 1929 as in 1928. A development-tunnel was started in the gulch on the north side of the claim which is expected to intersect the shear-zone found on the *Highland Lass* claim. In the cross-section sketch the fact that the top part of the vein is lying at a lower elevation than the intermediate section is evident. The roots of these veins will probably be found some distance to the south-east, depending upon the throw of the faults.

Very little mining was done by this company during the year. In the summer *Sally Mines, Ltd.* a lease was obtained by Nordman Bros. *et al.* and some ore was sorted and shipped to the smelter. In the autumn a complete survey was made of the workings and, it is understood, a bond taken on the *Sally* group by Vancouver interests. At the present time about eight men are working and some high-grade ore is being mined in the old *Rob Roy* levels. Whether this endeavour will be successful or not depends to a great extent upon the close attention paid to faults whilst mining and the possibility of segments of ore having been left in the mine by the former operators. The *Sally* group covers attractive ground and is worthy of intensive exploration.

This claim, bonded by the Highland Lass Syndicate, of Penticton and Kelowna, *Highland Lass.* is under the management of A. J. Finch. Great credit is due to the management for the way mining has been done under extreme difficulties. For the first time in the history of Wallace mountain the shear-zones on the contact of the Wallace formation have been mined on this claim. It is generally known that these rocks overlie and blanket the quartz-diorite rock which contains the high-grade ores. It was surmised that on the

shear-zone contact of these two rocks a certain amount of enriched ore segregations might be looked for. Developments up to the present have shown that at the contact there is no noticeable difference in ore values, and beyond the contact in the Wallace the ore is almost completely dissipated. On the steep hillside, where the workings are located, large blocks of the Wallace rocks have faulted into the quartz diorite and completely cut off the ore. This condition prevails chiefly on the north side, where the contact strikes across the claim. To the east and farther into the hill the Wallace rocks should lie at a high elevation above the workings, which will facilitate mining. A hoist, bunkers, and ground-tram have been installed to hoist the ore up to the road, so that it can be shipped by truck to Beaverdell.

Revenge. This mine was operated for a short time during the year by the Silver Star Mines, Limited, of Vancouver, under the management of W. V. Somerville, and one car-load of silver-lead ore shipped. On the bottom of the No. 2 tunnel

level north a narrow shear-zone carrying silver-lead still remains. Practically all development was done on the upper levels in an endeavour to follow the ore mined formerly. Work done in the lowest level did not uncover any ore. A new road has been built from the lower *Sally* mine-workings to the No. 2 tunnel, which will greatly assist any future operations. It is understood that the above company has ceased operations. No work was being done on October 29th and a watchman was in charge. The owner of this claim is Geo. Barrett, Beaverdell.

Beaver Silver Mines, Ltd. This company operated the *Beaver* during the year, at first under the management of Roy Clothier and later under E. Nordman. Production has been spasmodic owing to the extremely faulted nature of the ground. Until more easily mined shear-zones are found shipments will probably continue to be intermittent. Some high-grade ore was found in the east drift across the porphyry dyke in the shaft, but this was badly faulted. With careful surveying this body of ore can no doubt be followed. On the surface, above the Sutherland tunnel, more high-grade ore was found, according to the management. Formerly some stripping was done on this shear-zone, but only a small amount of ore mined.

An open-cut has been driven about 80 feet in length and a maximum depth of 12 feet on the mineralized zone found last year in the Wallace formation at the north end of the claim. The rocks here have a slightly porphyritic structure common to its type. Throughout the entire length of the cut segregations of galena, sphalerite, pyrite, and arsenopyrite occur, with an apparent enrichment to some extent at the north end. This ore, even when sorted, is too low grade at present to ship directly to the smelter. Another open-cut, 6 feet long and about 150 feet to the south, exposed galena, sphalerite, pyrite, and arsenopyrite. Numerous pits dug in a southerly direction have uncovered slight mineralization for 500 feet. It is interesting to note that an outcrop of quartz diorite was found near the south extension of this zone. The strike is generally north and south (mag.), with a probable dip to the east. This ore occurrence is interesting because it is the largest and most consistently mineralized structure yet found in the Wallace rocks. Owing to the flat nature of the ground in the immediate vicinity, development at depth will have to be undertaken either by diamond-drilling or shaft-sinking. A Radiore survey indicated a mineral-zone for several hundred feet south of the main cut. A road has been built from the camp to this working.

Wellington Syndicate, Ltd. The lowest crosscut tunnel, commenced in 1928, struck a high-grade silver vein early in the year. Owing to the absence of a narrow andesite dyke which always accompanied the ore in the upper levels, this occurrence was supposed to be a separate mineral-zone. Near the top of the upraise on this ore small pieces of andesite were found. An extension of the main tunnel discovered the lower segments of this ore above and below a fault in association with an andesite dyke. An upraise above the fault developed 2 feet of ore and the level below is looking favourable. This ore persists in the bottom of the drift, so that deeper developments may be justified later. Several car-loads of high- and medium-grade ore have been shipped to the smelter. The shear-zones found on the *Wellington* are the deepest, in elevation, found up to the present on Wallace mountain. It is not yet an assured fact that these bodies are the bottom or the top part of the main system, faulted down. On the *Bell* and *Highland Lass* the ore mined at depth is the top part of the vein. The topography on the *Wellington* suggests that the higher zones are being mined and that the roots will be found farther into the hill.

These claims, owned by P. B. S. Stanhope, are being developed by Alec. **Bounty and** McPhee. More ore was found in the stope above the main crosscut tunnel **Bounty Fraction.** and a shipment made to the smelter. The *Bounty Fraction* was acquired this year and two likely-looking shear-zones discovered on the surface striking along the boundary-line between the claims. Insufficient work was done to prove the value of this find.

This group was optioned by Kelowna interests and a considerable amount of **Gold Drop** surface development done on the vein extension below the old shaft, including **Fraction.** several trenches, open-cuts, and the extension of the lowest tunnel to a total distance of 60 feet. In the tunnel a quartz vein was found varying from 1 to 6 inches in width and mostly barren of mineral. In an open-cut 75 feet in elevation above the vein splits and dips in different directions. The section dipping to the south contains galena, sphalerite, and pyrite and is probably the top section of the ore mined in a parallel tunnel to the south.

About 200 feet north-east of the main shaft several shallow shafts and open-cuts have been sunk, exposing 5 feet of vein-matter containing pyrite, sphalerite, and specks of galena in a gangue of quartz. Picked samples of ore from this vein system assayed up to \$60 in gold to the ton, but the general mine-run at present is low grade. Some high-grade silver-lead ore was mined in the south parallel tunnel, but this was pockety. The country-rock is quartz diorite, in which the high-grade silver ores are found in other parts of Wallace mountain.

OSOYOOS MINING DIVISION.

Hedley Gold and mill operations of this company have been published in some of the **Mining Co.** mining magazines. For the benefit of those who have not had the opportunity of reading these details they are incorporated herewith.

INTRODUCTION.

(By Gomer P. Jones, General Superintendent.)

The Hedley mine, perhaps better known as the *Nickel Plate* mine, is one of the outstanding properties of Southern British Columbia. Discovered in 1898 by Woollison and Arundell, prospectors, the property was bonded in 1899 to M. K. Rodgers for the Marcus Daly Estate, of Butte, and development was started the same year.

From the high grade of the ore-outcrop and its colour, due to oxidation of the arsenopyrite, it was not difficult to open up and trace the showing. The *Nickel Plate* ore-shoot, which apparently had been easy to follow on surface, was more difficult to trace underground. In 1903 prospecting on an adjoining property, the *Sunnyside*, showed commercial ore at surface, but it was only after two years' work that the ore-body was defined and shipments started. From this property \$1,200,000 have been taken out.

Prospecting was also carried on on the *I.X.L.*, *Climax*, *Copper Cliff*, *Mound*, *Bulldog*, *Exchange*, *Silver Plate*, *Gold Plate*, and other properties, all of which had surface showings, but up to date only the *Nickel Plate*, *Iron Duke*, *Morning*, and *Sunnyside* have produced commercial ore. In 1904 the *Bulldog* looked like a very promising mine, but it failed to make good. In 1905 the *Sunnyside No. 1* was in the limelight, but it also failed to make the grade. In 1906 an outcrop on the *Sunnyside No. 3* looked interesting. Subsequent work on this claim produced \$840,000, and at the same time ore which yielded \$400,000 was mined from the *Sunnyside No. 4*. In 1908 the *Nickel Plate* ore-body entered a lean zone and, as the diamond-drill failed to give satisfactory results, the Daly Estate, after making a profit of \$1,151,000, sold the property to the Hedley Gold Mining Company, Limited, for \$760,000, retaining, however, a large interest.

The new company was successful from the start. High-grade ore-bodies were found and in the *Nickel Plate* mining was carried to a depth of 2,400 feet. Up to June, 1919, the total profits were \$4,089,000, but in 1919, owing to the war conditions and excessive taxation, it became difficult to maintain a satisfactory surplus. However, the property continued to operate and has done so up to the present time, and operations have been financed from ore in the mine. During this non-dividend period the mine has produced for British Columbia \$2,715,046.84, has paid out in wages and for supplies the sum of \$2,794,966.91, and has maintained a population of approximately 400 souls.

Thirty years' association with the *Nickel Plate* mine—from the prospect stage right through every move made to bring it to fruition and following along when it got "sick tum-tum"—has been very interesting, and surely goes to prove that a pessimist has no place in our mining game. Had it not been for a little optimism Hedley would have been closed in 1903, and again in 1909, since which time it has produced much more gold than it did before that date—which goes to prove that in mining, as "Cousin Jack" says, "Where there is life, there is always 'opes." Early this year he was very shaky, but the addition of a few monkey glands has caused the old fellow to stage quite an exciting comeback, thus proving the appropriateness of the Mexican saying, "Quien sabe?"

THE HEDLEY MINE.

(By B. W. Knowles, Mine Superintendent.)

The *Nickel Plate* mine of the Hedley Gold Mining Company, Limited, lies at an altitude of 5,600 feet, or approximately 4,000 feet above the town of Hedley, British Columbia, where the mill is situated. Hedley is accessible by railway from either Spokane, Washington, or Vancouver, B.C., the two nearest cities.

The mine may be reached most readily by the ore-tramways, gravity and electric, from Hedley in about an hour. An old freighting-road which leaves the Penticton-Keremeos highway about midway has been put in good condition, and automobiles can make the 13-mile run to the mine in a little over an hour, though the total length of the trip from Hedley is 45 miles.

Climatic conditions at the mine are similar to those of high-altitude camps in Colorado at 10,000 or 11,000 feet elevation, though the timber-line here is at 7,000 feet. The difference in latitude between the two places accounts for this feature. Hedley, at an altitude of 1,700 feet, has a climate similar to that of Denver, except that winter temperatures are usually much lower in Hedley.

The mine is unusual in some respects and a description of the ore occurrence and method of mining may be of interest. Briefly, the ore is a gold-bearing combination of sulphides, chiefly arsenopyrite, with chalcopyrite and pyrrhotite. These occur in a gangue of lime silicates, with garnet and epidote predominating, and calcite. The origin of the ores is a complex subject which has been ably investigated and reported upon by Camsell (1) and Bostock, of the Canadian Geological Survey, and Paul Billingsley (2), and others.

The ore-bodies are of the contact-metamorphic type and occur in limestone at or very near its junction with sills of very hard, light-coloured porphyritic rock, locally called andesite, and classified by Camsell as a white gabbro. These sills or sheets were intruded into the limestones, altering them and adding to them the sulphides with which the gold is associated. The sedimentaries are the oldest rocks in the district, and the whole mass was originally lifted and tilted to the west by a batholithic intrusion of granodiorite. The granodiorite magma is considered the source of all the igneous rocks, the gabbro being merely one of a number of phases. The fissuring and faulting of the limestone due to the granodiorite intrusion was followed by penetration of the gabbro sills along and across bedding-planes of limestone.

Mine-workings.

The principal workings are the *Sunnyside* mines Nos. 1, 2, 3, 4, and the *Nickel Plate* mine. The *Sunnyside* mines are no longer being operated, but Nos. 2 and 3 were very valuable ore-bodies, over \$2,000,000 in gold having been mined from them. They were comparatively shallow deposits and easily worked. The high gold ore contained, relatively, a much lower percentage of sulphides than the present ore and was not nearly as hard and tough as that found in the *Nickel Plate* mine. This feature, of course, allowed both cheap mining and milling, and it is hoped that other bodies of this type will be eventually revealed by prospecting.

Since the *Nickel Plate*, which has produced gold to the value of nearly \$10,000,000, is the largest and oldest of the mines, it will be described in some detail.

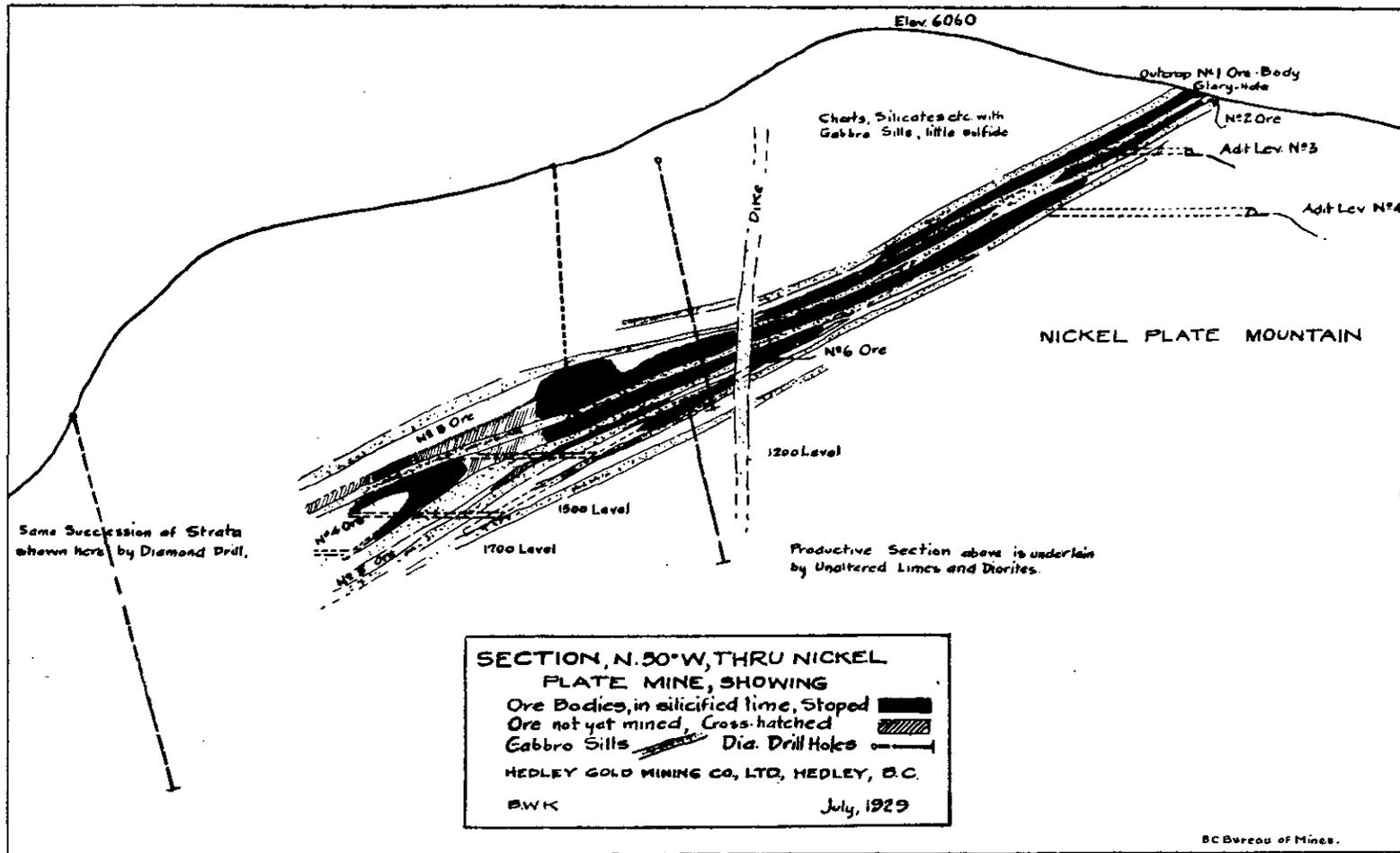
Nickel Plate Mine.

There have been six different ore-bodies or lenses developed on this property and, as far as is known at present, these cover the whole range of the productive beds. For convenience in mapping they are numbered from 1 to 6, No. 1 being the uppermost. This lens is the only one whose outcrop showed commercial ore. Its surface values were very high, running up to 6 or 8 oz. in gold to the ton. It was first mined as an open-cut, now called the glory-hole. Later, it was opened up from two haulage-adits, driven into the mountain at vertical depths of 150 and 300 feet respectively below the outcrop. The rock is very hard and tough and stands without support other than pillars left at intervals in the stopes. As stated before, the ore occurs on either the upper or lower contact of the altered limestone with sheets of gabbro, which form in most cases the hanging-wall or foot-wall of the stopes.

The limestone and gabbro have, all through the mine, a general dip of 20° to 25° to the west; but the ore-shoot has a very definite trend to the north-west, so that, instead of following directly down the dip, the ore-bodies make diagonally across it, with a gradual fading-out of values both up and down the dip.

The adit-levels are numbered 3 and 4, their elevations being respectively 5,750 and 5,600 feet above sea-level. No. 3 is 700 feet long and No. 4 is 1,160 feet. Two of the six ore-bodies were developed between the No. 4 adit and the surface. No. 4 is now the main haulage-level and, from a point 800 feet inside, a 30° inclined shaft has been sunk to a depth of 1,500 feet, slope measurement. This has 3-foot gauge, double track, is 9 by 18 feet, and is timbered. A double-drum, air-operated hoist at the collar of the incline pulls skips of 2 tons capacity to a 50-ton ore-pocket, from which 12-car trains hauled by electric locomotives are loaded. Transportation from this point to the mill will be described later.

This inclined shaft, the Dickson incline, at 30° has a steeper dip than the formation itself. Consequently, starting in the No. 3 ore-body, the shaft gradually cuts down through the gabbro foot-wall and enters No. 4 ore-body at the 600-foot level. Thence it passes through No. 4 and No. 5 ore-bodies and encounters No. 6 at the 800-foot level. From the 800-foot to the 1,200-foot level it follows No. 6 lens until finally it reaches and cuts through the foot-wall, and at the 1,500-foot level it is below any known ore-lens. The course of the incline (N. 49° W.) coincides closely with the



trend of the ore-shoot, so that crosscuts to the different lenses at the several levels are as short as possible.

One of the most striking features, geologically, is a nearly vertical dyke which practically separates the mine into two portions; but it has not faulted the strata to any great degree. On the lower levels this dyke is of much the same composition as the wall-rock, but in the upper levels it shows a much less uniform structure, being a partly oxidized, somewhat brecciated mass. The series of altered limestone-beds and gabbro sills terminate abruptly at the upper side of this large dyke, but continue again, with but slight variation in dip, on its lower side; and as the dyke turns nearly east and west it bears away from the ore-shoot at the 900-foot level.

Mining in general is rendered costly on account of the following factors: (1) The hardness and toughness of the rock; (2) the flat angle at which the ore dips (24°); (3) the form of the ore-shoot, which has relatively slight lateral extent and must be followed by sinking and by long crosscuts and raises into the hanging-wall.

To offset these disadvantages the qualities of the rock render timbering unnecessary and the stopes can be opened up as wide as desired, with no danger of caving or movement of any sort. The ventilation is natural and the air, even at the lowest level, is good. There is little water encountered, and that little is easily handled with pumps.

Mining Methods.—Ore is first broken from the sides and back of the stope up to the hanging-wall, which may be the gabbro sill or, in many cases, the upper limit of pay-ore. The side limits of the stope are nearly always determined by the fading-out of sulphides and values, though in some cases the vertical dyke described above terminates the stope very abruptly. The foot-wall gabbro forms the inclined floor of the stope, and ore is either shovelled directly into cars at the various levels or drawn through chute-raises to a tramming-level. All ore is hand-trammed to loading-pockets over the shaft at each level. On the 1,500-foot level 2-ton capacity cars on a 24-inch gauge track are used, but on other levels 1-ton cars on 18-inch gauge are standard. The larger cars are much more satisfactory.

The stope-backs are barred down carefully before broken ore is drawn and the rock will then stand indefinitely without further attention.

Fig. 4 shows conditions in one of the larger stopes, where the ore passes from No. 3 ore-body through the gabbro foot-wall and No. 4 ore-body to the tramming-level below.

Exploration.—Diamond-drilling has been the standard method of prospecting since the early days of the mine. Over 20 miles of drilling has been done, and a drill is kept at work constantly, proving up new ground in advance of ore requirements.

Transportation.—After being loaded into the cars of the electrically operated train at the collar of the Dickson incline the ore is transported $1\frac{1}{2}$ miles to a 200-ton ore-bin at the head of a gravity-plane 2 miles in length. This tram has a difference of 3,400 feet vertically between terminals. Skips of 6 tons capacity are drawn by 1-inch steel cables on a track whose grade varies from 10 to 69 per cent. and averages 49 per cent.

The tramway is divided into two sections on account of a deflection of 20° in its course at the Central station. This division makes it necessary to maintain a head-gear and cable at both the Upper (or Ore-bin) station and the Central station. By an arrangement of passing tracks, spring switches, and an auxiliary cable at the Centre station, skips are transferred from one section to the other and a loaded and an empty skip may travel on each section simultaneously, the load of course pulling up the empty. The skips travel on three 20-lb. rails. The centre rail is used by both skips in turn after they pass each other on two pairs of rails at the centre of the section. The 20-lb. rail is too light for the present traffic and could well be a 30-lb. or even a 50-lb. rail. Both electric and gravity trams are operated only on the day shift, and during that time they provide 220 tons of ore for a 24-hour run of the mill. The mine is operated on two 8-hour shifts.

Power.—Power for both mine and mill is generated at a 1,600-horse-power hydro-electric plant on the Similkameen river, 3 miles below Hedley. An older high-head plant, taking water from 20-Mile creek, supplies 300 horse-power, generated at a power-house in Hedley. A transformer-station at Hedley steps the Similkameen plant voltage down from 6,600 to 2,200 volts for distribution to the mill and mine. At the Ore-bin station two motor-generator sets transfer the 2,200 volts a.c. to 500 volts d.c. for use on the electric locomotives.

Motor-driven air-compressors at the mill power-house supply air to the mine through a 6-inch main 4 miles long. This long line acts as a storage-reservoir, so that receivers at the mine are not needed; but the drop in pressure due to friction and other causes is rather high.

THE HEDLEY MILL.

(By Roscoe Wheeler, Mill Superintendent.)

The ore is conveyed to the tippie as described in the previous section of the paper. From the tippie it is trammed about 300 feet to the crusher-bin, from which all the ore passes into a Traylor-built, swing-jaw crusher of 36- by 24-inch opening. The entire product from this first crusher drops to a belt, which delivers its load on to a set of grizzlies 3 feet long. The oversize from these grizzlies goes to a second swing-jaw crusher of 20- by 10-inch opening. The product from this second crusher goes over a set of grizzlies 8 feet long, the oversize from which goes to a third swing-jaw crusher of 20- by 6-inch opening. This third crusher drops its product to the same belt that carries all the undersize from all the grizzlies and conveys it to the ore-bin that supplies the stamps. The maximum size of lumps delivered in this bin by the crusher is about 1 by 1 by 2 inches. All three crushers are placed in tandem. This battery-bin contains, when full, about four days' run for the forty 1,050-lb. stamps.

From the stamps the ore passes first through a 12-mesh screen and then goes to five Dorr drag-line classifiers. The fines passing off the lower end of these are conveyed directly to the slime-tanks, while the coarser particles leaving the upper end go to five tube-mills, each 5 feet in diameter and 22 feet long, which work in a closed circuit with the classifiers. Eighty per cent. of all material leaving the lower end of the classifiers will pass through a 200-mesh screen. All crushing is done in cyanide solution. The lump lime is fed in the battery-bin and the cyanide solution first comes in contact with the ore under the stamps.

From the lower end of the Dorr classifiers the slimes go to three settling-vats of 30 feet diameter with 12-foot staves and conical bottoms of 22°. This incoming slime settles readily and the solution is drawn off continuously and goes to a lower sump-tank. When the charge of slimes in a settler amounts to the equivalent of about 100 dry tons the slime feed is switched to the other two settlers. The solution of the slime charge in the cut-out settler is decanted as far as possible, then the tank is filled with barren sump solution, and the charge agitated and thrown over by a 6-inch centrifugal pump to an empty vat. Here the charge is agitated for about eight hours, or as long as time will permit, allowed to settle, and the solution decanted. The vat is then filled again with barren solution, reagitated, and the charge transferred to a slime-vat that acts as feeder for the Oliver filter-press.

All solutions decanted from all slime charges go to a common lower sump-tank, and here they are strengthened by addition of lump sodium cyanide. From this tank the solution is pumped to a tank above the stamp-battery floor and becomes the feed solution for the ore under the stamps. The overflow from this battery-feed solution-tank goes to two filter-tanks, 34 feet diameter by 6 feet high, with canvas bottom. This clarified gold-bearing solution from the two filter-tanks is lowered to another tank, which is a unit of the Merrill zinc-dust precipitation system. Six hundred tons of this solution are sent through two 21-frame and one 11-frame Merrill precipitation-presses. Clean-ups from these precipitation-presses are made about three times per month. The zinc-dust sludge is treated with sulphuric acid, washed, dried, roasted, melted at the mill, and shipped as gold bullion.

The slime from the Oliver feed-tank goes to two 8 feet long by 11½ feet diameter Oliver filter-presses. The tailings from the filter-presses are elevated to a series of eight Spitzkastens. The overflow from these goes to ten Deister concentrating-tables and the middlings from these ten tables go to two other Deister slimers below the first ten. The overflow from the eight Spitzkastens goes to twenty-four 6-foot Frue vanners. From the Deisters and vanners the tailings are passed out of the mill. The concentrates are shipped to Tacoma, Washington.

General Data.

Tonnage of ore treated per month, about 6,000.
Sodium cyanide used, 2 lb. per ton of ore.
Lime used for all purposes, 8 lb. per ton of ore.
Extraction varies with fineness of crushing from 88 per cent. to 92 per cent.

Stamp-battery Data.

Weight of stamps, 1,050 lb.
Drops per minute, 108.
Height of drop, 7½ inches.
Screen aperture, 0.125 by 0.5 inch.
Moisture in discharge, 89 per cent.
Drop sequence, 1, 5, 2, 4, 3.
Duty, tons per stamp per 24 hours, 5.5.
Horse-power per stamp, 3.
Lost time, per cent., 7.4.

Tube-mill Data.

Tube-mills revolve 28 times per minute. Grinding media used in them is mine rock, picked from the belt, after passing through the 36-inch by 24-inch crusher.

Equipment in the Mill.

Three crushers, 36-inch by 24-inch, 20-inch by 10-inch, 20-inch by 6-inch.
Forty stamps, 1,050 lb.
Five Dorr drag-line classifiers.
Five tube-mills, 5 feet diameter by 22 feet long.
Eight Spitzkastens.
Twenty-four 6-foot Frue vanners.
Twelve Deister slimers.
Ten slime-tanks, 30-foot diameter by 12-foot staves, conical bottom 22°. Equipped with line shafts and propellers for agitation purposes.
Four 34-foot diameter by 6-foot stave tanks for filter and reservoir purposes.
Complete Merrill precipitation outfit.
Two 8-foot long by 11-foot diameter Oliver filter-presses.
Clean-up outfit and refinery for melting precipitate.
Three 30-foot diameter by 12-foot stave tanks for sump purposes.
Ten pumps of various sizes.
Twenty-seven motors of various sizes.
Two magnets at the crushers for extracting iron and steel.

Peggy. This group, owned by Ed. Baxter, Dan McKinnon, *et al.*, of Hedley, and mentioned in former Annual Reports, has been continually prospected. Mineralized segregations consisting of chalcopyrite, pyrite, and arsenopyrite carrying gold and copper in limestone have been uncovered in various open-cuts and tunnels on both slopes of the ridge. The main mass of rock forming the ridge is diorite and the limestone-beds, split by this intrusive, are tilted into the valleys on each side.

At the present time insufficient work has been done to prove the continuity of the mineral-zone between each discovery, and until this is done the owners will find it difficult to interest capital. High-grade assays have been obtained from some of the arsenopyrite and the outcrops containing chalcopyrite are of interest. Transportation, both by road and railway, is excellent and power is available close at hand.

Yuniman. This group, situated near the head of 15-Mile creek, has been named after the man that owned and worked it. There are no claims in the vicinity by this name. The only posts that could be located were marked *Bush Rat*. Two old cabins, one on top of the ridge near the workings and the other in the hillside below, are in bad repair. The former still affords some protection in bad weather. The main workings, at an elevation of 6,600 feet, are nearly all caved and in a condition which renders examination impossible. From sketches drawn by former miners it is evident that several hundred feet of tunnelling, upraising, and sinking was done by the owners and lessees. The country-rock in which the ore occurs is gabbro, intruded by fine-grained porphyry near the contact of highly altered greenstone and quartzose rocks. Where seen, the veins, two in number, vary from 2 to 10 inches in width and strike in a north-westerly direction. The ore-minerals are pyrite and arsenopyrite containing gold. Two dump samples of ore assayed: Gold, 4.30 oz. to the ton; silver, 6.2 oz. to the ton. And: Gold, 1.46 oz. to the ton; silver, 1 oz. to the ton. The quartzose rocks are mineralized with fine-grained pyrite which is heavily oxidized on the porphyry-dyke contact.

Big Horn Mines, Ltd. Nothing was done by this company on the *Horn Silver* group in Similkameen during the early part of the year. Later, the mine and plant were optioned by Vancouver interests and five men employed developing the east vein in the mine. In this drift, which has been driven about a total of 380 feet from the main crosscut, the vein has been displaced by faults, followed by shearing, so that the gangue-matter is entirely disintegrated. It seems probable that the silver values released from the vein have migrated. Evidence of this is found in films of native silver which are plastered on the rock-fractures adjacent to the vein. In the old workings to the west practically all the high-grade ore was mined on the anticline of the fold, which will be found to the north of the present tunnel. A tunnel in this direction with occasional upraises to the vein will prove the possible continuity of this higher-grade ore on the east side.

Tiger Gold Syndicate. The group controlled by this syndicate and reported upon in the 1928 Annual Report was explored during 1929 under the management of A. T. Miller. The old shaft, 78 feet deep, in the *Buller* tunnel was cleaned out. The vein, about 2 feet wide, is crushed but in place for 25 feet down from the collar of the shaft. The strike is N. 12° W. (mag.) and the dip about 50° to the west. Beyond this point a fault dipping at about the same angle has dragged the vein down and nothing but disintegrated quartz remains. It is probable that this shaft was sunk mainly on the fault and that the vein lies in the foot-wall. In an upraise, 35 feet high, beyond the shaft, the vein, varying in width from 1 foot to 3 feet, is also sheared and intermixed with schist. Samples of this material taken by the management assayed about \$4 to the ton in precious metals. A winze was sunk about 60 feet on a cross-vein varying from 2 to 10 inches in width and containing pyrite and chalcopyrite, carrying gold, to its intersection with the main *Buller* vein, in hopes that minable ore might be found. At the time of examination (October 2nd) this vein intersection appeared to be unattractive and only slightly mineralized.

The whole schistose area in which these veins occur has been badly faulted and sheared on the vein and contains low average sample values. Further development here does not seem to be warranted. In the upper workings, about 100 feet above the *Buller* tunnel, a short crosscut has been driven close to a fault and an old open-cut cleaned out. Along the foot-wall of the cut about ½ inch of disintegrated schist carries variable but high values in gold. The quartz vein is to a great extent barren. Occasional small segregations of pyrite and chalcopyrite are found.

An electrical motor-driven rock-drill has been tried on this property and proved unsatisfactory up to the time of examination. It seems advisable to explore other areas on this group of claims, which are said to contain quartz veins, in hopes that less disturbed conditions may be found to prevail. An old cabin on top of the hill was reconditioned and a kitchen lean-to built. Water is very scarce.

This company, with headquarters at Leavenworth, Wash., has optioned a **B.E. Mining Co.** group of six claims situated about 4 miles south of Twin lakes and owned by A. Piper *et al.*, of Oliver. Several open-cuts and a crosscut tunnel 110 feet long have been driven to develop a quartz vein varying from 2 inches to 5 feet in width and impregnated with pyrite and galena containing gold. Small segregations of galena, which are generally spasmodic, carry phenomenal values in gold. The general average mine-run may, however, be worked profitably. The vein conforms generally to the strike of the schist, which varies considerably, due to warping. A small jaw-crusher, 20-horse-power Fairbanks-Morse engine, a 3 by 3 ball-mill, and a Wilfley table have been installed on the property. Water-tanks have been built.

Two samples taken from 13 inches of vein-matter on the lead in the face of the crosscut tunnel assayed: Gold, 0.68 oz. to the ton; silver, 0.12 oz. to the ton. And: Gold, 0.50 oz. to the ton; silver, 0.10 oz. to the ton. A general sample from an open-cut on the same vein containing no sulphides assayed a trace in gold and silver. The idea of building a small plant, before sufficient ore was blocked out to justify the expense, was to assist, if possible, the financing of the company. A great deal of trouble was experienced in erecting the mill and a considerable loss in values followed. The ore appears to be ideal for cyaniding. Only a small flow of water is available from a spring above the camp which may hinder milling operations during the summer months.

OLALLA SECTION.

Only a small amount of work was done on the nickel-bearing deposit which created a good deal of interest in 1928. Owing to the inability of the owners to act as guides during the time available, this section was not examined during the season. A rough road was built from Olalla to the *Golconda* mine-workings.

SIMILKAMEEN MINING DIVISION.

The most important operation in this Division is the *Copper Mountain* mine, **Granby Consolidated Co.** owned by the Granby Consolidated Mining, Smelting, and Power Company. The mine is situated at Copper mountain and the mill at Allenby, both points being connected by railway transportation with the Kettle Valley Railway at Princeton. The origin of the Copper Mountain ores was discussed by V. Dolmage, of the Geological Survey of Canada, during the year.* As this is the only matter printed in recent years on this subject, a part of his address is appended.

GEOLOGY.

Geologically, the ore-bodies are situated along the contact of a stock composed of gabbro, diorite, and other related rocks, thrust up through a series of steeply folded andesitic and basaltic breccias. The only other rocks of importance are some large white felsite and quartz-porphry dykes, which cut both the stock and the breccias as well as the ore-bodies. The metallic content of the ore is believed to have originated in the magma of the stock and to have been deposited some time prior to the injection of the large white dykes.

BRECCIAS.

The breccias occupy a large area in this general region, and prior to this replacement by the stock and other similar intrusions and to their being buried under more recent lavas they occupied the entire region. The total thickness of the series is not known, but it must measure several thousands of feet. The breccias vary in texture from fine to very coarse, with fragments up to a foot or more in length, and in composition they range from andesite to basalt. Fragments and matrix alike consist almost entirely of plagioclase and augite, usually in nearly equal proportions. The breccias are steeply folded and in the vicinity of the mine strike north-west and dip 50° to 70° to the south-west. In the vicinity of the stock they are in places intensely biotitized and where the ore has been deposited they are severely fractured. These metamorphic phenomena will be more fully described in a later section dealing with the ore. The breccias probably belong to Dawson's Nicola series of Triassic age.

COPPER MOUNTAIN STOCK.

The stock is elliptical in plan, having a major axis 5 miles long extending in a north-west direction, and a minor axis of about 3 miles. The Similkameen valley, with its steep sides and deep rock canyon,

* The Canadian Mining and Metallurgical Bulletin, June, 1929.

cuts fairly through the centre of the stock from north to south, clearly exposing it not only in a horizontal section, but over a vertical range of nearly 2,000 feet. The stock varies markedly in composition from periphery to core. The outer zone consists of a fine- to medium-grained syeno-gabbro made up of approximately 57 per cent. labradorite, 20 per cent. augite, 10 per cent. orthoclase, and 2 per cent. magnetite. In a few places portions of the plagioclase and augite are replaced by considerable amounts of biotite. Inside this zone is a coarser and more salic one, ranging in composition from a syeno-diorite through a monzonite to almost a syenite, and in the centre of the stock is a core nearly 1 mile in diameter of syenitic pegmatite of medium-coarse grain and consisting of orthoclase, microcline, albite, and albite-oligoclase, with small amounts of biotite, chalcopyrite, and bornite. The sulphides, though present in only minute quantities, are almost as evenly and as widely distributed through this core as are the other constituents. The same copper-iron sulphides occur in minute particles also in tiny veinlets which cut the rocks adjoining the pegmatitic core. Little or no pyrite is present.

Quartz is absent from all phases of the stock, as well as from numerous related pegmatites and also from the ore. No feldspathoids were observed. A noteworthy feature of the stock, as well as its pegmatites and related ore veins, is the conspicuous amount of apatite, usually in large crystals from $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter. Still another important peculiarity of the stock is the large amount of orthoclase present in its outer basic phases. A number of quantitative microscopic determinations were made of these outer zones, all of which indicated 10 per cent. or more of potash feldspars (microcline and orthoclase).

The boundary separating the pegmatitic core from the next zone is sharply defined and resembles an intrusive contact. The boundary, however, between the central and outer zones is much more gradual and is clearly not an intrusive contact. Some doubt still remains as to how the stock came to have its present form and range of composition, but there is no doubt regarding the consanguinity of the various rocks now composing it.

PEGMATITE DYKES.

At a number of localities in the outer zones of the stock, as well as in the surrounding breccias, are irregular bodies of extremely coarse syenitic pegmatite, some of which also contain chalcopyrite and bornite. Some of these dykes have feldspar crystals 1 foot in length, as well as leaves of biotite with similar dimensions.

WHITE DYKES.

The large white dykes, though a conspicuous feature of the geology, are of little consequence and need not be described at length. They follow a northerly trend and vary in width from 10 to 200 feet. In composition they range from dense felsites to medium-grained quartz porphyry. Their principal influence has been to replace a quantity of good ore and also to complicate mining and milling operations, as it has been found necessary to mine the great bulk of them and to eliminate the fragments from the ore by hand-sorting.

Besides these large white dykes there are also a few much smaller dark-green andesitic dykes, which tend generally to strike in a direction normal to the white dykes.

THE ORE.

The ore consists of basaltic and andesitic breccia which has been intensely biotitized, then foliated and fractured, and later and adjoining rock impregnated augite, orthoclase, and later the albite, epidote, zoisite, bornite, chalcopyrite, pyrite, and magnetite. Notwithstanding all these impregnations, the original fragmental character of the rock can usually be recognized, and under the microscope the bulk of the original feldspar and augite is easily visible, except in the zone of most intense biotitization; and even here some of the original minerals can be seen. The following analysis of a specimen of typical ore indicates roughly the comparatively small amount of chemical change which has been produced in the original basaltic breccia by the mineralization process:—

SiO ₂	50.52
Al ₂ O ₃	15.08
Fe ₂ O ₃	1.99
FeO	4.43
MgO	4.00
CaO	8.88
Na ₂ O	4.10
K ₂ O	3.23
H ₂ O—	0.10
H ₂ O+	1.23
TiO ₂	0.50
CO	0.73
P ₂ O ₅	0.24
S	3.25
MnO	0.10
Cu	2.17
	100.55
Less oxygen combined as iron oxide (for sulphur)	0.85
Total	99.70

The amounts of pyrite and magnetite are exceedingly small and they are both entirely absent from much of the ore. It is evident from the above analysis that both were absent from the sample analysed. The magnetite appears to be more abundant in sections where the copper-iron sulphides are absent.

The biotitized zone lies adjacent to the contact of the stock, but is extremely irregular in width and in the intensity of the alteration. The outer limit of the zone is so irregular and indefinite that it could not be satisfactorily mapped, even in the underground workings. In some areas there appears to have been almost complete conversion to biotite, and here the rocks have a dense black colour. Where the biotite crystals are large they show a tendency to lie in parallel planes, producing a schistose structure, but where they are small no such tendency can be detected and the rock has the appearance of rubber. Under the microscope, this biotitized rock can be seen to consist of feldspar and augite replaced by large quantities of biotite and some crystals of later augite. A considerable amount of bornite is found as disseminated particles in this biotitized rock; some of it may probably have been introduced with the biotite, though there is no doubt that the bulk of the bornite was introduced during the main period of metallization, which came later. A few tiny fresh dykelets of diorite were observed cutting the biotitized rock and both were affected by a later period of fracturing. These facts seem to indicate that the fluids which produced the biotite escaped prior to the solidification of the magma and probably before it had finally come to rest. The biotitization may have advanced like a wave in front of the slowly rising magma.

Outside of the biotitized zone, and at a few places in it, the breccias are converted to a densely fine, greyish-green, chert-like material. This alteration affected the matrix of the breccia to a much greater extent than the coarser-grained fragments, which are frequently found in a fairly fresh condition enclosed in this densely fine chert-like matrix. Under the microscope, this chert-like material was found to have been produced by the introduction of a vast number of crystallites of a pale-green pyroxene, probably augite. A large proportion of the ore mined occurs in this chert-like pyroxenite, which has the objectionable property of being exceedingly tough and difficult to grind. A small amount of scapolite was also observed in some of the altered rock.

After this period of biotitization, or during its close, the breccias were subjected to stresses which caused the formation of vast numbers of minute, parallel fractures standing vertically and striking in a direction almost precisely normal to that of the contact of the stock. In places they are so numerous as to be only a small fraction of an inch apart, while in other places they are fewer but are longer and wider. They vary in width from microscopic to $\frac{1}{4}$ inch or more, but average less than $\frac{1}{20}$ inch. They are important in that they provided the openings by which the copper-bearing fluids entered the breccias, and a large proportion of the copper is now found in these fractures.

The grade of the ore varies with the number and size of the fractures. Besides the fractures, the rocks in the vicinity of the deposits have an indistinct foliation parallel to the stock-contact, and therefore perpendicular to the fractures. It is not known whether or not this foliation was produced by the same stresses which caused the fracturing, but the foliation planes assisted in the formation of the ore by conducting some of the mineralizing fluids away from the fractures, causing the spread of copper minerals throughout the rock.

The exact time of the fracturing is not known, but it is clearly later than the biotitization and earlier than the solidification of the stock-magma, or at least earlier than the solidification of more than a very thin shell of it, for the fractures do not occur in the stock itself except to a very slight extent close to the contact. Since, also, the fractures are not all filled with the same minerals, it is possible that the fracturing took place over an extended period of time.

Many of the fractures, probably the majority of them, and particularly the larger ones, are filled with large amounts of orthoclase, albite, and green mica; or, in other words, syenitic pegmatite. With the pegmatite are smaller but important amounts of bornite, chalcocite, and chalcopyrite, and still smaller amounts of epidote and zoisite. The copper minerals tend to segregate along a narrow line in the centre of the vein, but occur also in small amounts throughout the pegmatite. Some of the sulphides appear to have been deposited later than the feldspars, but the bulk of them have the appearance of having been deposited simultaneously. The orthoclase, besides filling these veins, is also to some extent disseminated as small isolated crystals in the adjoining rock, which seems to prove that it was deposited from solutions and not formed by the solidification of a magma.

Other fractures are filled mainly with augite, epidote, zoisite, albite, and the same three copper minerals. Along the margins of these fractures, bleached zones occur up to $\frac{1}{4}$ inch in width, which owe their lighter colour to the injection of crystallites of augite, zoisite, and sericite. Still other fractures, which are usually smaller, contain only bornite and chalcopyrite, with a few small crystals of albite. A very few fractures are filled with magnetite, and one or two were observed which contained only pyrite. As previously mentioned, much bornite and chalcopyrite is disseminated throughout the rock between the veinlets, in places bringing the copper content up to 3 per cent. or more.

Since the deposition of the ore the only geological events by which it has been affected are the injection of the white dykes and the removal of a large amount of overlying material, as well as some of the ore itself, principally by erosion, but to a slight extent by glaciation also. Since glacial times a small amount of oxidation has affected the ore, producing some malachite and probably some chalcocite, though undoubtedly much of the chalcocite is of hypogene origin.

To sum up the events affecting these ore-deposits, we have: (1) The folding of the tuffs; (2) the injection of the stock-magma; (3) the metamorphism of the adjoining breccias by the introduction of the large amounts of biotite and augite, with probably a small amount of bornite; (4) the fracturing of the breccias and, to a slight extent, a thin outer frozen shell of the stock; (5) the escape into the fractures of the fluids which deposited the ore and gangue minerals; and (6) the slow crystallization, differentiation, and final solidification of the stock, probably accompanied by the formation of many

pegmatite dykes. It is not intended to infer that each of these events was complete before the ensuing one commenced. Undoubtedly there was much overlapping and two or three of the processes may have been progressing concurrently. Even the fracturing of the breccia extended over a long period. It seems highly probable that the ore was deposited before the stock had solidified to more than small extent.

ORIGIN OF THE ORE.

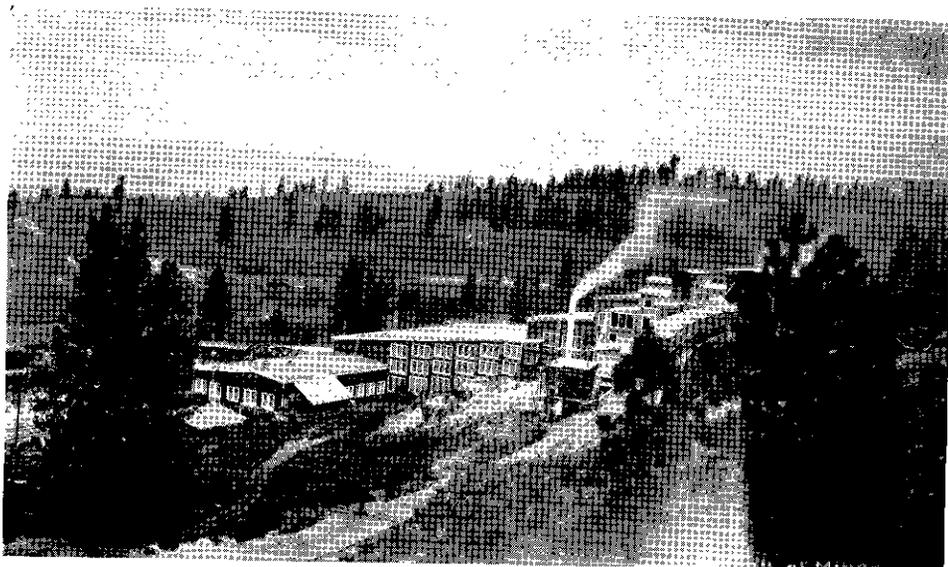
It is always difficult to prove that any particular ore originated in any particular magma. In general, the proof rests mainly on the proximity of one to the other and on the general theory that most metal-deposits are genetically related to some magma. In the case of the Copper Mountain deposits, however, the relations of the ore to the magma of the stock are extraordinarily well shown—first, by the relative positions, and, second, by certain striking similarities in the mineral content of each. The ore-bodies which compose the *Copper Mountain* mine lie adjacent to the contact of the stock, and several much smaller but exactly similar deposits occur at other places along the contact of the stock; one lies adjacent to the contact of an inclusion enclosed within the stock. Bornite, the characteristic ore-mineral, is present also in the pegmatitic core of the stock and in many pegmatite dykes obviously derived from the stock-magma. A considerable amount of pegmatite is associated with the ore and is a quartzless, syenitic type of pegmatite identical in character to that which forms the stock-core and the other related pegmatite dykes. The absence from the ore of quartz as a gangue-mineral is an unusual feature, but is in nice accord with its absence from all phases of the stock, including pegmatite dykes. Another notable feature is the absence from the ore of any appreciable amounts of pyrite, indicating that the mineralizing solutions were unusually low in iron. Pyrite is absent also from the many minute chalcopyrite veinlets occurring in that portion of the stock adjacent to the pegmatitic core, suggesting their deposition by similarly iron-poor mineralizing solutions. These striking similarities, together with the relative positions of the ore and stock, leave little doubt as to their common origin.

These features do not, however, prove that the ore-forming solutions came directly from the stock, moving more or less laterally away from it, but they admit of the possibility of the solutions having risen vertically along the contact from much deeper regions, probably from the main magma-chamber, of which the stock is only an appendix. As the ore-bodies are explored to greater and greater depth, evidence bearing on this question will certainly be obtained, but at present the only light on the problem must come from observations made on other contact-metamorphic deposits. Associated with the Coast Range batholith of British Columbia are many similar contact deposits, occurring either in limestone or porous tuff or, as in most cases, in sheared rocks of various composition. Many of these deposits are in inclusions lying within the batholith, while many others are in roof-pendants which project far down into the batholith. In some of the smaller of these the base of the ore is exposed, and it invariably butts against fresh, unaltered, and barren, or almost barren, granodiorite, thus proving that the solutions passed directly from the batholith into the soluble or porous rocks adjacent to the contact. In view of these facts it seems probable that the solutions which formed the Copper Mountain ores also passed directly from the stock into the fractured breccia.

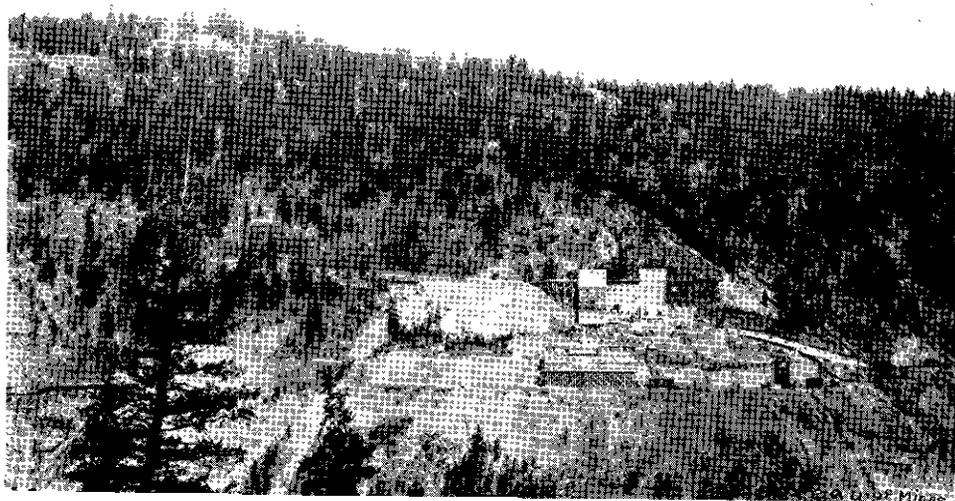
The above-mentioned facts—that many of the contact-metamorphic deposits of the Coast Range batholith occur in roof-pendants and in inclusions and that they lie against fresh, unaltered, barren granodiorite—seem to also indicate pretty clearly that the solutions came from the magma prior to its solidification, though not necessarily prior to the commencement of crystallization. That solutions do escape from magma prior to their solidification is believed by almost all students of petrology and metamorphism, who account for most contact-metamorphic phenomena in this way; and there is no apparent reason why some of these solutions should not transport some of the metals and sulphur contained in the magma and deposit them as metallic sulphides. The mechanism of the process by which these attenuated, probably highly aqueous, portions of the magma are separated from the more viscous portion has not been investigated, but it would appear to be a straining effect depending on the size of the openings penetrated. If the openings are large enough, the magma will rush in and form dykes or sills; but if they are less than certain critical size which will permit this, then only the thin attenuated liquids or gases will escape. This process is really an early phase of magmatic differentiation and should be so regarded. Not all of the highly liquid portion of a magma escapes in this way, but much of it, probably the great bulk of it, remains in the magma to be slowly concentrated as a final residue by the ordinary methods of magmatic differentiation attendant on the crystallization of the anhydrous rock-forming minerals. There appear to be at least two main methods by which the volatile components of a magma may be separated from the more viscous portion—first, a very early one, by which the highly attenuated fluids escape from the molten magma through minute openings in the walls of the magma-chamber; and a second one by which they are concentrated as a residual liquor and squeezed out by the crystallizing of the rock-minerals, later to escape into the surrounding rocks through fissures. The former method produces contact-metamorphic ore-deposits as well as other metamorphic phenomena, including, in some cases, what has been called "injection gneiss," while the latter process results in the formation of mineral veins and pegmatite veins or dykes.

The Copper Mountain deposits have not been proved to belong to either one or the other of these two periods of magmatic differentiation, but there are some reasons for believing that they belong to the earlier period and were formed before the magma of the stock had solidified beyond a very limited extent.

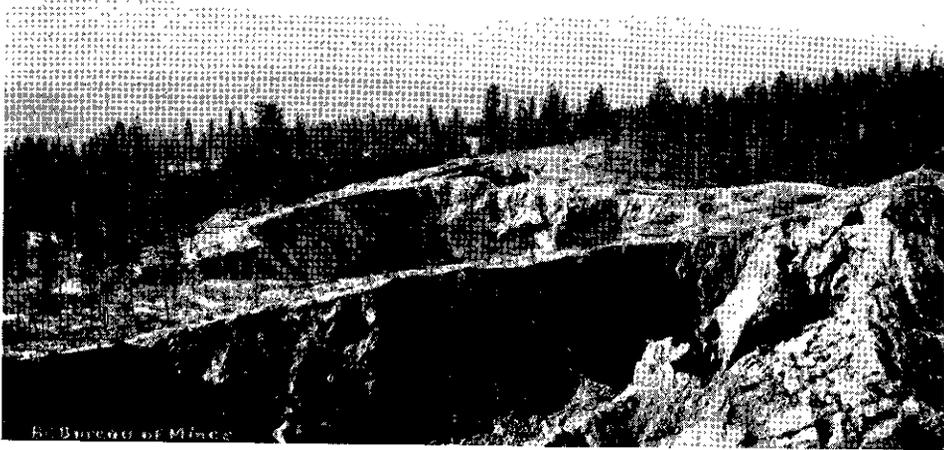
At the Mine.—Developments underground consist of blocking out ore by upraises between levels; diamond-drilling to locate new ore-bodies, as well as locating the boundaries of known deposits; and sinking a vertical shaft from the lowest level to handle the ore found below.



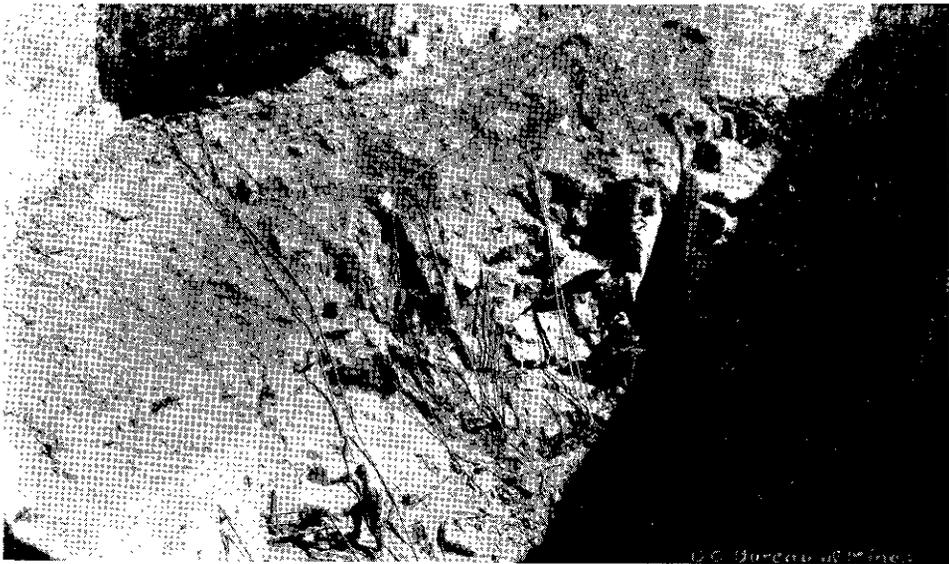
Allenby Concentrator, Similkameen B.C.



Copper Mountain Mine—Portal.



Copper Mountain Mine—Glory-hole.



Copper Mountain Mine—Interior of Glory-hole.

Surface work done in 1929 was as follows: A steel-sharpening shop, a machine and blacksmith shop (both of which are steel construction), a warehouse and office building, a shiftboss office, a 500-ton extension to the railway ore-bins, a school-house, a community hall, and six new seven-room dwelling-houses. The latter are of wood construction. A 7-foot Symons cone crusher was installed in the primary-crushing plant. In addition to this work many of the old buildings were reshingled and painted. The ore mined totalled 919,752 tons.

At the Mill.—The only new construction consisted of one seven-room frame house. The old buildings were reshingled and painted and all the residences were completely lined with gyproc, which creates much warmer living conditions. The total number of employees is approximately 600.

A detailed report on the Allenby concentrator by H. R. Taylor, mill superintendent, follows:—

PRIMARY CRUSHING.

The primary-crushing department, which is located at the mine, is near the portal of the lower tunnel, from which all of the ore is hauled and dumped into two receiving-bins. The flow-sheet of this department is shown diagrammatically in Fig. 2. The ore that requires sorting is put into No. 1 bin, which has a capacity of 1,650 tons, and the higher-grade ore is dumped into No. 2 bin, with a capacity of 450 tons.

The plant is equipped with two 30-inch by 42-inch jaw-crushers and two 10-inch fine reduction gyratories, together with the necessary conveyor-belts for sorting and waste-disposal, and has a capacity of 2,500 to 3,500 tons operating about sixteen hours a day.

The ore-sorting department was constructed in 1927 and has proved successful in raising the grade of ore by the elimination of the barren dyke-rock. All the conveyors run on anti-friction rollers and are driven by induction-motors with inbuilt helical reducing-gears.

The product of the gyratory crushers, which was minus-2-inch in size, was conveyed to a 2,500-ton storage and shipping bin.

During the month of May, 1929, a new 7-foot Symons cone crusher was installed to take the place of the two gyratory crushers. This new machine is driven by a direct-connected 250-horse-power motor having a speed of 450 r.p.m., and has a capacity of 200 tons per hour when set to deliver a product of minus-¾-inch in size. This crusher is fed by a short feeder conveyor, over which is suspended a large magnet that removes any scrap steel that gets into the ore.

The gyratory crushers have not been used since the installation of the new cone crusher, but they will be kept as spares and ready to run if needed.

The crushed ore is hauled in 60-ton steel-bottom dump-cars to the concentrator at Allenby, where it is weighed and then dumped into the coarse-ore storage-bins, which have a capacity of 2,500 tons.

SECONDARY CRUSHING.

The flow-sheet of the secondary-crushing department is simple, but with the ore which is extremely hard and tough it presents an interesting grinding problem.

There is less than 2 per cent. moisture in the ore, which made it necessary to install an efficient dust-control system in this department, and it has proved to be very satisfactory.

Only one of the eleven belt feeders under the coarse-ore bins is operated at a time. These belts discharge on to the first 30-inch conveyor, which is equipped with a magnetic head pulley that takes out all the small pieces of scrap-steel before the ore drops on to the first stationary screen.

The oversize from this screen is sent to the primary-grinding circuit, consisting of one set of 72-inch by 20-inch rolls in closed circuit with a 30-inch elevator and stationary screen. During the first couple of years of operation impact screens were used on this circuit, but it was found that a stationary screen was just as efficient, because of the dryness of the ore. The undersize from these stationary screens is the feed to the second set of 72-inch by 20-inch rolls, the product of which is elevated and conveyed to hammer and impact screens. The oversize from two of these screens is the feed to the 54-inch by 20-inch rolls, which are in closed circuit with 24-inch elevators and hammer and impact screens. The undersize from these vibrating screens is the product of this department and is conveyed to the 2,700-ton fine-ore bins. It is automatically sampled, and the following is a typical screen analysis and assay:—

Mesh.	Per Cent. Weight.	Per Cent. Cu.
On 8	6.10	1.26
" 10	12.46	1.31
" 14	16.90	1.33
" 28	25.30	1.35
" 35	9.40	1.36
" 48	5.80	1.45
" 65	3.76	1.53
" 100	4.84	1.69
" 150	2.36	1.69
" 200	2.00	2.02
" 270	1.60	2.05
" 325	1.46	2.40
Through 325	8.02	2.34
Average		1.492

Each one of the rolls is belt-driven from the line shaft, which is in turn driven through a flexible coupling by a 150-horse-power, 300-r.p.m. induction-motor.

The first set of 72-inch by 20-inch rolls run at 67 r.p.m. and the second set at 118 r.p.m., while both sets of 54-inch by 20-inch rolls run at 130 r.p.m.

Forged chrome-steel roll shells are being used, and the average life of the 72-inch shells is fifty-seven days and of the 54-inch shells fifty days.

The average consumption of roll steel is 0.35 lb. per ton of ore.

Manganese elevator-buckets are used in all elevators, as their life is three times that of malleable iron on this ore.

All conveyors in this department have recently been equipped with roller-bearing idlers, which has cut down the power-consumption somewhat and made a considerable saving in grease and labour.

FINE GRINDING.

The fine-grinding department, shown on the accompanying flow-sheet (Fig. 4), requires little explanation. There are six 7-foot by 10-foot P. & M. ball-mills, which run at 21 r.p.m. and are driven by 200-horse-power motors through texrope drives. The Allenby plant is credited with the pioneer work for this type of drive for ball-mills. Each of these mills is in closed circuit with a heavy-duty Model D Dorr classifier. The overflows from these classifiers flow through two inverted siphons to an 18-foot bowl classifier, which is in open circuit, the overflow going to flotation and the sands to two 5-foot by 20-foot ball tube-mills, which are in closed circuit with two 20-foot bowl classifiers.

There are also four 5-foot by 20-foot ball tube-mills in this department, driven by 150-horse-power motors through texrope drives, which are in closed circuit with Model C Dorr classifiers, the overflows of which also go to the 20-foot bowl classifiers.

The combined overflow of the bowl classifiers is the feed to the flotation department, and the following is a typical screen analysis and assay:—

Mesh.	Per Cent. Weight.	Per Cent. Cu.
On 100	9.17	0.79
" 150	9.57	0.93
" 200	8.93	1.03
Through 200	72.33	1.92

The principal minerals in the ore are chalcopyrite and bornite, with very little chalcocite present, and the grain is extremely fine, irrespective of the grade of ore. These copper sulphides are intimately associated with and finely disseminated throughout the gangue, which is very hard. Other metallic minerals present are hæmatite, limonite, and a small amount of pyrite, but these are for the most part associated with the gangue and are usually well separated from the copper minerals.

In order to make a satisfactory recovery, it is necessary to grind this ore so that at least 70 per cent. will pass a 200-mesh screen.

Forged-steel balls are used as the grinding media and the average consumption is 1.95 lb. per ton of ore. The liners used in the mills are made of white iron and the average consumed per ton of ore is 0.35 lb.

FLOTATION.

The flotation department originally consisted of seven strings of mat-type pneumatic machines, but, as these machines were more or less obsolete, a considerable amount of experimental work was conducted during 1927 and 1928 with matless cells in order to find a more efficient flotation-machine for our ore. After we had developed a suitable flotation-machine of this type, it was adopted, and during the early part of 1929 a complete installation, consisting of twenty-eight rougher-cells each 18 feet long, two cleaner-cells each 24 feet long, and two recleaner-cells each 12 feet long, was installed. These machines have proved to be very satisfactory, and the extraction has increased since this new installation was completed, which is due in part to the steady operating conditions maintained with this type of cell and also in part to floating of coarser mineral.

The air for the cells is produced at a pressure of 1.6 lb. by a 400-cubic-foot-per-revolution Connorsville blower, which was installed at the same time as the matless cells. This blower, which requires about 375 horse-power, is driven by an induction-motor through a texrope drive, which is reported to be the largest of its kind in the world, having twenty-six 1½ texropes.

The feed for the flotation-cells is equally distributed to eight rows of rougher-cells, each row consisting of three 18-foot cells. The concentrates from the rougher-cells contain a large percentage of copper sulphides that are still attached to gangue and have to be liberated by regrinding in order to produce a high-grade concentrate, which is necessary on account of the high freight rate.

The rougher concentrates from the second and third cells of each row are recleaned and then combined with the first cell concentrates and pumped to the thickener of the regrind plant.

This regrind plant consists of a 40-foot Dorr thickener, a 16-foot-diameter Dorr bowl classifier, one 7-foot by 10-foot ball-mill, and Wilfley pumps for returning the regrind and original concentrates.

The overflow from the 40-foot Dorr thickener is used as return water on the ball and tube mills, and the thickener underflow, which averages about 33 per cent. solids and 9 per cent. copper, is the feed for the 16-foot bowl classifier. The bowl sands are regrind in the 7-foot by 10-foot ball-mill and then returned to the bowl classifier.

The overflow from the bowl classifier, which is 98 per cent. minus-200-mesh and 20 per cent. solids, is re-treated in two 24-foot and one 18-foot matless cells. The concentrates from the first 24-foot cell are double recleaned in two 12-foot cells, which produce a final concentrate of about 33 per cent. copper.

The tails from the first 12-foot cell and the concentrates from the second 24-foot and the 18-foot cells are returned to the thickener, and the tails from the last 12-foot cell are sent back to the bowl classifiers. The tails from the 18-foot cell are cut to waste.

The final concentrates are dewatered in a 40-foot thickener and filtered in a 6-foot 6-disk American filter to about 11.5 per cent. moisture, and then conveyed to railway-cars for shipment to the smelter.

GENERAL.

All the ore contains small values in gold and silver. The average assays, in ounces per ton, for the heads and concentrates, are as follows:—

	Gold.	Silver.
Head assay	0.01	0.24
Concentrate assay	0.18	5.00

The performance of the concentrator for 1928, and for a more recent representative period, is tabulated below:—

	1928.	Recent Operations.
Dry-tons milled per day	2,449	2,528
Head assay, total copper	1.48	1,508
Concentrate assay, total copper	32.99	32.38
Tails assay, total copper	0.271	0.223
Extraction per cent. of total copper	83.34	85.77
Ratio of concentration	27.06	25.06
Dry tons concentrated per man operating shift	43	45

The reagents used in this plant are lime, pine-oil, and xanthate or aerofloat. The ore is slightly alkaline and only a small amount of lime, which is fed as milk of lime to the ball-mills, is necessary to maintain the correct alkalinity. Xanthate or aerofloat and pine-oil are added to the bowl classifier overflows. The average consumption of the reagents is as follows:—

	Lb.
Lime per ton of ore milled	0.17
Pine-oil per ton of ore milled	0.11
Xanthate or aerofloat per ton of ore milled	0.06

The flotation-cells use about 70 cubic feet of air at 1½ lb. pressure per lineal foot of cell.

The following are representative screens and assays of the general tailings and final concentrates:—

Tailings.

Mesh.	Per Cent. Weight.	Cum. per Cent. Weight.	Per Cent. Cu.
+ 100.....	10.70	10.70	0.316
+ 150.....	9.30	20.00	0.264
+ 200.....	10.76	30.76	0.250
+ 270.....	6.70	37.46	0.238
+ 325.....	7.00	44.46	0.226
— 325.....	55.54	100.00	0.186

Copper, 0.212 per cent.

Concentrates.

Mesh.	Per Cent. Weight.	Cum. per Cent. Weight.	Per Cent. Cu.
+ 100.....	0.50	0.50	17.37
+ 150.....	1.10	1.60	20.45
+ 200.....	2.84	4.44	19.93
+ 270.....	5.00	9.44	19.63
+ 325.....	9.00	18.44	21.33
— 325.....	81.56	100.00	35.43

Copper, 32.34 per cent.

The water-supply for the plant is pumped from the Similkameen river by 6-inch four-stage 800-gallon-per-minute Worthington-Janesville centrifugal pumps, through a 15-inch all-steel Victualic joint pipe about 1 mile in length, with a rise of 525 feet, to three 100,000-gallon-capacity storage-tanks.

The following is the amount of water used in the concentrator:—

Gallons of initial water per ton of ore concentrated	780
Gallons of initial water per minute	1,410
Gallons of return water per ton of ore concentrated	490
Gallons of return water per minute	700
Gallons of total water per ton of ore concentrated	1,180

This is equivalent to 2.75 tons of water per ton of ore.

On account of the extreme hardness and toughness of the ore, and the fine grinding which is necessary to free the mineral, the total power consumed per ton of ore is high, when compared with other concentrators of this type. It is consumed as follows:—

	Kw. Hours.
Coarse crushing and sorting	1.5
Secondary crushing	6.1
Fine grinding	15.7
Flotation	4.0
Initial water and miscellaneous	3.5
Total	30.8

The *S. & M.* and *Marion* groups on Whipsaw creek were operated during the early part of 1929 by the Pacific Slope Mines, Limited, under the management of Percy Hugh Fraser, of Vancouver (now president and director of the Copper Basin Mines). By defaulting a payment due in May this company forfeited its bond. The lowest crosscut tunnel on the *S. & M.* was driven ahead about 70 feet and a short upraise put in on a slightly mineralized quartz vein. It was also extended to the right for 100 feet in a semicircle without discovering minable ore. At a point about 360 feet from the portal of the main tunnel another crosscut was extended to a total distance of 200 feet. In this tunnel a 12-inch vein was tapped which assayed: Gold, trace; silver, 1.6 oz. to the ton; zinc, 10 per cent.

Since May, when the Pacific Slope Mines, Limited, forfeited its bond, nothing has been done upon these claims. According to Sam Spencer, of Princeton, the owner, a 50-foot tunnel and open-cut, driven later by the Copper Basin Mines, Limited, is on his ground. Some discussion has arisen between the former Pacific Slope Mines, Limited, and the owner regarding the original description of the locality of these claims and where the work has been done. Assessment-work has been done faithfully by Sam Spencer for about twenty years.

This company was incorporated on June 27th, 1929. The registered office is situated at Room 322 Pacific Building, Vancouver. The authorized capital is \$1,000,000, divided into 1,000,000 shares, par value \$1 each. President, Percy Hugh Fraser, Vancouver; secretary-treasurer, Henry C. Duffus, Vancouver. Directors, Percy Hugh Fraser, Vancouver; Henry Cleveland Duffus, Vancouver; Bernard Leigh, North Vancouver; James Archibald MacKichan, Vancouver; James Kelman, Vancouver; John Barnes, North Vancouver; and William Leonard Wheeler, North Vancouver. Solicitors, McGeer, McGeer & Wilson, Vancouver. Under the management of Percy Hugh Fraser, this company's holdings, comprising sixty-five mineral claims, were exploited during the latter part of the year. In the vicinity of 45-Mile creek many stakes cover ground that is claimed by the *S. & M.* group. Until the entire groups of claims are properly surveyed the ownership of the ground is in doubt, and the different claimants may be minus property claimed to be owned by them. The stockholders in the Copper Basin Mines would do well to insist on a survey, so that development will be done on their own claims.

The geology of this area was reported upon by C. E. Cairnes, of the Geological Survey of Canada, in 1922. The theory that the geology is favourable does not mean that ore is sure to occur, but that in these types of rocks minable ore may be found. Several veins and stringers, widely separated and varying from ½ inch to 2 feet in width, cut across the schist and altered sediments which occur on the west side of the valley of Whipsaw creek. Recent work done consists of a combined 50-foot tunnel and open-cut, which is claimed by the owner to be on the *S. & M.* group ground. Also several cuts and stripping near the old *Fitzgerald* workings have been made farther up the creek. The ore-minerals found in these veins are chiefly sphalerite and pyrite with small percentages of chalcopyrite and galena. A picked sample from a 6-inch stringer crossing the creek on the old *Fitzgerald* claim assayed: Gold, 0.44 oz. to the ton; silver, 8.4 oz. to the ton; copper, 0.5 per cent. This property has been acquired by the company. According to the management, an old tunnel across the creek was cleaned out and extended. Only slight mineralization occurred near the mouth of this working. There is no deep development done on these properties and nothing is known at the present time regarding the possibilities of finding minable ore in the lower horizons. In the prospectus large bodies of ore are quoted as being sure to occur in depth. The scale of the prospectus map—i.e., 1 mile equals 2 inches—is incorrect and places the Granby mines much closer than they really are. The

sample assays quoted under the name of C. E. Cairnes were taken from a property that does not belong to the company.

Wheeler. This group is situated a short distance up Friday creek, which flows into the Similkameen river about 17 miles south of Princeton. The owners, A. E. Wheeler and associates, have done a great deal of development-work, chiefly low down on each side of the creek close to the cabin. Three of the tunnels were caved and could not be examined. According to the owner, these are 250, 100, and 50 feet long respectively; the first two encountered ore. On the dumps several tons of ore have been piled. Up-stream from the cabin two more tunnels have been driven on the same side of the creek. One of these, 75 feet long, contained a fractured zone about 12 feet wide which tapered to a few inches in a short drift. Across the creek a 40- by 50-foot open-cut has been excavated, but the overburden has fallen in and covered the rock-exposures to a great extent. Several tons of ore are piled in the cut. Under this hole a tunnel supposed to be 50 feet long has been driven, in which no ore was found.

The ore on the dumps and where seen in place is associated chiefly with a pink pegmatite very similar in appearance and structure to that found at Copper mountain. The ore-minerals are bornite and chalcopryrite, which are specked through a gangue of epidote, chlorite, and pegmatite, and also in solid slabs in the rock-fractures. The country-rock appears to be chiefly diorite associated with bands and segregations of hornblende and biotite. The relation of these rocks could not be determined owing to caved ground and a heavy mantle of top soil.

Whether or not there are any older volcanic rocks or sediments in the vicinity, in which larger bodies of ore may have been deposited, remains to be discovered. The occurrence is very interesting and well worth intensive prospecting at higher elevations away from the igneous rocks. There are two trails leading to the property, one from the Trans-Provincial road and survey and the other cutting across from the old tote-road.

Princeton Mining and Development Co., Ltd.—Through failure to renew its free miner's certificate this company lost a number of the claims held by it. Walter R. Gilbert, formerly of Chilliwack, one of the stockholders and later a director, restaked three claims covering part of the ground held by the company. It is understood that Gilbert now holds this ground in trust, subject to compensation by the company.

Golden Copper Co., Ltd. This company has an authorized capital of 100,000 shares, par value \$1 per share, with W. R. Gilbert as president; Francis Federici, Vancouver, as vice-president; A. C. Ray, 530 Seymour Street, Vancouver, as secretary; A. O. Topley, Chilliwack, as treasurer; and directors, W. R. Gilbert, F. Federici, John Summers, C. S. Halfnights, and C. N. Davidson. These claims cover part of Lot 40½, which is owned by S. Sheppard, and, it is understood, the base-metal rights go with the lot and cannot be claimed by the company unless paid for. An arrangement was made between W. R. Gilbert and S. Sheppard so that the latter receives payment for his rights.

Work done consisted of an upraise about 45 feet long from a point about 100 feet from the mouth of No. 2 tunnel. This was done to test the size and quality of the ore above No. 2. High-grade stringers of chalcopryrite were found which were too widely separated to be mined profitably. In No. 3 tunnel, at a point about 35 feet in from the first crosscut east, a small stope and shallow winze were driven on a 4-foot shear-zone containing stringers and lenses of chalcopryrite. A car-load of ore found in the bin was shipped and, according to the management, did not pay expenses. The financing was done by W. R. Gilbert, for which he will receive 51,000 shares for three claims and will advance up to \$11,000 if necessary for development.

Snowstorm. This group, situated on Siwash creek and owned by Frank Barber, J. Cunningham, and H. Avery, of Princeton, was developed by driving a No. 2 tunnel 140 feet long and 60 feet down-stream from No. 1 tunnel. Two veins were cut in this tunnel, varying from 2 inches to 2½ feet in width and converging towards each other. The intersection of the veins has not been struck yet. It seems likely that the vein found in the face of this tunnel is the downward extension of No. 1 tunnel vein.

Samples taken assayed as follows: (a.) Six-inch vein in crosscut, No. 2 tunnel: Gold, trace; silver, 1.6 oz. to the ton; copper, 1 per cent.; zinc, 13.4 per cent. (b.) Two and a half feet ore from face of No. 2 tunnel: Gold, trace; silver, 1.8 oz. to the ton; copper, trace; zinc, 24 per cent. (c.) Fourteen inches ore from vein, 500 feet down-stream: Gold, trace; silver, 1.6 oz. to the ton; copper, 1.4 per cent.; zinc, 16.2 per cent. (d.) Three feet ore from open-cut across creek: Gold,

trace; silver, 5 oz. to the ton; copper, 0.7 per cent. (e.) Sample ore taken at intervals from bottom of No. 1 tunnel:—Two feet ore: Gold, trace; silver, 2 oz. to the ton; copper, 0.6 per cent.; lead, *nil*; zinc, 2.4 per cent. Two feet ore: Gold, 0.44 oz.; silver, 20.4 oz. to the ton; lead, 5 per cent.; zinc, 16 per cent.

Shamrock Nos. 1 to 6. These claims, owned by J. Armstrong *et al.*, of Princeton, are situated about 23 miles up Summers creek on the west side. A mineralized zone striking in a northerly and southerly direction has been traced for about 1,500 feet along the slope of the side-hill. In open-cuts and a short tunnel near the south end the ore-zone varies in width from 18 inches to 10 feet and is made up of pyrite, chalcopyrite, and chalcocite, which has been deposited chiefly in the fractures of the porphyritic rocks. Some very attractive samples of chalcocite assayed high in copper. A shipment of this ore was made late in the year and the copper contents amounted to 5.78 per cent.

Regal. This group, situated north-east of and close to Princeton, is owned by W. C. McDougall *et al.*, of Olalla. A lease and bond was taken, it is understood, by A. G. Trites, Vancouver, and some diamond-drilling done under the supervision of J. L. Parker. The holes were drilled in the vicinity of development-work done several years ago, but owing to crushed ground very poor cores were obtained. The values were also considered to be too low grade as far as the drilling extended. There is a large area of altered volcanic and sedimentary rocks containing malachite in the fractures. Some sulphides were also found.

SUMMIT CAMP, TULAMEEN.

Silver King Mining Co. This company acquired by assignment from William B. Dornberg, Vancouver, two leases of five mineral claims, one of which is Crown-granted; i.e., *Bluebell*, *Mary E.*, *Mattie*, *Lobe*, and *Allen*, all situated at Summit camp. The leases are for a term of ten years, and one is from the Capitol Mining and Milling Company and C. C. Julian, and the other is from the Cascade Consolidated Silver Mining Company and C. C. Julian, to W. B. Dornberg. The rentals to be paid to the lessee and mortgagee is one-fourth of the net smelter returns from all ore shipped.

Since this company was formed a crew of men worked until November 1st, when operations ceased owing to trouble in the plant and severe weather. Work in No. 1 tunnel consisted of cleaning up debris and driving a short tunnel on a stringer containing sphalerite and specks of galena, also shipping sorted ore formerly mined from the stope in this level.

Work done in No. 2 consisted of timbering and cleaning up the south-west drift for 300 feet and putting in chutes, etc., preparatory to stoping. A winze was also sunk for 20 feet in the ore. At the time of examination (August 25th) no stoping had been done. When work stopped, according to the management, the stope was 50 feet long and 25 feet high, with ore exposed in the back. An intermediate tunnel was also driven for 50 feet between No. 1 and No. 2 tunnels with the idea of intersecting the vein and supplying air for stoping operations. In No. 1 tunnel the vein on the south side of the dyke has been developed to some extent, but nothing done to ascertain the value of the vein on the north side. In No. 2 tunnel the north vein is the best and similar ore may be found in No. 1. The crosscut tunnel should be produced in No. 1 to the first vein. Three car-loads of sorted ore was shipped to the smelter, containing silver, lead, and zinc.

Advice from H. C. Stephenson, manager, states that it is the intention of the company to erect a jigging and concentration plant in the spring; also No. 3 or the lowest tunnel may be cleaned out and extended in a westerly direction. A truck was employed which hauled in supplies 23 miles from Tulameen and carried sacked ore on return trips. Costs have been figured as follows: Mining, \$12; trucking, \$10; railway freight, \$8; smelter treatment, \$9.58 a ton. The first car-load lot assayed: Silver, 113 oz. to the ton; lead, 40 per cent.; zinc, 19 per cent. The other lots were lower grade owing to being sorted in the mine where visibility was poor.

Summit Camp Mines, Ltd. During the winter the *Queen Bess*, situated near Amberty basin in Summit camp, was developed by driving a crosscut tunnel 171 feet, which intersected the vein about 147 feet vertically below the outcrop. A drift was driven 33 feet on the vein each way from the crosscut. In the right drift the vein varied from 1 to 8 inches and was mineralized chiefly with pyrite and sphalerite. In the left drift the vein appeared to be widening at the face and contained segregations of galena inter-

mingled with pyrite and sphalerite. A sample of broken ore taken from this vein assayed: Gold, trace; silver, 10 oz. to the ton; lead, 5.6 per cent.; zinc, 10 per cent. The strike of the vein is N. 36° E. (mag.).

This group, consisting of five claims, is owned by John Marks, Tulameen, and **Triangle Fraction**. is situated about 6 miles up the river from Tulameen. An outcrop extending for over 150 feet along the bank of the river has been stripped and open-cut in several places. A sample taken by the owner before much work was done assayed high in gold. A general sample taken later across 20 feet of heavily mineralized rock assayed: Gold, *nil*; silver, *nil*; copper, 0.5 per cent. The rock in which this mineral occurs is hornblende impregnated with pyrite and magnetite, with occasional specks of chalcopyrite. The discovery is interesting and probably warrants development at higher elevations.

This company did a small amount of development on the *Liverpool* claim **Hope Range** near Lawless (Bear) creek. A crosscut was driven about 8 feet long from **Copper Co.** the bottom of the inclined shaft. Massive pyrite containing segregations of chalcopyrite was struck in this tunnel. A 6-foot sample taken across the dip of the vein assayed: Gold, 0.06 oz. to the ton; silver, 0.50 oz. to the ton; copper, 1.26 per cent. A general sample from the face assayed: Gold, 0.14 oz. to the ton; silver, 0.60 oz. to the ton; copper, 1.31 per cent. This ore is part of the main body developed in the tunnel above and in the shaft. An offshoot from the main porphyry dyke cuts the left corner of the tunnel from the shaft. The distance across the mineral-zone cut by the tunnel above is about 60 feet. About 500 feet from these workings an open-cut tunnel has developed rock impregnated with copper similar to that which is found near the face of the main tunnel. This is probably on the hanging-wall of the mineral-zone.

This company was formed to take over the *Red Bird* group on Rabbitt **Federation Cop-** mountain and is capitalized for \$1,000,000, divided into 1,000,000 shares of **per Mines, Ltd.** the par value of \$1 each. The directors are Frank McMahon, T. E. O'Neil, George E. McFall, Donald Matheson, and John Lucy, of Vancouver, and John Speck, of Tulameen. A Radiore survey was made on this group and, according to the owners, attractive results were obtained. Nothing will be known as to the value of results until development-work is done.

Spokane-Motherlode.—This group adjoins the Federation Copper Mines and is owned and being developed by John Osborne, Tulameen. Some attractive mineral-zones, containing pyrite and chalcopyrite, over an area several hundred feet long, have been uncovered. The ore occurs in schist.

This company, under the management of J. J. Minne, 435-6 Rogers Building, **Coalmont Gold** Vancouver, has been developing a group of claims situated on Arastra creek, **Mines.** a tributary of Granite creek, and about 6 miles south of Granite Creek village. Two or three men have been employed during the winter and early summer on an arrangement of half-cash and half-stock for work done.

A tunnel about 65 feet long has been driven on the *Vera No. 1*, close to Granite creek, and a 4-foot quartz lead developed for that distance. Occasional segregations of pyrite were found, but the vein was for the most part entirely barren of values. Higher up the hill and to the east the old *Fitzgerald* workings (now *Dora*) were cleaned out and retimbered. A new upper tunnel (elevation 5,360 feet) was driven for 30 feet to tap the downward extension of a quartz vein, 3 feet wide and 60 feet distant, which had been stripped at an elevation of about 40 feet above the tunnel. A general sample of this vein assayed a trace in gold and silver. Open-cuts and stripping uncovered the vein at intervals over a distance of about 1,500 feet on the slope. Barren quartz occurred in these cuts.

A middle tunnel, 180 feet long and about 500 feet lower elevation, was driven by former owners on a fault which cut the vein diagonally. Disintegrated quartz was found in the drag of the fault. Occasional segregations of pyrite and chalcopyrite were found in this vein. A picked sample of the mineralized quartz vein assayed a trace in gold and silver and 0.20 per cent. copper. Another tunnel about 400 feet lower and 80 feet long had been driven by the former owners. Sheared and displaced pieces of quartz occurred in this tunnel. Several samples were taken in different parts of these tunnels; but only traces of value were found. The vein varies from 2 inches to 4 feet in width and occurs as a fissure in the gabbro. A suggestion made that the crosscut should be driven from the middle tunnel has, according to the management, met with favourable results and some higher-grade ore found.

Numerous carefully selected samples taken by the management and miners are said to have assayed as high as \$77 a ton in gold and silver. There was no ore of this kind left at the mine at the time of examination. It is possible that the new ore found in the crosscut will develop into a minable ore-shoot, but much development must be done before there is any suggestion of road-building or mill-construction. General information published by this company, which cannot be substantiated by the Resident Engineer, is as follows:—

“General information of twelve mineral claims known as *Vera, Vulture, Victory, Brandon, Viking, Moonstone, Spokane, Crystal, Hope, Gold Tread, Robertson, and Bluemoon*, and situated 1 mile from the North fork on Granite creek, running north-west and south-east directions in the Similkameen Mining Division, Yale district, in the Province of British Columbia.

“*Values.*—The principal values of these claims are highly mineralized in gold, silver, with a percentage of platinum, assays running:—

Gold, \$15.80; silver, \$1.33; total, \$17.13.

Gold, \$53.60; silver, \$23.76; total, \$77.36.

Gold, \$5.20; silver, \$15.54; total, \$20.74.

Gold, \$24.39.

Gold, \$23.20; silver, \$8.66; total, \$31.86.

“*Developments.*—The property is under development with a crew of men at the present time driving tunnels and opening up veins throughout the property. The veins run straight through the entire property. The width of these veins is 4 feet and inclined to widen out to 16 feet, carrying high values in gold and silver. The veins consist of white free-milling quartz.

“*Transportation.*—Facilities for transportation are wonderful, being only 5½ miles from Coalmont, B.C., on the Kettle Valley Railway of the Canadian Pacific Railway.

“*Water and Timber.*—Plenty of water and timber for domestic purposes and for mining operations is available right on the property.

“Coalmont Gold Mines, Limited, 500,000 shares, par value \$1 each; capital, \$500,000.

“Office: 435-6 Rogers Building, Vancouver, B.C.”

The statement made that the vein-widths vary from 4 to 16 feet is entirely wrong, and the high values in gold and silver could not be substantiated. Transportation facilities are extremely difficult and road-construction is expensive.

COAL-MINES.

The coal-mines, which are dealt with in detail by the Coal-mine Inspectors, in the neighbourhood of Princeton are being developed in a way that promises a bright future for the industry. Amongst those that are shipping for local consumption, as well as the Coast market, are the Pleasant Valley Coal Mines, Lynden Coal Company, Finlay Creek Coal Mines, Tulameen Valley Coal Company, and a syndicate of local men who are mining in a small way a 4-foot seam across the Similkameen river. Other prospects are also being developed.

PLACER-MINING.

Several efforts have been and are being made from time to time to mine the bench-gravels on the Tulameen river. In the past every operation was commenced with the insurmountable handicap of not knowing the depth to bed-rock or the values to the cubic yard of the estimated yardage. It is well known that the old channels are sinuous and their location must be followed if success is to result. Most of these old channels are buried deep beneath glacial gravels which contain “spotty” values in gold and platinum. Along the edge of these moraines, next to the stream or water action, a gradual concentration of values takes place, which is apt to lead the unwary into the belief that the whole mass is similarly valuable. It is vitally necessary to churn-drill before installing machinery, and this has not been done, with the result that failure has followed. Close to Princeton some years ago a drilling campaign was financed by English capital with the idea of dredging the river-flats. Some values were found in channels, too narrow for this type of machine, but as a whole the gravels were too low grade to be profitable. This drilling was done about 22 miles from what is considered as the source of the gold and platinum, and it seems very likely that the values found were the result of reconcentration from glacial moraines rather than from direct stream-action. In any case the location appeared to be too far away from the source of the precious metals.

John Guest Leases.—These leases are situated about 2 miles below Coalmont, on the Tulameen river. The lease being worked lies on the south side of the river along the Kettle Valley

Railway. A P. 4 model, $1\frac{1}{4}$ -cubic-yard bucket shovel, with drag-line equipment, on a 50-foot boom, was installed. A grizzly and stationary 24- by 18-inch sluice-boxes have also been built. Water-supply is provided by a Fairbanks-Morse 75-80, heavy-duty, 5,000-gallons-a-minute pump through a 12-inch main. A Grant 4-inch nozzle is used for hydraulicking when the shovel is not working. The sluice-boxes are equipped with 4-inch poles, inverted rails set $\frac{1}{2}$ inch apart, angle-iron 2 inches apart, followed by perforated screens and a trap for black sands. The grade used is an 11-inch drop in 10 feet. The tailings are being dumped across the Tulameen river. Numerous pits and two shafts, 36 feet and 26 feet deep respectively, have been sunk. The former struck rim-rock. Pay-gravel found in these workings prior to the installation of machinery averaged 44 cents a cubic yard in free gold and platinum.

The total yardage moved was 32,525, but values recovered have not been received at present. A sample of black sand taken from the sluice-boxes after the first "clean-up" and after panning out all visible metal assayed: Gold, 0.80 oz. to the ton; platinum, 0.60 oz. to the ton. No large-scale attempt has been made to save these sands by concentration. The residue from the boxes is being piled temporarily. Operations have been hindered to some extent by isolated masses of boulders varying in size up to 2 cubic yards. The shovel can handle most of these boulders once they are loosened. Until a larger area of bed-rock is uncovered, so that it can be properly cleaned and room excavated for the boulders, very little can be said regarding the possibilities of this endeavour. A good deal of time was lost when boulders piled up against the grizzly and the shovel had to remain inactive.

Granite Creek Mining and Development Co.—This company installed a steam-driven shovel and sluice-boxes on a small barge in the Tulameen river at the mouth of Granite creek. A short operation proved that this type of sluice-box was too congested to handle the sands and work was stopped for the time being.

Slate Creek Consolidated Placers, Ltd.—This company continued driving the tunnel up and under Slate creek during the year. In October a total of 1,200 feet had been driven without finding bed-rock. Advice from the manager, Norman McCormick, on November 20th stated that the work was continuing and that some trouble had been encountered when an old prospect-shaft was struck, which necessitated making a detour. A 12-inch tube sunk in the drift discovered river-gravel 7 feet below the floor. The management estimates that during December this gravel should be reached with the tunnel, when the success of this project will, to some extent, be ascertained.

Big Bend Platinum and Gold Mining Co., Ltd.—Under the management of John Marks, these leases, situated about $6\frac{1}{2}$ miles up the Tulameen river from Tulameen village, were operated only a short time owing to water-shortage. A small amount of gold and platinum was recovered. This is an old high channel being worked to bed-rock and some good recoveries have been made.

Small amounts of gold and platinum were recovered from the Sootheran, Andrew Gordon, and several other leases along the Tulameen river and Granite creek.

The British Columbia Platinum Mining Company, Limited, reported upon in No. 1 Bulletin, 1920, has not, it is understood, commenced any large-scale operations up to the present time.

EASTERN MINERAL SURVEY DISTRICT (No. 5).

By B. T. O'GRADY, RESIDENT ENGINEER, AND A. M. RICHMOND, ASSISTANT RESIDENT ENGINEER.
(Reports marked * are by A. M. Richmond.)

INTRODUCTION.

The Eastern Mineral Survey District (No. 5) comprises the following twelve Mining Divisions in the West and East Kootenay: Revelstoke, Lardeau, Trout Lake, Slocan, Slocan City, Ainsworth, Nelson, Trail Creek, Arrow Lake, Golden, Windermere, and Fort Steele. The district is well served by railway and lake transportation, and the already extensive system of arterial roads is being continually extended by the Department of Public Works. To meet the especial needs of the mining industry substantial assistance, under the "Mines Development Act," has been given wherever justified by conditions. Owing to the exceptionally large number of applications received for assistance in the building of roads and trails, many hurried trips were necessitated, more with a view to determining whether assistance was warranted by the general conditions than of making extensive examinations for writing more comprehensive reports. Information is, however, submitted on all known activities, with special attention to the properties operated by companies offering shares for sale to the public. A. M. Richmond, Assistant Resident Engineer, spent a considerable part of the season in the examination of mining properties in the Slocan mining camp, which takes in the Slocan Mining Division and adjoining section of the Ainsworth Division, and is responsible for the comprehensive report on that area.

There has been a considerable falling-off in production from independent shippers, notably in the Slocan Division, but the total district production has been well maintained by the increased output from the *Sullivan* mine. The number of independent properties shipping to the Trail smelter amounted to fifty-four in 1929, as compared with sixty-four in 1928. Most of the shipments were made from mines in the Slocan and Ainsworth Divisions, the larger proportion of the tonnage consisting of lead and zinc concentrates.

When metal-market conditions improve a large increase in production from silver-lead-zinc mines can be expected, judging from the increased capacity made available at the *Sullivan* concentrator, the substantial production to be expected from the *Monarch* at Field, and the encouraging results of numerous operations still in the development stage. Under favourable conditions a very substantial contribution should be available from the Slocan district, where the silver content of the galena is an important factor in profitable production. Unfortunately, results in this section during 1929 did not come up to the optimistic predictions of the last two years. This was due to various factors, to which attention has already been directed in recent publications of this Department. In some cases insufficient development was done in advance of mill-construction, and towards the end of the year the situation was further complicated by the prevailing low metal prices and the exceptionally severe winter and low-water conditions. These circumstances have resulted in the suspension of operations at several prominent Slocan properties which had been quite recently equipped with concentrating plants. This substantial reduction in the number of active mining operations is believed to be of a temporary nature, however, and in most cases work will in all probability be resumed eventually. A graph showing the returns obtained by shippers for lead and zinc in various grades of concentrates is included in the discussion on the Slocan Mining Division, to which attention is directed. This shows clearly that only a relatively small proportion of the gross market prices of lead and zinc are obtained by the miner. Throughout the district generally, small mining and milling operations dependent upon water-power have been severely handicapped. The mining industry, therefore, is suffering from an unusual combination of adverse circumstances, which, it is confidently anticipated, will be overcome in due course.

FUTURE PROSPECTS.

Perhaps the most important factor in considering the future of mining in this district is the continued investigation of and demand for promising properties by responsible mining companies and substantial interests. The search for good prospects is permanent and is not affected by fluctuations of mining stocks or temporarily adverse market conditions. In this

connection it is satisfactory to note the entry into the district of Eastern mining engineers, who have in several cases taken up properties for their principals. The Consolidated Mining and Smelting Company has taken a leading part in the exploration of prospects and mining properties, while other large mining corporations have also been active in investigating likely prospects. A large number of these have been tried out during the last few years, but, as is usual in most mining camps, the resulting number of indicated commercial propositions is comparatively small.

There have been few new discoveries of importance during the last twenty-five years and the productive mines of to-day were discovered by the old-time prospectors, who thoroughly covered the high exposed ground in most sections. To supplement the limited number of available prospects likely to attract capital for their development we must apparently look to properly organized scientific exploration if sufficient new mineral-deposits are to be found whereby the present important mining industry is to be maintained and expanded for coming generations. In this connection considerable information is now available from the work and reports of officials of the Geological Survey of Canada, whereby it should be possible to outline certain areas, and the more favourable structures and formations within them, for intensive prospecting.

NEW DEVELOPMENTS.

Among recent developments of exceptional interest may be mentioned: Extensions to the *Sullivan* concentrator which, when fully completed in 1930, will bring its capacity to 6,000 tons a day; the commencement of the huge construction programme involved by the chemical-fertilizer plant at Trail; the completion of important improvements and additions to existing zinc plants at the Trail smelter which bring its potential zinc capacity to 400 tons a day; the completion of a 300-ton concentrating plant at the *Monarch* mine near Field; continuation of important development-work at the *Reeves-McDonald* on the Pend d'Oreille river; equipping of the *Mammoth* mine near Silverton with a 100-ton mill and 16,000-foot aerial tramway; the operations of the Galena Farm Consolidated Mines, Limited, which include the recent completion of a 150-ton mill and the construction of an aerial tram; the resumption of work at the famous old *Blue Bell* property at Riondel, on Kootenay lake; the acquisition by Spokane interests of the Cunningham holdings near Three Forks, including the *Queen Bess*, *Black Colt*, and *Idaho-Alamo* mines.

GEOLOGICAL SURVEY WORK.

Information of considerable value to Eastern Mineral Survey District No. 5 is contained in the 1928 Summary Report, Part A, of the Geological Survey of Canada, which includes the following reports:—

Geological Reconnaissance in Slocan and Upper Arrow Lakes, Kootenay District, B.C., by C. E. Cairnes.

Big Ledge (Consolidated) Property, Upper Arrow Lake, Kootenay District, B.C., by C. E. Cairnes and H. C. Gunning.

Kootenay Lake District, B.C., by J. F. Walker.

Geology and Mineral Deposits of Big Bend Map-area, B.C., by H. C. Gunning.

The geological work done in District No. 5 this season consisted of areal geology by J. F. Walker in the vicinity of Salmo and the Sheep Creek camp near Salmo. Material awaiting publication includes: The Lardeau Map-area with general geology, by J. F. Walker and M. F. Bancroft, and mineral-deposits, by H. C. Gunning; the Slocan Map-area, by C. E. Cairnes. These memoirs are being awaited with considerable interest. Recent work of the Geological Survey of Canada, together with previous publications by the same authority, now permits of an accurate correlation of the geology of the rocks of the district, and much information of economic value has been accumulated.

HYDRO-ELECTRIC DEVELOPMENT.

The large power-developments of the West Kootenay Power and Light Company had not been affected to any serious extent by the exceptionally low water conditions prevailing at the end of 1929. This company's three hydro-electric plants on the Kootenay river develop a total of about 160,000 horse-power. An application has been made to the International Joint Commission to permit the storage of flood-water in Kootenay lake, to be used to maintain the minimum flow of water required to run the power plants on the Kootenay river to full capacity

during the winter months. The Commission has ordered an investigation to determine the effect of this storage on lands in the State of Idaho, reserving judgment in the meantime.

The company has for some time been investigating power-sites on the Pend d'Oreille river. Preliminary applications for one or more dams and permission to develop power have been made to the Provincial Water Board and surveys, etc., are being carried out. Provided the right is granted, it is the intention of the company to ultimately develop over 300,000 horse-power. This power would be eventually used mainly in the fertilizer plants, but a profitable use of the remainder is expected to be found in time through the output of other products.

The company is also developing 30,000 horse-power on the Adams river, Kamloops Division, at an estimated cost of \$2,662,000. This power will be available to supply any needed electrical energy during the low-water period of the Kootenay river.

The bulk of the present power generated by the West Kootenay Power and Light Company is used at the Trail reduction-works, the rapid extension of which during recent years has called for an ever-increasing supply. The new programme of power-development is largely to meet the requirements of the chemical-fertilizer industry to be established by the Consolidated Mining and Smelting Company in proximity to the Trail smelter. The first unit of this new plant, involving a huge capital outlay, is to be completed by 1931.

The Reeves-McDonald Mines, Limited, has also applied for permission to develop hydro-electric power on the Pend d'Oreille river nearly 15 miles farther up-stream. The conflicting claims are *sub judice* at the time of writing, but in any event it would seem that important power-developments are to be undertaken on the Pend d'Oreille river in the very near future.

ELECTRICAL PROSPECTING.

The use of geophysical methods of locating ore-bodies increased considerably during the year under review. The Radiore Company made electrical surveys at the *Reeves-McDonald*; the *Aspen* property of the Salmo-Malartic Mines, Limited; the *Emerald*; the *Berengaria* property under development by interests associated with the Base Metals Mining Corporation, Limited; *Cork-Province*; *Leadsmith*; *Bluebird*; *Carnation*; and *Kootenay King*. Electrical prospecting was also conducted at the *Reeves-McDonald* by Mason, Slichter & Gauld, of Toronto and Vancouver. In every case the indicated "conductors" have been followed by diamond-drilling or underground work, but no information has yet been made available concerning the possible value of electrical-prospecting methods as at present developed.

PRODUCTION.

The following table shows the shipping-mines and tonnage produced in No. 5 District in 1929:—

Mine or Group.	Tonnage.	Character of Ore.
Windermere Mining Division—		
Lead Queen.....	14	Silver, lead.
Paradise.....	895	Silver, lead.
Trail Creek Mining Division—		
I.X.L.....	52	Gold, silver.
Mayflower.....	31	Silver, gold, zinc, lead.
Midnight.....	27	Gold, silver.
Fort Steele Mining Division—		
North Star.....	114	Silver, lead.
St. Eugene.....	138,036	Silver, gold, zinc, lead.
Sullivan.....	1,774,925	Silver, lead, zinc.
Alnsworth Mining Division—		
Cork-Province.....	5,975	Silver, lead, zinc.
Banker.....	93	Silver, lead, zinc.
Davy's Mill.....	2,333	Silver, gold, zinc.
Kootenay-Florence.....	41	Silver, lead.
Montezuma.....	316	Silver, zinc, lead.
No. 1.....	3	Silver, lead.
Revenue.....	74	Silver, gold, lead.
Silver Bear.....	43	Silver, zinc, lead.
Spokane-Trinket.....	64	Silver, lead.
Whitewater.....	23,017	Silver, gold, zinc, lead.

PRODUCTION—Continued.

Mine or Group.	Tonnage.	Character of Ore.
Slocan Mining Division—		
Alamo.....	44	Silver, zinc, lead.
Bosun.....	958	Silver, lead, zinc.
Canadian-Brandon.....	42	Silver, lead, zinc.
Colonial.....	37	Silver, lead.
Galena Farm.....	9,808	Silver, gold, zinc, lead.
Helenita.....	4	Silver, lead.
Hewitt.....	3,972	Silver, gold, zinc, lead.
Ivanhoe.....	73	Silver, lead, zinc.
Lucky Jim.....	4,379	Silver, zinc, lead.
Lucky Thought.....	396	Silver, lead, zinc.
Mammoth.....	634	Silver, lead, zinc.
Soho.....	4	Silver, lead.
Molly Hughes.....	100	Gold, silver.
Monitor.....	81	Silver, gold, lead, zinc.
Mountain Chief.....	132	Silver, lead, zinc.
McAllister.....	5,511	Silver, gold.
Noble Five.....	21,156	Silver, lead, zinc.
Queen Bess.....	63	Silver, zinc, lead.
Ruth-Hope.....	13,279	Silver, gold, lead, zinc.
Sovereign.....	43	Silver, lead, zinc.
Slocan Rambler.....	132	Silver, zinc, lead.
Standard.....	445	Silver, zinc, lead.
Surprise.....	63	Silver, lead, zinc.
Victor.....	55	Silver, lead, zinc.
Wakefield.....	40	Silver, lead, zinc.
Slocan City Mining Division—		
Two Friends.....	26	Silver, zinc, lead.
Westmont.....	29	Silver, lead.
Lardeau Mining Division—		
Multiplex.....	6	Silver, lead.
Teddy Glacier.....	7	Silver, zinc, lead.
Revelstoke Mining Division—		
Snowflake.....	30	Silver, lead, zinc, copper.
Golden Mining Division—		
Crown Point.....	1	Silver, lead.
Monarch.....	1,730	Silver, lead.
Nelson Mining Division—		
Delaware.....	17	Silver, lead.
Euphrates.....	1	Gold, silver.
Goodenough.....	337	Gold, silver, lead.
Hunter V.....	13,397	Gold, silver (flux).
Perrier.....	18	Gold, silver, lead.
Reno.....	2,008	Gold, silver.
Second Relief.....	505	Gold, silver.
Total.....	2,025,636	

GOLDEN MINING DIVISION.

The most important development in this Division was that at the property of the Base Metals Mining Corporation, Limited, near Field, where a concentrator of 300-ton initial capacity has been installed and production commenced. The *Monarch* and *Kicking Horse* mines are situated on both sides of the Kicking Horse river in Yoho Park, about 3 miles east of Field, on the main line of the Canadian Pacific Railway. The holdings of the company include the *Monarch* and *St. Etienne Fraction* Crown-granted mineral claims, the *Kicking Horse* and other claims, aggregating some 2 square miles of mineral rights held under lease from the Dominion Government. Good roads connect the new concentrator, camp, and the town of Field.

The *Monarch* mine-workings, situated on the precipitous face of Mount Stephen, are connected by aerial tram with the new concentrator, which is on a level with the railway-tracks. The early history of the property, which dates back to its staking in 1884, is summarized by John D. Galloway in the Annual Report for 1915. Work was discontinued in 1916 and no further

activity occurred until 1925, when the *Monarch*, and *Kicking Horse* property on the opposite side of the valley, were acquired by the A. B. Trites interests (Pacific Mines Development and Petroleum Company, Limited).

The opening-up of substantial ore-bodies by this company's engineer, A. W. Davis, directed attention to the important possibilities of the area and in 1928 the properties were acquired by the Goldfield Consolidated Mines Exploration Company. Subsequently a substantial interest was acquired by the Mining Corporation of Canada. The Base Metals Mining Corporation, Limited, representing the joint interests, was then formed to continue the operations, which are being conducted under the direction of F. R. Eichelberger, prominently identified with the acquisition of the properties by the American interests and responsible for subsequent participation in the enterprise by the Mining Corporation of Canada. A description of the general geology of the area is contained in Memoir 55, Geological Survey of Canada, by J. A. Allan (published in 1914). Under the chapter devoted to "Economic Geology" he describes the character of the *Monarch* deposit as follows:--

"The ore-body occurs in a band of bluish-grey limestone about 300 feet thick, which has, on the weathered surface, a slightly pinkish colour. The limestone belongs to the Cathedral formation which is at the base of the Middle Cambrian. The rock is fissured nearly vertically by a major fissure which strikes approximately S. 10° E. There are a series of cross-fissures which strike nearly east and west.

"There is a well-marked zone of sheared rock which can be readily seen from the opposite side of the valley or from the floor of the Kicking Horse river. This zone in its widest portion is approximately 500 feet wide, but it is not possible to examine it close at hand, as it occurs on the vertical face of Mount Stephen. It cuts diagonally across the bedding of the Cathedral limestones and finally pinches out on the south-west side of the mountain about 800 feet higher up, and close to the base of the Stephen formation. In the mine-workings the zone where exposed consists of a shattered mass of rock. The fragments are cemented together by calcite or by ore, so that in some places the limestone-band appears as a typical shatter-breccia. The blocks vary from a few inches in diameter to several feet. The ore-minerals, which are essentially galena, sphalerite, and pyrite, occur on and near the major and cross fissures, and also in the cementing material about these shattered blocks.

"When the fragments of limestone are small the ore-minerals may form the larger part of the cement or may frequently impregnate the blocks themselves. In some cases, but not always, there is an enrichment of ore at the junction of two fissures. In other places there is a replacement of the carbonate rock by the ore-minerals, and pockets of almost pure mineral, principally galena, occur. Some of these pockets already opened up are over 10 feet in diameter. It is difficult to outline the form of the deposit as it is now developed, because a large 'horse' of the shattered limestone sometimes displaces the ore-body several feet in any direction. The main north-south fissure, which has been followed for about 250 feet, seems to branch into several smaller ones at the inner (south) end. A fault with small apparent displacement has cut off the ore-body at this end. The upthrow has been on the south side of this break, which strikes nearly east-west. The floor of the ore-body consists of a much more massive block of siliceous dolomitic limestone, which has been less shattered about the fissure and which contains very little ore. A zone of pyrite seems to mark the lateral extent of the ore-enriched rock. The sphalerite occurs usually intimately associated with the galena, although it is occasionally found alone in certain parts of the deposit. The sides of the larger fissures are usually highly oxidized and some contain from 2 to 5 inches of gouge-clay. Assays show that the galena carries a maximum of 5 oz. of silver to the ton, but the sphalerite does not contain any of this metal.

"In general it may be said that the ore occurs along and about a series of cross-fissures, sometimes replacing the limestone and cementing together fragments of the shattered rock. The ore solutions have also spread out along the bedding-plane on top of the more impervious underlying dolomitic limestone, giving the deposit the general form of a blanket lode.

"The ore solutions have come up through the fissures and spread out into and replaced the shattered limestone in the sheared zone. It seems possible that the ore enrichment will continue in the same irregular manner so far as the shattered zone extends both laterally and vertically."

The above was written at a time when the only known ore-body was the old slightly developed *East Monarch* shoot, in which the ore has since been proved to continue beyond the supposed fault. It was formerly thought that the fissuring was alone responsible for the location

of the ore-bodies, but in view of recent work this does not seem to have been definitely established, and it is now being considered that folding is the major factor which controlled ore-deposition. In this connection C. C. Starr, in his report which resulted in the acquisition of the properties by the American interests in 1928, says:—

“The *Monarch* and *Kicking Horse* workings lie on the east limb of a gentle anticline, the axis of which strikes approximately N. 25° W. and pitches to the northward at a small angle.

“The average resultant dip is between 10° and 20° at the *Monarch* workings and from 10° to 30° at the *Kicking Horse*, both to the north-east. The dips, however, are not uniform, as the limb of the anticline is slightly ‘wrinkled’ more or less parallel to the axis of the anticline.

“Both of the known *Monarch* ore-bodies lie in gentle wrinkles, or flattened troughs, and the same appears to be true of the *Kicking Horse* ore-body. As J. A. Allan states, they also occupy a zone of intersecting fractures; these seem to have their strongest development along the wrinkles.

“A zone of brecciation, in which no bedding-planes can be observed, first shows at the talus-slope at the north-east end of the *Monarch* claim, where it is some 300 feet thick and lies directly on top of the ‘massive siliceous dolomitic limestone’ mentioned by Allan as the floor of the ore-body. It follows the top of the dolomite to a point on the cliff some 300 or 400 feet south-west of the *West Monarch*, where it begins to diverge upward, cutting diagonally across the bedding at an angle of about 15°, and finally passes from sight, well toward the apex of the anticline, at a distance of half a mile or more. This brecciated zone is from 200 to 500 feet thick and its outcrop is inaccessible, except where it emerges from under the talus to the north-east. The same zone shows clearly on the *Kicking Horse* side. It emerges from the talus north of the camp, follows on top of the dolomite to a point midway between the No. 3 and No. 4 tunnels, where it diverges and passes diagonally through successively higher strata. On the *Kicking Horse* side faint bedding or shearing planes may be seen in this zone near the talus north of the camp.

“It is rather evident that the brecciation is later than the folding, and it probably is in some manner connected with the Stephens-Cathedral fault, possibly through adjustments of strains during the faulting.”

In describing the ore occurrence Starr states that “development has indicated that the ore-bodies occur: (1) In troughs on the east-dipping leg of the anticline, coinciding with zones of intense shattering; (2) near strong comparatively recent fissuring, which is probably governed by (1); (3) with their greatest elongation to the north-north-west with a gentle pitch downward in the same direction; (4) solely within the brecciated band before mentioned as cutting across the mountains on both sides of the river.”

At the *Monarch* mine the ore so far discovered lies in two zones, one in which the *East Monarch* workings are located and the other lying at about 700 feet distant, known as the *West Monarch*. The outcrops of these ore-bodies are situated on the precipitous face of the mountain about 800 feet, almost vertically, above the railway-tracks. A trail crossing the talus-slope at the back of the concentrator continues along the face of the bluffs and gives access to both groups of workings, but beyond the *West Monarch* and above both deposits the cliffs along the ore-bearing zone are absolutely inaccessible. The rugged character of the topography has an unusual bearing on the development and working of the property, and surface exploration of the known ore-bearing areas has been confined to a few isolated points where a precarious foothold could be secured on natural ledges of rock connected up by trails and ladder-ways. To open the mine for production and to facilitate development the two ore-bodies have recently been connected by a main working-incline as shown on the accompanying illustrations. The plan and sections show the extent of the workings as at the end of October.

The principal development has been done on the *West Monarch*, which has been explored by drifting, crosscutting, and raising for a length of about 850 feet, with continuous ore throughout. The width of the deposit is about 130 feet, with a tendency to taper slightly as exploration proceeds to the south. The thickness of the ore as exposed in raises through the ore-body varies from 20 to 40 feet and an average thickness of 23 feet has been used in calculations. A few thousand tons have been extracted from the north end of the ore-body, which appears to have been as much as 40 feet thick in places. This stope was partly filled with ore from development, the disposal of ore and waste having until recently presented a difficult problem, as any material dumped from the adit-levels would fall on to the railway-line below. The whole

ore-body will, it is understood, average around 26 per cent. combined metals, in the proportion of, roughly, 14 per cent. lead and 12 per cent. zinc. The silver values will approximate 1.7 oz. to the ton. The lead content, and proportionately the silver, has been noticeably increasing as development progresses to the south. According to advices just received from the mine, the average assay for the last 140 feet of drifting, not taken into consideration in calculating the average values previously mentioned, is: Silver, 3.1 oz. to the ton; lead, 17 per cent.; zinc, 18 per cent.

Summarizing impressions of the *West Monarch*, the ore-minerals are remarkably uniform in distribution for a deposit of this character and there is no indication of the southerly limit of the ore-body having been reached. Only a few hundred feet of exploratory work has been done on the *East Monarch* deposit beyond the old stope, 350 feet long, from which past production was made. In the new workings a substantial body of ore has been partially explored by drifting, crosscutting, and raising, but this work is not sufficiently far advanced to indicate the possible dimensions of this deposit, which, however, occurs under conditions similar to the *West Monarch*. The comparatively small tonnage definitely assured in the *East Monarch* will average about: Silver, 1.9 oz. to the ton; lead, 20 per cent.; zinc, 14 per cent. The possibility of finding other ore-bodies in the vicinity of the known deposits is indicated at several points where similar physical conditions apparently prevail. In this connection a study of the inaccessible *Monarch* cliffs with field-glasses has been made by the company's geologist and several favourable positions for ore have been observed in parallel zones of folding, accompanied by fissuring and shattering of the ore-bearing stratum. The rocks are bare and devoid of vegetation, and the dolomite-band, above which the known deposits occur, can easily be followed with the naked eye. On account of the shape of the ore-bodies and their relation to the accessible part of the surface, diamond-drilling from the surface is impracticable and underground tunnelling must be resorted to for both exploration and development.

The *Kicking Horse* mine, situated on the bluffs on the opposite side of the valley, develops ore-bodies in the same formation and of similar character to those at the *Monarch*. The workings, at an elevation of about 900 feet above the valley, are reached by a trail leading first over talus-slopes, then along a bench between cliffs to the tunnels. There was no activity at this mine when the area was visited in October and the workings were not inspected. However, it is understood that only a comparatively small amount of work has been done during 1929 on this side of the valley and that the situation has not changed materially since these workings were described by A. G. Langley in the Annual Report for 1928. It was estimated at that time that approximately 50,000 tons of ore had been developed which contained 20 per cent. combined metals, the zinc predominating, with 2.5 oz. silver to the ton. According to the management, the combined total tonnage of ore developed, including the *Kicking Horse* deposits, amounted to some 320,000 tons in October, since when the ore reserves appear to have been very substantially increased by the southerly extension of the *West Monarch* as reported by F. R. Eichelberger.

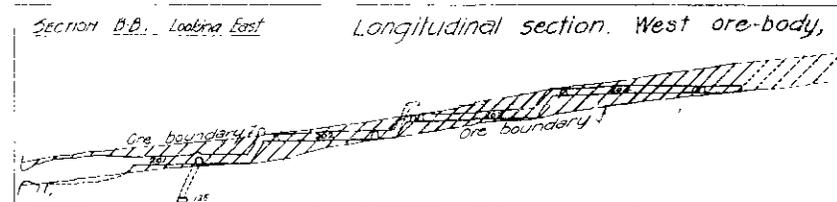
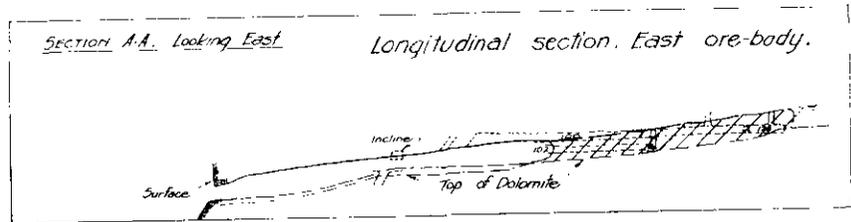
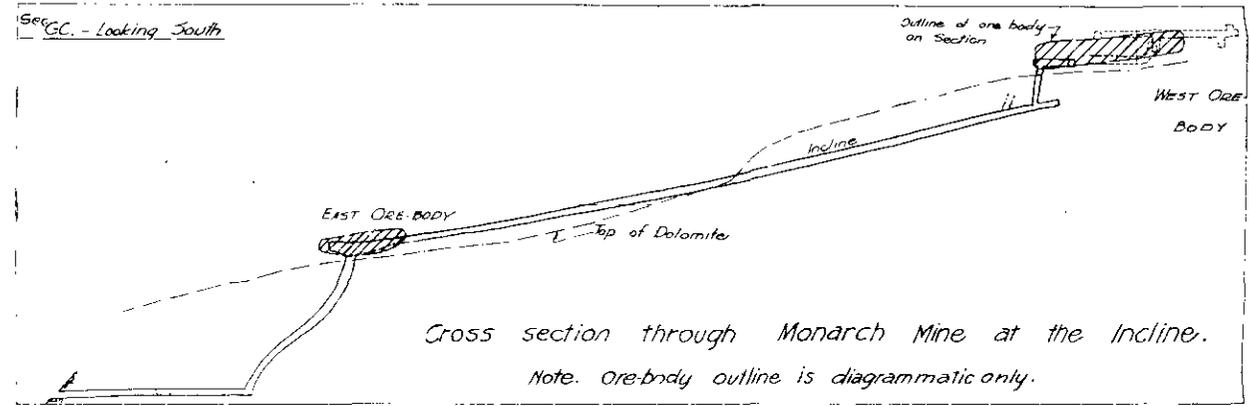
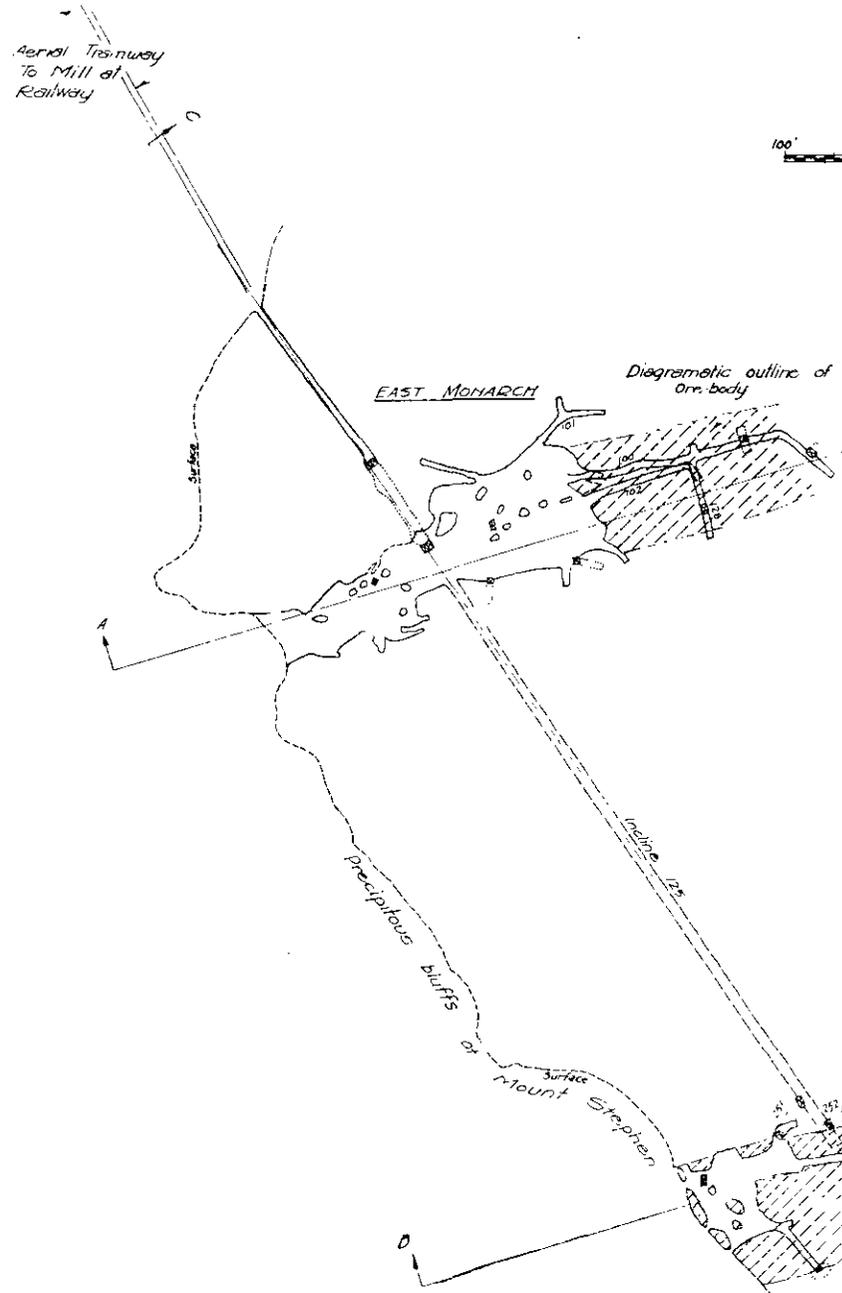
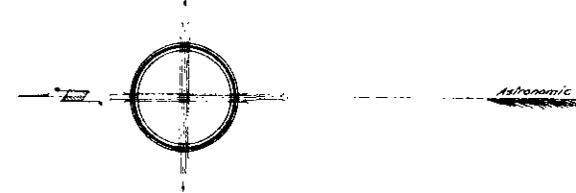
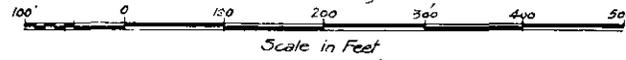
Situated in the most spectacular scenery of the Rocky mountains, the *Monarch* property is very conveniently located, the concentrator being right on the main line of the Canadian Pacific Railway.

The mill flow-sheet shown on the accompanying illustration follows modern standard practice. All the machines are electrically driven by two 420-horse-power, type Y Fairbanks-Morse Diesel engines, direct-connected to Westinghouse a.c. generators and exciters. In addition, there is a 180-horse-power Diesel engine of similar type, direct-connected with a Sullivan angle compressor, to supply air to the mine. The mill has been designed so as to permit of considerable expansion, at comparatively low cost, when warranted by development. Provision has been made in the power plant for installation of an additional 420-horse-power unit in case the mill capacity is eventually increased.

Production was commenced about the end of November. Recoveries made are reported to have been highly satisfactory, considering the comparatively short time that the plant has been running. According to latest information from the management, no difficulty has been experienced in keeping the lead concentrates to 75 per cent., with a saving above 96 per cent. Some trouble was experienced at first in keeping the zinc concentrates above 55 per cent. A product containing as high as 61 per cent. zinc was made, but the tailing ran up a little too high, and better results are now obtained by maintaining an average containing from 57 to 58 per cent. zinc. The mill has been running three shifts, and the tonnage milled, which at first was from

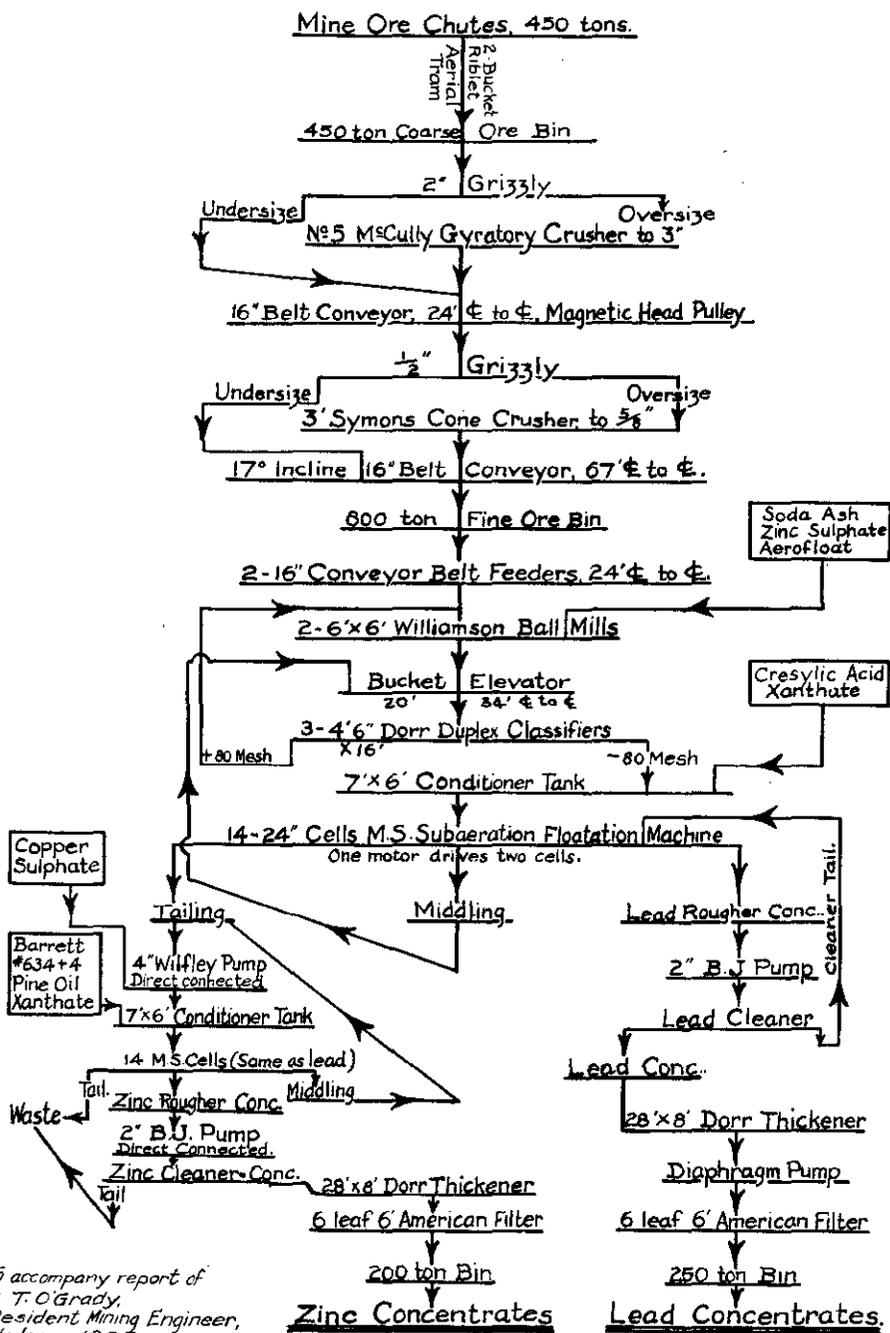
PLAN OF MONARCH MINE

FIELD, BRITISH COLUMBIA
Golden Mining Division.



To Accompany report by B.T. O'Grady
Resident Mining Engineer, Nelson, 1929.
B.C. Bureau of Mines.

BASE METALS MINING CORPORATION, LTD., FLOW SHEET OF CONCENTRATOR, MONARCH MINE, FIELD, B. C.



To accompany report of
B. T. O'Grady,
Resident Mining Engineer,
Nelson 1923.
B.C. Bureau of Mines.

1,200 to 1,400 tons a week, is gradually being increased as the men get used to the chemicals in the circuits. No serious troubles have been experienced in spite of the exceptionally severe weather prevailing at the end of the year, the buildings having proved warm and comfortable.

This group of claims is situated on the northern side of the Spillimacheen river at a distance of between 6 and 7 miles by road from the railway. The elevation at the camp is about 3,000 feet above sea-level. The property was acquired by A. B. Trites in 1926, since when a considerable amount of underground work has been done and some diamond-drilling. The ore consists chiefly of argentiferous galena disseminated throughout a gangue of barytes. Chalcopyrite and bornite are occasionally associated with the lead sulphide, but not in important amounts.

According to C. S. Evans, of the Geological Survey of Canada, the country-rock of the deposit is the Ottertail limestone of lower Upper Cambrian age, usually fine-grained, light-weathering, light-grey siliceous dolomitic limestone. In general the mineralization occurs as bedded and irregular replacements in this limestone. Large widths of low-grade lead ore exposed in surface and underground workings present possibilities for the development of a large tonnage. Exploration by a succession of tunnels has proved mineralization to be persistent throughout a considerable vertical range, but in lateral extent continuity of the showings has not yet been definitely established. The baryte, apparently free from impurities, occurs in considerable quantity. An analysis of a sample gave: Barium sulphate, 96.76 per cent.; specific gravity, 4.72. A large quantity of this grade of material could probably be mined if a market could be developed for it.

When the mine was visited in October the new low-level crosscut tunnel had recently cut through the vein, which is here about 40 feet wide. Of this, about 26 feet consisted of low-grade silver-lead mineralization, with which some bornite and chalcopyrite were associated in places. Drifting had been commenced along the hanging-wall side of the wide vein and subsequently it is understood that some crosscutting was done from the easterly drift. The more important past references to the *Giant* are contained in the Annual Reports for 1923, 1927, and 1928.

This property, consisting of two Crown-granted claims, the *Toronto* and *Toronto.* Simcoe*, is situated on the eastern side of the Spillimacheen river at an elevation of 3,400 to 5,000 feet above sea-level, 6 miles north of Spillimacheen Station and 1 mile south-east of the *Giant* property.

Two short tunnels and one open-cut constitute the development-work at this property. The most southerly or No. 1 tunnel is but 15 feet long and was driven in on a baryte-filled fissure in the limestone. The baryte has been impregnated with small amounts of copper sulphides which have weathered to give the malachite and azurite now found. At the portal of this tunnel, which is at an elevation of 3,950 feet, a sample taken across a width of 24 inches assayed: Gold, 0.04 oz. to the ton; silver, 1.1 oz. to the ton; copper, 2.26 per cent. Thirty-five feet below No. 1 tunnel an open-cut, 4 by 15 feet, disclosed malachite and azurite in a baryte gangue in close proximity to the limestone. The width of copper mineralization in this open-cut was 1 foot.

About 500 feet to the north and at an elevation of 4,075 feet a 40-foot tunnel has been driven N. 30° W. on a narrow calcite and quartz-filled fissure in the limestone. Values in this stringer, which has an average width of 4 to 6 inches, are fairly persistent throughout the length of the tunnel, and a sample near the face across a width of 6 inches assayed as follows: Gold, 0.04 oz. to the ton; silver, 1 oz. to the ton; lead, 15.6 per cent.; zinc, 0.45 per cent.; copper, 0.44 per cent.

The Witwatersrand Syndicate, Limited, a privately financed company formed in Eastern Canada, controls a group of ten claims at the headwaters of the North fork of McMurdo creek, which creek in turn is a tributary of the North fork of the Spillimacheen river. The claims, consisting of the *New Crown Point*, *King Midas*, *New Midas*, *Rialto*, *Rialto Fr.*, *Regina*, *Royal Sovereign*, *Royal Sovereign Fr.*, *Viking*, and *Viking Fr.*, are reached by a 40-mile trail from Parson, a station on the Kootenay Central Railway 23 miles south of Golden.

Three places on the property have been developed to some extent by G. W. Edwards during the past few years. He is still in charge of the development programme. The showings are of two types, the first consisting of small mineralized quartz stringers and veins striking normal to the schistosity of the country-rock, a chlorite-schist, and the second consisting of interbedded

slates and limestones, in which the limestone has in places been replaced by galena and sphalerite carrying silver values.

At the "A" showing, the most easterly of the three showings, considerable drifting, cross-cutting, and sinking at 7,000 feet elevation has been done on one or two of the bands of mineralized limestone and along some of the small quartz-filled fissures. Still farther to the east of this development-work an outcrop of mineralized limestone is apparent, but to date development has been very limited and it is not possible to form any opinion as to the value of the showing. Eight hundred feet to the west of "A" there is stated to be an outcrop of banded limestone carrying galena and silver values. This showing, called "C," was not examined.

The "B" showing, 1,600 to 1,800 feet west of "A," has been developed by two tunnels, one at 6,100 feet and one at 6,030 feet elevation, and both drifts showing galena mineralization in quartz-filled fissures. About 100 feet below the 6,030-foot level the top of the bedded limestone and shale was discovered, but at this place it was unmineralized. There is an open-cut 30 feet above the upper tunnel at 6,130 feet elevation which shows 3 feet of well-mineralized quartz, the values being chiefly in galena and silver.

During the season of 1929 extensive repairs were made to the transportation facilities. The trail was brushed out to permit the use of caterpillar tractors and go-devil sleighs and wheeled buggies. An air-compressor and oil-engine were taken in to the mine camp and installed. Supplies to enable winter operations were also transported to the mine and late in the fall a small crew of men was put to work on further underground development on the "A" showing.

This group of claims is situated on Vermont creek, a tributary of Bobbie Ruth-Vermont. Burns creek, about 35 miles from Spillimacheen, on the Kootenay Central Railway. The property, described by A. G. Langley in the Annual Reports for 1926 and 1927, was acquired by the Galena Syndicate, of London, in 1926. The principal showing, a replacement deposit, up to 50 feet wide, of low-grade silver-lead-zinc ore, is considered to have possibilities warranting exploration with a view to the development of a large tonnage. On other parts of the property there are a series of small fissure-veins from which some high-grade ore has been extracted.

In 1928 and 1929 the progress of development-work has been restricted and during the latter year a small crew under the direction of C. W. Riley has been chiefly engaged in trying to ship ore. According to latest advices, a contract had been let to haul 400 tons, but up to the end of the year only a few tons had been hauled to Spillimacheen. The *Ruth-Vermont* is handicapped by the existing rough road connections and no profitable results can be expected from shipping ore under present conditions. The property needs systematic exploration with a view to blocking out sufficient tonnage to warrant its equipment for the production of milling-ore.

At this property, situated at the head of Bobbie Burns creek, 30 miles by trail from Spillimacheen, no mining activity has occurred for some years. During the summer, however, the deposits were very thoroughly investigated by W. R. Jones, of the geological staff of the Royal School of Mines, London, and F. H. Gill, mining engineer. Presumably the examination was made for English interests associated with the Alpha Mines Syndicate, Limited, which financed the exploratory work done in 1922 and 1923. The Annual Report for 1922 contains a description of the property by A. G. Langley and work was discontinued early in 1923.

Reports, allegedly written by Julius Rickert, self-styled mining engineer and geologist of Calgary, have recently been circulated in connection with **United Resources Development Co., Ltd.** "titanium and iron-ore deposits" at the head of Moose creek, in North-east Kootenay. A blue-print accompanying the typed report, allegedly signed by J. Rickert, includes an exaggerated section through the mountain indicating vast bodies of titanium and magnetite. In the body of the report the following definite statements occur which substantiate the impression given by the section: "The whole mountain is mineral"; "immense iron and titanium deposits at the head of Moose creek"; "millions of tons of these minerals are awaiting extraction."

The explanation of all these superlatives can be found in the Summary Report, Part A, 1925, of the Geological Survey of Canada, under "Knopite and Magnetite Occurrence, Moose Creek," by H. V. Ellsworth and John F. Walker; also in Geological Survey of Canada, Memoir 55, "Geology of the Field Map-area," by J. A. Allen. J. Rickert's report evidently refers to the basic rocks of the area as described in these publications. These rocks contain titanite in

most cases, but this is only of scientific interest and no great body of valuable "mineral" is known. The United Resources Development Company, represented in Rickert's report as owning the property, is not registered in British Columbia and so far has no company free miner's certificate. The properties to which the report has reference are the *Porcupine*, *Grizzly*, and *Goat* groups, aggregating seventeen claims owned by Calgary interests.

A report allegedly written by the same author, J. Rickert, of Calgary, has **Interprovincial Oil, Gas, and Mineral Syndicate** also been circulated recently in connection with claims represented by him as being owned by this syndicate of Calgary. The names of the property or claims are not specified in the typewritten copy forwarded to this office, but the property, consisting of fourteen claims, is described as being situated in Copper Butte basin, tributary to Bugaboo creek and the Columbia river, 24 miles from the Kootenay Central Railway. On inquiry at the Gold Commissioner's office at Golden it was ascertained that the claims in question were located by R. McKeenan, H. W. Conover, and associates, of Castledale. No reliable information is yet available and the claims have never been examined by engineers of this Department. The Interprovincial Oil, Gas, and Mineral Syndicate is not yet registered in British Columbia and so far has no company free miner's certificate. No recent activity, other than assessment-work, is reported.

PLACER.

Quartz Creek.—Minor placer activities occurred on Quartz creek, south of Beavermouth, on the main line of the Canadian Pacific Railway. The Quartz Creek Syndicate, which had operated there previously, has not been active and the leases have been cancelled.

WINDERMERE MINING DIVISION.

Mining activities have somewhat declined in this Division and prospecting has been less than usual. Many of the mines are situated at high altitudes and at considerable distances from the railway, so that, with rare exceptions, operations are at present necessarily of a seasonal nature, work being discontinued during the winter months.

Lead Queen. This mine is situated near the headwaters of Frances creek at a distance of approximately 24 miles by road from the railway at Brisco. The property was acquired by New York interests in 1925, since when exploration has been continued with a moderate crew during each summer season. Recent work has been chiefly confined to driving a lower tunnel to develop the vein at an additional depth of 500 feet below the upper workings. The mine has been closed down for the winter months, operations being severely handicapped during this period by the high altitude of the property and its distance from transportation.

HORSETHIEF CREEK AREA.

Pretty Girl. At this property, situated on the summit between Slade and Law creeks at an elevation of about 8,800 feet, exploratory work was carried on by the North Kootenay Mines, Limited. A proposed visit to the property, postponed until the late fall owing to pressure of other work, was not made as work at the mine had then been suspended and the crew withdrawn. Previous to its acquisition by the above company in 1928 the *Pretty Girl* had remained idle for many years. References to the old workings are contained in the Annual Reports for 1898 and 1915. The ore is described as grey copper containing substantial values in silver and copper.

White Cat. This property, largely owned by J. C. Pitts, of Invermere, is situated on the south side of Slade creek at an elevation of 7,250 feet. Some new surface showings are reported to have been uncovered by recent prospecting-work and more claims have been staked around the original group. Shipments of high-grade lead ore were made in 1924, 1925, 1926, and 1928, and references to the property are contained in the Annual Reports covering the same period.

Grotto.—At this property on Horsethief creek there has been no activity other than assessment-work. The Kootenay Giant Mining Company was incorporated in 1928 to develop the *Grotto* and other claims in the vicinity.

Prospects in the Horsethief Creek area which have been actively prospected by their owners include the *Myrtle* group, where J. Morigeau has been busily engaged, and the *Bald Eagle* group, where J. Burman worked all summer.

TOBY CREEK AREA.

Paradise.* This mine is situated 19 miles by road west of Lake Windermere Station on the Kootenay Central Railway. The lowest level of the mine at 7,800 feet above the level of the sea is approximately 1 mile above the railway. The road to the property extends from the station, through Invermere, 11 miles up Toby creek to Pinehurst (Jackpine flat), and from there 8 miles up the steep mountain-side in a series of switchbacks to the mine camp at 7,400 feet elevation.

The property is an interesting one. It was first owned by the Hammonds and later by the Hammond Estate. The control then passed to R. R. Bruce, now Lieutenant-Governor of the Province, who successfully operated the mine until 1926, when it was acquired by the Victoria Syndicate, of London, at that time under the management of R. H. Stewart.

When the property changed ownership in 1926 a 50-75-ton flotation-mill was constructed at the mine. This was operated with varying success and disappointment until the summer of 1928, when experimental work had demonstrated and solved most of the metallurgical difficulties. The mine and mill, however, were closed in November, 1928, and some of the heavy mill machinery was moved to Pinehurst, where it was proposed to reconstruct the mill. This step would eliminate the heavy charges for hauling supplies, oil, etc., up the mountain road to the mine. Surveys and tentative profiles for a 4-mile aerial tramway from the mine to the new mill-site have been made in anticipation of the move.

During the past year a few men have been employed under the technical direction of H. H. Yuill and the personal supervision of R. Macdonald, mine superintendent, in drifting and crosscutting off the 7,800-foot level of the *Paradise* mine on the *Shamrock* claim. When the property was visited in October four men were employed in hand-mining on this development. Late in December a new company called the Paradise Holdings, Limited, was formed to take over the *Paradise* group and the new company has stopped all development-work. The option on the *Shamrock* group has been dropped and future plans of the company are not known at the time of writing.

Detailed references to this property are contained in the Annual Reports for 1903, 1915, 1917, 1925, and 1927. Memoir 148, written by J. F. Walker, of the Canadian Geological Survey, supplies very useful data relative to the geology of the Windermere district and of the *Paradise* mine.

Look Out. This prospect is situated on Delphine creek and is described in the Annual Report for 1924 under *Outcrop* and *Outlet*. The claims were acquired by the Kootenay Metals Corporation, Limited, in 1928, since when prospecting-work has been carried on at intervals.

Mineral King. This property, situated at the end of the Toby Creek road, about 24 miles from the Kootenay Central Railway, was worked during the latter part of the season by a small crew of men under the direction of J. L. McKay. A crosscut tunnel was being driven by hand to test the westerly extension of the vein at depth. The *Mineral King* was described in the Annual Reports for 1920, 1921, and 1922, which covered the preceding period of activity.

Bear Group.—Some claims adjoining the *Mineral King* have been acquired by V. Sontag and associates, of Seattle, and some prospecting-work was carried on during the summer.

Minor prospecting activities also occurred at the *Lucky Boy*, owned by J. Taynton, and the *Silver Spray*, owned by M. McLeod, both prospects being on Copper creek, tributary to Toby creek.

FORT STEELE MINING DIVISION.

Sullivan. At Kimberley important extensions were made to the *Sullivan* concentrator, whereby its capacity was increased from 4,000 to 6,000 tons a day. The enlargement of this great mill has been carried out in stages, whereby it has been possible to treat a gradually increased tonnage. The tonnage treated during 1928 was on a basis of 4,000 tons daily, at which rate it was found that the crushing and grinding facilities were taxed to the limit, though the balance of the mill equipment ran at normal rating. This inequality has been adjusted and the extensions have provided more crushing and grinding equip-

ment proportionately than of equipment for other services. Fine-ore bin capacity of 9,500 tons is now available. The only radical change in treatment effected is thickening between classification and flotation. For the fine crushing the roll plant has been rebuilt. A 7-foot Symons cone crusher reduces ore received from the primary crushing plant at the mine to $\frac{3}{4}$ inch; this product passes over Hummer screens in open circuit and through two sets of 72- by 20-inch rolls in parallel which reduce it to $\frac{3}{8}$ -inch size. The fine-grinding equipment has been increased by two primary and four secondary 10-foot by 48-inch Hardinge ball-mills. In the mill extension fifteen Aikens classifiers have been installed. The ground pulp is thickened in two Genter vacuum thickeners introduced between classification and flotation to permit control of desirable densities in the adjacent treatments. Eight-inch Wilfley sand-pumps replace the 6-inch units formerly in use for secondary mill circulating loads. Flotation installation has been extended 50 per cent. The new equipment consists of 24-inch Mineral Separation subaeration-type machines with texrope-driven spindles. Retreatment and cleaning operations remain unchanged and the same applies to the boiler and turbo-generator plant.

The purpose of this increase in milling capacity is essentially to augment the ore reserves of the *Sullivan* mine, in that by providing facilities for the treatment of a larger tonnage it will be economically possible to include material of a lower grade than heretofore sent to the mill. On the other hand, it is not expected that the metallic output will be proportionately greater. Several of the new units in the grinding and flotation sections have been in commission since the middle of April, when the tonnage treated was increased to 5,000 tons a day. Towards the end of the year about 5,200 tons was being milled. The average daily tonnage milled throughout 1929 was about 4,821 tons.

Concurrently with extensions at the concentrator, the *Sullivan* mine has been prepared to handle the increased tonnage. The character and geology of the deposits, history of the property, and mining conditions have been exhaustively dealt with in technical publications and past Annual Reports. In the Annual Report for 1928 an ideal section through the mine, showing the relations of the main workings of the ore-body, is reproduced, together with quotations from a published technical paper by D. L. Thompson, assistant mine superintendent. An interesting paper of similar character was presented by J. R. Giegerich at a recent meeting of the Alberta branch of the Canadian Institute of Mining and Metallurgy at Lethbridge. This address is in part a concise recapitulation of information previously given out, but also includes some interesting new features. In regard to the problem of withdrawing huge pillars of ore in the mine, he says: "With present mining operations about 30 per cent. of the ore is being left in pillars. This problem of recovering pillars has been undertaken during the past year by replacing the ore pillars with reinforced-concrete pillars. One pillar, 40 by 60 feet and averaging 60 feet high, has already been placed in the mine and work is being done on a second. The pillar is made with a wall of concrete 3 feet thick heavily reinforced with old rails, scrap-irons, etc. The interior is being filled with waste rock from the mine and lean concrete being run through it at various stages. Where the vein does not exceed a thickness of 100 feet this is considered the most economical and safest method of recovering the present ore pillars."

Development, carried on at the rate of 1,000 feet a month, has been kept well pace with production and more ore is being continually added to the already immense ore reserves above the main haulage-level. While these are known to be sufficient to provide for many years' continuous operation, it is understood that a sinking programme is already under consideration to block out the ore reserves explored by diamond-drilling at deeper horizons. Total shipments of all classes of ore to the end of 1929 are estimated at 10,178,000 tons. Development footage amounts altogether to 21 miles, which is small compared to the value of the ore produced and reserves made available.

The mine works six days a week to provide ore for seven days' operation of the mill, so that the daily output of the mine has to be proportionately greater. The total tonnage mined is hauled from the 3,900-foot level. Production comes from five working-levels—namely, the 3,900, 4,250, 4,400, 4,500, and 4,600, in each case representing their actual elevation above sea-level. The largest percentage of the ore mined is broken in stopes off the 3,900-foot level, where the ore-body has reached its maximum thickness of 260 feet. The 4,600- and 4,500-foot levels are the working-levels of what is known as the "upper mine" and were the entire source of ore won prior to 1919. The 4,250- and 4,400-foot levels are intermediate levels opened up after the completion of raises connecting the 3,900-foot level with the "upper mine."

Recent additions to the mine plant include two electrically-driven, 3,000-cubic-foot, 2-stage Bellis & Morcom compressors, which, together with three other electrically-driven compressors and one water-driven machine, give a combined capacity of 21,000 cubic feet a minute. The old power-house and machine-shop have been replaced by fire-proof buildings of brick and steel. Electric-haulage facilities have been increased by the addition of a 300-kw. motor-generator set. An electric furnace manufactured by the General Electric Company, of Birmingham (England), is shortly to be installed in the mine and in future all drill-sharpening will be done underground.

An interesting side-issue connected with the mining end is the utilization of waste picked out of the ore at the mine rock-house, consisting of cherty material, which is being crushed and hauled away by the Canadian Pacific Railway, at the rate of about 500 tons a week, for use as track-ballast. Many other innovations and improvements, both underground and on the surface, have been made which add to the efficiency of this great operation.

Stemwinder. This mine, situated on Mark creek, a short distance above the *Sullivan* mine, has not been actively operated since 1927, when work was discontinued by the Porcupine Goldfields Development and Finance Company, Limited. The property was acquired in 1929 by the Consolidated Mining and Smelting Company, but no activity has yet materialized.

North Star. This property, situated on the hill above Mark creek, opposite the *Sullivan* mine, has been closed down since the Porcupine Goldfields Development and Finance Company relinquished its option some years ago. In 1929 Mike Kinsella and associates leased the property and shipped about 114 tons of ore derived from jiggling dump material.

Aurora.* This property is situated on the western shore of Moyie lake, almost directly west of the old *St. Eugene* mine of the Consolidated Mining and Smelting Company. During the early part of 1929 a new company, called the *St. Eugene Extension Mines, Limited*, was formed, and includes amongst its holdings the *Cambrian* and *Guindon* groups, an option on the *Aurora*, and a lease on the *St. Eugene*. Future plans of this company, which is under the technical guidance of R. R. Wilson, call for the unwatering of the *St. Eugene* shaft to a depth that will allow a westerly exploration of the fissure-zone of the *St. Eugene* to be undertaken.

At the *Aurora* a crew of twelve to fifteen men was employed during the summer and fall in development and exploration work on an east-west striking fissure-zone that is believed to be the westerly extension of the *St. Eugene* vein system. A winze sunk from the No. 2 level is reported to have struck encouraging sulphide mineralization and the extension of the No. 3 tunnel has been stated to have been attended with satisfactory results. More detailed information relative to the *Aurora* is contained in the Annual Reports for 1923 and 1926.

Moyie Concentrator.—At Moyie operations were continued on the recovery and re-treatment of the old *St. Eugene* mill tailings by the Consolidated Mining and Smelting Company, though this source of feed is now definitely exhausted. The concentrating plant, built in 1926, has been singularly successful and the old tailings, for many years wasted into the lake, provided feed for a considerably longer period than was originally calculated. Equipped with coarse-crushing machinery, the Moyie concentrator has also been utilized to treat a considerable tonnage of oxidized dump-ore from the *Sullivan* mine. Operations at the Moyie mill were discontinued towards the end of the year.

Kootenay King.* This property is situated on the north slope of the Wild Horse creek at an elevation of 7,000 to 8,000 feet above sea-level and 11 miles from Fort Steele.

Six miles of road from Fort Steele terminates at the packers' camp, from which point a 5-mile trail leads to the camp-site at 6,500 feet elevation. The ground was originally developed in a small way by W. Meyers, the owner, until in 1928 it was acquired by the Kootenay King Mining Company from W. B. Dornberg and associates, who had bought the property from W. Meyers in 1925. In the fall of 1928 the Britannia Mining and Smelting Company optioned the property from the Kootenay King Mining Company, built a cabin, and did a limited amount of underground work, the results of which were published in the 1928 Annual Report. Work was resumed by the Britannia Company in the spring of 1929, with W. Selnes in charge. Two Rix air-compressors, a steel-sharpener, oil-furnace, and Gardner-Denver drifters were installed at the mine and underground operations on the No. 2 and No. 3 levels pushed ahead with all possible speed. The following notes regarding the results of the past season, which led to the

option being dropped at the end of November, have been supplied by the Britannia Mining and Smelting Company:—

“In No. 2 tunnel drifting commenced in ore, but mineralization was irregular and gradually weakened, finally giving out after the drift had been advanced 50 feet. Assays failed to indicate much of it being commercial.

“Crosscuts driven in the ore-zone indicated a thin lens of mineral lying at the crest of a sharply overthrust fold and overlain by barren quartzites.

“The drift was driven ahead 99 feet, but the last 49 feet were in barren quartzites and argillaceous quartzites. Crosscuts and diamond-drill holes failed to reveal commercial mineralization extending beyond the end of the drift. A drill-hole put vertically down in the mineralized zone was in barren quartzite throughout.

“The No. 3 tunnel was driven ahead 500 feet to penetrate the area below No. 2 tunnel and prospect for the possible downward extension of mineralization encountered in the tunnel above. It failed to encounter any ore. No. 3 tunnel now extends a short distance farther north than does No. 2.

“During the year about 3,400 feet of diamond-drilling was done, 2,600 feet from the surface and 800 feet underground. All the underground drilling was done in No. 2 and No. 3 tunnels and was barren. The surface drilling encountered 3 feet of mineralization in one hole. A drill-hole put vertically below this failed to indicate any downward extension. A thorough Radiore survey of the main claims was made.

“The surface cuts and the short adit-tunnel immediately below the outcrop, together with the diamond-drilling done in the fall of 1928, showed up some very promising silver-lead-zinc mineralization.

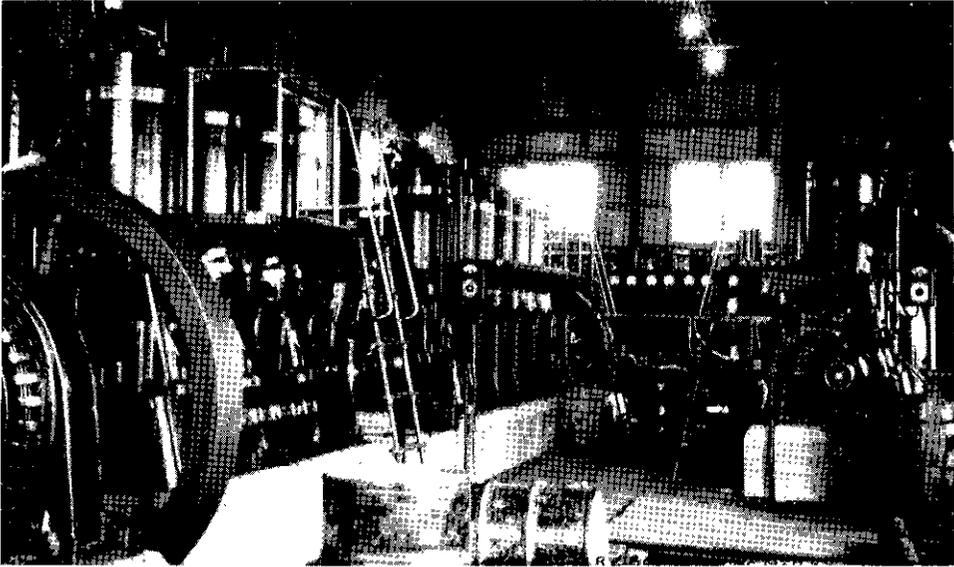
“The extensive diamond-drilling, electrical surveying, and underground drifting and cross-cutting campaign of 1929 failed to materially increase the previous indications, while it did, over a considerable area, indicate that no further mineralization of importance existed.”

Since the Britannia Mining and Smelting Company withdrew from the property in November, 1929, it has been reported that the Kootenay King Company will do further development-work at the property in the spring of 1930.

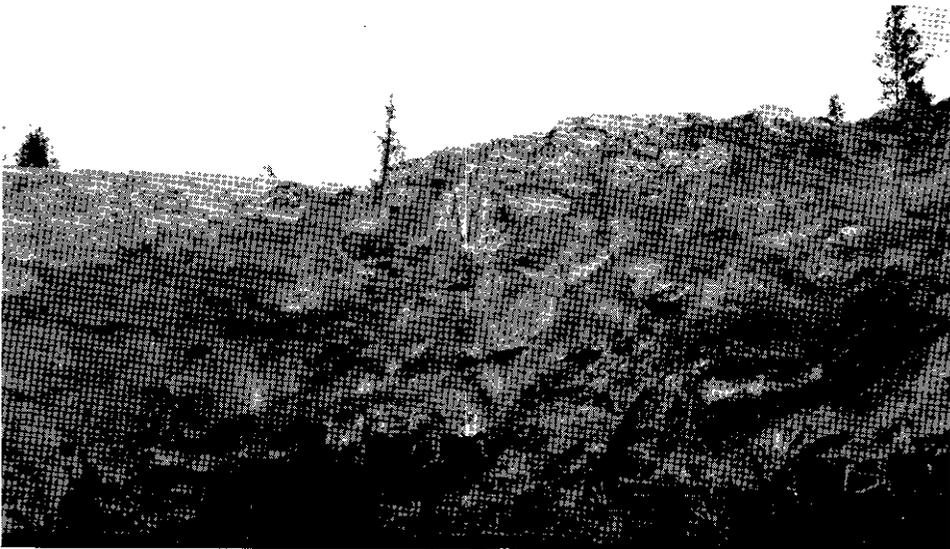
The Kootenay Selkirk Mining Company was formed in the spring of 1929 for the purpose of developing thirty-five mineral claims situated in Grundy basin, 8 miles north-east of Fort Steele. The company is capitalized for 2,000,000 shares, no par value, under Dominion charter, and P. A. McGrath, of Cranbrook, is manager. The stock of the company has not been put on the market and the development-work done during the past year is stated to have been financed by a small syndicate of Cranbrook men.

The claims are reached by road from Fort Steele and a 4-mile trail up Saugum creek to the camp-site at an elevation of 6,500 feet, where two substantial log cabins have been erected to accommodate the crew of three to five men employed. The formation in the vicinity consists of argillites and quartzites of the Aldridge formation that have been intruded by diorite sills and stocks. In the quartzites close to the contact of a diorite stock narrow quartz veins have been mineralized with galena containing small silver values.

Development-work during the past season has been confined to drifting on the 7,200-foot level and open-cutting and drifting on the 7,050-foot level. The mineralized quartz vein, which strikes N. 50° E. and dips at 70° to the north-west, varies in width from 8 inches to 4 feet. The mineralization occurs as lenses of galena in the quartz, and when the property was visited early in the summer a sample was taken across a representative width of 14 inches at the face of the 7,200-foot level, then in 30 feet from the portal. This sample assayed: Gold, trace; silver, 14 oz. to the ton; lead, 60 per cent.; zinc, 0.3 per cent. Since the property was last visited this tunnel has been advanced 65 feet and about 3 tons of ore of the above sorted grade has been added to the 4 or 5 tons which had previously been sorted from this tunnel. At the 7,050-foot level an open-cut across several small quartz stringers was made at a point on the downward projection of the vein. The open-cut did not locate mineralization of importance and a drift was driven for 110 feet at N. 35° to 45° E. to prospect the quartz stringers, which here occur close to the contact of the quartzite with the diorite. Small amounts of galena were found at the face of the tunnel just before it became necessary to close the property for the winter months. It is planned to continue the development-work in 1930 with a small crew.



Monarch Mine, Golden M.D.



Gypsum Quarry, Mayook, Fort Steele M.D.



Ruth-Vermont Mine, Golden M.D.



Alpha Claim, Golden M.D.

Rex. A small amount of work was done on this property, situated on 6-Mile creek. A deal is being negotiated whereby a development syndicate is to prospect the claims systematically for a share in the property. The ore is copper pyrites, carrying gold and silver values, in a siliceous gangue.

Estrella.—At this property, near Wasa, diamond-drilling was continued all summer by the Consolidated Mining and Smelting Company.

Boy Scout. This property, referred to in past Annual Reports, is situated on Hellroaring creek in the St. Mary Lake area. The lowest or No. 3 tunnel has been advanced 280 feet. Some crosscutting was done on this level. A crosscut from the No. 1 tunnel is reported to have cut 5 feet of massive sulphides consisting of pyrrhotite, galena, and sphalerite.

Simmons. This property, consisting of thirty-two claims near Galloway, has been prospected steadily by Lethbridge interests and a scheme of systematic development is being laid out for the early spring of 1930. Open-cuts have been made and prospect-shafts have been sunk to test the continuity of the ore, which consists of copper sulphides in a siliceous gangue.

Finlay Leask. A small amount of development-work is reported to have been done at this property, which adjoins the railway at Aldridge. The ore carries values in gold, silver, and lead, the silver values predominating.

Homestake.* This property of the Cranbrook Gold Mining Company comprises twenty-nine mineral claims situated 26 miles by road west of Cranbrook, on the north-west side of Perry creek. The group has been adequately described in the Annual Reports for 1915, 1925, and 1926. During 1929 the open-cuts and portions of the underground workings were cleaned out preparatory to an examination by Eastern interests.

The claims were visited in June and the showings consist briefly of a sheared zone several feet in width, striking N. 30° E., dipping 85° to the east, and containing several narrow broken quartz stringers between an argillaceous quartzite hanging-wall and an indefinite schistose foot-wall. The sheared zone has been traced for several hundred feet by a series of open-cuts, two shafts now in a caved or flooded condition, one 560-foot tunnel, and short crosscuts on the south end of the zone, together with several other short drifts and crosscuts at other parts of the property.

Several channel samples were taken underground and at one or two of the open-cuts to determine what gold values might be expected over minable widths. The sample locations, widths, assays, etc., are given here in tabulated form. They were disappointing. Recent reports from the camp indicate that the small crew of men employed for the summer months was withdrawn early in August.

The results of the sampling were as follows:—

Sample Location and Width.	Gold.	Silver.
Channel sample across the face of the Scorgie tunnel at the south end of the sheared zone	Oz.	Oz.
	0.02	1.0
Channel sample across 78 inches of schistose material in the left crosscut off the Scorgie tunnel, approximately under the 60-foot shaft on the shear-zone (Columbia shaft)	0.01	0.1
Channel sample across 63 inches of honeycombed quartz and oxidized material in a short crosscut to the right and 150 feet from the portal of the Scorgie tunnel	0.02	0.1
Channel sample across 46 inches in the back of the Scorgie tunnel 150 feet from the portal	0.01	0.3
Channel sample across two honeycombed quartz stringers, 12 and 24 inches wide, in an open-cut 75 feet north of the 60-foot shaft	0.01	0.2
Sample across 36 inches of quartz and oxidized material 25 feet below the collar of the 60-foot shaft.....	0.02	0.4
Sample across 28 inches of oxidized quartz at the collar of the 60-foot shaft	0.02	0.5
Grab sample from the dump at the portal of what is called the Homestake tunnel	0.03	0.1

B. and V.* A. Van Arsdalen and B. Frisia are the owners of this group of thirteen mineral claims situated south-west of Cranbrook, and during the past year they have continued prospecting and done a limited amount of development-work on their property. The property, 3½ miles west of the railway and 6 miles from Cran-

brook, is connected to town by a fair wagon-road. When visited the shaft was full of water and it was impossible to make a detailed underground examination. Several open-cuts in the vicinity of the shaft show the country-rocks to be quartzites of the Aldridge formation which have been intruded by igneous rocks, mostly diorites, of the Purcell sills. The scattered mineralization, which is not in itself commercial, consists chiefly of galena with low silver values and can be regarded as indicating prospecting possibilities.

Empire and Strathcona. This property, situated on the northern side of Sand creek, about 5 miles from Galloway Station, was recently bonded by P. V. Parkes from the S. Steele Estate. A new camp has been constructed and preparations are being made to mine and ship ore. Towards the latter part of the year twenty men were employed, most of them on the construction of a surface tram. Preliminary work done includes cleaning out and reconditioning the old tunnels.

The surface tram, of rather original design, connects the mine with the camp, situated in a small valley. It is about 3,000 feet long, rising on a 35° to 40° pitch, and is built of 4- by 4-inch wooden rails; it has three rails with a passing in the centre and is a gravity-tram controlled by a drum at the top. The ore consists of copper sulphides in a gangue of siderite, calcite, and quartz, gold and silver values being associated with the copper content.

Moyie River Mining and Development Co.* The property of the Moyie River Mining and Development Company consists of the *Royal Crown, Beaver Owl, Bulldog, Silver Dollar, and Gold Bar* claims. It is situated 12 miles north-east of Lumberton, at the junction of Moyie river and Ridgeway creek, and 200 yards west of the end of the road serving the logging camps of the B.C. Spruce Mills. A crew of three to five men has been employed sinking a shaft on a small pegmatite stringer, or vein, in a diorite intrusive. The country-rocks in the vicinity of the shaft are quartzites and argillites of the Aldridge formation and in this locality they lie almost horizontal. The boundary of the diorite intrusive is covered with a heavy blanket of overburden and brush, one exception being at a point in the river-bed some 200 feet west of the shaft. The pegmatite stringer, which strikes east and west and dips almost vertically, is said to contain a massive showing of galena at a point in the creek-bottom 300 feet east of the shaft, but it was impossible to verify this due to high water. However, efforts made to trace the vein to the shaft failed to show commercial mineralization over minable widths along the surface.

The shaft was down a depth of 85 feet when examined. It had one small crosscut and one short drift driven from it. The crosscut had been driven to the diorite-quartzite contact, where a small patch of chalcopyrite-pyrite mineralization occurred. In the short drift near the bottom of the shaft a few small lenses of galena were examined in the pegmatite vein, which here has a width of about 6 inches. The pegmatite stringer as shown in the shaft varies in width from 1 or 2 inches at the collar to 8 or 10 inches at the bottom. Disseminated through the pegmatite are small lenses of galena only a few inches in their dimensions.

The property is equipped with a small compressor driven by a gas-engine and supplies sufficient power to operate the jack-hammer drill and small air-hoist used in the shaft-sinking. Unverified reports since the examination last June are that a diamond-drill has been engaged to further prospect the ground.

Minor activities which have been reported include: The *Payroll* on Nigger creek, where exploratory work was done by Maurice Quain; the *Elsienoir* placer lease near Lumberton, worked in a small way by G. A. Ness; prospecting-work done by R. E. Austin and associates on eight claims situated 3 miles easterly from Roosville. There was considerable prospecting activity in the area north of Fort Steele, stimulated by the activities at the previously mentioned *Kootenay King, Estella, Kootenay-Selkirk, and Rex* groups.

PHOSPHATE.

Two deposits of phosphate are being developed by the Consolidated Mining and Smelting Company, one on Lizard creek near Fernie and the other near Crowsnest. These developments are in connection with the great chemical-fertilizer plant being erected on Warfield flats near Trail. The phosphate-beds were found after intensive systematic exploration under the direction of the company's geologists, who continued, farther to the north, the previous work done by H. S. Spence, of the Geological Survey of Canada. The phosphoria-beds, as they are known, are

a series of layers of chert, quartzite, and shale, with occasional rusty partings of sand and clay, all of which contain small amounts of phosphoric acid. They contain one or more layers of phosphate rock. The phosphoria-beds, wherever they occur, are found to lie at a definite horizon in the sedimentary rocks, near the top of the Carboniferous system, which in Canada is at the top of the series known as the Rocky Mountain quartzite and just below the Banff shales. These beds have been traced in the Western United States from Northern Utah to Northern Montana and had been picked up again in Canada at Banff and near the Kananaskis lakes on the main line of the Canadian Pacific Railway. The beds of phosphate rock vary a great deal in thickness, being as much as 200 feet wide in some places in Idaho. Up to the time of the recent discoveries made by the Consolidated Mining and Smelting Company near Fernie and Crowsnest, no deposits of high enough grade to be workable had been discovered in Canada.

The Lizard Creek deposits are situated some 5 miles westerly from the city of Fernie at an elevation of about 1,200 feet above the Crowsnest branch of the Canadian Pacific Railway. The phosphate, found here at the contact of the Banff and Fernie shales, occurs in two beds separated by a narrow band of shale. When the property was visited in October a tunnel from the end of a short crosscut was being driven along the phosphate. Previous exploration consisted of numerous deep trenches and open-cuts showing the phosphate rock to be very persistent for a long distance along the strike. The local strike of the rocks is about N. 45° W., with dips of from 60° to 65° to the south-west. Substantial camp buildings have been erected on the flat ground below and some distance from the workings. At the mine two Ingersoll-Rand portable gas-driven compressors were in use. The Crowsnest deposits, situated on Alexander creek near the boundary between British Columbia and Alberta, were not inspected. Development, however, is reported to be proceeding along similar lines.

The following statement regarding these properties is quoted from the annual report of the Consolidated Company:—

Phosphate.—Transportation facilities were improved by the construction of motor-roads and trails and equipment was installed at both the Lizard and Crowsnest outcrops, preparatory to serious underground development, which was started in June.

"The work in hand is mainly to determine the grade and width of the phosphate-beds below the weathered and disturbed areas close to the outcrops, and to get accurate information as to production costs and quantities available of a grade suitable for the manufacture of super-phosphates, and consists of adit cross-tunnels to the beds and drifts along them, with raises or crosscuts at suitable intervals for cross-sections of the formation. In general, although the work to date is inconclusive, the important beds of oolitic phosphate have been shown to be rather narrow, but fairly persistent, with a comparatively regular content of phosphoric acid. Those at the Crowsnest, however, have shown a greater width, due to folding and overlapping of beds at certain sections. If this condition is found to prevail over any large area, the quantities available per foot of development will be materially increased.

"A considerable amount of stripping was done on the Crowsnest outcrop in anticipation of further shipments for experimental purposes."

GYP SUM.

Gypsum was mined by the Canada Cement Company on its property near Mayook Siding, 15 miles easterly from Cranbrook. The quarry, from which some thousands of tons are mined yearly, is conveniently situated on the main highway. The rock, mined by hand, is hauled by team to Mayook Siding, less than a mile distant, and shipped to the cement-works at Exshaw, in Alberta.

PETROLEUM.

Drilling operations are reported to have been carried on in the Flathead River valley by the Crow's Nest Glacier Oil Company and the B.C. Coal and Oil Development Company. The acreage concerned is understood to be controlled by a Vancouver syndicate, which has leased its holdings to the above two companies, on a basis of royalty payments to be made on any production obtained. The area, which lies in the extreme south-east corner of District No. 5, is not at present accessible from the Canadian side, but can be reached from the American side by road from Columbia Falls, Montana, the nearest railway point. The possibility of finding commercial petroleum-deposits is briefly referred to by the late J. D. MacKenzie in Geological Survey Memoir 87, "Geology of a Portion of the Flathead Coal Area." The district has not

yet had, however, an investigation specifically directed to the study of the geological structure as applied to oil possibilities.

SLOCAN MINING DIVISION.*

For purposes of this review of mining in the Slocan it will be convenient to include that portion of the Ainsworth Mining Division served by the Kaslo-Nakusp Railway. The area thus described is commonly called the "Slocan Camp."

Mining conditions in this camp are not as satisfactory as could be desired. The pronounced decline in the market prices of silver, lead, and zinc has had an unfortunate effect on mining in the Slocan camp. In order to understand the situation it will be advisable to repeat the past history of this mining area briefly. The first discoveries were made in 1891, and for a period of years thereafter small syndicates and mining companies actively prospected and mined the rich silver-lead lenses of ore that were found near the summits of the various ridges. Many discoveries were made and several of the small operating companies are reported to have paid good dividends over a short period of years. The discoveries were, with few exceptions, of relatively small tonnage, and when the known reserves were depleted it was necessary to spend large sums of money in long-neglected exploration-work, endeavouring to find other lenses, or at least a sufficient tonnage of lower-grade ore to justify the construction of gravity-concentrators. Several such milling plants were erected and operated at various mines in the district. As depth was attained on the ore-deposits the presence of increasing proportions of zinc with a decreasing proportion of lead and silver added to the milling difficulties, seriously interfering with operating profits. One by one the companies were forced to discontinue operations for several reasons, and as many of them had only made small, if any, actual profits, it was impossible for them to spend large sums of money in further exploration-work.

The Slocan then reverted largely to leasers, and shipments were small for several years until the war years 1914-18 and thereafter, when the increased prices obtainable for lead, silver, and zinc created favourable operating conditions for many of the companies. It was during the years 1914-24 that such properties as the *Bosun*, *Cork-Province*, *Galena Farm*, *Hewitt*, *Queen Bess*, *Rambler-Cariboo*, *Slocan Star (Silversmith)*, *Standard*, *Surprise*, *Utica*, *Van Roi*, *White-water*, and *Wonderful* were the more important shippers of the Slocan.

In 1923 selective flotation of lead-zinc-silver ore by the Consolidated Mining and Smelting Company at the *Sullivan* concentrator was successfully adopted and the year 1925 was marked by the announcement that the company would accept for treatment Slocan ores at the Trail plant. This announcement, coupled with favourable metal prices, resulted in increased activity in the district and several properties shipped ores to the smelter for milling and smelting under the new arrangements.

The years 1926, 1927, and 1928 witnessed a boom in general business conditions throughout the world and much activity was shown in British Columbia mining; particularly was this so of Slocan properties. Optimistic reports were prepared on a number of the Slocan mines, indicating large tonnages of ore, with a correspondingly long life, if worked on a basis of from 100 to 200 tons a day. Expensive and extensive milling plants were constructed and hopes were buoyed up by overenthusiastic statements.

No large ore reserves are developed in mines of the Slocan camp. The nature of the ore occurrences is such that in the opinion of many engineers it is not practicable to block out large reserves, as in the course of actually mining ore much information is secured which enables development-work to be intelligently directed. A policy of attempting to develop far ahead of requirements would lead to excessive development charges, resulting in uneconomic operation. It follows, therefore, that the Slocan properties only have ore reserves ranging from a few months up to possibly three years. The wisdom of erecting costly milling plants, power plants, tramways, and other surface equipment without the adequate ore reserves usually demanded by sound engineering principles is a matter of opinion and much difference exists amongst reputable engineers. It should be remembered, however, that at most productively equipped Slocan properties, while actual ore reserves may be small, there are normally numerous objectives for exploration and development, and that past experience shows that a fair percentage of these objectives result in ore discoveries.

Looking over the past history of the Slocan, it is apparent that mining since its inception in that camp has been hand-to-mouth, with many alternating periods of prosperity and depression. Nevertheless, much profit has been won from Slocan mines, together with the usual failures that

are inseparably associated with mining. At the present time depressed metal prices have been the cause of closing down practically all the properties in this camp, and it is evident that a material increase will be required in metal prices before these mines will be reopened.

Mining costs in the Slocan are relatively high, due to many factors, but principally owing to heavy ground that must be timbered, narrow and small ore-shoots, high exploration and development charges, and the small tonnages treated resulting in high overhead costs. Milling costs are good, but suffer from the small daily tonnage that may be treated; heavy plant depreciation and amortization charges that should be made, due to the relatively short life that most of the properties have actually assured, at any one time.

A summary of present conditions (February 19th, 1930) shows that fifteen of the more important companies in the Slocan have a capitalization of \$21,000,000 and an approximate issued capitalization of \$14,000,000. Eight of these properties are equipped with mills of a combined milling capacity of 900 tons a day, all of which are closed. Two of these mills are closed due to lack of ore reserves, five are closed due to low metal prices, and one has not started milling operations due to low metal prices.

Of the seven properties without modern milling plants, three are equipped with old mills that will have to be remodelled should the exploration programmes find tonnages sufficient to justify the conversions, and the remaining four properties without milling facilities have been lately engaged in exploration and development work, one of these four having been a large shipper of dry ore to the Trail smelter.

Summing up, we find that the Slocan has a number of well-equipped properties, with relatively small ore reserves at most of them, and a large amount of money has been expended ahead of necessary exploration and development work, and these factors when included with the recent very drastic drop in silver and zinc metal prices have stopped mining activity in the Slocan camp. The Slocan, shipping as it does about 5 per cent. of the total tonnage treated each year at the Trail smelter, plays a negligible part in affecting the market conditions of these two metals, and it is not to be expected that conditions will improve in the district until such time as metal prices improve.

A graph is included in this summary to show the metal prices obtained by the shipping properties for the lead and zinc in various grades of concentrates. It may be useful to many and will, with some study, show the layman the actual metal values that the Slocan miner has to work with. Silver is accounted for in lead concentrate at 95 per cent. of the New York price, the other metals being figured out on the London spot price for lead and zinc. It will be noted that the graph does not take into account the recoveries at the milling plants; it does not include freight on the concentrates to the smelter from the mill; nor does it take care of bonuses and penalties that may exist for any particular concentrate. Mill recoveries vary according to milling practice and ore being treated, but possibly vary from 65 to 92½ per cent. for silver, 80 to 95 per cent. for lead, and 75 to 90 per cent. for zinc. Freight charges are \$2 to \$3 a ton and up, depending on the grade of concentrates and the distance from the smelter.

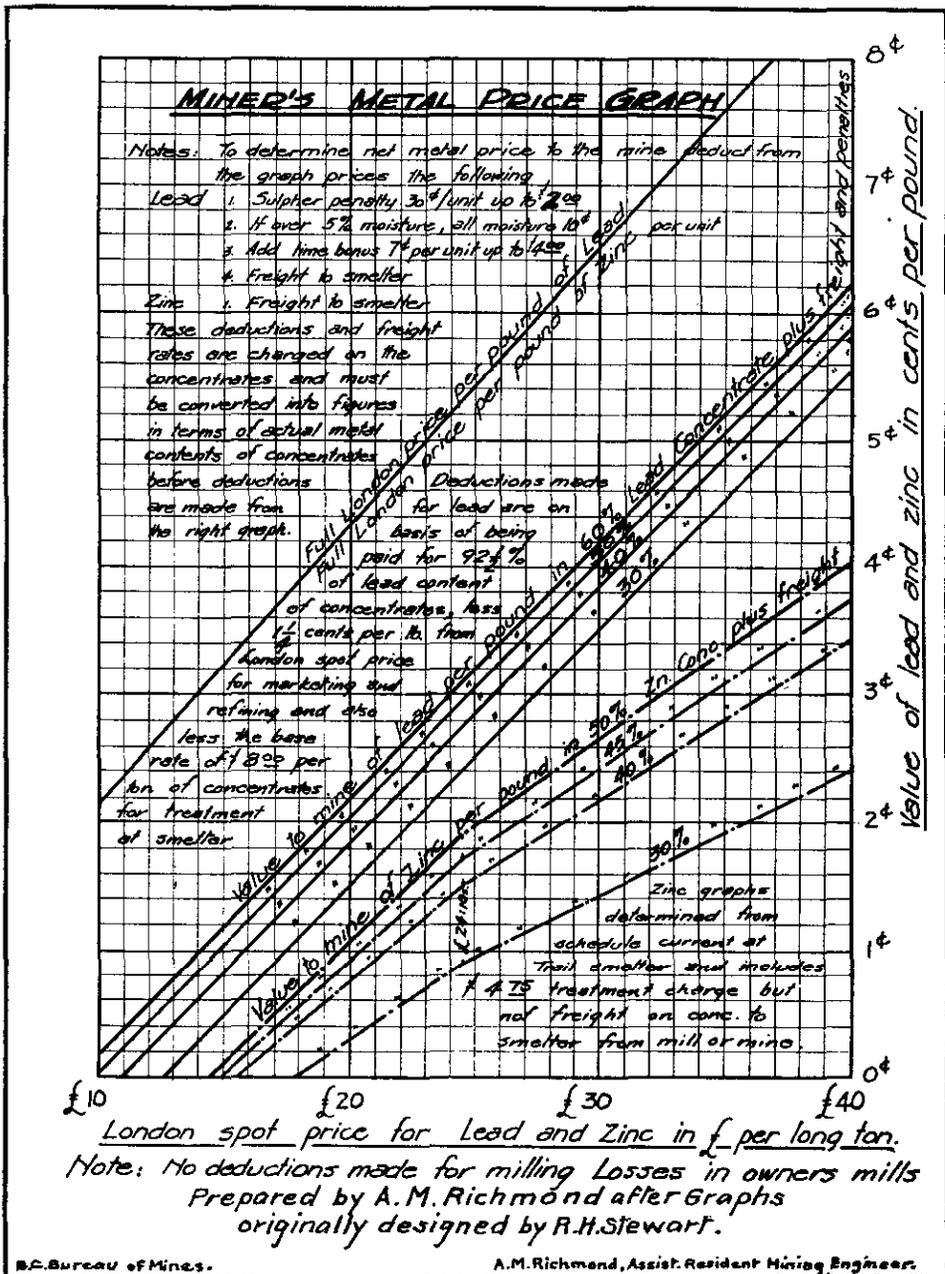
ZINCTON.

Lucky Jim.* This property, situated at Zincton, on the Kaslo-Nakusp Railway, is owned by the Lucky Jim Lead and Zinc Company, Limited. H. H. Yuill is president and managing director and Peter Price is superintendent at the property.

The holdings of the company consist of some seventeen claims near the head of Seaton creek, a short distance west of Bear lake. The property is an old one, having been discovered about 1892, and is referred to in past Annual Reports in considerable detail. The more recent mining operations and development have been referred to in the Annual Reports for the years 1925 to 1928, inclusive, and this report will deal only with the work accomplished in 1929.

The mill was operated for twenty-eight days in January, 1929. Milling and mining was stopped at the end of January because it was becoming increasingly difficult to obtain a supply of profitable mill-feed from the mine and the entire operation was being conducted at a financial loss. It was then decided to make an extensive search for ore and to close the mill until a sufficient tonnage could be counted on as available for profitable mining and milling.

Accordingly a crew varying from forty down to fifteen men was employed during 1929 and accomplished a total of 1,446 feet of drifting, 418 feet of raising, 956 feet of crosscutting, and 5,644 feet of long-hole drilling. The long-hole drilling campaign proved to be decidedly worth while, in that the holes, which averaged about 95 feet in depth and have reached a single length



of 160 feet, eliminated a large amount of what would have otherwise been dead-work. This drilling was done principally at right angles to the strike of the various levels and at small vertical angles above the levels, usually from 10° to 20° being necessary and sufficient to clean the holes. The practical results of this extensive exploration programme started to take shape in June and July, and at the end of January, 1930, it was estimated that there was an indicated tonnage of from 150,000 to 200,000 tons of ore containing approximately 15 per cent. zinc, with very low values in lead and silver.

The first exploration-work done consisted of completing the raise from the 6 level to the 5 level, concurrent with the driving of the 550 level and connecting raises to explore the downward projection of the 4 level sill showings. The work on the 550 level did not find ore, except in a small crosscut in the raise connecting the 550 level and the 4 level, and 60 feet below 4 level. A large amount of drilling from the 550 level met with similar disappointing results.

Exploration-work was next directed to the 675 level west of the raise connecting 6 and 5 levels. The results were every encouraging and it was decided to further explore the hanging-wall of the stoped area on 5 level, 80 feet above, and this development-work also resulted in a discovery of mineralization of encouraging character. Exploration-work was then started on a new level called the 650 level, and the west face of the drift is in heavily mineralized ground and further work will have to be done to determine the mineralized area on this level. A crosscut on the 610 level was next driven in a northerly direction and intersected a strong showing of sphalerite. Long-hole drilling from the 6 level, 200 feet vertical distance below the 610 level, has not encountered mineralization under the strike in 610 level, and it is thought that the limit of drilling, 160 feet, was reached without getting into the most favourable ground. The drilling gave evidences of narrow bands of sphalerite, but has not shown conclusively that the sphalerite intersected on 610 level extends down to the 6 level. Towards the end of the year, while drilling in a southerly direction from the west end of 6 level, the drill located a new body of mineralization, and subsequent crosscutting from 6 level has been attended with encouraging results, the average width of the sphalerite mineralization being 30 feet where encountered in the crosscuts.

To appreciate the work accomplished at the *Lucky Jim* this year it is necessary to examine the excellent mine-maps, assay plans, and geological sections made of this property by P. Price and C. N. Disney. A wealth of material has been painstakingly gathered and made into valuable working records.

From a detailed survey of the work done at the *Lucky Jim* in 1929 it may be said that the property is physically much improved over conditions existing one year ago, both as regards mining conveniences and the all-important point of probable tonnage of material as a reserve for future mining operations at this plant. The development and exploration crew was withdrawn from the property at the end of January, 1930, and it is to be expected that mining and milling operations will not be resumed until market prices improve to a level where mining, milling, and treatment of the zinc now in probable reserve can be done profitably.

The production for the year was 4,379 tons, containing net recovered metal contents of: Gold, 2 oz.; silver, 7,620 oz.; lead, 119,845 lb.; zinc, 464,437 lb.

SANDON CAMP.

The *Ruth-Hope* property, comprising fourteen claims, is situated at the town of Sandon and adjoins the *Silversmith* property. Detailed descriptions of the property and milling plant are contained in the Annual Reports for 1926, 1927, and 1928. Mining and milling operations were continuous throughout 1929, with the exception of time lost due to minor break-downs and a forced curtailment in the spring of the year due to water-shortage and freeze-up. The tonnage treated in the mill has been approximately 50 tons a day.

A total of 2,755 feet of exploration and development work underground, in addition to stoping, was done during the year and included 706 feet of drifting, 777 feet of raising, and 1,272 feet of crosscutting. This work was done principally in the workings adjacent to the *Silversmith* on the No. 5 and No. 6 levels of the *Ruth-Hope*. During the year the tonnage going to the mill has been mostly derived from this section of the mine, and it has been recently reported that some of the tonnage for milling is being obtained from a block of stoping-ground in the old *Ruth* workings between the No. 4 and No. 5 levels. While there is never a large

tonnage of ore blocked out ahead of the mill, because of the complicated nature of the vein with its numerous dykes and faults, rolls, etc., development has been kept ahead of production during the year. Several good stopes of milling-ore were found, developed, and mined during the summer, some of the stopes containing widths of 4 to 5 feet of rich silver-galena-blende sulphides.

During 1929 a total of 188 tons of crude ore averaging 144.34 oz. silver and 72.83 per cent. lead was mined and shipped direct to the smelter at Trail for treatment. The mill treated 13,091 tons of ore, average mill-heads being 16.57 oz. silver, 7.59 per cent. lead, and 6.94 per cent. zinc; 1,427 tons of lead concentrates assaying 123.1 oz. in silver, 62.81 per cent. lead, and 3.42 per cent. zinc were produced; 1,464 tons of zinc concentrates assaying 24.52 oz. in silver, 2.50 per cent. lead, and 54.81 per cent. zinc were also produced.

New equipment added during the year consisted of a No. 30 Cletrac tractor for hauling supplies to the mine, a steel-sharpener and forge, and one 8½ by 10 double-clutch drum-hoist for sinking operations. A crew of fifty to fifty-five men has been employed under H. A. Rose, superintendent. The most recent information from this property on February 19th, 1930, is to the effect that mining and milling has been stopped due to low metal prices.

The production for the year was 13,279 tons, containing net recovered metals of: Gold, 54 oz.; silver, 234,651 oz.; lead, 1,978,219 lb.; zinc, 1,230,837 lb.

This property is owned and operated by the Noble Five Mines, Limited, with a capitalization of \$3,000,000, divided into 6,000,000 shares of 50 cents each par value, 3,000,000 shares of which are issued. The mine and mill are located at Cody, 1½ miles east of Sandon, by road, on the north side of Carpenter creek. The property held by the company consists of the following claims: *Noble Five, Knoxville, Bonanza King, World Fair, Maud E., Lucetta, Deadman, Wild Goose, Summit Fraction, Surprise No. 2, Surprise Extension, Lady Jane, and Derby*. As rather complete descriptions of the milling plant and underground workings of the property have been given in the Annual Reports for 1925 and 1928, the following notes will pertain to the work accomplished during 1929.

The mill was operated throughout the year with the exception of minor shut-downs and curtailment due to water-shortage. A table showing in summary form the feed to the mill, month by month and for the year, is given here as a matter of record.

Table showing Mill-heads for 1929 at the Noble Five.

Month.	Tons.	Tons a Day.	ASSAYS.		
			Silver.	Lead.	Zinc.
			Oz.	Per Cent.	Per Cent.
January.....	1,142	36.8	*15.0	9.0	5.8
February.....	912	31.5	*15.0	9.0	7.0
March.....	1,243	40.1	14.9	9.0	8.6
April.....	1,628	54.3	12.1	7.1	8.7
May.....	1,359	43.9	18.6	9.5	8.0
June.....	2,027	67.6	14.6	6.0	6.0
July.....	2,068	66.7	13.1	5.9	7.4
August.....	2,242	72.4	18.9	8.0	9.1
September.....	1,491	49.7	15.7	5.8	7.5
October.....	2,671	86.2	11.6	4.8	7.7
November.....	2,183	72.8	8.6	5.1	7.7
December.....	2,144	69.2	7.0	4.3	8.2
Totals.....	21,110	57.7	13.35	6.55	7.76

* Silver for January and February was estimated approximately.

During the year a crew varying between seventy-five and fifty-five men has been employed by the company in mining, milling, exploration, and development-work. Stopping operations were carried out in the 800-foot level stopes a short distance east of the main raise for the greater part of the year, but for the present work has been stopped in this section due to the narrow width of mineralization and the lower grade of the ore. A stope east of the fault in the east end of the 800-foot level was developed and mined during the year to the 700-foot level. Operations have been discontinued in this stope also. The exploratory drift from the east end of the 800-foot level towards the *Surprise* ore-zone is estimated to have about 200 feet more to go

before reaching favourable ground for ore-deposition. It is planned to then crosscut from the end of the drift to the north to explore the possible downward extension of the *Surprise* vein under the old *Surprise* stopes some 800 feet vertically above this level.

When the property was last visited in January, 1930, there was one machine, in what is called No. 1 stope, 300 feet east of the No. 2 stope on the 800-foot level, doing a limited amount of prospecting-work on a strong iron-showing.

The 1,600-foot level crosscut to cut the upward extension of the *Deadman* was being advanced two machine shifts a day and had approximately 50 feet to go early in January, 1930.

The 1,800-foot level gives access to the *Deadman* ore-body and during the year this ore-body has been developed above the level by a series of raises at 50-foot intervals. The raises are up from 70 to 110 feet above the 1,800-foot level, and at the west end pass out of ore into the hard slate-bands that have apparently acted as dams for the ore solutions when they were being deposited. The ore in the *Deadman* is also cut by three of these bands in the stoped area, and it was noted that where the mineralization encountered the slate the width of the ore-body decreases to but a few inches or possibly 1 foot. Stopping operations followed the development done early in the year and the ore-body has been mined to 55 to 75 feet above the level and over a length of approximately 320 feet. Work at the present time in this section of the mine is being confined to driving one raise near the eastern end of the *Deadman* to prospect and develop the ground recently opened up in the extension of the 1,800-foot level to the east. One machine was being employed in stoping in the *Deadman* near the east end of the stope and 65 feet above the level. On the level proper the drift has been advanced to approximately 420 to 440 feet east of the point where the *Deadman* ore-body was first encountered. This drift encountered a faulted area or possibly a large fold in the vein (this could not be ascertained definitely at the time of examination), and recently the 1,800-foot level drift was driven in a south-easterly direction for 60 to 75 feet along a zone consisting of crushed slates, quartz, with an appreciable amount of mineralization in the quartz.

As has been noted before, the *Deadman* ore-body has a developed length on the 1,800-foot level of approximately 350 feet. The width as mined at the west end was approximately 20 to 25 feet, and an inspection of the stopes above the level, with a further inspection of the easterly end of the level, would indicate an average width of 6 to 7 feet in the area as mined. The upward extension of the *Deadman* appears to be definitely marked at the west end of the stope, and the work now under way in the east end of this ore-body will tell better what expectancies can be held out for the eastern end of the ore-body above the 1,800-foot level. There has been no development-work done on the ore-body below the 1,800-foot level to date, and while there is an available probable tonnage in this portion of the *Deadman*, from the development-work that has been done it is not possible to estimate any large tonnage at this property as probable and blocked-out ore.

In addition to the mining and milling of 21,156 tons of ore this year, the development of the *Deadman* ore-body above the 1,800-foot level and the development of stopes on the 800-foot level, a large amount of exploration-work has been done. (Exploration here taken to mean, looking for ore as compared to development, meaning to prepare for mining, ore already discovered.) The property has interesting possibilities where favourable geological conditions are known to exist, and the results of the present extensive exploration programme, now well advanced towards its several objectives, will add considerably to the knowledge of the importance of these possibilities.

This property, situated at the town of Sandon, has been practically idle throughout the year. Early in the spring announcements were made through the press that milling operations would be resumed in June, but this announcement has not materialized to date, and with the present depressed state of the silver and zinc markets it is quite reasonable to suppose that milling operations will not be resumed for some time.

The management has retained a small crew of seven or eight men throughout the year in furthering exploration and development work on the downward extension of the *Slocan-Star* ore-shoot. The winze from the No. 10 level of the *Silversmith* has been deepened to the No. 14 level and a considerable amount of lateral development has been done from levels off this winze.

For complete details on this property the reader is referred to the Annual Reports for the years 1925 to 1928, inclusive. The mine is owned by the Silversmith Mines, Limited, and John B. White, of Spokane, is president of the company.

This property adjoins the *Silversmith* and is controlled by the *Slocan King Mines, Limited*, of which John B. White, of Spokane, is president. During the year a limited amount of development drifting has been done from the No. 10 level of the *Silversmith* with a view to tapping the downward extension of the *Richmond-Eureka* vein. When the property was visited in November the objective was several hundred feet ahead of the drift-face and drifting was progressing slowly through a heavy graphitic shear. It is understood that the crew of seven men employed by the company on this development-work was withdrawn from the tunnel about this time and were put to work in further developing the lower levels of the *Silversmith*, which is under the same management as the *Slocan King*. The No. 10 level of the *Silversmith*, from which *Slocan King* development has been done, is approximately 500 feet vertically below the workings of the No. 5 level of the *Slocan King*, and in which it is stated there was a fair showing of silver-lead mineralization in the vein. This is the objective of the present work.

This property, owned by the *Leadsmith Mines, Limited*, is situated 2 miles from Sandon, on Cody creek. The fissure-vein of country-rock, spathic iron, quartz, and minor amounts of calcite, contains along its length a few small narrow lenses of galena and sphalerite mineralization. The vein strikes S. 40° W. and dips to the south-east at 70° and occurs between slate foot and hanging walls. In recent years the company has expended a large amount of money on the development of the No. 5 level of the property, with disappointing results. A crosscut 690 feet long was driven to the vein, which varies from 1 to 4 feet in width, and a long drift was run to the south-west to an intersection of the vein with a 60-foot quartz-porphry dyke approximately 2,200 feet from the crosscut. Subsequent drifting and crosscutting from the end of this drift has picked up several very much smaller veins on the south side of the dyke. From a point in the drift 900 feet south of the crosscut a raise has been driven for 160 feet following the vein.

This extensive development programme has shown the presence of several small low-grade lenses of sphalerite and galena mineralization along the drift and in the raise. The impression conveyed to readers of the company's promotional literature is not borne out by an inspection of the property, as the tonnage of low-grade mineralization exposed in the lower workings of this property is quite small and gives no justification for the statement: "It now appears that *Leadsmith* may rapidly pass from the prospect stage and be classified as a mine."

During the summer of 1929 the *Radiore Company* made an electrical survey of the claims and succeeded in locating a conductor in the creek-bed some 900 feet north-east of the present vein. When visited in September the crew at the mine was reduced to two or three men, who were engaged in surface prospecting to determine the value of the electrical prospecting. John B. White, of Spokane, is president of the company.

This property, adjoining the *Ivanhoe* group, is owned by Joe Brandon and consists of eleven claims on Silver ridge, west of the town of Sandon. The claims are reached by trail from the upper workings of the *Ruth-Hope*. As a rather complete description has been given in past Annual Reports for the years 1923 and 1928, it will only be necessary to outline the developments at the property during the past summer.

A limited amount of trenching and prospecting was done by the owner and one or two men to the north-west of the No. 1 vein. Three leasers working in the No. 1 level on the No. 1 vein encountered a showing of high-grade sorting-ore and at the time of the writer's visit in September they had mined and sacked approximately 40 tons of sorted ore. This high-grade showing occurs in the second, or inside, ore-shoot, and a small winze down 25 feet at the time showed a width of approximately 1 foot of sulphides and carbonates down both side-walls of the winze. Additional small showings of clean sulphides and carbonates were being mined from above this showing and it is understood that a small tonnage of ore was mined and sorted from the outside ore-shoot on this level by the same leasers. To the end of the year a total of 42 tons had been shipped by the leasers.

Recent announcements have been made that the *Ruth-Hope Mining Company* has taken an option on a four-fifths interest in the group and will proceed to develop the property on a somewhat larger scale than has been the case in the past. Accurate surveys of the underground workings were made by the new company and they will throw considerable light on what happens to the No. 1 vein below the No. 1 level.

The property of the Colonial-Slocan Mines, Limited (N.P.L.), comprising the **Colonial-Slocan.*** *Colonial, Freddie Lee, Cristein, Airdrie Fraction, and Nellie* claims, the first four named being Crown-granted, is situated on Freddie Lee mountain, south of Cody creek and 1½ miles from Sandon. The company is capitalized for \$1,000,000, with 4,000,000 shares of 25 cents par value. A. J. MacDonald, of Vancouver, is president of the company and A. L. McPhee, of Kaslo, has been in charge of the crew of twelve to fourteen men which has been employed throughout the summer and fall months of 1929. Comfortable cabins of log construction were built at the camp with the intention of continuing the development-work throughout the winter months.

The vein of crushed country-rock with small amounts of spathic iron and calcite is at places mineralized with narrow lenses of high-grade shipping-ore, values being chiefly in galena and silver with considerable carbonates of lead. The vein, having a north-east strike and dipping at a rather flat angle to the south-east, has been opened up by former operators on four levels, totalling in all some 1,800 feet of underground workings. During the summer one or two men were employed underground on the No. 1 level at 5,405 feet elevation and on the No. 2 level at 5,800 feet elevation, stoping, by hand-mining methods, small narrow lenses of sorting-ore. A shipment of 37 tons was made to the Trail smelter by the company late in the year. Exploration-work was stopped early in January, 1930, for the winter season.

The **Carnation.*** *Carnation*, consisting of seventeen claims and fractions, is owned by A. R. Mann and associates and it is situated west of Sandon at an elevation of 7,000 feet. The camp is reached by a 4-mile caterpillar road from the town of Sandon. The ground was optioned in 1925 by the Victoria Syndicate, which did considerable work at the property before dropping the option in 1928. The results of this development-work have been given in the Annual Report for past years.

This season an aggressive programme of exploration and development has been carried out by George Clark, of Sandon, and a crew of seventeen men under the technical direction of R. H. Stewart. A 90-horse-power Petter oil-engine, Diesel type, and a 326-cubic-foot displacement Ingersoll-Rand air-compressor were installed below the north portal of the No. 3 tunnel on the Sandon side of the ridge. The necessary mining supplies and equipment were taken to the camp and underground work was commenced in August. The claims were electrically prospected for one month by the Radiore Company during the summer.

The vein of crushed and sheared argillites and calcite, which contains small bunches of galena, has been prospected this year by extending the No. 3 level, at 6,240 feet elevation, a distance of 818 feet in an effort to locate the downward extension of ore, said to occur along the bottom of the No. 2 level at 6,445 feet elevation. The vein strikes S. 80° W. and dips at a flat angle to the south in slates of the Slocan series. The drifting was being continued when the water-supply froze early in January, 1930, and temporarily stopped the work. Recent reports from the property are to the effect that the drifting had advanced into the foot-wall side of the vein and will be turned to the south when operations are resumed. Other work to the end of the year included 120 feet of tunnelling on the "D" vein, 1,000 feet to the north of the *Carnation* vein, 860 feet of 3- by 10-foot trenching, and 300 feet of 3- by 5-foot trenching.

The **Mercury.*** *Mercury* property is situated on the east side of Carpenter creek, approximately 2 miles north of Sandon. A small syndicate including R. S. Lennie, A. W. Davis, George Clark, *et al.*, spent considerable money in further exploration at the property early in the year. This work included 262 feet of drifting, 10 feet of cross-cutting, and 14 feet of sinking. The crew was withdrawn from the claims early in the summer and the future plans of the group of men controlling this ground have not been disclosed to date.

This property, owned by Frank Bourne and Charles French, was acquired by **Majestic.*** H. A. Turner for Coast interests under the terms of an option. The claims are located 3 miles by road and trail north of Sandon, on the east side of Carpenter creek, at an elevation of about 5,700 feet above sea-level. The formation in the general vicinity consists of slates and argillites of the Slocan series, which in places have been intruded by massive quartz-porphry dykes. The vein varies in width from 3 to 7 feet and consists of brecciated slates, quartz, spathic iron, pyrite, and subordinate amounts of galena and sphalerite. It strikes N. 50° E. and dips south-east at 50°, angles common to many other veins in the Slocan camp. The vein has been developed by four adit-levels, the upper two of which are caved and consequently closed for inspection.

The No. 3 level, at an elevation of 5,760 feet, comprises approximately 600 feet of drifting along the vein. Several small faults or slips throw the vein to the south-east for short distances in this tunnel. The ground above No. 3 level has for the most part been stoped through to No. 2 and No. 1 levels and on up to the surface. In the bottom of the drift, 250 feet from the portal, there is a showing of spathic iron, lead, and zinc, averaging 4 to 5 feet in width and 80 to 90 feet long, and samples of this showing were stated to be sufficiently encouraging to warrant the driving of a No. 4 level at an elevation of 5,660 feet. When the property was visited late in September this level had been advanced 250 feet from the portal and still required about 180 feet of driving to reach its objective under the showing on No. 3 level. The small crew of three men who have been driving the No. 4 level by hand-mining methods were temporarily idle at the time of examination, due to a heavy flow of water from the face of the tunnel.

Sovereign.*—This property, situated near Sandon, was further developed during the year by J. Vallance and a small crew of men, and a total of 48 tons of ore sorted and shipped to Trail smelter.

Wonderful.* This property, situated a short distance north of Sandon, on the west side of Carpenter creek, was taken under option from the Cunningham Mines, Limited, late in the fall of 1928 by the Standard Silver-Lead Mining Company. Throughout the season of 1929 a crew of ten to twelve men has been working under the direction of W. H. North doing a considerable amount of exploratory work in the crosscut below the "A" level of the *Wonderful* workings.

Monitor.* A limited amount of hand development-work has been done during the year on the *Monitor* group at Three Forks by George Gormley. Special attention has been given to the upper tunnels of this old mine and during the year 81 tons of sorted shipping-ore was sent to the Trail smelter.

Payne.* This property, situated on the east side of Carpenter creek, between Three Forks and Sandon, was taken under option by R. S. Lennie and associates, of Vancouver. Announcements were made in the press that development operations would be started during 1929 at this once-famous Slocan property. However, no activity at the mine has materialized and no official intimation of future plans has been given out to date.

Victoria.* The Victoria Silver Lead Mining Company, owning the *Victoria No. 6* and the *Galt* claims at Sandon, employed a crew of two or three men in the fall of 1929 contract-drifting on the No. 2 level of the property. A total of 70 feet of drifting was done by H. Peterson and partners, of Sandon, and the results, which have not been examined, are not known. Litigation over title to the ground has been settled and title to the above claims has been registered in Nelson in the above company's name.

Black Colt.* This property is part of the ground formerly included in the holdings of the Consolidated Queen Bess Mines, Limited, and it is located on the west side of Carpenter creek, 3 miles north of Sandon. Development-work under the direction of Clarence Cunningham, of Alamo, during the summer and early fall months of the year succeeded in opening up good showings of high-grade silver-lead ore, both on the *Black Colt* and *Palmita* claims, and resulted in the entire holdings of the Consolidated Queen Bess Mines, Limited, including the *Queen Bess*, *Idaho*, *Alamo*, and *Silver Ridge* groups, the *Black Colt* and *Palmita* claims, together with the Alamo mill and various power and water rights, being taken under option by Paulsen, Pfeffer & Porter, Inc., of Spokane. The development crew has been augmented to a strength of twenty men under the technical direction of W. L. Bell and necessary mining machinery and equipment purchased and transported to the mine.

It is planned to push the development-work on the *Black Colt* during the winter months and to ship a considerable tonnage of clean lead-silver ore to the smelter for treatment. The future operations at this once-famous property will be watched with interest.

Victor.* George Petty, of Sandon, has continued mining with a crew of three to four men at his *Victor* property, located on the west side of Carpenter creek, some 3 miles north of Sandon. This interesting little mine has been fully described in Annual Reports for 1922 to 1928, inclusive. The owner each year ships a car or two of high-grade silver-lead ore to the smelter, and since the property was discovered in 1921, by ground-sluicing, it is reported that net smelter returns have been close to \$60,000. This year 55 tons was shipped from the small stopes above the No. 1 level of the five levels with which this:

narrow high-grade vein has been developed. The vein is apparently a continuation of the *Queen Bess* fissure-zone and occurs in slates of the Slocan series, the ore forming in narrow lenses close to the hanging-wall and noticeably near the quartz-porphry dykes that cut the formation.

This property comprises four claims, situated on the ridge between the *Noble Bluebird** *Five* and Jackson basin, and is reached by road from Retallack to the Silver Basin Mines property, a distance of 4 miles, and thence 1 mile by trail to the camp at an elevation of 6,700 feet. The property was acquired by the Bluebird Mines, Limited, in 1928, which has expended a considerable amount of money in exploration-work.

When the property was visited in July the old underground workings near the summit of the ridge were caved and could not be examined. Open-cuts on the surface show a vein occurring as a fissure in the slates of the Slocan series, the fissure striking N. 75° E. and dipping to the south-east at 45°. History relative to the past at this property is vague and the best information available is by old-timers, who state that several shipments of silver-lead ore were mined and shipped many years ago from the now caved workings on the property.

The new company did several hundred feet of tunnelling on the *Idaho No. 2* claim in 1928, and late in the fall of that year they reopened and retimbered the *Stranger* tunnel on the Jackson Basin side of the ridge and advanced it several hundred feet. This tunnel has been advanced to well over 1,000 feet from the portal, considerably past the objective set out last year, and when examined in July failed to show the existence of commercial ore. A small crew of men is still reported to be at the property, continuing the exploration programme in the *Stranger* tunnel. Recent work reported consisted of a crosscut from the hanging-wall of the vein to the foot-wall side, the results not being known. During the summer an electrical survey of the property was made by the Radiore Company.

This property, situated in McGuigan basin is reached by switchback road from *Rambler-Cariboo** *Rambler* Siding, a station on the Kaslo-Nakusp Railway. This property has been described in a general way in the Annual Reports for 1927 and 1928, and as only a brief examination of the work accomplished to the end of July was made during the summer months, but a few notes concerning the year's development-work can be given.

A crew varying from twenty men and less has been engaged by the Slocan-Rambler Mining Company, Limited, in furthering development-work on the 1,400-foot level, on the 1,200-foot level, and in driving a raise from the 1,400-foot level to the 1,300-foot level, a vertical distance of 112 feet. When visited a narrow showing of mineralization on the 1,400-foot level, averaging 2½ to 3 feet in width and about 200 feet long, had been opened up by drifting and one or two stub raises from the drift. The mineralization consisted of sphalerite, pyrite, and galena in a well-defined fissure-vein striking S. 50° W. and dipping 55° to the west. The showing was not sampled, and until such data containing the widths, sample locations, and assays, etc., could be inspected it would be impossible to form a correct opinion as to the commercial value of the discovery.

It has been recently reported by J. M. Robertson, superintendent, that the small crew of men has been working on the 1,200-foot level of the mine, where there are interesting possibilities for mineralization. The property was not being worked in the middle of January, 1930, the water-supply having failed. One or two men are retained at the camp to act as watchmen.

The property of the Altoona Mines, Limited, consisting of the *Altoona*, *Altoona** *Bowknot*, and *Commander* claims, is situated 1½ miles north of Sandon on the Sandon-Three Forks road. The company was formed in the spring of 1929, with 1,500,000 shares capitalization, by the brokerage firm of Baldwin-Zachman & Kirschner, of Seattle, Wash.

The property was owned for many years by a New Denver man, who spent considerable time and money in its development and finally allowed the property to revert to the Crown for taxes. The property was purchased from the Crown a few years ago by A. Murphy, of Sandon, who has done a limited amount of hand development-work on the property. During the summer of 1929 a new bunk-house, office, and mess-house capable of accommodating fifteen to twenty men was erected by the new company.

The property has been developed on four levels by adit-tunnels on the *Washington* vein. The fissure-vein has been considerably sheared and strikes generally N. 60° E. and dips to the

south-east at 60°, cutting the slates and shales of the Slocan series. The general strike of the Slocan series in this locality is N. 40° W., with a dip of 55° to the south-west. There are numerous quartz-porphry dykes cutting the slates and shales.

The No. 1 level at 3,600 feet elevation consists of approximately 500 feet of drifting and crosscutting along a narrow quartz-filled fissure that in places is heavily mineralized with pyrite, containing small amounts of lead and zinc sulphides with associated silver values. A short crosscut to the north at 60 feet from the portal intersects a quartz-porphry dyke that is next to a small lens of pyrite mineralization. From a point 90 feet to the south of the dyke a drift 350 feet long has been driven along the narrow fissure-vein and one or two lenses of low-grade milling material have been opened up. The best lens on this level consists of a length of 20 feet and an average width of 3 feet of material that upon assay gave the following result: Gold, 0.01 oz. to the ton; silver, 5 oz. to the ton; lead, 4.9 per cent.; zinc, 12.9 per cent. This sample was obtained by taking a chip sample over the entire exposure. Other mineralized showings on the level were narrow short lenses in the very tight sheared fissure that has been followed for almost the entire length of the drift.

The No. 2 level is at an elevation of 3,525 feet and consists of 350 feet of drifting and crosscutting. One hundred and twenty feet from the portal a 9-inch stringer was sampled which assayed: Gold, trace; silver, 2.6 oz. to the ton; lead, 0.7 per cent.; zinc, 3.3 per cent. The best showing on the level consists of a lens 30 feet long, with an average width of 2½ to 3 feet, occurring under the showing obtained on No. 1 level. A sample taken across the widest section of the lens over a width of 75 inches assayed as follows: Gold, trace; silver, 2.5 oz. to the ton; lead, 1 per cent.; zinc, 15.6 per cent. The same sheared fissure that is evident in No. 1 level has been followed along the length of the No. 2 level, with about the same results as far as commercial mineralization in quantity is concerned.

The No. 3 level, located 75 feet lower than No. 2 level, was caved at the portal, but a careful examination of the dumps at the tunnel portal failed to indicate the presence of mineralization in this tunnel, which is 90 feet in length. The No. 4 tunnel at an elevation of 3,360 feet is apparently to the foot-wall side of the fissure developed on No. 1 level, and although approximately 500 feet of drifting, crosscutting, and raising has been done on this level, results to date have been entirely negative. A grab sample was taken of a small dump at an open-cut above the No. 1 level and the resulting assay was: Gold, *nil*; silver, 2.5 oz. to the ton; lead, 1.5 per cent.; zinc, 2.7 per cent.

The above work has been done on the *Washington* vein and vicinity. The *Altoona* vein, which is stated to lie to the north of the *Washington* vein, was not examined as no development-work had been done on this vein and nothing of value could be examined. The property has never been a shipper, according to records available. The equipment outside of the new bunk-house and office building is negligible and consists of a few small hand-mining tools and one or two old cars and rails in the tunnels. The property is essentially a prospect on which some 1,500 feet of development-work has been done. It is not a proven mine, the mineralization occurring in small low-grade lenses that could not be mined profitably in themselves.

The property of the Mary Ryan Mines, Limited, consisting of the *Old Tom Moore*, *Liberator No. 2*, *Sadie*, *Soho*, *Northern Pacific*, *Red Cross*, *Bower No. 2*, *Faraway*, and two fractional claims, is situated on the sharp ridge separating McGuigan and Washington basins and is best reached by road and trail from Rambler Siding, a station on the Kaslo-Nakusp Railway. The camp-site is 6 miles from the station and lies at an altitude of 6,600 feet above sea-level. In the spring of 1929 the Mary Ryan Mines, Limited, was formed by the brokerage firm of Baldwin-Zachman & Kirschner, of Seattle, Wash. The company is capitalized with 4,000,000 shares of 25-cent par-value stock, of which 500,000 shares are stated to be in the treasury.

The *Tom Moore* vein, on which most of the development-work has been done, strikes N. 40° to 50° E. and dips to the south-east at 75°, cutting the slates and limestones of the Slocan series at approximately right angles. The vein has been opened up from the western slope of the ridge by four adit-tunnels, and intermediate tunnel known as the No. 4 level, which has its portal on the eastern slope of the ridge. The No. 5, or lowest, level at 6,600 feet elevation consists of a crosscut 200 feet long to the vein, with a drift 80 feet to the west and 400 to 450 feet to the east on the vein. In the west drift a 2-inch stringer of galena—which assayed: Silver, 50 oz. to the ton; lead, 31.5 per cent.; zinc, 25.1 per cent.—appeared to be the full width

of mineralization developed in this drift. In the east drift, 300 feet from the crosscut, a 70-foot raise connects the No. 5 level to the No. 4 level. At the foot of the raise a bunchy occurrence of pyrite mineralization assayed: Silver, 1.5 oz. to the ton; lead, 1.1 per cent.; zinc, 0.8 per cent. Narrow widths and short lengths, with a few small inclusions of a higher-grade sulphide mineralization, are apparent along this level, generally on the foot-wall side of the vein. Near the face of the east drift the ground is broken and the vein can only be traced with difficulty.

The No. 4 level at 6,670 feet elevation and the No. 3 level at 6,750 feet elevation contain several small stoped areas from which small shipments of sorted ore may have been obtained. The remaining mineralization, which occurs as small lenses in and near the quartz-porphry dykes that cut the levels, is narrow and of low grade. The No. 2 level at an elevation of 6,830 feet and the No. 1 level at an elevation of 6,900 feet are near the top of the ridge, which has a summit elevation of 6,940 feet where the vein outcrops. The No. 2 level is cut by a large porphyry dyke 100 feet from the portal. The No. 1 level is caved and could not be examined.

The *Mary Ryan* vein, which outcrops 200 feet to the north of the *Tom Moore* vein, has been opened up at the 6,720-foot elevation by a drift and crosscuts. The vein has a strike N. 50° E. and dips 35° to the south-east, or at a dip that should cause the vein to intersect the *Tom Moore* vein before a very great depth. The drift, which is in 170 feet, ends in a quartz-porphry dyke. Some 20 feet from the face of the drift a winze 30 to 40 feet deep has been sunk and from the bottom of the winze a small stope has been mined. A shipment of sorted ore is reported to have been made from this stope, which at the time of examination was filled with water. An examination of the winze failed to show ore of commercial width and grade. On the western slope of the ridge a crosscut about 450 feet long has been driven in an attempt to pick up the downward continuation of the *Mary Ryan* vein, but when it was examined during the summer the crosscut was entirely in the slates and limestones of the *Slocan* series. This level, at an elevation of 6,540 feet, is 180 feet vertically below the east drift on the *Mary Ryan* vein.

The only other development-work on the property that the writer was shown was the collar and shaft of the *Soho* vein workings, situated about a quarter of a mile to the north of the *Mary Ryan* vein. The shaft was half-full of water and ice, which prevented an examination of this vein, which, it is stated, has been developed by an east and west drift on the vein at a depth of 90 feet from the surface. The material on the dump at the collar of the shaft contained small amounts of galena, zinc-blende, and pyrite, mixed with slate and quartz porphyry.

Records of production kept by the Provincial Mineralogist show that in a period of twenty-nine years approximately 167 tons of sorted ore averaging 41 oz. in silver and 25 per cent. in lead has been shipped from this property. In 1929 a shipment of 4 tons was made, containing net recovered metals of: Silver, 662 oz.; lead, 4,473 lb.

During the past two years the camp has been equipped with substantial buildings of log and frame construction and consists of a bunk-house for twelve men, a mess-house, blacksmith-shed, stables, and ore-sorting shed. Power equipment consisting of an oil-engine of the Diesel type and an air-compressor, together with power-drilling equipment, was added during the past summer, and a small crew of men has been steadily employed in the further exploration of the property.

Helenita.* This property, formerly known as the *Rio* and consisting of eight Crown-granted and four surveyed claims, was incorporated under Dominion charter in May, 1929, as the Helenita Mines, Limited, with the head office in Calgary.

It is situated on the divide between McGúigan and Jackson basins at an elevation of 6,000 to 7,200 feet above sea-level. The log camp-buildings are served by trail from the end of the *Slocan-Rambler* road.

A quartz-filled fissure occurring in slates and limestones of the *Slocan* series has been partially developed by four adit-tunnels, several open-cuts, and one or two winzes and shafts. The upper two levels, at 7,130 and 6,975 feet elevation respectively, were caved and could not be examined. The limited size of the dumps at the portals of these two levels would indicate but a small amount of underground work. The third level, at 6,880 feet elevation, consists of over 1,000 feet of crosscuts and drifts on the vein, which in several places is cut by narrow, flat-dipping quartz-porphry dykes. The vein, which varies in width from 1 to 5 feet, is mineralized in places with a narrow hanging-wall streak of lead-silver ore. The ore is chiefly of the "dry" type. The lowest level of the mine at 6,750 feet elevation has not been advanced sufficiently to reach the supposed downward extension of the vein. The vein has a strike of S. 70° W. and

dips at 40° to the south-east and has been traced along the surface for several hundred feet to a point near the summit of the ridge, where a shearing movement apparently has faulted the ground and destroyed the continuity of the vein. In past years a limited amount of leasing has been done at the property and early in 1929 two men were working around the camp. It has been reported recently that the new company has had a small crew of men doing exploration-work at the 6,880-foot level of the property throughout the fall and winter months.

Native Silver Bell.* The late W. E. Zwicky, of Kaslo, employed a crew of four men throughout the summer months of 1929 in further exploration-work at his *Silver Bell* property, situated in McGuigan basin at an altitude of 7,100 feet. The men, who were working on contract, drove a crosscut tunnel into the hill to strike the downward projection of the *Silver Bell* vein at a point 100 feet below the depth attained by the No. 1 level at 7,250 feet elevation. The results of the summer's work have not been officially disclosed, and as the property was visited before the crosscut had advanced far enough to strike the vein it will be necessary to visit the property during the coming summer. The crew, who were working, have been withdrawn on account of the treacherous nature of the country in winter months, due to snowslides.

McAllister.* This property is situated on the east side of Kane creek, 3½ miles north-east of Three Forks, the nearest railway-station on the Kaslo-Nakusp Railway, and is connected to it by a fair road. The mine camp, at 5,700 feet elevation, is connected to the end of the road at the lower tram terminal by a 4-foot trail and a 2-bucket reversible aerial tramway 4,000 feet long. The mine is owned by the Slocan Silver Mines, Limited, the controlling interest being held by the Standard Silver-Lead Mining Company, of Silverton, of which W. H. North is manager.

The property has been described in previous Annual Reports, so that only a few notes as to development and mining activity for the past year will be given here. The fissure-vein, striking N. 50° to 60° E. and dipping to the south-east at 45°, occurs in quartzites that are underlain by soft beds of slate. Toward the north-east end of the underground workings the vein passes from the quartzites into the slates and changes from a well-defined quartz-filled fissure to a number of small scattered quartz veinlets. The mineralization is with tetrahedrite carrying silver values, and average values in the past mining operations are stated to have been 30 to 40 oz. in silver to the ton.

The mine has been developed by six levels, all of which are adit-levels with the exception of the fourth and fifth. During 1929 a crew of twenty-five men was employed on further exploratory work on the downward continuation of the vein between the No. 5 and No. 6 levels, and to mining and shipping to the smelter at Trail 5,511 tons of silver ore that is reported to have averaged between 25 and 30 oz. in silver to the ton. The stoping operations were confined to ground between the No. 3 and No. 5 levels and consisted in mining pillars and level sills, with some small blocks of ground stated to contain quite high silver values over comparatively narrow widths. The average width of the vein above the No. 5 level is 4 to 5 feet, but below this level the vein where encountered on a short raise from the No. 6 level is from 1 to 2 feet in width and contains very low silver values. The development was being confined to the driving of a drift north-east from a 76-foot raise up from No. 6 level and at the time of examination toward the latter part of September the drift had advanced 60 feet along the vein and had approximately 400 feet to go before reaching favourable ground on the downward projection of the stopes from No. 5 level. The values in this development-drift were considered too small to be of economic importance, though quite satisfactory in that they indicated similar conditions to what had existed on the No. 5 level.

The mining operations were curtailed toward the end of the year due to the falling price of silver, and the prospects are that the property will remain inactive until silver prices improve.

Among the minor operations that have been reported during the year are the following: The *Jo-Jo* near the McAllister has been developed in a small way by the owners; assessment-work of an exploratory nature was done at the *Miner Boy*.

SILVERTON.

Galena Farm.* This property, comprising the *Galena Farm*, *Hewitt*, *Hazard*, *Noonday*, and *Lakeshore* groups, containing approximately thirty-five claims, is situated 1½ miles south of Silverton and extends east from Slocan lake to the *Van Rot* property, a distance of 3 miles along a strong shear-zone close to the contact of the sediments

of the Slocan series and the rocks of the Nelson granite batholith. In March, 1929, the above properties were amalgamated to form the Galena Farm Consolidated Mines, Limited, with H. H. Yuill as managing director and W. L. Sheeler as resident manager. The capitalization of the new company is 2,500,000 shares of no par value, of which 1,650,000 shares have been issued, including the issue of 600,000 shares underwritten by Vancouver brokers and placed on the market at \$2 a share.

The history of the various units of this company has been described in past Annual Reports, the years 1904, 1915, and 1928 dealing more particularly with the *Galena Farm* and *Hewitt* units, which are the most important in the company groups. The development progress for 1929 will constitute the bulk of this report.

At the *Galena Farm* a strong quartz-granite filled fissure-vein, striking S. 60° to 70° E. and dipping to the north at 45°, was in past years developed along a length of 1,100 feet and to a depth of 150 feet by a series of drifts and staggered raises and connected to the mill by an 850-foot crosscut. Above this level, known as the 150-foot level, mining operations have depleted about 850 feet of the developed length of the vein. This year extensive exploration-work has been done in an endeavour to find the downward continuation of the vein below the 150-foot level horizontal fault that heretofore has caused this level to be the lowest in the mine. A winze was sunk on what is called the *Noonday* vein, and which may be the continuation of the faulted *Galena Farm* vein, to a depth of 75 feet below the 150-foot level. Short drifts from the bottom of the winze have been driven along a quartz-filled fissure containing considerable amounts of mineralization in galena and silver values. The winze shows a width of 4 feet of fair milling-ore to a depth of 50 feet below the 150-foot level. The *Noonday* drift on the 150-foot level was advanced for several hundred feet to a point under the vein on the 100-foot level and a raise to the 100-foot level intersected the main horizontal fault some 25 feet above the drift. Above the fault to the 100-foot level the raise is in excellent milling-ore for a distance of 35 feet.

When the property was visited in November a drift was being driven east from this raise along the top of the horizontal fault and 35 feet below the 100-foot level. Further development-work at the property during the year consisted of holing through one or two raises from the 100-foot level stopes to the surface for ventilation. A considerable footage of long-hole drilling with a Waugh 34 drifter was done underground both at the *Galena Farm* and at the *Hewitt*, and the results of this prospecting have been said to have saved an appreciable amount of dead-work in drifting.

At the *Hewitt* the year's development programme was largely confined to the driving of the long haulage-tunnel through the mountain to the *Galena Farm* side. This tunnel, which will be over 6,000 feet in length and which still requires 1,400 feet of drifting to complete it, has been worked from two portals. Late in the year the East No. 10 Hewitt tunnel, the name given to the tunnel from the *Hewitt* side of the hill, was reported to have struck the downward continuation of what is called the Cunningham stope. This ore-body on the No. 9 level had a length of 90 feet and an average width of 11.3 feet, according to A. G. Langley. The development-work on the No. 10 level, however, has consisted of drifting in the hanging-wall and lateral development-work has not yet disclosed the width, length, or values that may be expected from this strike. At several points in the mine minor improvements, such as retimbering and a certain amount of development raising, has been done. The development-work from the west end of No. 10 level, called the West No. 10 Hewitt tunnel, is reported to have encountered a narrow band of mineralized quartz.

When the amalgamation of the properties took place in the spring, both the *Hewitt* and the *Galena Farm* were equipped with 50-ton flotation-mills. The *Galena Farm* mill was redesigned and altered to handle from 100 to 150 tons a day. The mill alterations were completed in October and the mill was operated October, November, and eighteen days in December on an accumulation of jig and table tailings that had been left from former milling operations at this property. The mill was closed on December 18th and has not been operated since, due to the low price of silver and zinc. The tailings-pile from which the mill-feed has been derived has been practically depleted. The concentrate was produced in the form of a bulk concentrate and shipped to the Trail smelter for further treatment.

In addition to the improvement to the *Galena Farm* mill, the company constructed an aerial tramway from the portal of the West No. 10 Hewitt tunnel to the mill at the *Galena Farm*. It is 8,800 feet long and has a grade of 14.3 per cent. in favour of the load. The 180-horse-power

Petter Diesel engine at the *Galena Farm* mill was replaced by one of the same make, but of 250 horse-power.

During the year a crew of as high as 100 men has been employed on construction and development work. The crew was gradually reduced until at the end of January the entire plant was closed indefinitely. The future plans of the company are not known at the time of writing, but it is expected that the resumption of development-work will depend on metal prices.

The production for the year was 9,808 tons, containing net recovered metals as follows: Gold, 10 oz.; silver, 41,758 oz.; lead, 242,563 lb.; zinc, 599,202 lb.

Metallic.* This property is located 2 miles south of Silverton on a short spur road from the old Silverton-Slocan road and is owned by R. McFarlane and associates, of Silverton. During the past summer some 200 feet of drifting and cross-cutting was done on the No. 2 level of the mine by the *Galena Farm Consolidated Mines, Limited*. Results of this work were disappointing and the company dropped its option. The development-work is being continued at the present time by R. McFarlane.

The vein, which is quite well defined, has an east-west strike and dips to the north at 55°. It consists of crushed country-rock, quartz with small lenses of galena and zinc-blende, and occasionally small pockets of tetrahedrite and silver. The country-rocks are sedimentaries of the Slocan series, principally slates and quartzites. To the south of the vein the contact of a batholith of granodiorite and the sedimentaries has been traced in an easterly direction from near the *Galena Farm* to country just to the south of the *Hewitt*. A few car-loads of shipping-ore have been mined from the lower level of the two with which the property has been developed. The shipments which were made several years ago were reported to run well in silver values.

Van Roi.* This property, comprising fourteen claims adjacent to and east of the *Hewitt*, is situated on the south side of Silverton creek, 4 miles by road east of Silverton. The property for a number of years has been owned by the *Cunningham Mines, Limited*, Clarence Cunningham, of Alamo, being president of the company. In June, 1929, an agreement was entered into whereby the *Van Roi* was acquired by the *Van Roi Mines, Limited*, capitalized at 2,500,000 shares of 20 cents par value. The new company engaged a crew of twenty-five men and commenced development-work on the property, the past history of which has been fully described in the Annual Reports for 1911 and 1924.

The season's development-work has been largely confined to further exploratory work on what is called the South vein in the upper levels of the mine. The No. 3 level on the South vein has been extended to the east for 240 feet and still requires some distance to go before reaching ground regarded as having favourable possibilities for mineralization. A raise 255 feet long has been driven to connect the No. 3 level to the No. 1 level on the South vein, and the vein in the upper portion has carried very promising values in silver and zinc. The No. 1 level was driven 167 feet to the west along the vein and from a point 100 feet west of the 255-foot raise a raise 178 feet long has followed the vein to the new "A" level.

A total of 322 feet of drifting and crosscutting on the "A" level has been done to the west of the raise, and at the time of visiting the property in January, 1930, a drift was being started to the south-west to follow what appears to be the continuation of the South vein. The raise to the "A" level from the No. 1 level followed in well-mineralized ground for almost its entire length, losing the vein as the "A" level was reached. The work done to date has been promising and the intentions of the company are to continue development-work, together with surveys and sampling of the vein, until such time as sufficient tonnage is available for the economical operation of a selective flotation plant. The mine is equipped with a mill of ancient lineage, which will require remodelling after sufficient ore has been developed.

In January, 1930, it was necessary to suspend underground work for a few days, due to a fire destroying the mess-house and dry-house at the camp. However, a crew of seventeen men has been maintained at the property and will resume underground work early in February, 1930. W. Nelson is foreman in charge of the development-work.

Mammoth. This property is owned by the *Western Exploration Company*, with offices in Silverton. R. A. Grimes is manager of the company, which is largely financed by private interests in the Eastern States. The property has been described in considerable detail in the Annual Reports for 1926 and 1928 and will be but briefly referred to here.

In the spring of 1929 those in charge of the company had the property thoroughly examined and sampled by a consulting engineer, and on the basis of his findings the present fine milling

plant and aerial tramway has been installed. The milling plant is one of the best of the many mills in the Kootenays and the flow-sheet is similar to most of them. It is roughly as follows: Ore is delivered to a 150-ton bin from the aerial tramway. The primary crushing is done by an 11- by 18-inch jaw-crusher in closed circuit with two vibrating screens, the resulting fines being stored in a 300-ton mill-bin. The ore from the mill-bin will be delivered by conveyor to the 6- by 48-inch Hardinge ball-mill and ground in closed circuit with a Dorr duplex classifier. The oversize from the classifier is delivered to the lead cells, there are eight rougher and two cleaner cells on the lead side, and the lead concentrate is thickened in a Dorr thickener and filtered with a 1-leaf American filter. The tailings from the lead unit are then delivered to the zinc cells, consisting of eight rougher and two cleaner cells, and the zinc concentrate treated in a Dorr thickener and in a 2-leaf American filter. The tailings from the zinc cells are run to waste storage. The lead and zinc cells are of the Minerals Separation sub-aerial type. Sufficient storage-space is provided for both lead and zinc concentrate in the concentrate-bins to enable a month's run to be stored. A system of conveyor-belts will deliver the concentrate direct to cars on barges at the mill slip.

Power for the mill will be supplied by a Pelton wheel driving a 400-k.v.a. Westinghouse alternator, located close to the mill. It was necessary to build several thousand feet of flume to supply the necessary water and head to drive the water-wheel, the water coming from Silverton creek.

The aerial tramway is the longest and largest one in the Slocan, having a length of 16,000 feet from the mill to the upper terminal at the mine No. 7 level. From the mine at an elevation of 4,925 feet at the No. 7 level the tramway climbs 200 feet to the break-over tower 4,000 feet west of the mine terminal. From the break-over tower to the angle tower at the *Standard* is 4,000 feet. The angle tower at 3,200 feet elevation deflects the tram 27° to the north. It is 8,000 feet distant and 1,400 feet vertically to the mill or lower terminal at 1,800 feet elevation.

During the year the mine was surveyed and assay plans made of all the levels. The raise connecting the No. 7 and the No. 4 levels was completed late in the year and a limited amount of lateral work was done off the raise on the No. 5 and No. 6 levels. When the property was visited in January, 1930, the mine crew was being used to finish the construction of the tramway, on the installation of necessary mining machinery and equipment, and in general preparing the property for production at the rate of 100 tons a day.

It was expected that the plant would be ready for operation in February, 1930, though it is considered doubtful if the prevailing market prices for the metals will be sufficiently encouraging for the company to start production operations.

Wakefield.* During the summer of 1929 A. Jarvis and partner, of Silverton, obtained a lease on the old *Wakefield*, located on the north side of Silverton creek (locally called 4-Mile creek) and approximately 4 miles east of Silverton. The property has been idle for many years since the *Wakefield* Mining Company, an English company, suspended operations. The flat-dipping vein, containing appreciable amounts of calcite, contains small lenses of galena, sphalerite, and high silver values over small areas. The vein has been opened up on several levels and considerable stoping over narrow widths was done by the old company. Work in the past season has consisted of mining a few small remnants of high-grade lenses of shipping-ore from the lowest level and the sorting-over of the dumps left from former operations. A grab sample representative of the sorted ore to be shipped to the smelter assayed: Silver, 40 oz. to the ton; lead, 22 per cent. A total of 40 tons was shipped during the fall of the year by the two leasers.

NEW DENVER.

Bosun.* The *Bosun* mine, owned by C. J. Campbell, of New Denver, is situated on the shore of Slocan lake, about 1½ miles north of Silverton. The property has been worked at intervals since its discovery in 1898 and was owned first by the *Bosun Mines, Limited*, an English company, and latterly by the *Rosebery-Surprise Mining Company* until 1928.

The true fissure-vein in which the mineralization makes in small narrow lenses has a strike of N. 55° E. and dips to the south-east at 50°. The width of the vein varies from a few inches to 4 or 5 feet and the commercial section of the vein is from a few inches to a maximum of 2 to 3 feet in width. The ore consists of galena and sphalerite with some grey copper and associated silver values. The country-rocks in the vicinity of the vein are argillites and quartzites of the

Slocan series and the vein is characterized by sheared zones close to narrow porphyry dykes which offset the vein to the right for short distances. The displacement of the vein is invariably in the same direction along a N. 50° W. strike. The vein has been quite difficult to follow on account of the indefinite nature of the foot-wall and the large number of rolls that occur in the vein.

The mine has been opened up by six adit-tunnels and one level 100 feet below the No. 6 (or lowest) adit-level. This No. 7 level is approximately 75 feet below the surface of the lake and the vein has been drifted on for some 500 feet. During 1929 a small stope in the east end of No. 7 level was mined by the owner and a total of 958 tons of milling-ore was shipped to the Trail smelter. The average grade of the ore shipped has been reported as: Silver, 60 oz. to the ton; lead, 20 per cent.; zinc, 25 per cent.

The stope from which the above shipment was made played out, and in order to provide further ground for stoping operations it will be necessary to sink a shaft and start the development of a No. 8 level. This new development-work has not been undertaken to date, efforts having been made to dispose of the property to a company which could handle the necessary development programme with considerably less risk than would be the case were the risk assumed by one man. Since August 1st, when C. J. Campbell discontinued mining operations, fifteen leasers under eight different leases have been working at the mine. Two or three of the leasing parties are jigging the old dumps of the mine and making a product that has assayed 82 oz. silver, 22 per cent. lead, and 23 per cent. zinc when shipped to the Trail smelter. The remaining leasers are working underground, re-treating the old stope-fill and where possible mining any ground that is accessible and of grade good enough to ship. The latest group of leasers to start work at the dumps has installed a centrifugal pump and a 4-compartment jig operated by a 16-horse-power Crossley engine.

The Molly Hughes Mines, Limited, capitalized at 2,000,000 shares of \$1 par value, was incorporated in March, 1929, to acquire the property of the Pinto Mines, Limited, and 1,075,685 shares of the new company's stock were to be paid for the property, which has for long been known as the *Molly Hughes*. It is situated on the eastern shore of Slocan lake, 1 mile north of New Denver, and has been adequately described in the Annual Reports for the years 1904 and 1922 to 1928, inclusive.

Briefly, a series of quartz-filled fissure-veins, striking east and west with a dip of 60° to 70° to the north, occur in a granite batholith that is closely related to the Nelson batholith, which outcrops a few miles to the south of the mine. The principal development-work has been done on the *Kincara* vein, which has been developed to some 100 feet below the level of Slocan lake by a series of levels, connecting raises, and winzes. The ground above the lake-level, called the No. 3 level, has been largely stoped out by past operators. Recent work undertaken before the refinancing took place was the sinking of a winze from the No. 3 level and the establishment of the No. 4 level at a depth of 100 feet below No. 3 level. A limited amount of stoping close to the winze has been done. The purpose of the refinancing is to provide funds for sinking the shaft another 150 feet below the No. 4 level and to provide the necessary working capital for the working of the property.

The vein varies in width from 4 to 10 feet, but the mineralization of galena, argentiferous tetrahedrite, pyrite, and small amounts of sphalerite is confined to a narrow band varying in width from 6 to 12 inches and lying on the hanging-wall side of the quartz-filled vein. At several points in the underground workings splits in the vein mineralization give two narrow pay-streaks averaging 6 to 8 inches in thickness, one along the foot-wall and one along the hanging-wall of the vein. The property is well equipped for a small operation, being supplied with two Diesel-engine-driven air-compressors and the necessary air-boists and air-drills used in power-mining. The results of the financing have not been made known to date and as these notes are being written the property is not being worked.

This property, 1½ miles east of New Denver, on the south side of Carpenter Mountain Chief,* creek, has been operated during the past season by three leasers, J. Cechelero, M. Zatonl, and L. Vingneaux. The claims under lease are the *Mountain Chief*, *Mammoth*, and *Apeax*, and during the past year work has been confined to the *Mammoth* between the No. 1 and No. 2 levels.

A small pillar of the vein carrying galena, sphalerite, and associated silver values has been stoped from below the No. 1 level elevation, at 2,960 feet above sea-level. The ore, broken by

hand-mining methods, is hand-sorted at the No. 2 level and the ore is wheeled to and dropped down through a raise to the No. 3 level, 70 feet below. The ore from No. 3 level is then passed down a chute to a small bar grizzly, where the larger pieces of waste left in the ore are sorted out and the rest passed through a small water-driven Blake crusher and a 2-compartment jig. The product is washed down a 250-foot flume-pipe to the settling-tank alongside the wagon-road. The jig concentrate, which runs about 50 to 60 oz. silver, 20 to 25 per cent. lead, and 30 to 40 per cent. zinc, is shipped to the Trail smelter in sacks. During 1929, 132 tons was shipped to the smelter as compared to 126 tons shipped in the year 1928 by the same leasers.

The vein, which varies in width from 3 to 7 feet, occurs in slates and limestones of the Slocan series just to the south and east of a large stock of granitic rocks. Past experience at this property has shown the vein to contain silver-lead ores near the surface in the upper levels, changing to zincky-lead-silver ores, and finally zinc ore as depth is attained on the vein. The pillar to which the leasers are paying particular attention is comparatively narrow, from 3 to 4 feet, and is not high grade, but it enables them to make a satisfactory living by the use of hand-mining methods, sorting, and crude water-concentration. A limited amount of old stope-fill has been sorted and treated during the year in addition to the pillar-mining mentioned.

SLOCAN CITY MINING DIVISION.

This property is situated on the south side of Enterprise creek (locally called **Enterprise.*** 10-Mile creek), about 6 miles east of the Silverton-Slocan highway. The mine is connected to this main road by a very fair wagon-road. The property has been fully described in past Annual Reports, more particularly for the years 1924 to 1928. A very brief summary of past history of the property will be given here for those who may be interested and to whom the past reports may not be available.

Discovered in 1894 by R. Kirkwood and J. McKinnon, the mine was equipped, developed, and operated for several years by the Enterprise Mines (B.C.), Limited. Approximately 8,200 tons of ore was sorted or milled and shipped to the smelter for further treatment, and the grade of the ore thus shipped is stated to have averaged 127 oz. in silver and 19.2 per cent. lead, with an additional 23.8 per cent. zinc in the shipments toward the last of the operation.

Concentration methods of the early part of the twentieth century were not as efficient as present-day flotation methods when applied to ore of the type mined in the *Enterprise* vein and the company was forced to close. For several years leasers worked around the mine until 1924, when H. B. Pilcher acquired it under option and spent considerable money in necessary repairs and some underground development-work. In 1926 P. McGuire and E. C. Wragge, of Nelson, took the property under option and mined and shipped a considerable tonnage of milling-ore to the Trail smelter. This property was acquired by the Stobie, Forlong & Company interests in 1928 and amalgamated with the *Yankee Girl* mine, Ymir, to form the Yankee Girl Consolidated Mines, Limited. A limited amount of development-work has been done by the new company during 1928 and the early part of 1929.

The country-rocks in the vicinity are granites and granodiorites of the Nelson batholith. Many small dykes, some acidic and many lamprophyric, cut the vein system on *Enterprise* ground. The vein, which has been developed extensively by seven adit-levels, and all of which are now inaccessible except for a short distance from the portal and the No. 7 level, at an elevation of 4,578 feet, which is open for its entire length, varies in width from a few inches to 3 feet. The average width is about 1 foot and consists of a band of zinc ore on both the foot and hanging walls, with a vein-filling of brecciated country-rock, quartz, spathic iron, and calcite, with varying amounts of zinc-blende and galena carrying silver values. The ground above the No. 5 level has been largely stope out, as well as a considerable portion of the vein near the portals of No. 6 and No. 7 levels.

The Yankee Girl Consolidated Mines, Limited, has done appreciable drifting on the No. 7 level, extending it for about 550 feet into the hill in the hopes of picking up ore-bodies of commercial size and grade. Four short raises were also driven on the vein near the face of the No. 7 level on the most likely-looking drift showings. The mineralization disclosed by this work has been narrow and essentially zincky. The No. 2 vein on the property has been further developed by 300 feet of drifting on the 4,687-foot level. This vein is similar in strike and dip to the *Enterprise* vein (N. 55° E. and dipping to the south-east at 75°) and approximately 275 feet west of it. Very limited amounts of development-work have been done on this vein, which

was only discovered in recent years, and it is difficult to form an opinion of the possibilities that may exist in it. The present work is said to have been encouraging, though no ore of commercial grade and in sufficient quantity for mining has been discovered to date. In addition to the above work accomplished by the crew of ten or twelve men employed during the early part of 1929, about 140 feet of drifting was done on the No. 3 vein.

On July 8th, 1929, the mill building together with its contents were destroyed by fire. The Ingersoll-Sergeant air-compressor which was housed in the mill building was badly damaged by the fire. The development-work was discontinued and a crew of two men retained to watch the camp and do a limited amount of sampling and hand development-work. The future plans of this company are not known at the time of writing.

*Piedmont.**—The *Hope No. 2*, situated on Lemon creek and controlled by the Piedmont Mines, Limited, has been shut down during the year and future plans are not known.

*White Hope.**—The development-work at the *White Hope*, situated on the Slocan-Silverton road about 5 miles from Slocan City, has been discontinued.

*Arlington.**—The Bayview Mining Company, of Vancouver, has stopped exploration-work at the *Arlington* on Springer creek, and it is understood that the option on the property has been dropped.

AINSWORTH MINING DIVISION.

This Mining Division covers a large area and its mining activities are far-flung. It includes mines adjoining the Slocan Mining Division to the east which properly belong to the Slocan considered as a camp. These properties are described by A. M. Richmond, Assistant Resident Engineer, under the section devoted to "Properties Tributary to the Kaslo-Nakusp Railway." The same Division embraces the areas confined between the divides of the mountain ranges to the west and east of Kootenay lake, including the Woodbury Creek area, the Ainsworth camp, and the *Blue Bell* and other deposits on the opposite side of the lake.

The geology of the last two areas is described by S. J. Schofield in Geological Survey of Canada, Memoir 117, "Geology and Ore Deposits of the Ainsworth Mining Camp," and by J. F. Walker in the 1928 Summary Report of the Geological Survey of Canada under "Kootenay Lake District." The last-mentioned publication has made possible an accurate correlation of the rocks in the East and West Kootenay and earlier conceptions of the age of the rocks bordering Kootenay lake have been radically changed.

At the northern end of the Ainsworth Division are the mineral areas tributary to Poplar camp, Howser lake, and Duncan river. No comprehensive work has yet been published in connection with these northern sections, but field-work done in recent years by M. F. Bancroft, J. F. Walker, and H. C. Gunning, of the Geological Survey of Canada, is understood to be awaiting publication under the general heading of "Lardeau Map-area."

KASLO.

Properties Tributary to Kaslo-Nakusp Railway.

Whitewater.* This property, situated at Retallack, a station 18 miles west of Kaslo on the Kaslo-Nakusp Railway, is owned by the Whitewater Mines, Limited, the capitalization of which has been increased to 2,000,000 shares as compared to its former capitalization of 1,200,000 shares. The property is an old one, having been discovered in 1892, and as the past history and a large amount of detail relative to the mine and plant have been given in past Annual Reports, 1927 and 1928 particularly, the present notes will deal only with the results obtained during 1929.

The mine and mill were operated for the first seven months of the year, 21,900 tons being mined and 5,038 tons of concentrates produced and shipped to the Trail smelter. The net recovered metal contents of this production were: Gold, 73 oz.; silver, 52,279 oz.; lead, 576,501 lb.; zinc, 3,312,155 lb.

Milling operations were suspended at the end of July, due to unprofitable operation of the plant and also due to the reserves of milling material being of such grade that profitable operation was not possible at existing metal prices.

The underground workings of the mine below the 1,000-foot level have since been surveyed by H. H. Yuill's engineering staff and several interesting sections of the *Whitewater Deep* workings have been plotted by P. Price. The sections are interesting as they show clearly the

characteristic mode of mineralization in the lower workings of the *Whitewater*, the spathic iron and zinc mineralization occurring as a replacement deposit in limestone at and near the main *Whitewater* vein and roughly along the bedding of the lime. The general shape of the mineralized body is that of a long flat-dipping tabular bedded lens, raking to the south-east at about 10° to 20° from the horizontal. It is from this area that the stoping of the last two years has been done.

The examination-work, surveying, exploration, etc., continued since the cessation of milling in July, has recently been discontinued and a watchman placed in charge of the property. While the results of the geological examination, surveying, and sampling are not complete at the time of writing, sufficient data have been gathered to indicate only a relatively small tonnage of spathic iron and zinc mineralization between the 1,100-foot level and the 1,400-foot level. The result is disappointing as compared to former estimates of grade and tonnage for this property. This tonnage is made up largely of remnants and small unstoped blocks of material considered to be lower in grade than what was recently mined by the company, and the figures include the tonnage recently opened up by drifting on the 1,472-foot level in the east end of the workings.

This property, owned by the Wellington Mines, Limited, is situated to the west of **Wellington.*** of the *Whitewater*, on the Kaslo-Nakusp Railway. The property consists of ten Crown-granted mineral claims on what is locally known as the westerly extension of the *Whitewater* zone of mineralization: The property is an old one and past references to it may be found in the Geological Survey of Canada Report for 1895 and in the Annual Reports for 1896 and 1928.

The company has been active since December, 1927, and has accomplished approximately 4,000 feet of exploration tunnelling and several hundred feet of diamond-drilling to the end of 1929. A long low-level tunnel, called the *Hazel*, was driven to intersect the western continuation of the *Whitewater* shear-zone at approximately the No. 10 level of the latter. This tunnel was stopped after 2,350 feet of exploration tunnelling had been completed with disappointing results. A further 240 feet of ground ahead of the face of the *Hazel* tunnel was explored with a diamond-drill with similar results.

Recently the company has been extending the *Ivanhoe* tunnel, 600 feet west of the old upper workings and 100 feet below them, to get under a showing of mineralization developed in a shallow tunnel on the *Wellington* vein. It is expected that the small crew of men employed on contract will reach their objective early in the summer of 1930.

This property, situated at an elevation of 5,600 feet above sea-level, is reached by mountain road from Retallack Station on the Kaslo-Nakusp Railway.

Jackson.* It was described in the Annual Report for 1923 under the name *Dublin Queen*. The development-work undertaken by the Silver Basin Mines, Limited, was continued in the early part of 1929 with a small crew of men, engaged principally on underground exploration on the east side of the creek and across to the east from where in past years a considerable tonnage of milling-ore had been mined and treated in the jig and table mill that was built at the mine. Since the renewal of development-work approximately 1,000 feet of underground crosscutting and drifting has been done on a strong showing of oxidized ledge-matter which carried streaks and small bunches of galena. The results of this underground work were disappointing and the option on the property was dropped and all development-work at the property discontinued at the end of July. The ground is owned by the Alexander Estate and James Anderson, of Vancouver, is agent.

The property of the Utica Mines, Limited, consisting of seventeen claims and fractions, is situated on and adjacent to Paddy's peak at the head of 12-Mile creek. The mine camp, at an elevation of 6,100 feet and 3,350 feet above the railway, is reached by a 5-mile road from Adamant Siding, a station 12 miles from Kaslo, on the Kaslo-Nakusp Railway.

The East and West veins of the *Utica* occur along fault-fissures in the country-rock, an altered Slocan sedimentary, called by A. G. Langley a chialstolite-schist. The veins strike S. 36° W. and dip at 68° to the south-east. Rocks of the Nelson granite batholith outcrop a short distance to the south of the underground workings. The vein-filling consists of calcite, quartz, some spathic iron, and inclusions of the chialstolite-schist.

Shipment records for the past show that about 5,600 tons of sorted ore averaging 129 oz. in silver, 15 per cent. lead, and 2.2. per cent. zinc were stoped from ground above and contingent

to the No. 4 level of the mine. However, several years ago stoping operations had largely removed the available ore above this level and an appreciable amount of underhand stoping had been done to a depth of 50 or 60 feet below the level. The underhand stoping proved unsatisfactory and the company started a crosscut, known now as the No. 5 level, to get under the extension of the *Utica* vein system 1,000 feet north-east of and 350 feet vertically below the old No. 4 level workings. This crosscut failed to locate the veins and the property remained for the attention of leasers for several years until 1921, when O. C. Thompson acquired the property and began to drift south from the end of the long crosscut towards a point underneath the No. 4 level stopes. This work was continued in recent years by the Canadian Mines Merger, Limited, under the direction of H. H. Armstead, and when the property was acquired by the Stobie, Forlong & Company interests in the spring of 1929 surveys of the mine indicated that 350 feet of crosscutting would be required to locate the West vein at a point 350 feet vertically below No. 4 level.

This new company, called the *Utica Mines, Limited*, with a capitalization of 3,000,000 shares of \$1 par value, started a small crew of men at work early in 1929, regrading the road to the mine, repairing the camp, and cleaning out the No. 5 tunnel. The crew of seven or eight men commenced development mining early in the fall and completed 394 feet of crosscutting and drifting to the end of the year. Early in December, just before it became necessary to close the property for the winter, it was reported that the West vein had been encountered.

While it is impossible to form a definite opinion as to the commercial value of the reported strike until such time as the vein has been inspected, drifted on, raised through, and thoroughly channel-sampled and valued in terms of net metal prices, it is decidedly encouraging, for the future and prospective value of the *Utica* has long been considered dependent on discoveries that might be made in this section of the mine.

Development-work was handicapped by lack of water during the past season and toward the end of the year it was necessary to store the water for forty hours to ensure a sufficient supply for an eight-hour drilling shift in the mine. This condition has existed for past operators and this year surveys were made of the power and water possibilities of 12-Mile creek with a view to remedying the situation. Surveys were made and tentative profiles were plotted of a tramway from the mine to a mill-site and from the mill-site to the railway at Adamant. It is not known when exploratory work at the *Utica* will be resumed.

Phoenix and Fletcher. At this property, situated on the western side of Lyle creek and reached by trail from Whitewater creek, a small amount of exploratory work was done early in the year by the Consolidated Mining and Smelting Company. This work, which consisted of crosscutting and drifting, was discontinued in March. The ore contains gold values in a quartz gangue and the vein occurs in the Kaslo volcanics.

Metals Recovery Co.* During the year a considerable tonnage of tailings from the old *Whitewater* jig-mill was reclaimed from the bed of Kaslo creek by this company, under the direction of M. S. Davys, of Kaslo, and treated in the 100-ton flotation-mill located a short distance below the *Whitewater*. A total of 154 tons of concentrates was shipped to the Trail smelter by the company.

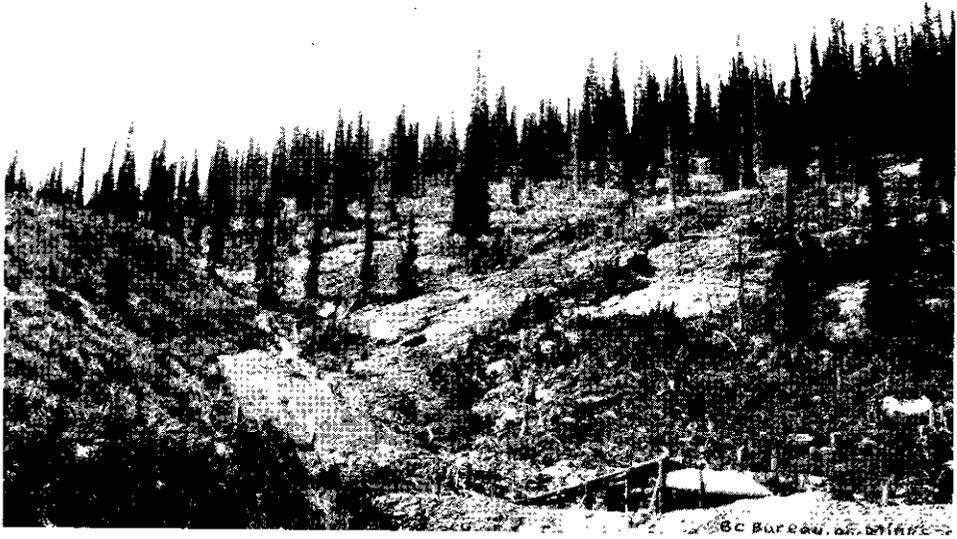
*Keystone-Charleston.**—Further exploration was done at this property, situated to the north of the *Whitewater*, by A. J. Harris and a few men. It is understood that a small tonnage of sorted ore has been made ready for shipment to the smelter.

Prospectors have been reported active at the head of 10-Mile and Schroeder creeks during the summer.

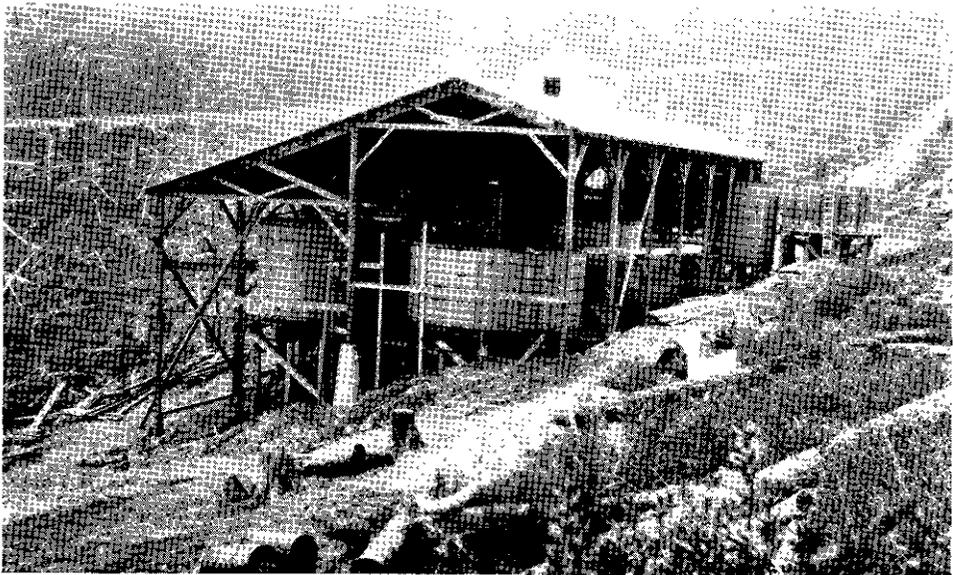
Keen Creek Area.

Cork-Provence. The property of the Cork-Provence Mines, Limited, comprises thirteen claims situated on the south side of Keen creek (South fork of Kaslo creek), 4 miles west of Zwicky (Nashton), the nearest station on the Kaslo-Nakusp Railway. The mine and mill are connected to the railway by a good road.

From a study of past records available this property was discovered about 1900 and for many years was operated at intervals as two mines, the *Cork* and the *Province*, of which the first named was the larger shipper. The two properties were combined about 1914 and continued intermittent operations until 1926, when the present company was organized with a capitalization of \$1,000,000, divided into 3,000,000 shares of 25 cents par value and 250,000 preference shares



True Fissure Mine, Trout Lake M.D.



Reno Mine—New Mill, Nelson M.D.



Mary Ryan Mine, Sloan M.D.



Galena Farm Mine, Silverton.

of \$1 par value. This company installed a 435-horse-power hydro-electric power plant and remodelled the flotation-mill to a modern flow-sheet mill of 100 tons a day capacity. Mining and milling operations were started in July, 1929, and ceased about the middle of November.

As the ore reserves at the property had been largely depleted, it was then decided to have the mine carefully examined in detail in order to make plans for future exploration. H. H. Yuill and staff were engaged for this work.

The general geology of the deposit has been described in past Annual Reports and is but briefly reviewed for purposes of this report. The rocks in the vicinity are slates and schists of the Slocan series, in which occur bands of limestone. In the mine it has been found that mineralization has taken place generally at the intersection of a strong fissure-vein with the limestone-bands. The fissure-vein strikes N. 55° and 65° E. and dips to the south-east at 75°. Recently a discovery on the No. 5 level has disclosed mineralization that occurs away from the limestone in the schist and slates. Mineralization is chiefly siderite or spathic iron, with subordinate amounts of sphalerite and galena carrying some silver.

The underground workings of the property have been largely stoped out by past operations above the No. 3 level at 3,300 feet elevation. There is one exception to this statement on the No. 3 level in what is called the foot-wall stope, where a limited amount of stoping was done during the fall of 1929 on a narrow low-grade lens of spathic iron and sphalerite. The available information now shows that there is only a few months' reserve of low-grade milling material in the mine, although there are certain objectives for exploration that might materially increase the indicated tonnage.

During 1929 the mill treated approximately 5,975 tons of material containing net recovered metals as follows: Gold, 9 oz.; silver, 20,307 oz.; lead, 412,685 lb.; zinc, 518,205 lb.

When the mill was closed in November some of the underground crew were retained to carry out an exploration programme on the No. 4 and No. 5 levels. The exploration crew was reduced to one shift toward the end of January, 1930, and at the end of the same month the work was discontinued and the plant placed in charge of a watchman. During the summer months a Radiore survey was made of the property.

This property, owned by the Sturgis Creek Mines, Limited, of which F. J. Harbour is president and manager, is situated at the headwaters of Sturgis creek, a southern tributary of Keen creek. The mine camp, at an elevation of 6,600 feet, is reached by 10 miles of road from Zwicky, a station on the Kaslo-Nakusp Railway, and 2.4 miles of pack-horse trail.

The property was formerly owned by L. McLean and associates, of Kaslo, and consists of seven claims, the past development of which has been described in the Annual Reports for 1920 and 1928. The vein, a quartz-filled fissure, occurs in a strong shear-zone in rocks of the Nelson granite and strikes N. 15° E. and dips to the east at 80°. The vein-filling of gouge along the foot-wall, quartz, inclusions of granite and decomposed granite where mineralized contains galena, sphalerite, and pyrite, with the principal value in silver. The shear-zone varies in width from 10 to 25 feet and the vein where opened up varies from 2 to 6 feet in width. The mineralization takes the form of small lenticular lenses in the vein and at some points as a dissemination of lower-grade material. The mineralization is not continuous, the ground that was stoped from above the No. 1 level during the past year containing several small lenses that varied from 1 foot in width to a maximum length of 30 to 40 feet.

The exploration and development work done at the property in 1929 by a crew of ten to twelve men was confined to the driving of a new No. 1 level, 15 feet vertically above the old level of the same number. When visited in September this level had been advanced 80 feet along the shear-zone and from a small stope above the level 40 tons of ore had been mined, hand-sorted, sacked, and shipped to the railway at Zwicky. This tunnel has since been increased in length to 145 feet and latest reports from the property indicate that a small crew of men is employed on contract drifting on this level. A grab sample of the shipment, taken from the car at the railway-siding, gave the following assay: Gold, 0.02 oz. to the ton; silver, 90.5 oz. to the ton; lead, 35.8 per cent.; zinc, 8.6 per cent. Additional exploration-work in the early part of the summer was done in the Intermediate tunnel, 100 feet below the No. 1 level, and in the No. 3 tunnel, 200 feet vertically below the No. 1 level. A total of 74 tons of sorted ore was shipped to the smelter at Trail during the year.

Silver Bear.* This property, which was not visited this year, has been described at some length in the Annual Reports for 1923 and 1924. It is situated on Keen creek, about 15 miles from Kaslo, and during the past two years F. Helme has mined and shipped 86 tons of high-grade shipping-ore. The work in 1929 resulted in the shipment to Trail of 43 tons by the crew of three men employed.

Flint.* The *Flint* group of four claims is situated at the headwaters of Dago creek, a tributary of Keen creek. The camp cabins at 6,500 feet elevation are best reached by automobile from Kaslo, 9 miles to the foot of the *Flint* trail, and thence 4 miles by steep trail up the north side of Dago creek. The property, which is owned by J. A. Carter, has been developed by drifting and considerable trenching. The quartz-filled fissure, which strikes N. 20° E. and dips to the south-east at 65° to 70°, occurs in granite rocks closely related to the Nelson batholith. The fissure varies in width from one to several feet and averages about 4 feet. The mineralization occurs as bunches in the shape of small lenses in the quartz and consists of galena, sphalerite, and pyrite and contains good silver values. The vein has been opened up by three drift-levels totalling 1,600 feet in length. Several small stopes have been mined and the ore sorted for shipment to the smelter. The mineralization on the No. 3 level at 6,550 feet elevation is confined to a narrow lens along the foot-wall of the vein. During the summer of 1929 further development-work on the vein was done by J. A. Carter and son in an effort to prove up additional high-grade shipping-ore.

Daybreak.* The Daybreak Mining Company's property, formerly known as the *Gibson*, is situated on Keen creek, 12 miles from Kaslo and 7 miles from the railway-siding at Zwicky, on the Kaslo-Nakusp Railway. During the summer a fire destroyed some of the buildings at the lower terminal of the company's tramway. A watchman was the only man at the property during 1929 and there has been no new development-work in the season just past. The property is reported to be still involved in litigation.

KOOTENAY LAKE AND AINSWORTH.

Kootenay-Florence. This property, situated on Kootenay lake, 2 miles north of Ainsworth, has been described at length in past publications of this Department and in Geological Survey of Canada, Memoir 117, "Geology and Ore Deposits of the Ainsworth Mining Camp," by S. J. Schofield. Only a brief résumé of the year's work will therefore be submitted herein.

The total footage accomplished on the low tunnel-level by the Kootenay-Florence Mining Company, Limited, now amounts to 7,985 feet, and of this total about 3,012 feet were driven during 1929. The low tunnel, or No. 9 level, workings were described in the Annual Report for 1928 and the accompanying illustration showed the progress of development to the end of that year. Since then drifting to the east and west has been continued on the main fissure-vein cut near the south end of the 905 tunnel, which contains the most definite shoot of ore so far encountered in the deep workings. The east and west drifts followed the vein for a total distance of 575 feet, defining the lateral limits of the ore in both directions. The ore-shoot has an apparent length of from 150 to 160 feet, with the best ore concentrated along the western drift for a length of about 80 feet and an average width of about 4 feet. In the east drift the mineralization is not so well defined, but is wide and strong in places. Beyond the limits of what may constitute ore of minable width in both drifts exploration encountered spots and bunches of mineralization over narrow widths. The upward continuation of this ore-body was cut in a vertical raise at 105 feet above the No. 9 level, and at this horizon, known as the No. 8 level, it was also explored by drifting in both directions. The aggregate length of these drifts is 295 feet.

Somewhat similar results were obtained as in the corresponding workings on the level below, the best ore being concentrated along the section of the vein for a length of about 60 feet westerly from the raise over a width of about 6 feet. In the eastern drift there is some low-grade mineralization of less definite character on the foot-wall side of the vein over a length of about 60 feet and a width of 3 feet. Measured on the dip of the vein, these workings are estimated to be about 160 feet above the corresponding workings on No. 9 level. The Lakeshore crosscut, or 903 tunnel, has been extended to a point 1,094 feet south of the main adit. At points 615 and 690 feet south of the main tunnel, east-west striking fissures, showing slight mineralization where they cut a band of limestone, were intercepted and subsequently explored by drifts to the west. The drifts are known respectively as the 936 west and 940 west. Since the property

was last visited another parallel fissure is reported to have been cut in the Lakeshore tunnel at a point 832 feet south of the main adit. The most definite ore occurrence seen in these southerly workings was in the 940 west drift, where development has outlined a small T-shaped ore-body, being in part ore along a fissure and partly replacement ore in the limestone, which is cut at right angles by the fissure. The dimensions are, roughly, 45 feet along the strike of the fissure and 47 feet along the bedding of the limestone. The ore, consisting of a mixture of iron, lead, and zinc sulphides, has its strongest development along the line of the fissure. The average width of this ore is about 5 feet, with a maximum width of 8 feet at the point of intersection with the northerly-striking replacement ore, which is confined to narrow widths.

In addition to the two ore-bodies described, there are other points in the No. 9 tunnel-workings where weaker mineralization has been encountered, indicating possible points of attack in considering future exploration. Development has now proved the existence of a series of parallel east-west striking fissures, the most important of these being apparently the first-described fissure, which is believed to correspond to the one formerly developed in the upper workings of the mine. Other parallel fissures are expected farther to the south and on Lakeshore ground, so that a large development project is involved to complete investigation of the possibilities of the area. Operations, which had gradually been curtailed since the summer, were suspended at the end of the year in conjunction with general discontinuation of activity at mines operated by companies sponsored by Stobie, Forlong & Company.

Princess Creek Mining Co., Ltd.—No activity has yet materialized in connection with this recently organized company, the property of which adjoins the *Kootenay-Florence* holdings to the north.

Banker. At this mine, situated near Ainsworth, leasing operations have been conducted by A. Garrett and R. Hughes, four or five men being employed. A good showing has been opened up in the old workings. The geology is described by S. J. Schofield in Memoir 117, G.S.C., "Geology and Ore Deposits of the Ainsworth Mining Camp," published in 1920. A large amount of underground work and some diamond-drilling was done in 1928 by the Consolidated Mining and Smelting Company on the *Banker* and adjoining *Maestro* and *Albion* claims. Subsequently the properties were allowed to revert to the owners.

No. 1.—In the same vicinity, this mine, owned by the Consolidated Mining and Smelting Company, was worked under lease for a short period.

Krao.* During the summer of 1929 the late W. E. Zwicky, of Kaslo, was responsible for a considerable amount of exploratory crosscutting on the *Crow Fledgling* tunnel-level of the *Krao* property. The development-work was stopped shortly after his death in the fall of the year. This old mine is situated 3 miles south and west of Ainsworth on the road to the *No. 1* mine and lies at an elevation of 3,100 feet, or 1,400 feet above Kootenay lake.

The ground has not been worked for many years, but a reference as to past production is contained in the Royal Zinc Commission Report of 1906, which states in part that: "The deposit has been stripped at surface for a width of about 60 feet and a length of 150 feet, and 6,858 tons averaging 22 oz. silver, 12 per cent. lead, and 8 per cent. zinc had been quarried out, hand-sorted, and shipped to the smelters prior to October 31st, 1905." It would appear that active production ceased soon after this date, and except for small amounts of very rich wire silver ore mined by leasers there has been little change in the property in recent years.

The rocks outcropping close to the mine-workings consist for the most part of a coarse crystalline limestone, white to grey in colour, together with several bands of quartzite. The mineralization, which is of the replacement type in limestone, consists of galena, sphalerite, and siderite in irregular masses along the outcrop of the sheeted, coarse-crystalline limestone.

The old underground workings of the mine were flooded at the time of visiting the property and could not be examined. They are stated to consist of a vertical shaft, in the hanging-wall of the mineralized zone, down over 100 feet and from which short drifts have been mined in a north-and-south direction along the limestone-band. Several years ago a tunnel at 2,800 feet elevation was started on the *Crow Fledgling* claim and driven west for about 850 feet as a true crosscut to intersect the *Krao* limestone-band some 300 feet below the surface. Several hundred feet of drifting from the end of this crosscut along a limestone-band proved to be disappointing. Recent surveys, however, pointed to the conclusion that possibly the drift was to the east of where the downward extension of the *Krao* limestone might be expected to intersect the *Crow*

Fledgling tunnel-level. Accordingly a crew of ten men was engaged by W. E. Zwicky and associates to crosscut from the north end of the low tunnel-workings toward a point south of the old shaft-bottom. When the crosscut was examined in September it had passed through several bands of quartzite and greyish crystalline limestone and according to surveys had a further 60 feet to go before reaching its calculated objective.

It is satisfactory to record resumption of work at Riondel by the **Blue Bell** Mines, Limited, which was incorporated in January, 1929, with a capitalization of 2,000,000 shares of \$1 par value. Options were previously acquired by S. S. Fowler and B. L. Eastman, who sponsored the undertaking, on the *Blue Bell* and the separately owned *Comfort* and *Kootenay Chief* claims, which adjoin it to the north and south respectively. Subsequently an agreement was entered into with the Consolidated Mining and Smelting Company, which has been financing exploration on the *Comfort* and *Kootenay Chief* claims. If the results of this work are successful it is to be expected that work will also be resumed in the *Blue Bell* mine-workings, which are centrally situated for deep exploration of the widely separated showings now being developed.

A 2-compartment inclined shaft is being sunk near the north end of the *Comfort* claim, about 1,400 feet north from the extreme northerly limit of the *Blue Bell* workings. This shaft, down 288 feet at the end of the year, is sunk at an angle of 38°, just south and on the foot-wall side of a strong surface showing previously discovered. At this point the bedding-planes of the mineralized limestone dip at about 25° to the west and the shaft, sunk at the steeper angle, was planned to keep below and on the foot-wall side of the ore-body. From 155 to 285 feet down from the collar, however, the shaft cuts through a flat-dipping body of ore which is apparently of milling grade, with a good percentage of galena. At about 285 feet down the ore is cut off or faulted by a dyke striking diagonally across the shaft. This ore-body, obviously of a considerable thickness, has no connection with the hanging-wall surface showing previously mentioned, but should outcrop in the swamp east of the collar of the shaft. A separate foot-wall ore-body is therefore indicated in the limestone which is believed to be 150 to 200 feet wide. In the *Blue Bell* workings farther south the ore-bodies are exclusively in the upper or hanging-wall side of the same band of limestone. The shaft is to be continued to a depth of 420 feet and a crosscut will then be driven to explore the hanging-wall ore-body indicated by the surface exposure. Air for machines and 6 by 10, 2-cylinder hoist is piped from the compressor at the *Blue Bell* mill.

On the *Kootenay Chief* claim at the south end of the promontory a crosscut has been driven to explore some promising showings facing Galena bay. This tunnel has cut an exceptionally fine showing of ore about 33 feet wide and containing probably over 20 per cent. combined lead and zinc, these metals being present in about equal proportions. Tunnels are to be driven on the foot-wall side of the ore to determine its lateral extent and sinking may be undertaken later. The whole area, including the *Blue Bell* and the above-mentioned adjoining claims, is described in detail by J. F. Walker under "Economic Geology" in his work on the Kootenay Lake District, published in the Summary Report of the Geological Survey of Canada for 1928. It is apparent that the *Blue Bell*, unprospected and unexplored beyond the limits of the old workings, still has good possibilities for important lateral ore extensions, while the potentialities of the old mine at depth are by no means exhausted. The present operations, however, are confined to the adjoining claims mentioned above.

The romantic history of the *Blue Bell* is recorded in the above-mentioned publication, together with some detailed figures of past production. Exact figures are not readily available, but the mine has been credited with a total past production of around 500,000 tons. S. S. Fowler, dean of Kootenay mining engineers, has been continuously connected with the management of this property for the last twenty-five years. The resumption of activity in the adjacent area would indicate that his continued faith in the property was justified.

This property, consisting of six claims formerly known as the *Talisman* group, is situated at Deanshaven, on the east side of Kootenay lake, 2¼ miles south of the *Blue Bell* mine. The accidental discovery in 1928 of an immense boulder of ore by R. T. Deane and subsequent results of preliminary exploration by the *Berengaria* Mining Company are described in the Annual Report for 1928 and in Bulletin No. 1, 1929.

Exploration in the vicinity of the occurrence has since been continued by the Goldfield Consolidated Mines Exploration Company of Nevada and the Mining Corporation of Canada.

who have acquired the property on a lease and bond basis. Following a theory held that the boulder might have slid from its original position higher up the hill, or was residual from the erosion of a parent limestone-body, the crosscut tunnel started by the previous operators was continued easterly to a point 285 feet in from the portal. No limestone such as must have formed the original host of the calcareous ore-mass was encountered in the tunnel and work was discontinued. As a result of an electrical survey made of the vicinity by the Radiore Company of Canada further exploration is being done in the floor of the tunnel near the portal to test a zone of "conductors" which farther south follow the general strike of limestone rocks as disclosed by subsequent trenching. It is thought that this limestone may pass under the gravels below and adjacent to the mouth of the tunnel.

About $1\frac{1}{2}$ miles north of the *Berengaria* and on the *Kootenay Chief* claim, which adjoins the *Blue Bell* to the south, the main ore-bearing band of limestone goes under the lake at the south end of the promontory formed by Galena bay. It has a general northerly and southerly strike roughly paralleling the lake-shore and dips to the west. Opposite the *Berengaria* this limestone, if its strike and dip are maintained without serious displacement, should be some considerable distance away under the lake. It is therefore considered probable that the limestone which is exposed south of the approach to the *Berengaria* tunnel will correspond to the wide bed of limestone which passes east of the *Kirby* workings 1 mile north-east of the *Blue Bell*. This limestone is believed to have been traced southerly to within about a mile of the *Berengaria* property by A. J. Curle, who found indications of mineralization in outcroppings. The "Kirby limestone," as it is known locally, is referred to as an interesting prospecting possibility in H. C. Gunning's report on the *Kirby* group, published in the Summary Report of the Geological Survey of Canada for 1928.

Mineral Dyke. Following a recent discovery of platinum-bearing ore by C. Rossiter, four claims were staked south-east of Walker's Landing, about 1 mile by trail from Kootenay lake. Besides appreciable values in platinum and palladium the ore contains some copper and a little gold. The very limited amount of shallow digging done is insufficient to afford much information as to the character or continuity of the mineralization, which apparently occurs in a sill of massive hornblende rock. As rocks of similar character, intercalated between the altered sediments of the Lardeau series, are of common occurrence in the area, interesting prospecting possibilities are suggested. The Consolidated Mining and Smelting Company has acquired a working option on the property and exploration is expected to start very shortly.

Minor activities in the Kootenay Lake and Ainsworth area include: Continuation of work by O. Augustine on the *Otto* group, situated on the southern side of Campbell creek, about $2\frac{1}{2}$ miles from Kootenay lake; prospecting activity by D. M. Wadams and associates in connection with their *Lookout* group on Fry creek and *Pegleg* group on the South fork of the same stream; prospecting activity on Woodbury creek in connection with the *Violet*, the *Jessie Bluebird*, and the *Baltimore* groups. These three properties have in past years made shipments of exceptionally high-grade silver ore.

HOWSER LAKE AND DUNCAN RIVER.

Further extensions were made during the year to the Duncan River trunk trail, which, it is expected, will be completed during the coming year. This work is being done to afford access to the upper river during the low-water period.

The *Riverside* group of six claims, situated on the eastern side of the Duncan river south of McGuire creek, includes the old claims formerly known as the **Riverside and Southern Pacific.** *International* group, which constitute the nucleus of the present undertaking. In 1927 an option was taken on the original property by J. W. Mulholland and W. J. Sturgeon and additional claims were staked covering the vein extension to the south. In 1928 a deal was made with the Omo Mines Corporation, of Spokane, and four claims to the west of the *Riverside* group were added to this property, in connection with which a substantial cash payment has already been made. The original deal also covered the *Southern Pacific* group of six claims, staked by Mulholland and Sturgeon to cover the vein extension still farther south, but the company's option on this ground is believed to have lapsed. The original *International* property is referred to in the 1918 Annual Report and the *Riverside* in the Annual Reports for 1927 and 1928.

Recapitulating briefly, the country-rocks are black, carbonaceous, siliceous schists and decomposed mica-schists. A bed of conglomerate lies above the dark schists and forms the hanging-wall of the quartz vein, which conforms to the bedding-planes of the country-rock. The quartz contains galena as the principal ore-mineral, with some pyrite and occasionally sphalerite. The galena is irregularly distributed in the quartz; in places it is strongly developed and at the other points it only occurs sparingly or is absent. The vein strikes north-westerly, with a generally flat dip to the north-east or into the hill.

On the *Riverside*, at an elevation of 5,200 feet, numerous superficial workings develop the vein at shallow depth for an estimated length of 700 or 800 feet. In these workings there are some good showings of disseminated galena up to 5 feet wide, but continuity of commercial mineralization remains to be demonstrated. When the property was visited in September a crew of eight men was employed in driving a crosscut tunnel to test the vein extension a short distance southerly from the above-described group of workings. This tunnel will develop the vein at an estimated depth of about 150 feet below the outcrop. About three-quarters of a mile farther south another group of superficial workings develop what appears to be the same vein on the *Southern Pacific* group. In this locality the vein is also explored at shallow depth below the outcrop by short crosscut tunnels and open-cuts. The quartz is mineralized in spots with disseminated galena and sphalerite and occasional pyrite, but as yet no continuous ore-body has been indicated. The quartz vein is remarkably persistent along the strike, having been traced through five claims.

In addition to the exploratory work done by the Omo Mines Corporation, substantial camp buildings have been constructed and a new trail, about $6\frac{1}{4}$ miles in length, has been built to connect with the Duncan River trunk trail. Work at the property was discontinued toward the end of the year owing to danger of snowslides. A. Sorcnson was in charge at the mine and J. J. Stanford, of Spokane, is consulting engineer.

This group of eight claims, four of which are Crown-granted, is situated on the western side of Howser lake near its northern end. The lower tunnel, at an elevation of 3,800 feet, is about 2,000 feet higher than the lake, with which it is connected by trail. Work has been done at intervals by R. S. Gallop for several years. Latterly the development-work has been financed by the President Mines, Limited, of Victoria.

The principal workings, consisting of four tunnels at approximate elevations of 4,075, 4,000, 3,960, and 3,800 feet respectively, are situated on both sides of a steep rocky gulch occupied by a small torrential stream. The two upper tunnels, having an aggregate length of about 300 feet, are driven to the north-west from near the bottom of the gulch. Ninety sacks of high-grade ore are reported to have been shipped from these workings. Going down the creek the next tunnel is a crosscut driven south-westerly for a roughly estimated length of 500 feet. The lowest tunnel, situated on the northern side of the creek, is a crosscut driven about 860 feet. There are also a number of open-cuts, mostly filled up with rocks and mud which are constantly sliding down from the steep banks above.

The formation of the area includes limestones, quartzites, and graphitic schists, which, according to J. F. Walkér, are members of the Lardeau series of late Pre-Cambrian age. (Refer to Map of the Kootenay Lake Area, issued with the 1928 Summary Report, Part A, of the Geological Survey of Canada.) The strike of the rocks here averages about N. 35° W. and the dip is from vertical to 60° to the west. In the immediate vicinity of the workings the formation has been badly shattered and crushed. The graphitic schist is very soft, making a rapidly eroding surface. There are supposed to be numerous parallel veins on the property, but some of these are very indefinite. Some shearing parallel to the bedding-planes is apparent and there are indications that the silver-lead mineralization, deposited in scattered aggregates along late fault-planes and fractures, is derived from downward-moving solutions.

The tunnels are numbered 1 to 4 in succession from the top. The No. 1 tunnel, about 90 feet long with a short branch drift, has been driven on a narrow vein of crushed quartz, showing occasional galena and carbonates, which terminates near the forks of the tunnel. Beyond this point there are barren quartz stringers in the north branch and in the western branch a little galena is to be found in the fractures of the quartzite. No. 2 tunnel develops a short length of vein, consisting of crushed quartz a few inches wide, in quartzite. This veinlet contains occasional nodules of galena surrounded by lead carbonates. No. 3 tunnel crosscuts four widely

separated "veins" of indefinite character. The first one encountered a short distance in from the portal is a badly leached and decomposed zone consisting of a jumbled mass of slate, quartz, and gouge. At about 250 feet in a 2-foot width of barren-appearing quartz is cut. At about 325 feet in from the portal a wide, north-westerly striking zone of crushed quartzite and schist is intercepted. At 415 feet in from the portal the tunnel cuts through a wide zone of crushed quartzite and gouge. No appreciable mineralization was apparent in any of these bodies. The No. 4 tunnel, recently driven and about 860 feet long, crosscuts the formation. At about 140 feet back from the face drifts have been run north-westerly and south-easterly along a streak of crushed quartz containing fragmental aggregates of galena. When the property was last visited (in September) these drifts had only been run a short distance in each direction. No other mineralization was noted, but galena in very small amounts is said to have been found at other points in planes of fracturing coinciding with the bedding.

On the surface it is difficult to distinguish any definite veins, but at a number of widely separated points small nodules of galena are found in planes of shearing which strike north-westerly. It has been argued that in the upper workings the work has been done in a badly broken and leached zone and that ore would be found in quantity when the veins were followed into solid unleached ground. No evidence was afforded, however, that the veins ever contained sufficient mineralization to form commercial deposits. While very high-grade assays could be obtained, there was no ore exposed or indicated in appreciable amounts and no reason was observed for any change to be expected at depth. The results so far obtained by the driving of the No. 4 tunnel show that the mineralization is still confined to streaks at widely separated points. In considering further possibilities of finding mineral in the adjacent area, the limestones to the west and above the workings might be worth investigation. In a report dated October 31st, 1928, by G. Jamme, represented as a mining engineer, of Seattle, considerable encouragement was given the owners in connection with the possibilities of developing commercial ore in quantity by continuing work in the lower tunnel. A curious feature of this report is the author's statement that "silver, in the form of chlorides, bromides, iodides, etc., also occurs, but not in quantity."

Minor activities which have occurred in the area tributary to Howser include: Continuation of a crosscut tunnel by J. C. Rady on his *High Grade* property on the eastern side of Howser lake; prospecting of the *Fresno* group on Gertrude creek by D. D. McPhail. Some prospecting activity is also reported in connection with properties on Hall creek.

This group, worked in a small way at intervals by J. Brochier, is situated on the north side of Hamill creek, 3 miles by trail and branch road from the **St. Patrick.** Argenta-Howser road. The principal workings are a shaft and a tunnel, aggregating over 1,000 lineal feet of underground work. The formation, including limestones, mica-schists, and carbonaceous schists, strikes N. 20° W. and dips steeply to the north-east. The mineralization is associated with the limestones. The shaft, 75 feet deep, and the tunnel-workings to the south-east of it, develop a series of veins and veinlets formed in general along planes of fracturing coinciding in strike and dip with the country-rock. The ore-minerals are galena and sphalerite, associated with pyrite and in places with limonite and lead carbonates, in a calcareous gangue. While there are several veins and small showings, well mineralized in places, the most interesting feature is probably the replacement deposit, 40 feet wide, cut by the main tunnel. Here the lead and zinc sulphides occur in somewhat scattered aggregates, but the showing is attractive and indicates possibilities for mineralization on a large scale.

These notes are based on a visit made in connection with an application for assistance in improving transportation facilities, and time was not available for making an extensive examination such as would be required to make a comprehensive report on this interesting prospect. The general geology of the area is shown on Map 236A, Kootenay Lake area, issued with the 1928 Summary Report of the Geological Survey of Canada. It is understood that the economic geology will be described in detail in the "Lardeau Map-area" by the same authority, awaiting publication.

POPLAR CAMP.

This group is situated at the head of Cascade creek, at a distance of about **White Eagle.** 12 miles from the Lardeau-Gerrard branch of the Canadian Pacific Railway. The property was acquired in 1928 by the Keene Mountain Gold and Silver Mines, Limited, of Calgary, and exploratory work has since been carried on continuously by

No important additions were made to the plant during the year, but the new hydro-electric installation, already almost completed in 1928, was brought into operation. A Pelton wheel operating under a head of 1,150 feet drives a Crompton-Parkinson a.c. generator having a capacity of 600 amperes at 220 volts. The two semi-Diesel engines of 90 and 200 horse-power respectively, each driving a separate alternator, which constitutes the former power plant, are available for use during periods of water-shortage. A single-stage compressor driven by a Pelton wheel and able to supply four drills completes the installation. Peter Price is the superintendent and Clarence Garrett is in charge of the mine.

SLOCAN MINING DIVISION.

The *Lucky Jim*, operated by the Lucky Jim Lead and Zinc Company, Limited, with Peter Price as superintendent and William Callin as mine foreman, employed sixteen men underground and seven on the surface at the time of the last inspection. No additions were made to the plant, which remains as described in A. G. Langley's report for 1927, and the mill was idle during the greater part of the year. The new raise connecting Nos. 5 and 6 levels, completed in the early spring, is a remarkably good piece of work in all respects and provides excellent ventilation. The conditions found to prevail in and around the mine were very good.

The *Noble Five*, at Cody, was operated throughout the year by the Noble Five Mines, Limited, with forty-seven men underground and eleven on the surface. The capacity of the mill has been increased to 100 tons in twenty-four hours, this corresponding to the enlarged activity of underground operations. The method of mining is overhand stoping with waste filling. Where timber is required, either square sets or stulls are used, according to circumstances. The ventilation was generally good everywhere, with the occasional exception of a part of the *Deadman* drift, where conditions in this respect will soon be improved. The remodeling of the blind shaft, begun in 1928, has now been completed and has proved quite satisfactory. The ore is brought to the head of the tram by a storage-battery locomotive. The men's living-quarters are comfortable and very well kept. John G. Shepard is superintendent, with R. S. Sanford as assistant and Wm. Findlay as mine foreman.

Two accidents, involving three men, were reported during the year. On April 27th Oscar Dalgren and Joseph Flatten were injured (the former more seriously than his partner) by a premature blast in No. 8 drift. The only explanation offered—i.e., a "running" fuse—seems improbable, as nothing of this kind has been brought to the writer's knowledge for a number of years, and the particular brand of fuse used at the *Noble Five* has been found highly reliable everywhere. It is true that a fuse may burn much faster than at its normal rate of combustion if it is strongly pinched or twisted at one point, which of course implies gross carelessness on the part of the person handling it.

On July 6th Stanley Duda lost his left eye through being struck by a small piece of rock, apparently thrown upwards with considerable force by one of the wheels of a moving train of empty mine-cars in which he was riding to his work.

The *Ruth-Hope*, at Sandon, operated by the Ruth-Hope Mining Company, employed forty-seven men underground and eight on the surface at the time of the last inspection. The method of working is a form of overhand stoping with waste filling. The workings were always found well timbered and the roadways and working-places were generally well kept, but some of the manways in the inner section are rather small. Conditions were good in all respects in the outer district, but in the inner section some difficulty is experienced in maintaining adequate ventilation owing to the fact that this part of the mine is isolated at the end of a long crosscut, without any other means of communication with the surface. In September the problem was solved by the establishment of an opening between these workings and the 910 level of the *Silversmith*, but owing to a disagreement between the two operating companies this was closed again towards the end of October, which meant a return to the conditions existing previously. However, the ventilating apparatus has been improved during the year and strenuous efforts will be made to maintain a sufficient amount of air in circulation. Naturally, only one exit from the inner part of the mine is available at present.

The bunk-house and cook-house, which were old buildings hardly suitable for their purpose, have been abandoned by the company and all employees, but two, are now living in Sandon. H. A. Rose is superintendent and Colin Stewart is the mine foreman.

At the *Silversmith* operations were limited to exploratory work and at the time of the last inspection there were five men employed underground and two on the surface. The conditions

crew, normally consisting of sixteen men, was recently reduced to eight men owing to the exceptionally severe weather at the end of the year. Equipment for the quarry-work consists of two steam-drills and three channelling-machines. In the mill are a 4-gang saw, a diamond saw, 25-horse-power boiler, compressor for the drills, and dynamo for the electric light. A description of the deposit is contained in the Annual Report for 1908, page 97. Three car-loads of marble in "gang-saw blocks" are awaiting shipment.

REVELSTOKE MINING DIVISION.

Most of the mineral-deposits in this Division are found in two well-defined belts of sedimentary rocks of Pre-Cambrian age which cross the main line of the Canadian Pacific Railway in the vicinity of Albert canyon and Flat creek respectively and, paralleling the Columbia river, extend north-westerly into the heart of the Big Bend district. This area contains numerous old superficially explored properties and prospects which have, to a considerable degree, escaped attention owing to their remoteness from transportation. This district is considered to have mineral potentialities meriting investigation, and the proposed new highway round the Columbia river from Revelstoke to Beavermouth is expected to stimulate activity in connection with numerous long-dormant prospects scattered at intervals from the main line of the Canadian Pacific Railway to Mica creek.

Interesting and valuable information is contained in "Geology and Mineral Deposits of the Big Bend Map-area," by H. C. Gunning, published in the Summary Report, Part A, of the Geological Survey of Canada for 1928. Included in this publication is a summarized history of the district and a description of the principal mining properties. Attention is directed to mineral-zones meriting investigation. In regard to the stannite occurrence at the *Snowflake*, the author on page 186 says:—

"In the field or in hand specimens the stannite might be mistaken for zinc-blende or for grey copper. It resembles sphalerite when tarnished, but gives a black streak rather than the ordinary white or brown, resinous one of zinc-blende. On fresh surfaces it has a dark steel-grey colour which would not readily be confused with zinc-blende. It is somewhat coarser in grain than the ordinary grey copper of the district and exhibits an indistinct cleavage. In addition, it is darker in colour and less silvery in appearance than grey copper."

And on page 156 of the same publication he says: "It is interesting to note that cassiterite is generally associated with stannite, and that cassiterite is most frequently found in quartz veins associated with acidic intrusives such as granite and pegmatite. Cassiterite is also found in pegmatite dykes. Fresh granite and granitic pegmatites occur in abundance in the granite-gneiss-sediment complex which is found short distances west and south of the *Snowflake*. The writer has found beryl in some of the pegmatites exposed on the *Snowflake* trail a short distance from the railway. The granite and granitic pegmatites of the complex are assigned to the same period of intrusion as the other granitic rocks of the region which are believed to have supplied the emanations that formed the ore-deposits of the district. No tin has as yet been found in the pegmatite, but future investigators might well bear in mind the possibility of cassiterite being associated with them."

In the northern part of the district, and beyond the limits of the area covered by Gunning, mica of good commercial grade is reported to occur in pegmatite dykes in the area at the head of Mica and Yellow creeks. The writer's attention was recently directed to a reported occurrence of cyanite, or aluminium silicate, located on the Columbia river about 50 miles north of Revelstoke. A group of claims, known as the *Wallace* group, has been staked and acquired by Seattle interests. Little is known of the extent or nature of the deposit. Specimens show the characteristic bladed crystals of cyanite in a ground-mass of quartz, feldspar, and a little mica. Exploratory work has been planned for next summer season with a view to determining the importance of this occurrence. There is reported to be an increasing demand for this mineral, which is chiefly used as high-temperature insulating material and in the manufacture of pottery, crucibles, glass, and spark-plug porcelain. Information appertaining to the broadening market for cyanite and allied minerals is contained in Serial No. 2587, "New Uses of Non-metallic Minerals," issued by the U.S. Bureau of Mines. A further report by the same authority entitled "Sillimanite, Kyanite, Andalusite, and Dumortierite" will be published shortly.

BIG BEND SECTION.

Placer-mining.

During the summer months minor activity occurred in connection with the following placer propositions: A. McRae on Camp creek; D. Fulmore and C. M. Williams on McCulloch creek; and R. Allen on the same creek. The principal placer activity was at the property of the French Creek Development Company, where hydraulic operations have been carried on for the past two seasons. When the property was visited towards the end of September one monitor was being operated. The bench on which the workings are situated is covered with soil, boulders, and heavy timber. A large area of bed-rock had been uncovered, but no appreciable quantity of gold-bearing gravel had yet been located.

Lode-mining.

This group of four claims, owned by A. Kitson and the McBean Estate, is situated on Kelly creek at an elevation of from 6,000 to 7,200 feet. Exploratory work, including the driving of a short length of tunnel, was carried on during the summer season. This interesting prospect is described by H. C. Gunning in "Geology and Mineral Deposits of the Big Bend Map-area," which has been referred to in the introductory section of this report on the Revelstoke Division. The ore carries values in gold, silver, lead, and zinc, appreciable gold values being associated with arsenopyrite.

Other minor activities by prospector-owners of claims occurred at: Gold-quartz prospect in the Groundhog basin by B. Maley; the *Montgomery* group on Boulder creek, a tributary of Downie creek, by J. C. Montgomery; *Keystone* group, at the head of Keystone creek, by A. MacIntosh.

SECTION EAST OF REVELSTOKE.

This property, operated by the Snowflake Mining Company, is situated on Woolsey creek, about 8 miles from the main line of the Canadian Pacific Railway. A sleigh-road has now been built from the railway-siding, 2 miles west of Albert Canyon Station, to the foot of the steep hill below the mine. At this point the road connects with the lower terminal of a surface tram, 2,000 feet long, used to haul supplies to the camp at 5,500 feet elevation. The property was described at some length in Bulletin No. 1, 1929, and the accompanying plan showed the progress of work on the No. 4 tunnel-level up to the end of June. The present brief notes are intended to be read in conjunction with this previously published information. Since the appearance of the above-mentioned bulletin the results of field-work done in the area by H. C. Gunning have been made available in the recently issued 1928 Summary Report, Part A, of the Geological Survey of Canada, under the section devoted to "Geology and Mineral Deposits of Big Bend Map-area." The following quotation from page 156 of this publication is of considerable interest:—

"Recent discoveries (*see* page 185) in the lower level of the *Snowflake* have revealed the presence of stannite (sulpho-stannate of copper, iron, and zinc) in the ore. Although no authentic information regarding the magnitude of the deposit is available, the occurrence is of considerable economic and scientific interest as stannite has not previously been found in British Columbia. As is noted on page 186, the mineral is not an easy one to identify and, if present in small amounts, might easily be confused with zinc-blende or grey copper. Consequently it would seem advisable to have samples from the lead-zinc deposits of the district tested for tin when any assaying is being done."

When the property was last visited (in December) the raise in the east drift on No. 4 tunnel-level was up about 370 feet and, according to latest reports, has since holed through into the No. 2 tunnel west drift. In the upper part of the raise, driven since the writer's previous examination, the quartz vein is strong and well mineralized in places. At 200 feet up from the level drifts have been run easterly and westerly, showing pronounced mineralization at this horizon. The vein here is from 3½ to 4 feet wide, with a strong development of sulphides over narrow widths. In the face of the western drift, 30 feet long, the mineralization was concentrated over a width of 12 inches on the hanging-wall side of the vein.

This pay-streak contained galena, pyrite, sphalerite, some stannite and ruby silver (proustite). The adjoining 3 feet of quartz contained sulphides in small disseminated aggregates. The eastern drift, 40 feet long, showed a width of about 4 feet of quartz containing galena and stannite in streaks and bunches. At 260 feet up the raise a drift had been run 6 feet westerly

on another good showing, 4 feet wide, containing galena and sphalerite, with which tin values are associated. Between this point and the top of the raise, then 370 feet up, the vein widens considerably and quartz containing disseminated sulphides is exposed up to 8 feet wide. No samples were taken on this occasion as extensive systematic sampling would be necessary to determine average values throughout the raise. The mineralization in the recently driven section of this working is somewhat irregular, but apparently compares favourably with the lower 120-foot section previously sampled, and the impression was formed that more consistent values might be expected from the recent work.

The west drift on the No. 4 tunnel-level had been advanced to 640 feet from the main crosscut and towards the inner end of the drift a crosscut had been run 300 feet northerly. It is intended to continue this crosscut to explore the parallel veins in that direction. The west drift contains short lengths of mineralization, consisting of disseminated galena, sphalerite, and occasional stannite in the quartz. In the westerly portion of this working the vein is shattered and contorted in a zone of considerable disturbance of the strata. Graphite is developed along slickensided planes of shearing. Towards the end of the year ore from the raise in the east drift, where the strongest development of stannite occurs, was being shipped for milling and treatment tests.

**Regal Silver
Mines, Ltd.**

The property of this company, more generally known as the *Morton-Woolsey*, adjoins the *Snowflake* on the south-east and covers the extension of the same vein system to considerably lower altitudes. The veins also occur in the same black-slate formation. The principal workings, situated on the steep mountain-side sloping towards Clabon creek, consist of three tunnels at elevations of 4,995, 4,700, and 4,200 feet. These are known as the No. 1, No. 2, and No. 3 tunnel respectively. The mineralization in the upper two workings is described by H. C. Gunning in "Geology and Mineral Deposits of Big Bend Map-area," published in the 1928 Summary Report, Part A, of the Geological Survey of Canada. On page 186 the author says: "The veins are similar to those described on the *Snowflake* group. The sulphides, principally pyrite and galena with small amounts of sphalerite and chalcopyrite, are later than the quartz of the veins. They occur in crushed or fractured quartz, in the crushed sediments adjoining the vein, and occasionally as irregular bodies of small dimensions filling vugs or porous crystalline spaces in the veins." In the No. 3 tunnel-workings, which have largely been driven since the report was written from which the above quotation is made, the mineralization is of similar character. It may be said that in general silver-lead-zinc mineralization in some degree is widespread, but continuity of commercial mineralization remains to be demonstrated and exploration has not yet reached the stage where any important tonnage can be estimated.

The interesting discovery of stannite at the *Snowflake*, on ground adjoining the *Morton-Woolsey* boundary, has had the effect of stimulating exploration at the latter property. In addition to the large amount of development accomplished on the No. 3 tunnel-level, work has been resumed in No. 2 and No. 1 tunnels. In the last-mentioned working, which is the nearest to the *Snowflake* boundary, stannite was detected in small amounts as reported in Bulletin No. 1, 1929. When the mine was visited in December the No. 1 tunnel was being advanced by hand and exploration was proceeding on No. 2 and No. 3 levels. The compressor equipment at the property had been increased by the installation of a Rix portable gas-driven compressor at the No. 2 level camp. The No. 1 tunnel, which is a drift on the No. 5 vein (supposed to correspond to the No. 1 *Snowflake*), had been advanced about 50 feet. In this new section no ore of consequence was developed and the vein splits into stringers at the face. It was in the old portion of this tunnel, about 100 feet long, that the stannite was previously detected.

The No. 2 tunnel, developing the No. 5 vein, had attained a length of about 450 feet, of which 315 feet has been driven recently. The old portion of the tunnel, driven on the foot-wall side of the vein, contains two short crosscuts which, together with the showing at the portal, expose the vein at three points over a length of about 120 feet. The general character of the mineralization in these crosscuts, as well as that in the No. 1 tunnel, is described in H. C. Gunning's report previously mentioned. No appreciable change in regard to distribution of the ore-minerals was observed in the new section of vein opened up. Opposite the second of these crosscuts on No. 2 level a tunnel driven 43 feet to the south-west recently cut what is believed to be the No. 6 vein. Total development-work in the No. 3 tunnel-workings amounted to about 4,200 feet of work at the end of the year.

The main crosscut had been advanced to 1,250 feet in from its intersection with the approach tunnel, 200 feet long, connecting it with the surface at the main camp level. The approach tunnel is driven north-westerly and the main crosscut is driven south-westerly at right angles to the strike of the veins. Four quartz veins, known as the Nos. 3, 4, 5, and 6, are cut at points 605, 655, 750, and 950 feet distant respectively from the approach-tunnel intersection. Of these, the No. 5 and No. 6 veins were considered the most promising and they have been explored by drifting in both directions.

The exact correlation of the veins on the *Morton-Woolsey* and *Snowflake* properties is not yet definitely known, but it is considered probable that the *Morton-Woolsey* No. 5 vein corresponds to the No. 1 *Snowflake* (silver-tin) vein. If this assumption is correct, the No. 3 *Morton-Woolsey* tunnel develops the No. 1 *Snowflake* vein at a depth of about 2,000 feet, measured on its apparent average dip, below the *Snowflake* No. 4 tunnel. In the *Morton-Woolsey* No. 3 level workings the average dip of the veins is about 38°, which is considerably flatter than the attitude of the veins in the No. 4 *Snowflake* tunnel.

The drifts run on the No. 5 and No. 6 veins had attained the following lengths in December: No. 5 west, 350 feet; No. 5 east, 150 feet; No. 6 west, 800 feet; No. 6 east, 550 feet. In the No. 5 west drift a raise 90 feet from the main crosscut has been put up 200 feet on the dip of the vein. At the top of this raise intermediate tunnels have been driven along the same vein for 225 feet north-westerly and 200 feet south-easterly. In the No. 6 east drift, a short distance from the main crosscut, a raise has been put up 136 feet on the dip of this vein. In addition to these workings numerous short crosscuts have been run off the several drifts.

A detailed description of the dimensions of the mineralized sections of the veins in the No. 3 level workings cannot be attempted at the present time as no authentic information regarding average values is available. The impression was formed that the galena, sphalerite, and pyrite were very irregularly distributed in fractured quartz areas, the mineralization being similar to that in the upper workings described in previous publications of the Department of Mines and the Geological Survey of Canada. The most continuous mineralization noted was a band of massive pyrite, 1 to 3 feet wide, in the drift and intermediate level developing No. 5 vein west of the raise.

Assay plans made for the Regal Silver Mines, Limited, show consistent tin values approximating 1 per cent. throughout the No. 5 vein raise. A sample taken at the top of the raise is shown as assaying 4.15 per cent. tin, and values in the same metal are also shown in assays of ore from the No. 5 vein intermediate west drift from the top of the raise. In all cases no copper values were noted in the assays, which would exclude the possibility of the tin occurring as stannite and by inference would indicate the presence of cassiterite. Although the assay plans show up to 6 per cent. tin, with no copper, in the No. 3 tunnel-workings, no specimens were available in which any tin-bearing mineral could be identified. The pyrite showing in the No. 5 drift was sampled at the time of the writer's inspection in June and assayed for tin, but with negative results. Five other samples taken on the same occasion in other sections of the No. 3 workings also failed to show the presence of any tin. The lack of any apparent tin minerals and the negative evidence of a limited amount of check sampling throw considerable doubt on the reliability of the sampling and assaying which show consistent tin values as indicated on the assay plans of the company. This statement, however, does not refer to the old No. 1 tunnel-workings, where, as previously noted, stannite has been detected in small amounts.

The No. 6 west drift from the No. 3 level is only a few hundred feet from the ground below (on the dip) the veins developed in the No. 4 *Snowflake* tunnel. The No. 6 vein developed by this westerly drift is believed to correspond to the Zero vein cut by the *Snowflake* No. 4 tunnel a short distance southerly from and on the foot-wall side of the No. 1 (silver-tin bearing) vein. This Zero vein was somewhat indefinite where intercepted in the *Snowflake* crosscut and little attention was paid to it. A little recent side-swiping, however, showed appreciable mineralization in quartz striking parallel to the No. 1 vein. The *Morton-Woolsey* No. 6 west drift, and No. 5 west drift workings when extended, will explore this ground at an additional depth of around 2,000 feet on the dip. Results of exploration in this direction will be awaited with considerable interest.

In addition to the above-described workings on Clabon creek, development-work has been carried on for a short period by the Regal Silver Mines, Limited, on its claims on Tangier river (North fork of the Illicellewact river), 5 miles from Albert Canyon. This company's holdings

extend from its *Morton-Woolsey* property over the mountain to Tangier river and cover a large territory with interesting exploratory possibilities.

Klondyke. This group of thirty claims, recently acquired by O. Larson and D. Lougheed, are situated on Tangier river just above the bridge, 9 miles from Albert Canyon Station. A large cabin has been built and three men were engaged

in exploratory work throughout the summer and fall. A crosscut tunnel is being driven to develop the vein at a depth of about 250 feet. The ore is reported to contain values in gold, silver, and lead, with traces of copper and tin. The property has not yet been visited.

Silver Gance. Exploratory work is reported to have been done on this property, consisting of sixteen claims, situated above timber-line at the headwaters of 9-Mile creek, which is a tributary of Tangier river about 9 miles from Albert Canyon Station. The claims, staked in 1928 and 1929, are owned by O. Larson, E. J. Cameron, and D. Lougheed, who acquired the J. H. Munro interest in the property. It is reported that the showings contain exceptionally high-grade silver-lead ore. Stannite, or tin pyrites, is reported to have been detected in association with the galena. The claims, which have not yet been visited, are located north-westerly from the *Lanark*, in rocks of the same sedimentary series.

George. At this property, situated 21 miles up the Tangier river, surface exploration was continued for a short period by D. and O. Woolsey. A brief description of the showings and workings is contained in H. C. Gunning's report on the area, published in the 1928 Summary Report, Part A, of the Geological Survey of Canada. The *George* group is understood to have been acquired by the Woolsey Mines, Limited.

Waverley-Tangier. A small amount of exploratory work is reported to have been done during the summer season on this property, situated at the head of the North fork of Downie creek, immediately north of the divide separating that stream from Tangier river. The property is reached by road and trail, of a combined length of about 28 miles, from Albert Canyon Station. A very comprehensive description of the *Waverley* and *Tangier* properties by H. C. Gunning is contained in "Geology and Mineral Deposits of the Big Bend Map-area," pages 175 to 182, Summary Report, Part A, of the Geological Survey of Canada for 1928.

Woolsey Mines, Ltd. The property of this company, which includes the *Donald* and *Round Hill* Crown-granted claims, is situated on the western side of Caribou creek, in Glacier National Park, about 3 miles by trail from Flat Creek Siding on the Canadian Pacific Railway. The elevation at the camp is about 5,600 feet, aneroid reading, or 2,500 feet above the railway. The property was described in some detail by H. C. Gunning in "Geology and Mineral Deposits of the Big Bend Map-area," published in the 1928 Summary Report, Part A, of the Geological Survey of Canada. This should be read in conjunction with the brief notes now submitted.

Recent work has exposed a wide showing in an open-cut about 100 feet south-easterly from the most northerly shaft developing the main vein. This new exposure, indicating another parallel vein, is 24 feet wide and consists of a width of about 20 feet of quartz heavily mineralized with pyrrhotite and pyrite, with accompanying disseminations, and stringers of galena and sphalerite, and occasional spots of chalcopyrite. Two samples, representing a continuous section across 20½ feet of this showing, assayed:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
12 feet on foot-wall side of showing.....	Trace	2.2	2.0	6.0
Adjoining 8½ feet on hanging-wall side.....	0.02	3.3	4.0	1.5

Other samples taken to get an idea of the values in widely separated exposures on the same (main) vein gave the following assays:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
Across 3 feet in south drift in upper tunnel.....	Trace	1.8	5.0	4.0
Across 9 feet near top of most southerly shaft.....	0.02	3.6	8.0	5.0

The last sample, constituting the best showing noted on the property, might be taken to represent an exposure about 30 feet long and from 9 to 10 feet wide. At both extremities of the lineal dimension given the vein is covered. Open-cuts about 150 feet south of this showing expose the same vein where it is $3\frac{1}{2}$ feet wide, but more sparingly mineralized with the same sulphides. When the property was visited in the fall, exploration was not sufficiently advanced to afford much information on the possible dimensions of ore-shoots indicated by widely separated showings.

This group of claims on Flat creek, about 11 miles by trail from the railway-siding of the same name, is reported to have been acquired by the Woolsey Mines, Limited. No information is yet available in connection with these claims, which are situated about 2 miles beyond the old *Dunvegan* property on the same creek. Some surface prospecting is reported to have been done by D. and O. Woolsey.

SECTION SOUTH OF REVELSTOKE.

This group of claims is situated on Akolkolex (Isaac) creek, about 6 miles by road from Wigwam Station on the Revelstoke-Arrowhead branch of the Canadian Pacific Railway. The camp, located on the flat on the north bank of the creek, includes a group of substantial and comfortable buildings. The property was acquired in 1924 by the Wigwam Mining Company, of Tacoma, and exploratory work has since been carried on continuously under the direction of W. T. Dumbleton.

Work done by this company during the last six years includes diamond-drilling, numerous open-cuts and trenches, together with some eight or nine short crosscut tunnels distributed over a length of about 5,000 feet of outcrop. In 1928 a survey of the area was made by the Schlumberger Electrical Prospecting Company. The total footage of diamond-drilling done amounts to 5,877 feet, distributed over thirty-nine holes along the outcrop. The results of the diamond-drilling are not known to the writer.

The mineralization exposed in the superficial workings consists chiefly of iron sulphides, with a considerable development of sphalerite in places and occasional accompanying lead sulphides. The deposits occur as replacements in limestone. The formation, which also includes quartzites and schists, strikes N. 25° to 30° W., with a dip averaging about 25° to the north-east or into the hill. The workings, climbing the steep side-hill diagonally in a north-westerly direction from the camp, develop the showings which are found in a wide band of white to grey crystalline limestone. This rock, very extensively and irregularly silicified, has been replaced in places by pyrrhotite, pyrite, sphalerite, and galena. The sulphides are mentioned in the order of their apparent abundance. They occur in the limestone and silicified rock chiefly in narrow bands or wide irregular bunches coinciding in general with the bedding-planes of the country-rock. Bunches of sulphides are occasionally developed at the intersection of cross-fractures.

The elevations used in describing the workings are taken from the company's plan, starting with zero at the camp, which is about 2,200 feet above sea-level. The highest or most north-westerly working is the Sleeper's tunnel at an elevation of 2,285 feet above the camp. In this short crosscut the mineralization is confined to a narrow band consisting chiefly of iron sulphides, with which specks of galena are associated. At 2,135 feet elevation the Gold tunnel is a crosscut about 200 feet long. This is being continued to cut a showing of oxidized "capping" exposed on the side-hill above. In the open-cut east of the Gold tunnel, and at about 2,150 feet elevation, there is a strong showing 8 feet wide of iron sulphides with some sphalerite. At 2,057 feet elevation an open-cut shows a width of 12 feet of limestone containing bands, streaks, and bunches of sulphides, chiefly iron, with some zinc and lead. A sample across this 12-foot showing assayed: Gold, trace; silver, 4.4 oz. to the ton; lead, 5 per cent.; zinc, 10 per cent. At 1,772 feet elevation the rock has been stripped, showing a width of 3 to 4 feet of iron sulphide mineralization containing a very small amount of sphalerite and galena. At 1,529 feet elevation there is an open-cut exposing a width of 7 feet of very low-grade material consisting chiefly of iron sulphides. Below this showing the No. 11 crosscut tunnel had been driven about 70 feet and was being continued to check results of diamond-drilling done here. At 1,504 feet elevation a short prospect-tunnel cuts calcareous rocks impregnated with iron sulphides. At the Crooked tunnel, 1,170 feet elevation, a wide open-cut exposes a strong but irregular mineralization of pyrrhotite, sphalerite, and some galena in silicified limestone. About 35 feet southerly on the

surface, the same rock, which is flat-lying, is strongly silicified, but devoid of sulphides, and in the tunnel, driven from the open-cut, there is only weak mineralization in evidence. A sample of selected material from this tunnel assayed: Gold, 0.01 oz. to the ton; silver, 0.70 oz. to the ton; lead, 1.45 per cent.; zinc, 0.8 per cent.

Over 100 feet, normal to the dip, above the main mineralized zone developed at the Crooked tunnel, stripping has exposed some streaks and bunches of clean galena. No mineralization of this character was noted elsewhere. At 1,016 feet elevation trenching has exposed a wide zone of oxidized limestone containing a width of 6 feet of disseminated iron sulphides, with some sphalerite. A sample across this showing assayed: Gold, trace; silver, trace; lead, trace; zinc, 6 per cent. The Andrews tunnel, at an elevation of 535 feet, is a crosscut about 40 feet long, which, near the face, cuts two mineralized streaks separated by 20 inches of waste. The foot-wall 9-inch streak assayed: Gold, trace; silver, 0.4 oz. to the ton; lead, trace; zinc, 5 per cent. And the hanging-wall streak, 4 to 9 inches wide, assayed: Gold, trace; silver, 0.4 oz. to the ton; lead, *nil*; zinc, 2.8 per cent. In the open-cut above the Andrews tunnel an oxidized showing, 3 feet wide, containing some sulphides, assayed: Gold, trace; silver, 0.7 oz. to the ton; lead, *nil*; zinc, 12.4 per cent. Another open-cut situated a short distance to the south-west, and on the foot-wall side of the 3-foot sample, shows some sulphide mineralization over a narrow width. There would possibly be about 20 feet of waste between the showings in the two open-cuts. At 468 feet elevation the Ice tunnel is a crosscut, a few hundred feet long, which is being continued. Towards the centre of this working two mineralized bands, 8 and 18 inches wide respectively and separated by 30 inches of waste, assayed as follows:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
8-inch streak on hanging-wall side.....	Trace	Trace	Trace	20.2
18-inch band on foot-wall side.....	Trace	Trace	<i>Nil</i>	7.0

In the foot-wall country of this showing, and about 36 feet farther towards the crosscut portal, there is an oxidized streak a few inches wide paralleling the bedding of the limestone.

At 402 feet elevation the Red tunnel, 10 to 15 feet long, cuts two bands of mineralization, each 7 inches wide, separated by 18 inches of iron-stained calcareous rock. A sample of the combined streaks, omitting the waste, assayed: Gold, trace; silver, trace; lead, trace; zinc, 3 per cent. In an open-cut at about the same elevation and 20 feet easterly from the Red tunnel some oxidized material has just been broken into. Towards the bottom of the hill, and at elevations of 127 and 76 feet respectively above the main camp, the Mud and Blue tunnels are crosscuts which have not yet developed anything. They would have to be driven a long distance northerly to intercept the mineral-bearing limestone on its flat dip to the north-east.

In addition to the workings mentioned, there are other open-cuts and shallow workings exposing similar mineralization. No attempt was made to thoroughly sample the numerous showings of sulphides as their continuity is not yet apparent. The iron sulphides predominate throughout, sphalerite forms an important percentage of the sulphide bodies, and galena, except in a few cases, is only sparingly developed. The mineralization is evidently strongest towards the north-western extremity of the outcrop. Structure has had an important bearing on the localization of the deposits and most of the numerous showings examined occur where the limestone is lying very flat or folded into small anticlines. The widespread mineralization and silicification would indicate possibilities for finding extensive deposits of sulphides if large favourable structures can be located in the mineralized area. It is understood that the result of recent field-work done in the district by H. C. Gunning will be made available in a Geological Survey memoir on the Lardeau Map-area awaiting publication.

TROUT LAKE MINING DIVISION.

The principal mining centres in this Division are Poplar, Trout Lake, and Ferguson. In the early days of the district these were busy mining camps, but of recent years activities have been very limited. The area contains some very interesting deposits, so far only explored in a superficial and desultory way, which deserve careful investigation.

POPLAR SECTION.

Swede. This group is situated on the southern side of Poplar creek. Some trenching was done recently by J. Gallo, who has the property under option for the Keene Mountain Gold and Silver Mines, Limited, across a wide zone of rusty and partially decomposed schist containing stringers and masses of quartz in places. Native gold is occasionally seen in association with quartz, but more importance is attached to the possibility of the schist containing sufficient concentrations of auriferous pyrite in places to constitute a commercial deposit.

Lucky Jack. This group, situated just south of Poplar creek near the railway, is being explored by J. Gallo for the Keene Mountain Gold and Silver Mines, Limited. The property, from which spectacular gold ore was produced in the days of the Poplar excitement, is described in the Annual Report for 1903 and in the Summary Report of the Geological Survey of Canada for the same year. The gold occurred in irregular pockets in quartz veins associated with pyrite and arsenopyrite, or as the native metal. High gold values were associated with the arsenopyrite. The panning of free gold from the oxidized schists in the vicinity has led to their investigation with a view to finding, if possible, zones in which a sufficient concentration of auriferous sulphides occurred to warrant mining operations.

Spyglass. This group, owned by the Spyglass-McLeod Mining Company, Limited, is situated on the southern side of Poplar creek, about 14 miles from the railway. Under the management of E. Foley Bennett, of Penticton, some useful development-work was accomplished towards the latter end of the season. The upper workings, at an elevation of 5,650 feet, were described by A. G. Langley in the Annual Report for 1928. In this part of the property are the occurrences of very high-grade silver ore. The writer's brief examination was confined to workings near the creek about 1,000 feet vertically below the upper workings.

A tunnel had been driven just above the creek, and on the south-eastern side of it, to explore wide showings of quartz containing disseminations of galena and pyrite. Granite is exposed on the hanging-wall side of the vein, which at this point strikes about N. 40° W. and dips from 25° to 30° to the south-west. The strike and dip are approximately similar to those of the vein developed by the upper workings, some considerable distance away, and allowing for the rugged topography it is possible that the veins are the same. On the opposite side of the creek a cross-cut tunnel was being driven through the overburden to cut the same vein. This tunnel had been driven 75 feet when work was temporarily suspended at the end of the year, and it is reported that solid rock had been reached with well-mineralized quartz in the face. The vein as exposed on the other side of the creek is wide and strong and the mineralization, though not strong at this point, indicates possibilities for finding an ore-shoot in the vicinity.

A sample taken in 1928 by A. G. Langley from a small pile of ore derived from the creek exposure assayed: Gold, 0.02 oz. to the ton; silver, 79.8 oz. to the ton; lead, 13.9 per cent.; zinc, 1 per cent. Improvements were also made to the mine cabin and to the upper part of the Poplar Creek trail. The lower section of the old trail is poorly located and crosses numerous snowslides, so that the property is at present handicapped for winter operation. Work is expected to be resumed during 1930.

Spyglass Extension. Adjoining the *Spyglass* property to the east, some nineteen claims were staked on behalf of R. G. McLeod on September 28th, 1928. On September 18th, 1929, or about ten days before the claims would run out, a crew of about seven men, including two packers, arrived at the property and work was started on the building of trails and cabins. Good progress was made with this work, in charge of W. J. Scorgie, and when the property was visited early in November preparations were being made to start underground work.

On the steep side-hill above the cabin some open-cuts have been made exposing a wide quartz vein striking N. 40° W. and dipping at from 45° to 50° to the south-west. Few rock-exposures, outside of the vein, are visible, and the character of the country-rock was not definitely ascertained. In the principal open-cut the vein is 10 feet wide, consisting of alternate bands of quartz and schist sparingly mineralized with disseminations of galena, sphalerite, pyrite, and possibly occasional grey copper. A sample across the 10-foot exposure assayed: Gold, 0.01 oz. to the ton; silver, 1.6 oz. to the ton; lead, 0.61 per cent.; zinc, 0.46 per cent. About 150 feet vertically below this open-cut the rock had been faced up preparatory to driving a crosscut

tunnel. Shortly after, the work was discontinued following alleged failure of R. G. McLeod to pay the men's wages and the crew came out in November. Subsequently a lien was applied for against the property. In connection with this proposition R. G. McLeod has been endeavouring to promote the Spyglass Extension Mining Company.

TROUT LAKE VICINITY.

Lucky Boy. This property is situated on the western side of the valley near Trout Lake "city," with which point it is connected by a wide trail on a good grade.

George Yuill, the owner, while driving a tunnel in the shaft-workings, recently opened up some very high-grade silver ore in a small vein. The associated minerals are galena, tetrahedrite, zinc-blende, chalcopyrite, pyrite, and native silver. Previous to recent resumption of work by Yuill the property had been idle for a long period. Prior to 1906, 400 tons of sorted ore was shipped, which assayed: Silver, from 200 to 300 oz. to the ton; lead, 20 to 35 per cent. In 1912, after six years of inactivity, 28 tons of ore of similar grade was shipped. Past references to the property are contained in the Summary Report of the Geological Survey of Canada for 1903 (R. W. Brock) and in the Annual Reports for 1903 and 1914.

FERGUSON CAMP.

Great Northern. This property, consisting of the *Great Northern*, *Hillside*, *Northland*, and *Northern Light* Crown-granted claims, is situated on Great Northern mountain at an elevation of approximately 6,000 feet. The claims, owned by H. McPherson, of Trout Lake, are reached by trail about three-quarters of a mile in length connecting with the recently completed *True Fissure* wagon-road, altogether a distance of about 3½ miles from Ferguson.

Work has been proceeding with a small crew since early in October, when the *Great Northern* was taken under option by T. D. Pickard, of Vancouver. When the property was visited at the end of the year crosscutting and drifting was proceeding in the lower tunnel, the work being done by hand. As deep snow covered the area the examination on which this report is based was confined to this lower tunnel. Three old prospect-tunnels higher up the hill were caved and inaccessible.

The *Great Northern* is situated between the *True Fissure* and *Broadview* groups, owned by the True Fissure Mining Company, of Cincinnati, Ohio. The *Great Northern* vein is apparently a continuation of the vein which has been very extensively explored on the *True Fissure* and *Broadview*. The formation of the area on all three properties, consisting of schists and carbonaceous slates, strikes north-westerly and dips to the north-east. On the *Great Northern* the rocks appear to have been considerably crushed and some folding is apparent. They strike about N. 30° W. and their dip is about 45° to the north-east. The vein has an approximately similar strike, but dips at from 25° to 35° to the north-east. It has apparently been formed along a zone of shearing in which the slates have been silicified and replaced by quartz and accompanying sulphides. The walls of the vein are somewhat indefinite and there is no distinct line of demarcation between the vein and the country-rock, especially on the foot-wall side, where the boundary of the vein is only noticeable by a gradual diminution of mineralization. The vein proper, or zone of intense silicification, will perhaps approximate 10 feet in width and the width of individual ore-showings varies from 36 to 75 inches.

The associated minerals are pyrite, arsenopyrite, sphalerite, and grey copper, carrying good silver values and a little gold. Small percentages of tin are also contained in the ore, but the tin-bearing mineral has not yet been definitely identified. Siderite was noted in small amounts. The ore occurs in some concentration at irregular intervals either on the foot-wall or hanging-wall side of the vein, but development is not sufficiently far advanced to determine the possible size of ore-shoots. The No. 1, No. 2, and No. 3 tunnels, at elevations of 6,125, 6,095, and 6,090 feet respectively, are caved and could not be examined.

The No. 2 tunnel develops the vein near its outcrop at a point about opposite the inner end of No. 4 tunnel, which is situated at an elevation of about 6,000 feet. The No. 2 tunnel is reported to have crosscut the vein and followed it a short distance at a shallow depth below the surface. A small shipment of sorted ore is reported to have been made in 1896 from this working, where stoping was done at the intersection of the main vein with a small cross-vein which was also followed a short distance.

The No. 4 tunnel, in which development-work is proceeding, is a tunnel driven about 410 feet along the strike of the vein, which, as before mentioned, is believed to be the southern extension of the *True Fissure* vein. This vein was encountered at about 100 feet from the portal and followed to the face. At 255 feet from the portal a crosscut run for 10 feet to the westward intersects a bunch of ore 4 to 4½ feet wide. A sample across 4 feet of this ore assayed: Gold, 0.25 oz. to the ton; silver, 47.6 oz. to the ton; copper, 2.31 per cent.; lead, 1.2 per cent.; zinc, 3.6 per cent.; tin, 0.07 per cent. The comparatively high silver values are probably due to the presence of a grey-copper mineral noted at this point. From the end of this crosscut a raise has been put up on the dip of the vein for a distance of about 10 feet; then there is a sharp bend in the raise which is continued for about 15 feet southerly at a slope of about 16° following a roll in the vein. A sample taken across 3 feet at the bend in the raise assayed: Gold, 0.04 oz. to the ton; silver, 18.6 oz. to the ton; copper, 1.28 per cent.; lead, 14.4 per cent.; zinc, 7.1 per cent.; tin, 0.07 per cent. Another sample taken across 3 feet near the top of the raise assayed: Gold, 0.14 oz. to the ton; silver, 54 oz. to the ton; copper, 4.71 per cent.; lead, 17.6 per cent.; zinc, 9.1 per cent.; tin, 0.10 per cent. These three samples were taken at points where the lead and zinc mineralization was apparently strongest. Between the sections of vein sampled there is a strong development of pyrite in disseminations and masses with less lead and zinc in evidence. At a point in the main tunnel a short distance south-easterly from the crosscut containing the raise a tunnel was being driven into the foot-wall country, apparently on the assumption that the upper part of the above-described raise developed a cross-vein. A pronounced fold or roll in the vein, however, is apparent in the raise and no useful results could be expected from the tunnel being driven in the foot-wall country.

On the opposite side of the main tunnel and just north-west of the crosscut leading to the raise a 16-foot crosscut has been driven to the hanging-wall side of the vein. A sample across 42 inches at the intersection of this working with the main tunnel assayed: Gold, 0.09 oz. to the ton; silver, 25.2 oz. to the ton; copper, 1.93 per cent.; lead, 7 per cent.; zinc, 7 per cent.; tin, 0.10 per cent. The continuity of this showing, which consisted of masses of pyrite with some galena and sphalerite, was not apparent. On the hanging-wall side of this showing the mineralization was confined to scattered streaks of sulphides associated with quartz. Near the inner extremity of the main tunnel, or about 12 feet back from the face, a 16-foot crosscut to the hanging-wall has intersected a width of over 6 feet of silicified country-rock containing finely disseminated galena and pyrite. Samples taken on each side of the crosscut across widths of 74 and 75 inches respectively assayed: Gold, 0.07 oz. to the ton; silver, 10 oz. to the ton; copper, 0.39 per cent.; lead, 8.4 per cent.; zinc, 7.2 per cent.; tin, 0.03 per cent. And: Gold, 0.06 oz. to the ton; silver, 6.5 oz. to the ton; copper, 0.39 per cent.; lead, 5.5 per cent.; zinc, 5 per cent.; tin, trace. This showing constitutes the most pronounced mineralization seen in the No. 4 tunnel and gives promise of more continuity than the other showings, which appear to be bunched. It is not definitely known how much ground lies between the extremity of the main tunnel and the boundary between the *Great Northern* and *True Fissure* properties, but it is understood that this distance is not in excess of 300 feet.

About midway along the main tunnel between the two short crosscuts driven to the north-east a raise has been started in the same direction to crosscut the hanging-wall side of the vein. This had not been driven far enough to afford much information, the first few feet having penetrated into quartz with streaks of galena. In the adjoining *True Fissure* property, where a large amount of development has been done on what appears to be the extension of the same vein, the locus of ore is understood to be governed to some extent by cross-fractures intersecting the main vein. Similar fractures are not yet noticeable to any appreciable extent in the No. 4 *Great Northern* tunnel.

The small tin values found in the samples are of considerable interest, although, with the present very incomplete knowledge of the extent of the deposits, it is difficult to estimate the possible economic importance of the occurrence of the tin-bearing mineral.

This property, owned by the *True Fissure Mining and Milling Company, Limited*, of Cincinnati, Ohio, consists of eight Crown-granted claims located on the eastern slope of *Great Northern* mountain at an elevation of 5,400 feet, and is reached from the town of Ferguson by a 3½-mile wagon-road recently completed by the company. G. F. Park is president of the company and Dave Morgan, of Ferguson, has been in charge of the exploration and development-work at the property since 1922, during which time

a large amount of underground work has been done by hand-mining methods. Extended references to the camp are contained in the Annual Reports for the years 1914, 1921, 1924, and 1927.

The formation in the vicinity is principally a black carbonaceous schist with areas of green chlorite-schist, and the mineralization has occurred in a north-west striking fissure, or fissures, that dip at 45° to 50° to the north-east. The vein varies from 1 to 20 feet in width and the average is about 3 to 6 feet. The vein-filling consists of quartz, siderite, some altered wall-rock, and pyrite, together with appreciable amounts of galena and sphalerite in places. Silver and gold in small amounts are also associated with the mineralization, the gold probably in conjunction with the pyrite that is found in the vein.

The property has been explored in such a manner as to give but a limited knowledge of the size and average metal content of the mineralization now exposed at various places in the underground and surface workings. The exploration-work that might be done in the future should be directed towards proving if sufficient tonnage of milling material exists which at the metal prices of the future would justify the erection of a small oil-flotation concentrator, either at Ferguson creek, where there is ample water for the mill and power, or at Trout lake, where there is water and barge connection to the smelter.

Late in the year announcements were made by the company that a small concentrator was to be erected at the mine, and a small amount of work has been done recently in finishing the wagon-road to the property.

A consolidation of these two properties on Gainer creek, described in past Annual Reports, is reported to have been effected, whereby a large area covering a promising mineral-belt will be available for development. Widespread mineralization is found in limestone-beds belonging to a belt which has been traced for many miles to the north-west and into the adjoining Lardeau Mining Division. The importance of structural conditions in connection with these silver-lead-zinc replacement deposits is referred to under the *Alma* group in the last-mentioned Division. In this connection favourable folded structures, where concentrations of mineralization occur, were noted towards the upper or north-western extremity of the *Mollie Mac*.

Numerous mining properties in the Trout Lake Mining Division have been examined in recent years by M. F. Bancroft, H. C. Gunning, and J. F. Walker, and the results of their comprehensive study of the mineral-deposits are expected to be made available in a Geological Survey of Canada Memoir on the Lardeau Map-area, awaiting publication.

LARDEAU MINING DIVISION.

This Division includes the drainage area tributary to Incomappleux (Fish) river and its main artery is the Camborne-12-Mile road. Beyond the latter point the main trail extends to the upper reaches of the river. At numerous points on both sides of the valley branch trails connect mining properties and prospects with the trunk road and trail. The outfitting-point for the mines of the area is the little town of Camborne, once a busy and prosperous mining settlement. Owing to various past circumstances, including mismanagement and doubtful promotion schemes, many of the properties have not had a fair trial. A reaction followed the period of intense activity which occurred during the early days, when much money was spent with little return, and the activities of the camp became more and more restricted until it was apparently going to join the ranks of "ghost towns" of past mining booms. Of recent years, however, there have been signs of reawakening life, and it is satisfactory to record that the past season has been the busiest experienced by Camborne for some time. Work to varying extent was prosecuted on the *Teddy Glacier*, *Lead Star*, *Multiplex*, *Oyster-Criterion*, *Paymaster*, *Alma*, and properties of the Lardeau Mines Exploration, Limited. The *Big Showing* and *Scout* were bonded by Eastern Canadian interests, now financing work at the *Multiplex*, and exploration of these two properties is expected to be undertaken during 1930. Prospecting was also active in certain sections. It is understood that results of the extensive field-work done in the district by M. F. Bancroft, J. F. Walker, and H. C. Gunning will be made available in a memoir on the Lardeau Map-area awaiting publication by the Geological Survey of Canada. This work, being awaited with considerable interest, is expected to shed new light on the possibilities of the camp.

Teddy Glacier. At this property, situated at the head of the Middle fork of Sable creek, about 12 miles by road and trail from Camborne, development-work was continued during the summer and fall season. G. Jorgensen was in charge

for the Bush & McCulloch interests, some thirteen men being employed. Considerable improvements were made to the trails leading to the property. The crosscut tunnel was continued towards the Dunbar vein. Equipment at the mine now includes a 60-horse-power type 43 B 4-cylinder Diesel engine supplied by the Canadian Fairbanks-Morse Company and a Gardner compressor. The surface showings, described in past Annual Reports, are very attractive and the ore is of a good grade and should be easily concentrated. It is to be hoped that this promising property will eventually receive the systematic development which it merits.

Lead Star. At this group of six claims, situated on the Stephney branch of Sable creek, 4 miles by trail from the road north of Camborne, development has been continued by Duncan McIntosh with two miners. A description of the property is contained in the Annual Report for 1925. The associated minerals consist of galena, sphalerite, pyrite, and tetrahedrite, with which appreciable gold and silver values are associated. The formation, including carbonaceous and graphitic schists, belongs to the same belt of sediments on which the *Teddy Glacier*, farther to the north-west, is located. The results of recent work are reported to be very encouraging.

Oyster-Criterion. At this old gold property near Camborne a small crew was recently engaged in reconditioning the aerial tram and in making repairs to the mill and camp buildings, apparently with a view to resumption of operations. Arthur Cole was in charge for the Camborne Mines, Incorporated, of Seattle. The same company is reported to be negotiating for the *Eva* and *Lucky Jack* properties in the same vicinity.

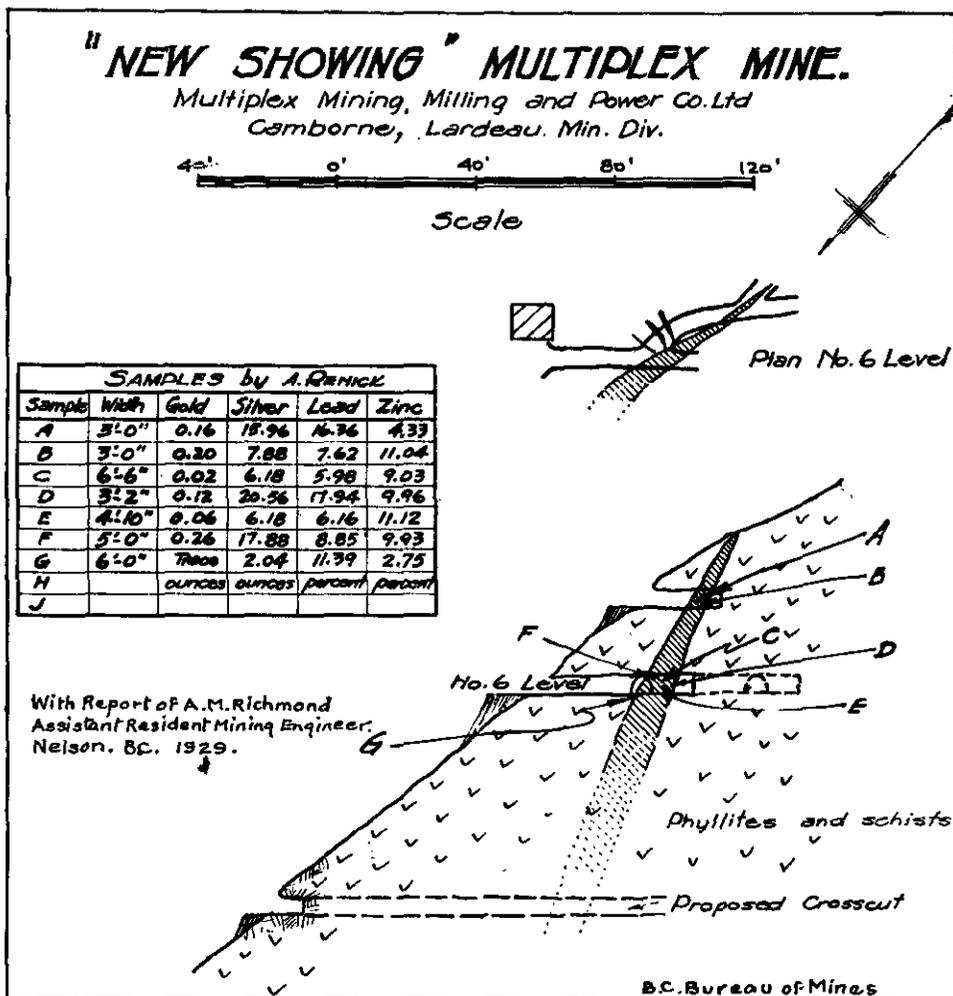
Alma. At this group, situated on Poole creek near Camborne, recent exploratory work is reported to have uncovered an interesting new showing in a parallel vein. The property, described by A. G. Langley in the Annual Report for 1927, is owned by the Paymaster Mines, Limited, one of the companies sponsored by J. M. Humphrey, who for some years has been active in directing attention to the mineral potentialities of the Lardeau district. The *Alma*, a silver-lead-zinc replacement deposit in limestone, is situated in a mineralized belt which has been traced for many miles in a south-easterly and north-westerly direction.

Along this mineral-zone are situated the *Big Showing*, *Scout*, and *Alma* in the Lardeau Mining Division, and the *Surprise*, *Big Five*, *Elsmere*, *Mollie Mac*, *Hidden Treasure*, and *White Quail* properties in the adjoining Trout Lake Mining Division. An old map of the Lardeau Mining District compiled by S. Shannon and A. P. Cummins, and published in 1901, shows that hundreds of claims were originally located along the "lime-belt." An uninterrupted chain of claims extended from Gainer creek in the Trout Lake Mining Division to Fish (Incomappleux) river in the Lardeau Mining Division. Mineralization, therefore, to some extent, has been found over a very large area. In this type of deposit, however, continuity of mineralization can only be expected where there are favourable structural conditions, and in this connection the limestones, which stand at uniformly steep angles, have not yet been shown to contain any important replacement deposits. Strong and wide surface showings have been found in many places, but continuity of the mineralization remains to be demonstrated. The widespread mineralization in the limestones of the district indicates favourable possibilities for finding important concentrations of ore where suitable geological conditions exist. The mineralized limestone-beds should be traced, if possible, into zones of folding and fracturing. This is intended as a general statement, the *Alma* not having been visited by the writer, who has, however, examined numerous replacement deposits of similar character in the adjoining area. They are of considerable interest in any consideration of the potential mineral resources of the district and deserve systematic exploration.

Multiplex.* This property, comprising twenty-four surveyed claims $1\frac{1}{2}$ miles west of Camborne, on the south side of Poole creek, is owned by the Multiplex Mining, Milling, and Power Company, Limited. Past references have been made to this property in the Annual Reports for 1924 and 1926. The camp at 3,700 feet elevation is connected to Camborne by trail.

The formation in the vicinity of the mine consists of a green chloritic schist, or phyllite, which has been altered in places to a grey carbonate rock. The strike of the schistosity is N. 50° W., with a dip of 75° to the north-east. There are many joints and fractures in the rock and the mineralization has been best developed in these fissures in the grey carbonates. From past work at the mine and an inspection of the workings the impression was formed that

the mineralization has occurred along the zone of altered schist in the form of narrow lenses containing galena, pyrite, sphalerite, and tetrahedrite and associated silver and gold values. The lenses are small in their dimensions and vary in length from 20 to 60 feet, with a maximum width in the longer lenses of approximately 5 feet. The general strike of the lenses is north-south and they dip at 75° to the east. The approximate grades of the ore in the lenses are shown by the records of past shipments from the property, which show that 165 tons of ore, presumably sorted, assayed: Gold, 0.063 oz. to the ton; silver, 73 oz. to the ton; lead, 17 per cent.; zinc, 20 per cent. This composite assay of shipments is of course considerably higher than run-of-mine ore, as it represents material from which a large percentage of the waste has been picked.



The development of the mineralization has been confined largely to the *Spider* claim between elevations of 3,600 and 3,900 feet. Five adit-tunnels, totalling approximately 2,000 feet of underground work, have developed several small lenses, from which the above shipments were made to Trail. Early in the summer of 1929 a new discovery, called the "New Showing," was made at a point 500 feet north of and 300 feet vertically lower than the No. 5 or lowest adit-level at 3,400 feet elevation. When examined in the middle of August the showing had been opened by a trench at 3,090 feet elevation and had exposed a width of 5 to 6 feet of sulphides similar in character to the showings developed in the upper workings of the property. A short crosscut to the lens 20 feet lower on the hillside had just reached the mineralization, which here appeared to be 3½ to 4 feet wide. A rough compass survey made of this discovery showed the New

Showing to be in the same zone of grey carbonate rocks as the lenses above. Shortly after this examination was made the property was acquired by A. Renick for Eastern interests under terms of an option, and a crew of twelve men was employed to further develop the New Showing.

At the end of the year it is reported that three new cabins and two blacksmith-shops had been built at the camp and approximately 109 feet of underground hand development-work completed. The results of the development-work on the New Showing are shown on the map accompanying this report and the samples taken by A. Renick are considered thoroughly reliable. A total of 65 feet of drifting and crosscutting was done on this showing. Other development-work consisted of advancing the No. 5 level 44 feet, leaving a distance of close to 115 feet to be driven before reaching the supposed downward extension of ore-showings in the No. 4 level, 130 feet vertically above.

A small crew of men is still working at the property and it is intended to drive the proposed crosscut, shown 80 feet below the No. 6 level on the map, to an intersection with the downward projection of the ore-showing. This piece of development-work would have an important bearing on the value of the lens of ore and on the future commercial value of the property. During the year a shipment of 6 tons of ore from the New Showing was made to the smelter at Trail.

ARROW LAKE MINING DIVISION.*

Mining activity increased in 1929 in this Mining Division, due principally to the exploration-work undertaken by the Consolidated Mining and Smelting Company at the *Hailstorm*, on Caribou creek, near Burton City, and the activity of the Cotton Belt Mines, Limited, at the *Meadow View No. 2*, 30 miles west of Edgewood on the Edgewood-Vernon road. Several prospectors were in the hills and new staking is reported in the area around Burton City. During the year a report on the *Big Ledge* property, situated on the west side of Upper Arrow lake 17 miles south of Arrowhead, was issued by the Geological Survey of Canada, Summary Report, Part A, 1928. The report is written by C. E. Cairnes and H. C. Gunning.

Hailstorm.* This property, comprising three Crown-granted claims and four staked by the company, is situated on the divide between the headwaters of Canyon and Caribou creeks at an elevation of between 6,000 and 7,300 feet above sea-level. The claims are reached by road to Dusty's camp, 10 miles up Caribou creek from Burton City in a north-easterly direction, and thence by an 8-mile trail up Canyon creek to the camp at 6,700 feet elevation. Early in 1929 the Consolidated Mining and Smelting Company of Canada took the property under option and worked throughout the summer and fall months in exploring the showings that have been developed in a small way by past owners on the summit of the ridge. The work was discontinued in December, due to winter conditions, and it is expected that further exploration-work will be done by the company in the spring of 1930.

The country-rocks are granites and quartzites and on the summit of the ridge an outcrop of oxidized calcite has been opened up by trenching. On the Caribou Creek slope a short tunnel driven in a westerly direction has penetrated the mineralized calcite at a depth of 25 to 30 feet, and channel samples across a width of 25 feet gave returns varying between 15 and 50 oz. in silver, with an average for the entire width of approximately 20 oz. in silver.

To further explore this surface showing opened by the short tunnel (35 feet) it was decided to drive a crosscut from the Canyon Creek side of the ridge to gain a depth of 300 feet on the showing, and during 1929 a total of 899 feet of crosscutting and drifting was done by the crew of twelve to fifteen men employed. The results in the lower crosscut at 7,000 feet elevation are not yet conclusive and the exploration-work is to be resumed in the spring.

Promestora.* At this property, situated on Mineral creek, about 3 miles north of Mineral City, the Production Mining Company, of Vancouver, was formed to further explore the quartz vein that has been developed in a small way by several open-cuts and one or two short tunnels. Due to failure of the company to complete negotiations for the acquirement of the property, work was not resumed and the claims have not been worked during the past year. References to this property are contained in the Annual Reports for 1896 and 1920.

Poorman.* During the year a group of six claims was staked by F. Bradley and associates on Bluegrouse creek a short distance north-west of Dusty's camp. The claims were not visited, but from samples sent in by the owners it would appear that silver values have been obtained in a graphitic schist. An assay of presumably selected material

gave the following returns: Gold, 0.44 oz. to the ton; silver, 160 oz. to the ton; lead, 3 per cent.; zinc, 11 per cent.

*Chieftain.**—Late in the year it was reported that this property, situated on Cariboo creek, was to be reopened by Vancouver interests. For information on this property the reader is referred to the Annual Report for 1920.

*Ora Grande.**—During the summer months this property, adjoining the *Promestora* to the east, was prospected by J. C. Anderson, one of the owners. Several trenches and open-cuts were made in an endeavour to trace the showings on the *Promestora*, east on to the *Ora Grande*.

This property, situated 1 mile north of the Vernon-Edgewood road at an elevation of 5,750 feet and 30 miles west of the town of Edgewood, is owned by the *Meadow View.** Cotton Belt Mines, Limited, of Vancouver. The company is capitalized for \$1,250,000, divided into 1,250,000 shares of \$1 par value, and 939,112 shares have been issued. B. F. Lundy is president and F. W. Guernsey is consulting engineer of the company, which also owns mineral property on Seymour arm at the north-eastern end of Shuswap lake.

A crew of twelve down to six men at the end of the year has been employed in further exploring the strong quartz vein that traverses the property for a length of 1,300 feet. As disclosed by several trenches it strikes in an east-west direction and dips to the north at 75° to 80°. A description of the property before the present exploration programme was started is contained in the Annual Report for 1927 on page 232. The work done since that time has consisted of sinking the three shafts to depths of 120 feet for the No. 1 or eastern shaft; 50 feet for the No. 2 shaft, 225 feet west of No. 1 shaft; and 57 feet for the No. 3 shaft, 350 feet west of the No. 2 shaft.

The No. 1 shaft at a depth of 120 feet encountered a step-fault and a short crosscut was driven to the north for a distance of 24 feet. It was then decided by the company that prospecting could be better accomplished by the driving of an adit-crosscut from a point on the hill below the No. 2 shaft. This crosscut, driven in a direction of N. 20° W., intersected the vein at 434 feet from the portal and 80 feet below the collar of the No. 2 shaft, and indicates that there is a step-fault of approximately 50 feet between the vein as disclosed in the shaft and in the crosscut. The No. 2 shaft was connected to the crosscut by driving a raise, from a point 50 feet back of the vein and crosscut intersection, to meet the short drift from the bottom of the shaft.

Since the property was visited in the fall, shortly after the vein had been intersected in the low-level crosscut, it is reported that the vein has been drifted on for approximately 400 feet, 200 feet east and 200 feet west of the intersection. The values in this drift are reported by the management to vary between about \$2.80 and \$15 in gold and silver values in the quartz gangue. A channel sample taken across a width of 3 feet 6 inches at a point 75 feet east of the intersection of the crosscut with the vein gave the following results when assayed: Gold, 0.11 oz. to the ton; silver, 1.7 oz. to the ton. It is reported that the vein has varied in width from 2 to 8 feet since the drift was started.

NELSON MINING DIVISION.

In the Annual Reports for 1927 and 1928 considerable space was devoted to a description of numerous mining properties in this Division and the present report is necessarily more restricted owing to pressure of work in other sections of District No. 5. The principal centres of mining are Nelson, Ymir, and Salmo. An interesting description of the various types of occurrences in the vicinity of Nelson is contained in the Summary Report of the Geological Survey of Canada for 1911. This includes the gold-silver, copper-gold-silver, and silver-copper deposits occurring either in the granitic rocks of the Nelson batholith or in the schists and limestones of the Rossland volcanic group. The geology of the gold and gold-silver-lead-zinc ores of the Ymir camp is described in Geological Survey of Canada, Memoir 94. The geology of the gold and silver-lead-zinc deposits of the Sheep Creek camp and Pend d'Oreille River vicinity is being revised by J. F. Walker, of the Geological Survey of Canada, who spent the summer seasons of 1927 and 1928 in mapping the geology of those areas.

There was about the usual amount of prospecting in the Division during 1929. In the vicinity of Creston prospectors were active. This section includes a large area underlain by Pre-Cambrian rocks of the Aldridge formation, in which there is a widespread development of quartz veins extending at least as far north as White Grouse mountain. G. A. M. Young, of Creston, who has been very active in prospecting this area, reports that "some of these leads

north of Kitchener are from 50 to 100 feet wide and miles in length. Most of them are barren, but some of the large ones carry low values in gold, or gold-copper." A trip to this section is planned for next season with a view to investigating the possible importance of the reported occurrences.

During the year under review mining activity in varying degree occurred at some thirty properties, the largest development operations being those at the *Yankee Girl* and *Reeves-McDonald* mines. The bringing into production of the *Reno* gold-mine constitutes an interesting new development and as a result renewed interest is expected to be taken in the possibilities of other gold properties in this camp. The deposits worked in former days have, with the exception of the *Queen* mine, been quite small and profitable production was confined to the oxidized zone of enrichment, which extended to depths up to 500 feet. In the case of the narrow veins the primary sulphide ore encountered below the zone of oxidation was too low grade to be mined profitably. A possible solution in these cases would be a merging of interests with a view to centralizing milling operations. In the quartz veins, which are very persistent, the ore-shoots have been confined to where the fissures cut the quartzites and the harder argillaceous quartzites. Where they cut the schists and softer rocks the fissures have not been productive. As a result of the detailed geological study of the Sheep Creek gold properties made by J. F. Walker, of the Geological Survey of Canada, it is expected that attention will be directed to formations geologically favourable for the occurrence of ore-shoots in veins which have as yet only been opened up in unprofitable zones.

Hydro-electric power development by the West Kootenay Power and Light Company, whose three plants on the Kootenay river generate a total of about 160,000 horse-power, is to be very largely increased by the proposed development on the Pend d'Oreille river, which involves an ultimate expenditure of many millions of dollars. This project, which opens up the prospect of low-cost energy for the *Reeves-McDonald* and other mines, is referred to in the introductory section of the writer's report under "Hydro-electric Power Development."

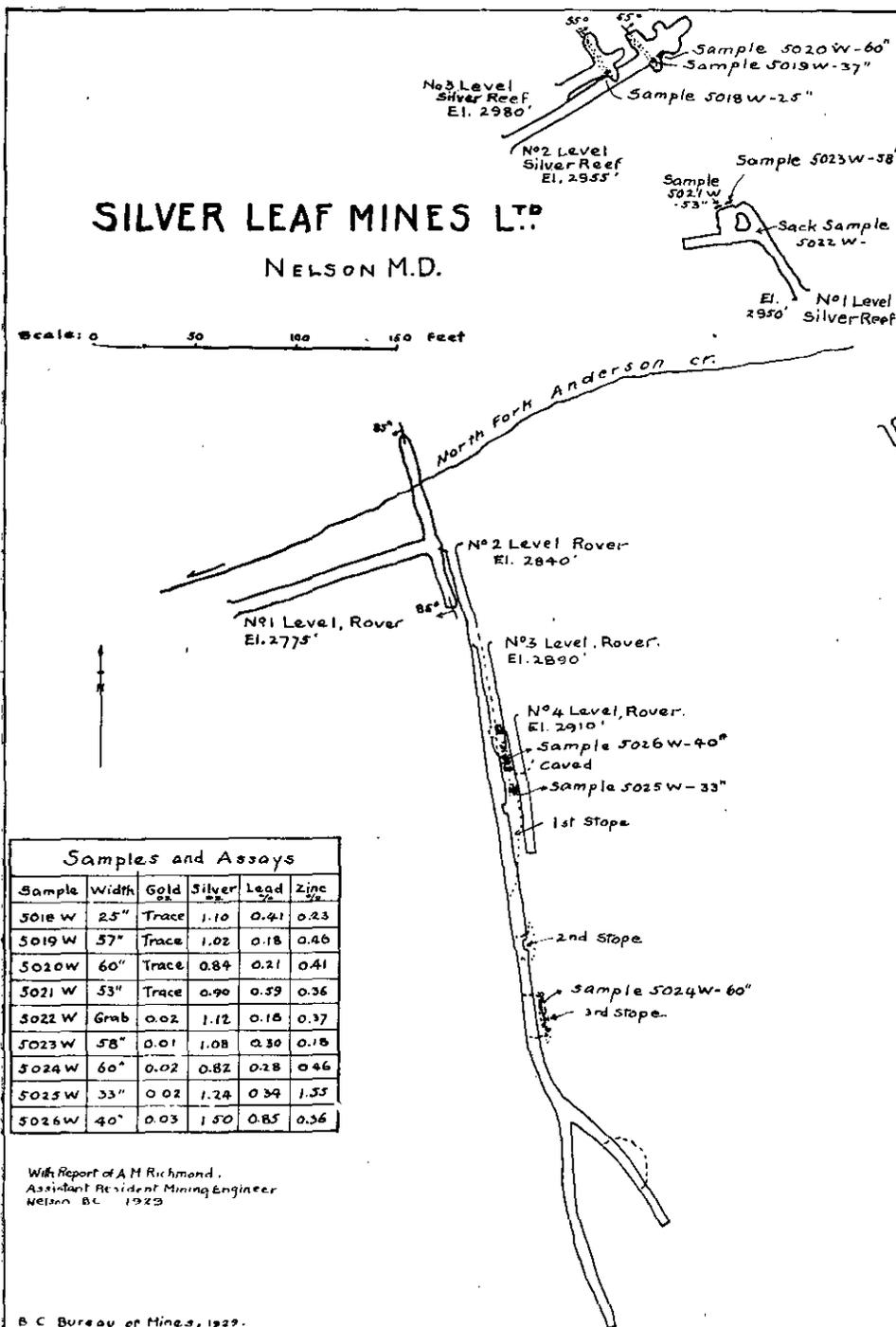
NELSON SECTION.

Silver Reef.* This property, comprising fifteen claims, including the *Silver Reef* and others, most of which are held by location, is situated on Anderson creek, about 1½ miles east of Nelson by road and trail. As the property has been described in considerable detail in the Annual Reports for 1921 and 1927, but a few notes to accompany the map with this report will be given.

The main workings on the property are on the south side of the North fork of Anderson creek at an elevation of 2,775 to 2,910 feet. The fissure-vein in the granodiorite strikes approximately N. 20° W. and dips to the south-west at about 85°, and is characterized by the banded occurrence of quartz, siderite, calcite, small amounts of galena, sphalerite, pyrite, and chalcocopyrite around a central drusy zone. Several samples were taken in the *Rover* workings to determine what values might be expected from the mineralization developed by the four adit-tunnels, raises, and small stoped areas. The values are given on the map and are quite disappointing; what was expected to be the best sample at the back of the small stope (No. 1 stope, a short distance above No. 2 level) over a width of 33 inches of heavy pyrite mineralization gave the following result on assaying: Gold, 0.02 oz. to the ton; silver, 1.24 oz. to the ton; lead, 0.34 per cent.; zinc, 1.55 per cent.

On the north side of the creek, and about 150 feet north-east and 100 feet above the No. 2 tunnel of the *Rover* workings, three adit-tunnels have been driven into the hill as shown on the map and they have developed in a small way a silicified zone in the granodiorite. In this zone several small quartz stringers or bands varying from a few inches to a foot in width have been encountered and the mineralization observed consisted of fine particles of pyrite, galena, and sphalerite in the silicified zone above referred to. Several samples were taken in this area and the results are shown on the map. Samples 5021-W and 5023-W across a combined width of 9 feet 3 inches were taken where values as high as \$12 a ton in gold and silver values had been reported, but the samples which were carefully taken proved to be disappointing, the average assay being: Gold, 0.005 oz. to the ton; silver, 0.99 oz. to the ton; lead, 0.45 per cent.; zinc, 0.27 per cent. From this section of the property 12 to 15 tons of material had been sorted and piled in sacks in the drift. A grab sample obtained by taking some from each of the sacks assayed: Gold, 0.02 oz. to the ton; silver, 1.12 oz. to the ton; lead, 0.18 per cent.; zinc, 0.37 per cent.

During the year a few men have been intermittently employed by the Silver Leaf Mines, Limited, the company promoted by H. E. Morgan that has the *Silver Reef* group under lease and bond. A limited amount of work was done on the No. 1 *Rover* tunnel, the vein here being in two streaks from 6 to 8 inches in width.



Queen Victoria Consolidated Mines, Ltd.—No activity has yet materialized in connection with the holdings of this company near Beasley.

After a long period of inactivity work was resumed at this gold property, **Granite-Poorman**, situated west of Nelson, by the Granite-Poorman Gold Mines, Limited. The low-level crosscut tunnel was driven approximately 1,000 feet, the work being done under contract by F. H. Fox and associates. Operations were discontinued in the fall of 1929 and future plans are not known. The past history of this property is briefly summarized in the Annual Report for 1928.

This property, situated on the western side of the Salmo river on the Nelson-Golden Age. Spokane highway and the Great Northern Railway, is owned by the Golden Age Mining Company, Limited. Work has been done at intervals and recently the mine was being worked under lease by Carl Anderson, of Spokane, who, with one man, was driving on the shear-zone in the lower tunnel. The property is equipped with a compressor, driven by water-power, which is located on the opposite side of the valley below the *Euphrates* workings. Compressed air is piped to both the *Euphrates* and *Golden Age* properties, worked by separate companies under the direction of the Terzian Bros., who sponsored both undertakings. The flume has now been extended to Clearwater creek and ample water is afforded for driving the compressor, which is operated under a head of 300 feet, the water being utilized through a 5-foot impulse wheel. The *Golden Age* mill was destroyed by fire in the summer of 1929. This property is described in the Annual Report for 1928.

This property, consisting of some sixteen claims, is situated on the north-eastern side of the Salmo river, opposite the *Golden Age* mine camp, on the Great Northern Railway, 9 miles from Nelson. Both properties were originally staked and acquired by the Terzian Bros., who held a controlling interest in the separate companies formed to develop them. The camp facilities are used jointly. The *Euphrates* Mining Company, Limited (N.P.L.), was incorporated in April, 1928, with an authorized capital of 4,000,000 shares, par value \$1, of which the promoters received 2,850,000 shares. The geology and general character of the *Euphrates* deposits are described in the Annual Report for 1928 and subsequent developments are recorded in the Annual Reports for 1927 and 1928. The present summary is based on the results of several examinations by the writer, corroborated by information from authentic sources.

In general there are three separate propositions, known as the *Minto*, *Lost Cabin*, and *Ell-Tee* veins. Of these the last mentioned is the most definite and will be described first. This vein is a clean-cut, narrow quartz-filled fissure containing in places high gold values. It coincides in strike with the enclosing schists of the Rossland volcanic group, which is about S. 40° E. and up the hill, but dips at from 60° to 70° to the north-east, cutting across the schistosity of the rocks. The width of the vein, as exposed in shallow trenching on the surface and in two tunnels, varies from a seam to 2 feet, with a general average of from 4 to 6 inches. A few tons of high-grade ore was extracted from the original surface cuts, where gold was concentrated in oxidized material, and from a small stope in the upper tunnel. One ton of ore shipped to the Trail smelter is reported to have had a gross value of about \$100 in gold and \$1.80 in silver. In addition, some small lots were put through the *Golden Age* mill, which was destroyed by fire in 1929. In describing the workings the elevations used are from a plan made for the company by C. Moore, B.C.L.S. The upper tunnel, driven on the *Ell-Tee* vein, is at an elevation of 4,160 feet, or 1,200 feet above the railway. Throughout this working, which at the face gains a depth of about 30 feet below the surface, the vein is very narrow. The best showing was sampled by F. W. Callaway, mining engineer, of Kellogg, Idaho, when he reported on the property in 1928 for the *Euphrates* Mining Company. The following assays of six samples, taken between points 105 and 127 feet distant from the portal, are reproduced from this report:—

Width.	Gold.	Silver.	Width.	Gold.	Silver.
Inches.	Oz. to Ton.	Oz. to Ton.	Inches.	Oz. to Ton.	Oz. to Ton.
4	3.88	1.10	6	6.37	2.30
4	3.59	1.60	4	6.18	2.20
4	0.84	0.60	5	1.52	1.00

The average of these samples gives: Gold, 3.77 oz. to the ton; silver, 1.5 oz. to the ton; over a width of 4½ inches and a length of 22 feet. Near the portal some ore has been stoped for a length of about 30 feet. The back here shows a thin seam of quartz. Below the stope and in the bottom of the drift, not conveniently accessible on account of water, the vein is apparently about 4 inches wide. A sample taken with difficulty from the floor of the tunnel assayed: Gold, 0.20 oz. to the ton; silver, 6.8 oz. to the ton. Going down the hill north-westerly from this tunnel, ground-sluicing has been done to uncover the vein which is exposed in a narrow trench for a length of several hundred feet. In this working the quartz varies from 1 to 18 inches in width, probably averaging about 6 inches. A sample taken of a short length of quartz, 8 to 18 inches wide, representing the strongest quartz showing in the trench, assayed: Gold, 1.46 oz. to the ton; silver, 2.1 oz. to the ton. In the same trench three samples taken by F. W. Callaway gave the following results:—

Description.	Width.	Gold.	Silver.	Lead.
	Inches.	Oz. to Ton.	Oz. to Ton.	Per Cent.
300 feet north-west of upper tunnel portal.....	14	0.21	5.7	2.4
340 feet north-west of same point.....	8	0.23	19.5	1.8
400 feet north-west of same point.....	5	0.11	8.0	4.6

From a point near the north-western extremity of the long trench, and at an elevation approximating 3,950 feet, a lower tunnel, mostly driven in 1929, was roughly estimated to be about 550 feet long when the property was visited in the fall. In this working, which is a drift, the vein is also very narrow and consists of quartz with streaks of oxidized material. For the first 65 feet from the portal the vein averages about 3 inches in width; it then swells to a maximum of 10 inches in a length of about 10 feet. For the next 375 feet it approximates 5 inches in width; then swells to 18 inches in a length of 30 feet; and for the last 70 feet of the tunnel it is from 3 to 4 inches wide. Samples taken in this working assayed as follows:—

Description.	Width.	Gold.	Silver.	Lead.	Zinc.
	Inches.	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
From portal to 0+65 ft., quartz and oxidized material	3	0.98	3.3	*	*
0+65 to 0+75, oxidized ore.....	9	0.84	1.7	*	*
0+75 to 4+50, chiefly oxidized material, streaks of quartz.....	5	0.59	3.1	*	*
4+50 to 4+80, quartz stringers and schist.....	18	0.04	1.0	*	*
In face at about 5+50, quartz containing sulphides..	3	0.17	5.6	1.75	0.6

* Not assayed.

The relationship of the lower and upper tunnels is not known exactly, but the lower tunnel evidently develops the vein exposed in the trench and has probably reached a point vertically below the high-grade ore sampled by Callaway in the floor of the upper tunnel. Summarizing the results of the work done, the *Eu-Tee* vein is sharply defined and well mineralized in places over narrow widths. How much of the gold content is due to local concentration of the metal by oxidizing agencies remains to be seen when the vein is further explored.

The *Lost Cabin* and *Minto* "veins" parallel the above-described vein at about 500 and 700 feet to the north-east respectively. The *Lost Cabin* and *Minto* workings are not opposite the *Eu-Tee* workings, however, and the distances mentioned are by scale from the company's plan, on which the first two veins mentioned have been assumed to extend to points opposite the *Eu-Tee* workings. The *Lost Cabin* workings, situated higher up the mountain at elevations of from 4,510 to 5,000 feet, are mentioned in the Annual Report for 1927. The old underground workings, consisting of two tunnels and two shafts, were all caved or largely inaccessible. Open-cuts indicate elongated lenses of quartz coinciding in strike and dip with the enclosing schistose rocks, the mineralization consisting chiefly of disseminated pyrite, with occasional spots of galena and sphalerite. These apparently disconnected lenses of quartz follow a rather poorly defined shear-zone. The collective results of sampling indicates that commercial values are chiefly

confined to oxidized showings where local concentration of gold has occurred. The following samples are from Callaway's report:—

Description and Nos. of Samples.	Width.	Gold.	Silver.	Lead.
		Oz. to Ton.	Oz. to Ton.	Per Cent.
Nos. 4148, 4150, 4151. Quartz and decomposed schist showing galena and pyrite in open-cut at 4,150 feet elevation. These three samples represent a continuous section across 18 feet 8 inches. An old tunnel was run in under this showing, but is now caved and inaccessible	6 ft. 8 in.	0.03	0.60	0.6
	7 ft. 6 in.	0.01	0.30	*
	4 ft. 6 in.	0.02	0.30	*
No. 4147. In face of open-cut uphill and south-easterly from open-cut at 4,150 feet elevation. Quartz stringers in decomposed schist showing galena and pyrite	8 ft.	0.02	0.50	0.5
No. 4152. Quartz showing in old inclined shaft 20 feet down from collar and just above water-level. This shaft is about 210 feet south-easterly from portal of old caved tunnel at 4,660 feet elevation	3 ft.	0.81	3.10	*
No. 4153. Near top of same shaft. Full width of vein not accessible, probably 5 or 6 feet wide	22 in.	0.62	3.10	*
No. 4154. Open-cut 250 feet farther south-east. Two streaks of quartz, separated by 3 feet of schist, sampled together	9 in. and 4 in.	0.46	1.80	*
No. 4155. Quartz showing in open-cut on Grand Pass claim, about 1,000 feet farther south-east and at elevation of about 5,000 feet	55 in.	3.56	2.30	*

* Not assayed.

Independent samples taken along the same section of outcrop assayed:—

Description.	Width.	Gold.	Silver.
		Oz. to Ton.	Oz. to Ton.
On Grand Pass claim at about 5,000 feet elevation. Patch of quartz 3 by 6 feet surrounded by rusty-weathering schist (same vicinity as Callaway No. 4155 sample)	Patch 3 by 6 ft.	Trace	0.4
Old cut 30 feet long with two narrow streaks of quartz in yellow-weathering schist (same place as Callaway No. 4154)	2 narrow streaks	Trace	0.7
On surface near top of old inclined shaft (in vicinity of samples 4152 and 4153)	10 in.	0.04	3.3
Picked sulphides from same place.....	Selected	0.26	35.3
In face of open-cut, 50 feet long, north-west of portal of caved tunnel at 4,660 feet elevation. Rotten quartz and schist with considerable iron oxides and some spots of galena. (Same place as No. 4147)	6 ft.	1.06	6.7
Same place as previous sample.....	7½ ft.	0.26	0.4
At sample open-cut as Callaway samples 4148, 4150, 4151. Continuous section across 15½ feet. These three samples contain small amounts of lead and zinc, not exceeding 1 per cent. in each case	7½ ft. on foot-wall 5 ft. in centre 3 ft. on hanging-wall	0.07 0.06 0.28	0.3 0.3 0.4

An analysis of the results of these separate samplings on different occasions indicates erratic and spotty values and the better assays are obtained when oxidized material is included in the samples. On the *Minto* vein, the only working seen by the writer, is an open-cut on the bank of a small creek at an elevation of 4,156 feet. Here there is a showing, 10 to 15 feet wide, consisting of alternating bands of quartz and schist, in which small amounts of copper-stain, galena, and pyrite were noted. The mineralization is chiefly concentrated over a width of from 5 to 6 feet. A sample taken by F. W. Callaway across 5 feet assayed: Gold, 0.95 oz. to the ton; silver, 5.9 oz. to the ton. At the same place independent sampling gave: Gold, 0.52 oz. to the ton; silver, 4.5 oz. to the ton; across 6 feet. These two samples were not assayed for lead and zinc. Another sample taken across a width of 4½ feet, where the sulphides were concentrated, assayed: Gold, 0.37 oz. to the ton; silver, 11.4 oz. to the ton; lead, 4.8 per cent.; zinc, 3.5

per cent. A grab sample from the broken ore on the dump assayed: Gold, 0.27 oz. to the ton; silver, 16.1 oz. to the ton; lead, 5.6 per cent.; zinc, 3.5 per cent.

This is an attractive showing, but no work had been done in the immediate vicinity to determine if any continuity could be expected along the strike or if it was an isolated lenticular mass. Some considerable distance south-easterly more work is reported to have been done which has exposed other showings along the general line of the same shear-zone. Near the bottom of the hill, and a long distance north-westerly from the previous workings described, there are several small showings containing low values in gold and silver. The possible connection between these showings and the *Ell-Tee*, *Lost Cabin*, and *Minto* veins is not yet known.

Summarizing the general results of exploration on the *Euphrates* property, it would seem that the deposits coinciding with the foliation of the enclosing schists are lensey. Trenching at close intervals is required to prove, if possible, the continuity of the more promising individual showings which could be further explored by underground workings in the event of ore-bodies of minable width and length being outlined along the outcrop. The small *Ell-Tee* vein, cutting the schistosity, is attractive and the high gold values obtained in places indicate a possibility that it might become profitably productive in a small way. As the vein cuts the formation on its dip, changes in the character of deposition might be expected as the vein comes into contact with successive strata, and the depth to which oxidation has extended will also have a bearing on the possible value of the deposit. Any important production from the property cannot, however, be predicted at the present early stage of exploration.

YMIR SECTION.

Yankee Girl. This property, situated easterly from Ymir, has been operated by the Yankee Girl Consolidated Mines, Limited, since March, 1928. Detailed descriptions of the group of upper workings, comprising some 18,000 lineal feet of development, are contained in the Annual Reports for 1927 and 1928. During 1929 efforts were chiefly confined to the driving of the big low-level tunnel on the Wildhorse Creek side, which at the end of this year had been advanced to about 2,850 feet in from the portal. It is estimated that it will have to be continued for about 2,000 feet farther to reach the projected position of the *Yankee Girl* vein system at this horizon, 765 feet vertically below the 1,235-foot level of the mine above. The scope of operations was somewhat restricted towards the latter part of the year and work was recently completely suspended in conjunction with cessation of work at all mines operated by companies sponsored by Stobie, Forlong & Company. It is to be hoped that the *Yankee Girl* operation, of importance to the Ymir camp, will soon be resumed.

Goodenough. This gold-mine, situated on Wildhorse creek, $4\frac{1}{2}$ miles by road from Ymir, was described at some length in the Annual Reports for 1927 and 1928. Owned by H. Jackson, A. McDonald, O. A. Lovell, and associates, of Ymir, the property was worked under lease and bond by the Porcupine Goldfields Development and Finance Company in 1926; the Goodenough Mines, Limited, in 1927; and the Enterprise Consolidated Mining Company, Limited, in 1928. For various reasons, not considered detrimental to the property, development-work has not been brought to full conclusions and interesting possibilities are indicated by recent work. During the four years mentioned shipments of gold ore, containing appreciable values in silver, lead, and zinc, were made at intervals, amounting to a total of about 3,566 tons. Of this some 337 tons was shipped in 1929 by the owners, who have resumed work at the property.

The last work done under company management was the driving of a lower crosscut tunnel, which was discontinued several hundred feet short of the ore-zone, which, in the two upper tunnels, is developed at depths of 220 and 374 feet respectively, measured on the dip of the shear-zone, below the surface. In these workings the character of the deposits is somewhat irregular, and the ore does not lend itself to the usual regular blocking-out methods owing to offsetting by numerous small faults and dykes and the lenticular shape of the ore-bodies. Milling-ore remains at numerous points in these tunnels and the strength of the mineralization in the No. 2 tunnel is promising for the downward continuation of the ore below that level. The shear-zone is wide and contained numerous small lenses of good ore. Recently the owners have opened up attractive new showings in faulted areas in the same workings.

The No. 3 tunnel, driven some 550 feet by former operators, will gain an additional depth of 220 feet on the dip of the shear-zone. This tunnel is now being driven ahead and the results

will be watched with interest. It is possible that larger lenses will be found at depth. In the adjoining *Ymir* mine the principal ore-body was a large lens 500 feet long and 30 feet wide, which was continuous for 500 feet in depth. The interesting possibilities for finding additional ore-bodies on *Ymir* ground are referred to in the Annual Report for 1928, in which an extract is quoted from the Summary Report of the Geological Survey of Canada for 1908. The *Goodenough* vein extension strikes close to the corner of the *Mugwump* claim of the *Ymir* property and will dip into the same claim at a short distance beyond the eastern extremity of the *Goodenough* workings. In order to get the best results for comprehensive development of the deposits the two properties should preferably be combined in one operation.

Six men are employed at the *Goodenough*, two in driving the lower tunnel by hand and the others in the upper tunnels. According to reliable report, a showing of strong sulphide ore containing high gold values, 10 feet wide, was recently struck in the raise between No. 2 and No. 1 level. The No. 1 tunnel, now being advanced, is reported to be in ore across the full width of the face. A substantial tonnage of good ore is being accumulated for shipment in the spring.

The *Big Horn* property, consisting of the *Sunbeam*, *Buckeye*, *Mary A.*, and *Nora Marie* claims, is situated 6 miles south-east of *Ymir*. The claims are reached by road up Porcupine creek and the South fork of Porcupine creek to the *Howard* mine compressor-house, and thence 2½ miles by fair trail to the ridge separating the South fork and Hidden creek. During the past season one of the owners, J. W. Peck, did a limited amount of work in improving the trail to the claims, and he is also reported to have cleaned out several of the open-cuts on the property.

The formation in the vicinity of the underground workings is a granite related to the Nelson batholith, in which occur beds and remnants of quartzite and argillite of the Summit series. The workings of the *Big Horn* group are largely in the granite and consist of a shallow shaft on top of the ridge and a 300-foot tunnel about 600 feet north-east and 270 feet below the collar of the shaft. The shaft, which is now caved at the bottom, was sunk in mineralized quartzite and three levels, of but a few feet each in length, have been driven to the north-east and south-west from the shaft along the quartzite.

The mineralization in the quartzite consists of small amounts of pyrite which is stated to contain small values in gold and silver. The long tunnel at 5,830 feet elevation was driven in a direction of S. 16° E. and is in granite for its entire length, except for a narrow band of quartzite at the face and a 10-foot band of quartzite at a point 155 feet from the face. The quartzite bands have a strike N. 85° W. and dip at 85° to the north where encountered in the tunnel. In addition to the above working-places there are several caved trenches and open-cuts near the shaft, but due to their caved condition very little information could be gained from them.

This property has been referred to in some detail in the Annual Reports for the years 1927 and 1928. The claims, five in number, are situated 1½ miles south-east of the *Howard* on the east side of the South fork of Porcupine creek. The country-rocks are slates, quartzites, and argillites close to the contact of the quartzite bands with granite rocks of the Nelson batholith. The quartz vein, which is in places mineralized with small lenses of galena, sphalerite, and small associated silver values, varies from a few inches to 4 and 5 feet in width. The vein has been opened up by two tunnels on the *Cariboo* claim at elevations of 6,150 and 5,980 feet and the drifts are in 87 and 8 feet respectively. The vein strikes N. 40° E. and dips to the south-east at 40° to 45° and has been traced along its outcrop for several hundred feet with small trenches. Since the claims were last visited the long tunnel has been cleaned out, exposing the quartz vein along the drift. This work was done late in the fall of 1928 and there has been nothing done at the property this past season.

This property, situated on the South fork of Porcupine creek, was described at some length in the Annual Reports for 1927 and 1928 and the brief notes now submitted are intended to be complementary to the previously published information. Exploratory operations, which have been carried on continuously since the property was acquired in 1928 by the J. F. Duthie interests of Seattle, were somewhat restricted during the later part of 1929. On the No. 1 tunnel-level recent exploratory work at the northern end of the Peck ore-body (north-south vein) indicates possibilities for an extension of the ore north-easterly along the granite-contact. This is suggested by banding of the sulphides paralleling the contact at a point opposite the shallow winze where side-swiping was done in November.

On the same level the tunnel driven easterly to explore for the possible faulted continuation of this ore-body south of the *Queen* vein is now 225 feet east of the Peck drift. At this point siliceous limestone occurs in contact with a basic intrusive, both formations being foreign to the region around the Peck ore-body. Further efforts in this connection will be confined to exploration of the area south of the tunnel following the *Queen* vein between the limestone occurrence and the Peck drift. In this section the foot-wall fracture is followed closely and no information is afforded concerning the character of the country to the south of the fissured zone. In the raise between Nos. 1 and 2 levels the foot-wall fracture of the ore-zone has been reached by a short crosscut tunnel 50 feet above No. 2 level. No more work has been done on No. 2 level since these workings were described in the Annual Report for 1928. No. 3 tunnel has been advanced 175 feet in a northerly direction for the purpose of developing the ore proved by diamond-drilling below the No. 2 level and exploring the granite-quartzite contact.

The old *Union Jack* tunnel, 103 feet vertically above the No. 1 level, driven on the *Queen* vein a short distance by former operators, was reconditioned and advanced to 70 feet from the portal. This tunnel is to be continued to crosscut the expected upward continuation of the Peck ore-body. Throughout this new level the *Queen* east-west vein is well mineralized with galena and sphalerite and a small amount of pyrrhotite over an average width of 4 feet. The same vein has been traced for a considerable distance on the surface, having been the object of exploration by the early operators, who abandoned work in the two lower tunnels on account of the erratic character of the mineralization in those workings. The new work in the upper tunnel, however, justifies the further investigation of the possibility of ore-development in this vein. Geological work has progressed under the direction of F. W. Holzheimer and results indicate interesting possibilities along the whole trend of the granite-quartzite contact. In this connection it is interesting to note that there is an indefinite but noticeable iron-lead-zinc mineralization wherever this contact is exposed in the workings, including the area recently opened up on No. 3 level.

Sunrise. Easterly and over the summit from the *Howard* property a group of claims has been staked by James Bremner and associates, of Ymir. A limited amount of surface work was done during the summer season on a reported occurrence of galena and sphalerite in limestone along the granite-contact. This demonstrates the interesting prospecting possibilities of the marginal contact-zone in which, about a mile to the west, the *Howard* deposits are found.

Hunter V.—Operations at this mine, situated south-east of Ymir, have been discontinued by the Consolidated Mining and Smelting Company. The property had been worked in connection with the fluxing requirements of the Trail smelter.

Consolidated-Alabama.—A small amount of preliminary work was done on this group of claims, situated on the south side of Stewart creek, near its junction with the Salmo river north of Ymir, under the direction of A. R. MacDonald, representing Seattle interests.

Prospecting of this group of claims, south-west of Ymir, has been continued by J. Harbottle, connected with the property for many years. The geology of the deposits was described by C. W. Drysdale in Geological Survey of Canada, Memoir 94. The ore, carrying good silver values associated with copper, lead, zinc, and iron sulphides, is found in a fissure-vein at the contact of monzonite and augite porphyrite.

SHEEP CREEK CAMP AND SOUTH OF SALMO.

The district known as the Sheep Creek camp embraces two distinct types of ore-deposits, one consisting of gold-bearing quartz veins and the other of lead-zinc replacement deposits in limestone. The geology of the area is being revised by J. F. Walker, of the Geological Survey of Canada, who has spent the last two seasons in mapping the geology of a sheet between 117° and 117° 15' longitude and between 49° and 49° 15' latitude. This sheet, taking in the district extending from the International boundary north to near Porcupine creek, includes the following mining properties, which have been before the public in recent years: *Reno*, *Queen*, *Kootenay Belle*, and *Nugget-Motherlode* gold properties; *H.B.*, *Aspen* (Salmo-Malartic Mines, Limited), *Emerald*, Salmo-Consolidated Mines, Limited, and other silver-lead-zinc properties. The Geological Survey party also visited other properties adjacent to the sheet being mapped. Considerable information of economic value has therefore been obtained which, when published, will be useful in planning further exploration. In this connection the recently

completed work of the Geological Survey in this area constituted the most comprehensive study of the two distinct types of deposits mentioned above. S. M. Steeves was in charge of the topographical party. The sheet will be published on a scale of 1 mile to 1 inch with contour interval of 100 feet.

Reno Gold Mines, Ltd. As the property of this company, situated on Fawn creek, was described at some length in the Annual Reports for 1927 and 1928, the present report will be confined to progress made during the year under review. The new 30-ton cyanide-mill has been in operation since the middle of August. Up to the end of December approximately 2,000 tons was milled, which averaged about \$20 in gold to the ton. Bullion recovered for this period was about \$37,000. This includes the tuning-up of the mill and experimental stage. Power for the mill is supplied by a 96-105-horse-power full Diesel-type oil-engine supplied by Crossley Bros., Limited, Manchester (England). The camp buildings now include a large cook-house, an office building with sleeping accommodation for the staff, a two-story bunk-house connected with a dry and store house, and garage. Power for the mine has been increased by the recent installation of a Crossley Bros. 2-cylinder, 124-135-horse-power, heavy-duty oil-engine, direct-connected to a 500-cubic-foot vertical compressor supplied by Alley & McLellan, of Glasgow.

Recent operations in the mine have chiefly consisted of stoping on the No. 3 level, where ore for the mill is being drawn from two stopes. With the additional compressor equipment now available a comprehensive development programme is planned. No. 3 level is to be advanced and crosscuts are to be driven northerly and southerly to explore for parallel veins. Since the present operations were initiated in September, 1928, the underground work done has been on the No. 3 and No. 4 levels. The No. 4 tunnel is driven on or parallel with the vein for about 495 feet and at 370 feet from the portal a raise connects with the No. 3 tunnel, 138 feet above. At 315 feet from the portal a crosscut has been driven 300 feet in a southerly direction without disclosing any parallel fractures. The vein is not well exposed throughout the greater portion of the No. 4 tunnel, which was largely driven by former operators, and the situation on this level is somewhat indefinite. Several short sections of ore were developed in the main drift to about 270 feet in from the portal, where a definite vein is picked up in the northern wall and followed to the face. It is considered possible that up to the point mentioned the tunnel lies to the south of the main fracture exposed at the inner end of the working.

The No. 3 tunnel has been driven about 732 feet and in this working the vein is better exposed, though in places it has been left in the north wall. When the mine was visited last the length of the two ore-shoots on No. 3 tunnel-level had not been fully determined, but ore had been stoped for a length of approximately 120 feet on the westerly shoot near the portal and for a length of 200 feet on the easterly shoot at the inner end of the tunnel. Westerly from this last ore-body the vein lies to the north of the main tunnel, but was picked up in a crosscut 440 feet back from the face.

The width of the ore is generally less than stoping-width and some dilution occurs in mining. The gold content of the oxidized ore, however, is sufficiently high to give a good average value over the width stoped. The depth to which the oxidized zone of enrichment has extended will have an important bearing on the future of the property. Possibilities for finding new ore-shoots to the east of the No. 3 tunnel are considered to be favourable, as in this direction the *Reno* vein will cut through harder rocks than have yet been encountered. In this connection the best ore-shoots of the Sheep Creek gold camp have been found where the veins cut the quartzites and harder argillaceous quartzites. Ordinarily the fissures are unproductive in the softer rocks which have sheared instead of fracturing and granulating as in the hard rocks.

The writer is indebted to J. F. Walker, of the Geological Survey, for the following notes on the geology surrounding the *Reno* deposits: "The *Reno* vein cuts a series of quartzites, argillaceous quartzites, and siliceous argillites which come at the top of the series of quartzites and form a transition between it and the highly argillaceous series higher in the section. The argillaceous series starts just west of the portal of No. 4 tunnel and continues westerly. The series which the *Reno* vein cuts is about 1,600 feet thick, and below it, or to the east, in the section there is about 900 feet of calcareous and argillaceous schist and limestone and then the main quartzite series. The face of No. 3 level is about 300 feet west of a point vertically under the crest of the ridge. It is about 550 feet from the face of No. 3 level easterly to the contact with the schists and limestones. From about 125 feet from the face the vein should cut uniformly

harder rocks than, have so far been encountered. Whether oxidation will reach the depth of No. 3 level farther into the hill and whether ore-shoots will be found is something which only development can prove. There is, however, favourable ground, so far as the rock formations are concerned, ahead of the present face of No. 3 level for some 500 feet."

S.B.—At this group of eight claims, situated westerly from the *Reno* property and on the Hidden Creek slope, surface prospecting has been done by Neil McColeman and associates. A considerable amount of deep trenching has exposed irregular zinc mineralization in metamorphosed limestone-bands near the contact with granite.

The property of this company, situated on the eastern side of Cariboo creek **Salmo-Consolidated** and reached from the *Reno* road, was described at length in the Annual **Mines, Ltd.** Report for 1928. Since then exploration was continued in the lower crosscut tunnel at 5,044 feet elevation. This working was extended to 440 feet in from the portal and drifts were run northerly and southerly for 125 and 160 feet respectively. The total footage driven by this company amounts to about 905 feet, including 485 feet done in 1929. Wide areas containing scattered mineralization were encountered, but no definite body of commercial ore was found. Work was suspended in the summer.

Emerald.—At this group, situated on the southern side of Sheep creek, surface prospecting was done and an electrical survey made by the Radiore Company of Canada. In past years substantial amounts of silver-lead ore were shipped from this property.

Aspen. At this property, situated on Deer creek, about 11 miles by road from Salmo, development was continued until about the end of November, when work was suspended. The *Aspen* deposits were described at some length in the 1928 Annual Report and the notes now submitted should be read in conjunction with the previously published information. Following an electrical survey made by the Radiore Company of Canada early in the year, some 2,000 feet of diamond-drilling was done and from 700 to 800 lineal feet of deep trenching. In the "A" tunnel-workings at the northern end of the property 190 feet of crosscutting and 200 feet of drifting was done. The total footage now amounts to about 2,137 feet of underground work, distributed between the "A," "B," and "G" workings. Summarizing results of the exploratory work done, mineralization in the limestones is scattered and indefinite, no appreciable body of commercial ore having yet been located. It is understood, however, that the results obtained are not considered conclusive by the management and further exploration is believed to be under consideration.

Queen.—W. A. Lavinge and associates, of Spokane, are reported to have completed the purchase of this well-known gold property on Sheep creek. Some more definite activity is now expected in connection with the *Queen*, which has only been intermittently worked in a small way during recent years.

Molly.—At this property, situated on Lost creek, some surface prospecting was done by the Consolidated Mining and Smelting Company. Molybdenite occurrences are found at widely separated points in the adjacent area.

Silver Dollar. At this property, situated on the outskirts of the townsite of Salmo, work was discontinued early in the year by the Consolidated Mining and Smelting Company. Subsequently another tunnel is reported to have been started by the owner, L. Clubine, who is considering the formation of a company to continue exploration. The ore carries values in silver, lead, and zinc.

This property, comprising some sixty-three claims situated on the Pend **Reeves-McDonald**, d'Oreille river, is operated by the Reeves-McDonald Mines, Limited, capitalized at 3,000,000 shares, no par value, of which 2,000,000 have been issued. The voting control is now held by the Pend d'Oreille Mines and Metals Company, with the Victoria Syndicate retaining a small interest. H. H. Yuill is president and general manager; Harold Lakes is in charge of work at the mine. The claims cover an area of approximately 2,082 acres, extending from the river in a north-easterly direction along a belt of limestones, in which zinc-lead mineralization has been found at intervals over a large area on both sides of the International boundary-line. On the Canadian side this series of rocks, known as the Pend d'Oreille limestone, contains the *H.B.*, *Emerald*, *Reeves-McDonald*, *Red Bird*, and other properties, and in the United States the extension of the same mineral-belt is marked by the property of the Pend d'Oreille Mines and Metals Company, the *Grandview*, *Electric Point*, *Gladstone*, and other mines.

The results of the detailed geological study made by J. J. O'Neill of the deposits controlled by the Pend d'Oreille Mines and Metals Company, including the Reeves-McDonald, have not yet been made available. On Map 80A accompanying Geological Survey of Canada Memoir 38, "Geology of the Forty-ninth Parallel," the Pend d'Oreille limestone group is tentatively referred by R. A. Daly to the Carboniferous period. This geology is undergoing revision, however, and it is understood that these rocks will be placed in the late Pre-Cambrian.

The deposits of the district, including the *Reeves-McDonald*, are characterized by the occurrence of sphalerite, which predominates, and galena in a silicified limestone gangue. Pyrite is present in some areas, but not intimately mixed with the ore-minerals. The typical zinc mineral is a light-coloured sphalerite, free from impurities, which concentrates to a product carrying over 60 per cent. zinc. The *Grandview* milling operation, near Metaline Falls, affords an example of the high ratio of concentration which can be obtained. In this case the ore, being free from iron, concentrates to 70 per cent. lead and 62 per cent. zinc. While mineralization in the limestone formation is widely distributed, a large amount of exploration has been required to locate sections where the ore-minerals were sufficiently concentrated to constitute workable deposits.

In the case of the *Reeves-McDonald* the importance of structural control was at once realized by the management. Detailed geological study revealed the large favourable structures with which are associated the more important concentrations of zinc-lead mineralization. On the area, some 3 miles in length, covered by the *Reeves-McDonald* property, the limestones conform in strike and dip with the important regional fracturing which provided the main channel of mineralization, and large folds or faulted areas have provided structural conditions favourable for mineral deposition on a large scale. A comprehensive description of the property is contained in the Annual Report for 1928. Since then two additional ore-bodies have been discovered, known as the B.L. and Norcross, respectively. From west to east the principal ore-zones are the River, McDonald, Reeves, B.L., Norcross, and O'Donnell, which are all in the same band of limestone. The last four mentioned occur in the vicinity of sharp major folds or faults which have displaced the ore-bearing limestone from 400 to 600 feet to the north. The Prospect ore-zone, apparently of minor importance, lies to the east of the O'Donnell workings and in a parallel limestone-band to the south. The present notes, which should be read in conjunction with previously published information, will be confined to the results of the new discoveries and work done during the year under review.

Surface prospecting done last summer disclosed the B.L. and Norcross ore-zones between the Reeves and O'Donnell workings. They have not been thoroughly prospected as yet, but present strong evidence for additional important tonnage. In each case these newly discovered shoots were located beyond or to the east of where the main limestone-band has been displaced to the north. On the B.L. shoot surface-trenching has been done and three diamond-drill holes, 125 feet apart, have proved its continuity for a distance of at least 250 feet along the strike and 100 feet in depth. These drill-holes show an average width of 26 feet of ore, which averaged about 1.6 per cent. lead and 8.4 per cent. zinc, with the usual low silver content. Although no exploration has yet been done beyond the limits mentioned, the strength of the mineralization and the favourable geological conditions surrounding this occurrence indicate possibilities for an ore-shoot rivalling the Reeves ore-body in potential importance.

The Norcross shoot, some 500 feet westerly from the O'Donnell workings, has been opened by a surface trench and one shallow diamond-drill hole, both in a carbonate-zone, indicating promising mineralization 30 feet wide. It is considered possible that the O'Donnell shoot, which is more distant from the sharp displacement of the limestone-beds, may represent the weaker extremity of a very extensive zone of mineralization comprising both shoots. New work done on the O'Donnell deposit includes 800 feet of drifting and crosscutting. Two crosscut tunnels, 150 feet apart, develop a very wide zone of low-grade mineralization in which the better values are concentrated in bands up to 20 feet wide. A section along the westerly crosscut from hanging-wall to foot-wall is roughly as follows: 15 to 20 feet of 8 per cent. combined metals, then 40 feet of 4.6 per cent. combined metals, and on the foot-wall another band of 20 feet of similar grade to the hanging-wall mineralization. The easterly crosscut shows two planes of mineralization, each about 15 feet wide, separated by a 10-foot barren section. The grade of these approximates that of the two 20-foot bands in the westerly crosscut.

The low-level or River tunnel will develop the principal ore-zones mentioned at a depth of from 700 to 800 feet below their respective upper workings. Excellent progress has been made in driving this tunnel, which at the end of the year was 3,286 feet in. The total development-work done on this level during 1929 was 3,350 feet, which includes two short crosscuts. Of this total footage, 3,020 feet was driven since March 1st, when hand-drilling was discarded for machine-drills. Power is supplied by a 108-horse-power Petter oil-engine driving an Ingersoll-Rand compressor of 528 cubic feet capacity. The equipment used includes a mucking-machine of the drag-scraper type and a Mancha Mule storage-battery locomotive. Twelve 2-ton side-dump cars are used to handle the muck over a 24-inch track equipped with 30-lb. rails. The dimensions of the tunnel are 11 by 9 feet. Timbering, used only where necessary in a few places, consists of 14-inch square timber and 4-inch plank lagging furnished from the company's sawmill.

According to the management, the first sulphide ore-body was encountered at 3,153 feet in from the portal and a crosscut driven from a point 3,272 feet in shows a width of 70 feet of mineralization, of which 50 feet averaged 9.6 per cent. combined metals. This ore, which had been drifted on for a short distance at the end of the year, is some distance westerly from the expected downward continuation of the Reeves ore-body and at a horizon 218 feet lower than a diamond-drill hole which cut 25 feet of 9.4 per cent. combined metals. In the new showing in the tunnel the proportion of zinc to lead is about the same as the Reeves and other ore-bodies. Towards the portal end of the River tunnel there is exposed a length of several hundred feet of carbonate mineralization believed to correspond to the oxidized ore previously opened up in the McDonald tunnel westerly from and at a lower elevation than the River tunnel. This shoot and the sulphide zone, of undetermined extent, exposed along the edge of the Pend d'Oreille river are possible factors to be taken into consideration in the ultimate development of the property. In addition to the substantial amount of underground work accomplished, trenching and diamond-drilling were continued to test the favourable ore positions indicated by previous intensive study of the surface geology. Throughout these operations a high standard of efficiency is maintained.

Summarizing conditions on the *Reeves-McDonald*, the ore indicated by partial exploration of the Reeves shoot, amounting to some 2,000,000 tons in round figures, averages about 0.5 oz. silver to the ton; lead, 1.7 per cent.; zinc, 6.6 per cent., according to information previously published. Superficial and incomplete lateral exploration of the B.L., Norcross, and O'Donnell shoots indicates very favourable possibilities for developing additional important tonnage of material of similar grade. Under existing market conditions the possibility for profitable production would seem to be remote, but with better prices obtaining for zinc the property would have potential importance. The very favourable physical conditions, together with the large widths of the ore-zones, should with other factors make for exceptionally cheap mining, while metallurgical tests indicate high recoveries at a low cost.

Red Bird.—On the opposite side of the Pend d'Oreille river and located along the extension of the *Reeves-McDonald* mineralized limestone-zone, this property has been diamond-drilled by the Boundary Basin Mines, Limited. The ore, entirely oxidized in the mine-workings, carries good zinc values with some lead.

Shenango Canyon.—This property, owned by M. C. Monaghan and situated on the Salmo river north of the *Reeves-McDonald*, was recently being explored by the Consolidated Mining and Smelting Company. Diamond-drilling was done for a short period preceding the advent of the cold weather.

International Crown Mines Consolidated.—A Washington corporation of this name, formed early in 1929 to develop mines in British Columbia and the United States, was reported to have acquired an option on the holdings of H. H. Shallenberger in the International Lead and Iron Mines. This property, situated on the eastern side of the Pend d'Oreille river adjoining the *Reeves-McDonald* holdings to the south-east, is described by J. D. Galloway in the Annual Report for 1915 under "Iron Mines" and in the Summary Report of the Geological Survey of Canada for 1902. No activity has yet materialized in connection with this proposed new undertaking.

ERIE CREEK (NORTH FORK OF SALMO RIVER).

This property, situated on Erie creek, 13 miles by road from the Great Second Relief. Northern Railway, was referred to at some length in the Annual Reports for 1927 and 1928. The name of the operating company has been changed from the Second Relief Mining Company, Limited, to Relief Arlington Mines, Limited. The new

company has acquired the *Arlington* mine near Erie. During the period under review mining has been confined to the *Second Relief*, where crosscutting, drifting, and stoping has been done. High gold values have been encountered on the No. 4 tunnel-level, where the main drift has been extended about 130 feet. Former operations were confined to the exploration of one vein, but there are several promising parallel veins, indicated by surface showings, which can be reached by comparatively short crosscuts from the present workings. These veins are shown on the illustration accompanying the Annual Report for 1928. In this connection a start had been made and a crosscut driven 55 feet to intersect a vein following the south-east contact of the diorite dyke along the opposite side of which the *Second Relief* vein is developed. The interesting character of the *Second Relief* deposits, which are high-temperature fissure-veins, is described in the previous Annual Reports mentioned.

The mill was operated during the months of June and July, but was then closed down owing to shortage of water. A new amalgamating unit has been added to the mill, which has a capacity of from 30 to 40 tons, and the recovery of about \$5,000 in bullion and concentrates is reported. The ore milled, amounting to some 500 tons, was derived from development-work in driving No. 4 tunnel. Since October work in the mine has been discontinued owing to shortage of water for driving the compressor. The only work done in connection with the *Arlington* was a study of the geology of the vicinity with a view to planning future exploration. Work on the *Second Relief* is to be resumed in the spring. The Oscarson Bros. are in active charge of the company's operations.

Juno and Last Chance.—In the same vicinity a few men have been employed on development of this property, owned by Joe Bernard. The work was financed by Seattle interests.

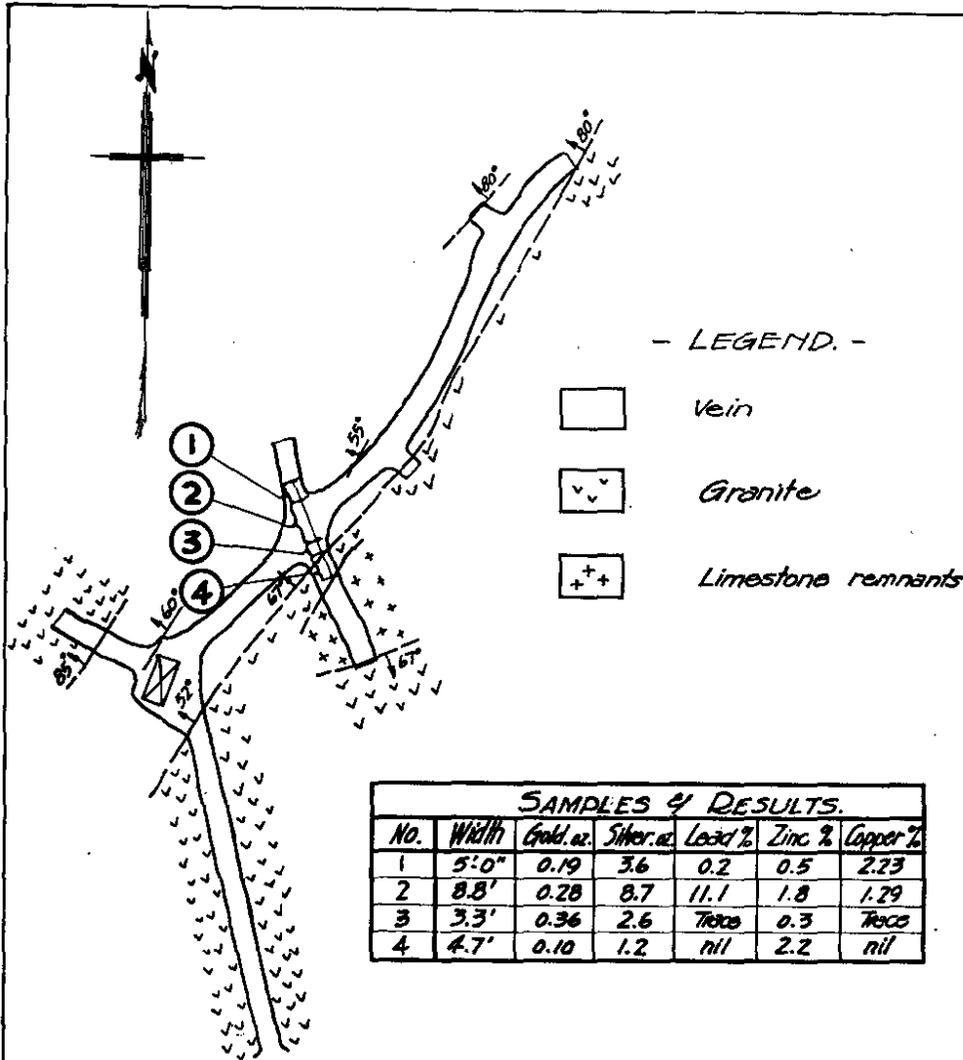
PROPERTIES TRIBUTARY TO KOOTENAY LAKE.

Sanca Mines, Ltd. A limited amount of development has been done on the property of this company, comprising a large number of mineral claims in the vicinity of Sanca creek and Ginol's Landing on the east side of Kootenay lake. Work was chiefly concentrated on the *Iolanthe* vein at the southern end of the company's property, described in past Annual Reports. In this vicinity an elaborate headquarters camp at the lake-shore includes some twelve frame and log buildings. Accommodation has also been provided at individual properties and considerable trail-work has been done.

Gold Medal and Cariboo. Exploratory work was carried on by J. L. Irving, M. Anderson, and associates on these claims, situated on the West fork of Kokanee creek, 5 or 6 miles from the *Molly Gibson* mine road. Improvements were made to the trail and a bridge built over Kokanee creek. The deposits, containing values in gold and copper, occur in granitic rocks of the Nelson batholith.

Wisconsin. This property, situated on the north side of Hughes creek, which is the main South fork of Midge creek, is reached from the west side of Kootenay lake by a rough trail 14 or 15 miles in length. It includes the *Wisconsin* and *Lucky Strike* Crown-granted claims, together with some additional claims staked recently. An interesting reference to the property by the late W. Fleet Robertson is contained in the Annual Report for 1903, under *Lucky Strike*. Since then no further mining activity occurred, possibly owing to the complex character of the ore. An examination made in 1926 by C. C. Starr for the Porcupine Goldfields Development and Finance Company, Limited, was responsible for redirecting attention to the old claims, and in 1928 an option was secured by O. D. Frith, who assisted Starr in his examination. The Interior Mine Development Company, Limited, was then formed and subsequently the firm of Stewart & Batten, mining engineers, became interested in the undertaking. An electrical survey was made by the Radiore Company of Canada in November, 1928, but no activity materialized during 1929. However, it is understood that the original option from the Finch & Campbell Estate, of Spokane, was extended, and according to latest advices the property is to be diamond-drilled and explored by Eastern Canadian interests during the coming season. The old camp buildings, now in bad shape, are situated at an elevation of 6,100 feet, or 4,300 feet vertically higher than the level of Kootenay lake. Most of the climb is made in the last 5 miles of the trip from where the trail leaves Midge creek.

The principal group of workings, situated above the camp, consists of two tunnels and ten open-cuts. Together these develop a wide vein, striking north-easterly and dipping at 60° to the north-west, for a length of about 650 feet. Rock-exposures in the area surrounding the mine



PLAN OF NO. 1. TUNNEL, WISCONSIN MINE.

SHOWING LOCATION OF SAMPLES.

Kootenay Lake, Nelson, M.D.

Scale 30' 30 60 90 Feet.

To Accompany Report by B.T.O'Grady,
Resident Engineer, Nelson, 1929.
B.C. Bureau of Mines

are rare and it has not yet been possible to outline the geology in detail. The principal rock exposed in the immediate vicinity of the workings is granite, but limestone also appears at points underground and considerable areas of metamorphosed sedimentaries are indicated to the south-west and north-east of the developed section of the vein. In the latter direction, over the summit of the ridge from the *Wisconsin*, limestones are exposed in outcroppings and old prospect-workings. The altered sediments, possibly occurring as roof-pendants in the batholith, also strike north-easterly and dip steeply to the west.

The ore-body has apparently been formed largely by replacement of limestone along the contact with the granitic tongues or sills which form its hanging-wall and foot-wall. The vein is about 30 feet wide as determined by the two crosscuts in No. 1 tunnel. At other points the full width has not been definitely determined. The width of the ore in the crosscuts mentioned is up to 18 feet. Outside the limits of the ore there are areas of limestone, evidently once mineralized, but which have been so completely oxidized and leached that they now consist of honeycombed skeletons of quartz and iron-stained residual material. They contain very low values in gold and silver. The minerals in the ore-body include arsenopyrite, pyrite, marcasite, pyrrhotite, chalcopyrite, galena, and sphalerite, named in their apparent order of abundance. Antimony is also present in small quantities, but the mineral containing it has not yet been definitely identified. The sulphides are associated with a mass of quartz, siderite, and residual gangue.

Oxidation of the ore-body in the present shallow workings has been intense, but very erratic, and accompanied by pronounced leaching. In the No. 1 tunnel, which affords the most information, the sulphides, in which arsenopyrite and pyrite predominate, occur in masses and stringers irregularly distributed through honeycombed quartz heavily stained with limonite. Some of the sulphides are completely oxidized and later have been leached out, leaving ribs of the more resistant quartz and arsenopyrite between. This last mineral, which occurs in large quantity, is frequently coated with copper-carbonate stains derived from oxidation of chalcopyrite. The values are chiefly in gold with some silver. The large amount of sampling done has been chiefly to determine the gold and silver content of the ore, which also contains minor values in copper, lead, zinc, and antimony. The arsenic content is high and might be turned to account if a market could be found for this metal.

The No. 1 tunnel at an elevation of about 6,200 feet, aneroid reading, is the principal working. It starts as a crosscut and continues as a drift to the north-east for a length of 145 feet. At the south-west end of the drift a 60-foot winze, now partially filled with water, has been sunk. In the No. 1 tunnel the full width of the vein has been crosscut in two places. Sampling results in this working, made available to the writer, show the following assays:— In drift, average width of 9.3 feet (full width of ore not exposed) and length of 145 feet: Gold, 0.35 oz. to the ton; silver, 3.4 oz. to the ton. Across 17.8 feet where full width of the ore is exposed in the two crosscuts, 60 feet apart: Gold, 0.43 oz. to the ton; silver, 3.9 oz. to the ton. Samples taken in surface cuts Nos. 2, 3, 4, 5, which cover a length of 155 feet of outcrop above and adjacent to the No. 1 tunnel-workings, averaged: Gold, 0.52 oz. to the ton; silver, 3.6 oz. to the ton; across a width of 7.2 feet. An analysis of the sampling showed that the strong sulphide ore contains better gold values than the oxidized material. Samples taken by the writer across the full width of the ore in the central crosscut in No. 1 tunnel gave the following values:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.	Per Cent.
Across 5 feet on hanging-wall side of the ore.....	0.19	3.6	2.23	0.2	0.5
Across 8.8 feet in centre and adjoining last sample....	0.23	8.7	1.29	11.1	1.3
Across 3.3 feet on foot-wall side of ore and adjoining last sample.....	0.36	2.6	Trace	Trace	0.3

These samples represent a continuous section across 17.1 feet. Samples were also taken across considerable widths of oxidized material on each side of the ore section, but these did not show any appreciable values. The best assay obtained outside the ore proper was across

4.7 feet, adjoining the last previously mentioned sample on the foot-wall side, which assayed: Gold, 0.10 oz. to the ton; silver, 1.2 oz. to the ton; copper, *nil*; lead, *nil*; zinc, 2.2 per cent.

The No. 2 tunnel, at an elevation of 6,160 feet, is a crosscut situated about 185 feet south-easterly from the No. 1 tunnel drift. It cuts the vein, showing it to be persistent, but the values here are low. The best ore is confined to a band 3½ feet wide, which gave a total value of \$8 to the ton in gold and silver. Summarizing the results of development-work done underground and on the surface, the vein is very wide and strong and an ore-body of considerable extent is indicated. If large tonnage of low-grade gold-silver ore is proved it is to be expected that the milling problem will eventually be solved.

About 1,000 feet easterly from the above-described group of workings, No. 3 tunnel, at an elevation of 6,085 feet, is caved at the portal. Judging from the map, it was started as a crosscut to prospect the main vein at a greater depth, but apparently numerous minor veins were cut and followed, with the result that the major objective was never attained. The total length of this tunnel is about 970 feet and it is estimated that the main vein could be reached by its continuation for a few hundred feet farther. There are several other veins on the property, judging from mineralized quartz on the dumps of numerous open-cuts, but these cannot conveniently be examined at present owing to debris which has covered the showings.

Iva Fern. This group, owned by the Iva Fern Mines, Limited, is situated on the northern side of Cultus creek, about 7 or 8 miles by road and trail from Kootenay lake.

The property was taken under a development bond by the Consolidated Mining and Smelting Company early in 1929, since when exploratory work has been carried on continuously. The *Iva Fern* deposits are described in detail in the Annual Report for 1928. Since the new operations were initiated a large amount of trenching and 834 feet of underground work have been done. The surface work indicated an ore-body to the south of the main tunnel, but subsequent drifting and crosscutting in this direction failed to prove the continuity of the ore to that depth. The northerly drift was also advanced without any appreciable results. Sinking has recently been started on the north side of the main crosscut. As the vein apparently dips steeper than the argillite country-rock, with which it coincides in strike, it is possible that at further depth conditions will be found more favourable for deposition in the underlying strata, which include a band of dolomitic limestone.

Spokane. This property, on Canyon creek, 18 miles from Kootenay lake, has been worked intermittently by the owners, the Laib Bros. Latterly, however, chief efforts were concentrated on widening and improving the Cultus-Canyon Creek trail, which serves the *Spokane* and numerous other prospects in the surrounding area. Through the assistance of the Department of Mines this trunk trail is being gradually improved and access is being afforded to a number of mining properties which have been handicapped through lack of transportation facilities. The *Spokane* has been very intelligently developed and a substantial quantity of gold-silver-lead ore has been put in sight. The property is described at length in the Annual Report for 1927.

North Wind. This property, situated on Canyon creek, about 2 miles easterly from the *Spokane*, has been acquired by the St. Bernard Mines, Limited, sponsored by W. H. Tyrrell, of San Francisco. Preliminary work done includes cabin-construction and a new trail has been built to connect with the Cultus-Canyon Creek trunk trail. The *North Wind* deposits are described in the Annual Report for 1927.

Bayonne. After a long period of inactivity work was resumed at this property, situated at the head of Summit creek, by B. N. Sharp with a small crew. James B. Gerrard, of New York, is financing the work. The present route to the *Bayonne* is by trail, about 12 miles in length, from the *Nugget-Motherlode* mill on Sheep creek. This trail, however, crossing over a summit country ranging from 6,500 to 6,700 feet in elevation, is very rough and contains unnecessary adverse grades. Construction of a new trail, for which the right-of-way has already been slashed out, is planned to connect with the Cultus-Canyon Creek trunk trail, which is gradually being improved to serve the whole camp. The mine camp, situated at an elevation of about 6,300 feet, has been improved by the addition of two new cabins and supplies were packed in for the winter.

The *Bayonne* property, consisting of nine Crown-granted claims, was described in the Annual Report for 1915. The granodiorite country-rock is cut by quartz-filled fissure-veins and the

values are mainly in gold, which occurs partly as free gold in the quartz and partly in association with iron pyrites. The main vein has been traced through two claims by some thirty open-cuts and is developed by two drift-tunnels, known as the upper, or *Bayonne*, and the lower, or *Ohio* tunnel. The *Bayonne* tunnel, at about 6,900 feet elevation, was in 500 feet at the time the property was examined in 1915 and throughout that distance the vein was found to be well mineralized and to contain some good shoots of ore. This drift, temporarily inaccessible on account of caving at the portal, is reported to have been continued some distance with satisfactory results, and the footage on this level is now said to amount to about 1,000 feet.

The *Ohio* tunnel, at an elevation of 6,400 feet and about 2,500 feet to the south-west (measured between portals), has attained a length of 950 feet. Systematic sampling by the management in this working indicates two well-defined ore-shoots. The first one, about 300 feet long and averaging 3 feet in width, is encountered at 50 feet in from the portal, and the second shoot at the inner extremity of the tunnel is 115 feet long and about $3\frac{1}{4}$ feet wide on the average. Good ore extends across the full width of the face of this tunnel. Between the two ore-bodies mentioned there are spots of low-grade mineralization not considered commercial. Just east of the first-mentioned shoot and against a fault there is a length of 6 feet of good ore over a width of $3\frac{1}{2}$ feet. Values for the two shoots, as computed separately from the higher-grade ore in the zone of oxidation near the surface, average \$10.20 to the ton for the easterly, or 115-foot, shoot and about \$14 to the ton for the portal shoot. In the outcrop workings, along the somewhat flat side-hill above this tunnel, the values are understood to average around \$25 to the ton.

Another lower crosscut tunnel, mostly driven since the previous published report, is 1,080 feet long, consisting of 350 feet of crosscut and 700 feet of drift. On this new lower level, which is at an elevation of 6,240 feet, the results of exploration have been indefinite. In the drift, which develops the ground below the 300-foot shoot in the *Ohio* tunnel, the ore is confined to short lengths. It is considered possible that this tunnel is not driven along the main vein and may follow a parallel minor fracture. Some crosscutting on this level would be advisable to clear up this point. Though handicapped by the existing difficult transportation conditions, the property affords an example of a very efficient small-scale operation. Transportation will probably be improved in proportion to the results obtained by the further development which will be necessary to assure sufficient tonnage of ore for a milling operation.

CRESTON AREA.

Delaware. This group of three Crown-granted claims is situated on the Arrow Creek slope of Rolfe mountain near Creston. The property, described in the Annual Report for 1928, was worked under option by G. A. M. Young and J. E. Hayden during the early part of the year and some 17 tons of silver-lead ore was shipped. Briefly recapitulating information previously given, the formation consists of Aldridge quartzites which have been invaded by igneous rocks of the Purcell sills. Quartz veins occur in a wide zone of shearing and the principal ore-mineral is galena. George Young states that small specimens of pyromorphite, or lead phosphate, are found and minor amounts of copper pyrites occur in one lead. In December the group was rebanded to F. S. Rivers, of Vancouver, and work is expected to be resumed in the spring.

Goat Mountain. E. W. and F. J. Klingensmith and James Compton have driven about 50 feet of tunnel on their claims near the *Alice* and are now working on a crosscut tunnel at a lower level. The values are reported to be in copper, gold, silver, and some lead. The country-rock at the tunnels is said to be greenstone, presumably one of the Purcell sills, and the vein-filling is quartz.

Other minor activities which have occurred in the vicinity of Creston include: Continuation of work by A. Desireau on his property at Duck creek; the driving of over 130 feet of tunnel by J. E. Hayden and associates on the McKelvey claim in the same vicinity; prospecting by Angus Currie and associates, who staked four claims at the head of Long creek, following the discovery of a large quantity of float after a forest fire which burned over this area last fall. These claims are about 2 miles west of the Kootenay flats, Long creek being a small stream between Corn and Boundary creeks. The float is a milling-ore consisting of galena in a quartz gangue and the formation is probably Aldridge. A large granitic dyke is said to cross the ground from north to south. The owners intend to do some stripping to find the lead as soon as the snow goes off.

TRAIL CREEK MINING DIVISION.

TRAIL SMELTER.

The year under review witnessed important expansions in the great reduction-works of the Consolidated Mining and Smelting Company at Trail, and its industrial scope is to be considerably extended beyond the metallurgical field into the sphere of chemicals and chemical fertilizers.

Fertilizer Plant.

The most significant development at Trail was the crystallization of plans, after years of experimentation, exploration, and testing, for the provision of actual commercial plants for the manufacture of chemical fertilizers for the Western Canadian market. While this project has been under consideration for a long time, its realization has been hastened on account of the desire of the International Joint Commission to obviate any smoke damage south of the International boundary. The primary object, therefore, is to remove the sulphur dioxide, or destructive content, from the smelter fume. Details of the projected plant to be built on Warfield flats, Trail, indicate an immense project.

It has been announced that the initial unit is to cost from \$7,000,000 to \$8,000,000, though recent reports indicate an enlarged programme involving a somewhat greater expenditure. Ground has been broken and a start made on preliminary construction, including the erection of a workshop, warehouse, and office. The work is to be rushed and it is expected that the whole first unit in connection with fertilizer-manufacture will be ready for production by the fall of 1931. Pure hydrogen, oxygen, and nitrogen will be among the primary products and ammonia will be produced by the Fauser synthetic-ammonia process, named after G. Fauser, chief chemical engineer for the Monte-Catini chemical interests in Italy.

According to the announcement made last summer, the first unit will produce 35 metric tons of fixed nitrogen a day, which means a daily production of approximately 192 short tons of ammonium sulphate, or alternatively 260 short tons of ammonium phosphate. Total power-consumption arising out of the first unit will be approximately 30,000 horse-power. An electrolytic hydrogen plant will account for 23,000 horse-power of this. There will be a liquid-air plant for extracting pure nitrogen from the air. The synthetic-ammonia plant will fix the pure nitrogen and the hydrogen gases from the foregoing two plants into anhydrous ammonia, which is ammonia vapour compressed into a liquid state. About 350 tons of acid will be produced daily by a contact sulphuric-acid plant, which will take the sulphur-dioxide from the zinc-roaster gases and convert it into sulphuric acid. The Consolidated Company has already a 35-ton sulphuric-acid plant which has been working on these gases since January and this has proved very satisfactory.

In addition to these plants, there will be the auxiliary plants for conversion of the ammonia into ammonium sulphate, plants for treating phosphate rock from the company's deposits at Fernie with sulphuric acid, thereby making fertilizers, such as triple superphosphate, mono-ammonium phosphate, and possibly diammonium phosphate. With the exception of the sulphuric-acid plant, which, like the present one, will be in conjunction with the metallurgical works, the first unit will be situated on the Warfield flat above the smelter, commonly known as Heintz flat. The site will be so arranged that the plant can be extended to ten times its initial unit if required. In connection with the electrical machinery for the first series of plants, contracts have been awarded to the American Brown Boveri Company and the General Electric Company. The liquid-air plant is already ordered and the sulphuric-acid and other plants are being designed.

The Consolidated Company for the last two years has been carrying on extensive experiments in conjunction with the Governments and universities of the three Prairie Provinces and the Canadian Pacific Railway, with all kinds of chemical fertilizer, so that when the plant is ready to produce, information will be available as to what results can be expected from the different kinds and in what districts they can be profitably used. A handicap to be overcome is the somewhat common but erroneous impression that any chemical fertilizer is suited to any land. Experts concede, however, that practically any land can be made to yield considerably more by means of chemical fertilizer if the type it needs is selected. Oxygen, which will be a by-product of the manufacturing of nitrogen from the air, will be made use of in metallurgical processes at the Trail plant. A thorough canvass has been made of the practices obtaining and the processes used in Europe, where this chemical-fertilizer question has been given serious

attention, and where about 3,000 tons of atmospheric nitrogen is fixed as ammonia daily, against 200 to 300 tons on the whole American continent. Up to a very few years ago the world's nitrogen-supply came almost exclusively from Chile in the form of sodium nitrate, while to-day much of the nitrate used is largely derived from atmospheric nitrogen. Authorization for this programme came after S. G. Blaylock, vice-president and general manager, accompanied by E. M. Stiles, of the construction department, made a tour of Europe, inspecting great plants in various countries. At the time of writing, E. M. Stiles and R. W. Diamond, superintendent of concentration, are in Europe in this connection and plans are being got out as fast as possible. Development of the site at Warfield, now already under way, includes, apart from plants, the necessary facilities of warehouses, shops, offices, laboratories, and water lines.

Smelter.

The increase of zinc capacity to bring the total up to 400 tons of refined zinc a day is being accomplished by new processes which will secure this added metal from operating sources instead of from additional ore. This development, which involves several new plants and which has been under way throughout the whole year, has now been nearly realized and the new capacity will become effective by the coming summer. The additional 100 tons of zinc a day will be provided in about equal proportions by molten slag from the lead-furnaces and accumulated zinc-plant rejects.

The big plant, to be known as the fuming plant, in which this work of salvage will be accomplished, has been under construction since the summer and will take about another six months to complete. Standing on the river-bank next the dressing plant, it will be 700 feet long and will be practically a smelter in itself. The zinc-plant rejects will be put through the blast-furnaces and powdered coal will be blown through the molten slag. Furnaces will be installed to handle 800 tons of molten slag a day.

In connection with the fuming plant will be a plant for drying and powdering the coal that is to be blown through the slag. There will also be a Cottrell plant to collect the oxides of lead and zinc from the gases.

Besides its main function of providing 100 tons of zinc a day, the fuming plant will perform another, for it will be equipped with waste-heat boilers, which will supply all the heat needed for the whole Tadanac plant. This will include the process heat for the refineries and the zinc plant, required for evaporating and heating the solutions, and that required for the fertilizer plants at Warfield, to which it will be piped. This installation will take the place of half a dozen separate boiler plants. The leaching plant for the new zinc capacity is still under way, but will shortly be completed.

All enlargements in connection with the refining end are about concluded. The expansion of tank-room capacity has been achieved in practically the same buildings by increasing the number of anodes and cathodes in the electrolytic tanks, and this alteration is finished. The addition to the melting plant is practically finished.

Another departure in connection with the refinery end is the mercury arc rectifier installation for converting the required electric current from alternating to direct, a function that in the older parts of the plant is performed by motor-generator sets and in the more recent by rotary converters. The new method, which is far more economical and effective, is borrowed from Europe, where it is in use in connection with railway transmission. This installation, which consists of three mercury arc rectifier sets, each consisting of two mercury arc rectifiers in parallel, and each capable of delivering 10,000 amperes of direct current at 550 volts, and rated at about 7,500 horse-power, not only embraces the biggest machines of their kind yet built, but is the first application of mercury arc rectifiers to the electrolytic refining of metals.

On the operating side the Consolidated Company has had a year of practically capacity production as to its principal metals. The lead capacity of about 425 tons a day of electrolytic product has recently been increased to 475 tons a day. The daily production during 1929 approximated the former figure. Zinc production was at capacity until toward the end of the year, when production was curtailed on account of the poor market conditions. The silver-output was proportionate with the lead and zinc.

Copper production was very limited, beginning in early summer with the regular shipment to Trail of blister-copper from the Anyox smelter by the Granby Company. From this source about 1,000 tons of electrolytic copper a month has been turned out.

Production of cadmium, a by-product in connection with the zinc-refinery, its source being from *Sullivan* concentrates, has been maintained, approximately a fourth of the world's 1929 supply being produced at the Trail plant.

For the first time the Consolidated Company has produced and marketed bismuth, a by-product from the silver-refinery. Ranked among the auxiliary plants, the new sulphuric-acid plant, completed a year ago, and utilizing the contact process, has produced 35 tons of 100 per cent. sulphuric acid daily, finding its raw material in the sulphur-dioxide from zinc-plant roaster gases. It supplies the process sulphuric acid required. The plant that it replaced obtained its raw material from roasted *Sullivan* pyrite.

In the foundry existing equipment was supplemented by an electric steel furnace of 10 tons daily capacity, making it possible to utilize raw material not available before, and giving a greater flexibility to the capacity to turn out steel castings. The shops and other auxiliary plants experienced the usual improvements.

MINING.

Since the closing-down of the once famous Rossland mines of the Consolidated Mining and Smelting Company mining activities in the Trail Creek Mining Division have been restricted to small properties, chiefly in the vicinity of Rossland. Among these activity has occurred at some of the high-grade gold properties, including the *Snowdrop*, *I.X.L.*, *O.K.*, and *Midnight*, which have been operated in a small way by local syndicates composed chiefly of experienced Rossland miners. The very profitable leasing operation at the *I.X.L.* some years ago, which secured small fortunes for the participants, has attracted attention to the possibilities of these gold-mines. At the *Mayflower*, just south of Rossland, R. H. Hackney has done some development-work. The ore carries values in gold, silver, lead, and zinc.

This property, adjoining the Trail City limits, was worked during the early part of the year by the Norway Mining Company, financed by Trail residents.

Norway. Two drift-tunnels, about 100 feet vertically apart, develop a quartz vein, up to 3 feet wide, in granitic rocks. The upper tunnel is about 200 feet long and the lower tunnel, 50 or 60 feet in when the property was visited in the spring, is reported to have been driven ahead some distance. The quartz contains gold in places, but a thorough sampling would be necessary to determine if there is any continuity of commercial values.

Last Chance.—This prospect, described in the Annual Report for 1928, has been intermittently worked by J. Kenney. The property is situated some 5 or 6 miles south-easterly from Trail and about a mile from the Columbia river. The ore contains values in silver, lead, zinc, and copper.

WESTERN MINERAL SURVEY DISTRICT (No. 6).

BY GEORGE A. CLOTHIER, RESIDENT MINING ENGINEER.

INTRODUCTION.

The Western Mineral Survey District (No. 6) includes the seven Mining Divisions—Victoria, Alberni, Clayoquot, Quatsino, Nanaimo, Vancouver, and New Westminster. They comprise the whole of Vancouver island, the Coast islands, and the Mainland west of the summit of the Coast range as far north as Seymour inlet. The natural geographical advantages and geological conditions pertaining in this district need no comment nor commendation so far as prospecting and mining conditions are concerned, for they are obviously ideal.

The reader is referred to the "Vancouver Sheet," published by the Geological Survey of Canada, for an outline of the geology of the district; and also to a list of references on page 358 of the 1928 Annual Report. From these reports and bulletins detailed geology can be obtained of many portions of the district, both Vancouver island and the Mainland.

This year the Geological Survey of Canada had a party under H. C. Gunning in the northern interior portion of Vancouver island, an area of which little is known geologically. Although this season's work was of necessity more in the nature of a reconnaissance, the very optimistic opinion of Dr. Gunning, expressed in a paper before the Canadian Institute of Mining and Metallurgy as to the mineral possibilities of the area, makes it highly important that this survey should be continued during the coming season.

I desire to express my thanks to the prospectors, operators, and mining men of the district for many courtesies extended.

PROSPECTING.

Under the provisions of the "Mines Development Act" the assistance available for this work has proven a boon to the prospector and operator. In 1929 the expansion of the operation of the Act to include the construction of trails to open up new promising mineralized areas has proven very beneficial.

The old road from Alberni canal to Cowichan lake was reconditioned a portion of the distance to Francis lake, making available a promising copper area. As yet it is better to take the trail from the Alberni Canal end at the old "headquarters camp," which is now the camp of the Island Copper Company.

The trail from Kennedy lake to Sproat lake was built this year from the head of Kennedy lake to the summit south of Taylor river, and should be completed in 1930 by bridging Taylor river and reconditioning the old trail down its north side to Sproat lake. This also makes accessible an area containing promising gold-bearing quartz veins. At present the best way in is from Tofino, on the west coast, from which point a small boat can be taken up the rapids, by lining, to Kennedy lake, and from there about 12 miles to the head of the lake, where the trail starts. This trail is the proposed route of the Canadian Pacific Railway branch from Alberni to the west coast and therefore might be a desirable area to prospect in anticipation of a railway.

Assistance was also granted toward the reconditioning and completion of the trail from Courtenay to Mount Albert Edward, which lies about 5 miles east of Buttle lake. This trail, known as the "Forbidden Plateau" trail, from an old Indian legend, is about 25 miles long. The first 5 or 6 miles from Courtenay traverses the Cumberland coal area, but beyond that is apparently in the Vancouver Island volcanics. Mineral discoveries were reported this year from Mount Albert Edward and the section no doubt has mineral possibilities.

The old "Fire Mountain" trail up Fire creek from the head of Harrison lake to the *Money Spinner* group on Fire mountain, a distance of approximately 12 miles, was reconditioned this year and is now in condition for pack-horses. This area on Fire mountain was very popular several years ago and considerable work was done on gold-bearing quartz veins from which spectacular specimens were obtained. This trail again makes that area accessible for exploration.

The trail up Britain river, which empties into Jervis inlet from the north, has been completed from the beach to the Mount Diadem Mines property and farther to the Britain River

Mining Company's property. This trail gives access to that mineralized belt which is said to extend through to Goat and Powell lakes.

The Nimpkish Lake country is reached by way of Englewood, a port of call for the Coast boats. From Englewood to the foot of the lake is 12 miles by company logging-railway and by company boats a further 12 miles to the head or south end of the lake. An old logging-road extends up the Nimpkish river for several miles. There is a 5-mile road up Lime creek from the east side of the head of the lake to the Kinman property. If the Kinman surface copper-showings fulfil expectations at depth, that area south to the Campbell lakes will be well worth prospecting and trails will be built by the Department of Mines to make the area accessible for prospectors.

In addition to the above-mentioned trails, many minor grants have been made as assistance toward trails to prospects and small operations.

I would advise all prospectors or any one contemplating exploratory work to procure the geological map of the district, called the "Vancouver Sheet," from the Geological Survey of Canada office in the Winch Building, Vancouver.

For prospecting purposes the district may be divided into two distinct geological areas—namely, the western flank of the Coast range, and the Vancouver range comprising Vancouver island. The former is composed of granodiorite in which are included great masses and belts (roof-pendants) which are the remnants of the overlying rock formation before the profound upheaval of the granodiorite and the forming of the Coast range. These belts are well-mineralized, highly altered sedimentaries and volcanics, of which Camsell,* after his reconnaissance across the range along the Pacific Great Eastern Railway, says: "These conditions (the included belts) are most favourable for the occurrence of metallic deposits of copper, lead and zinc, gold and silver, and the whole interior of the Coast mountains of British Columbia, therefore, becomes an excellent field for prospecting—and not only the eastern and western borders as was formerly believed to be the case. Prospectors are therefore urged to pay more attention to the possibilities of the Coast mountains than they formerly did."

The latter area, or Vancouver island, is predominantly composed of volcanic rocks, mainly andesite, basalt, and porphyries, with limestone-beds. In this formation ore-bodies may be looked for within zones of extensive movement (shear-zones), also along or near the contacts of later intrusive rocks, such as granodiorite or diorite or other dykes, with the andesite and particularly with the limestone, which is readily altered and replaced by the metallic minerals.

I judge there has been considerably more prospecting this year than last, for in addition to the normal scattered prospectors there has been more or less concentration in certain sections. For instance, the Nimpkish Lake area has been very active; on Kokshittle arm on the west coast several large groups have been staked and exploration carried on; the same applies between Alberni canal and Cowichan lake; between Bute and Loughborough inlets has had more than usual attention; the Harrison Lake and Pitt Lake areas have also been gone over more thoroughly; and south of the Fraser river in the Cheam range and the country contiguous to the Chilliwack river south to the International boundary has shown more prospecting activity this year than ever before; altogether a very interesting year.

The Government office statistics furnish a very interesting and comprehensive mining barometer. In 1928 there were 1,060 mineral claims recorded in District No. 6; in 1929, 1,567; or 50 per cent. increase. In 1928 there were 733 assessments done and the following year 968. These figures evidence the fact that not only is much more prospecting interest being taken throughout the country in staking, but also the important feature that more actual work is being done on prospects.

DEVELOPMENT.

The reader is referred to page 333 of the 1927 Annual Report for an index of all the claims, groups of claims, and companies in No. 6 District, referred to in the Annual Reports since 1917.

This branch of mining has again had a very active year in this district, but it seems to have been more successful and satisfactory than heretofore, for the reason that three or four properties give real promise of developing into something worth while. The surface copper-ore exposures on the *Kinman* group give reason to expect ore-bodies of magnitude at depth and the eventual development of the property into one of importance. The extent and grade of

* C.G.S. Summary Report, page 18-B, Part B, 1917.

copper ore exposed by surface work on the *Alpha-Beta* group near Cowichan lake certainly marks this property as one with more than ordinary possibilities. The Island Copper Company on Alberni canal has shipped 200 tons of chalcopryrite from its surface ore-exposures and has a very promising prospect. The Coast Copper Company, operating the *Old Sport*, appears to have reached a more definitely satisfactory stage than ever.

The Alexandria Mines on Phillips arm is opening up a promising body of gold-bearing quartz from the bottom of the 100-foot shaft sunk from the lower tunnel. The exploratory work on the old *Van Anda* properties on Texada Island being carried out by the Central Copper Gold Company is reported to be giving very satisfactory results. The Pitt Mining Company on Pitt lake has completed its power plant and is now installing machinery and expects to be in production in the near future.

In addition to these there are a number of properties on which work has been done during the year. The British Metals Corporation, of London, surveyed by the Radiore system and diamond-drilled the *Gabdro* group, adjoining the *Sunloch*. The Kootenay Central Mining and Development Company did some preliminary work by way of surveying, test-pits, etc., on its placer-ground at the mouth of the Sombrio river. The Canadian Quicksilver Company built a trail from the beach to the showings, about a mile, unwatered the 35-foot shaft, and did some open-cutting across the vein.

Work was done on the *Torse* group on Snug basin. The *Walton-McMillan* claims on Tofino creek, at the head of Tofino inlet, Clayoquot sound, have been bonded to Ed. Brown and associates, of Vancouver. The old road is being repaired and a small compressor plant installed preparatory for development-work. On Quatsino sound development has been carried on by the owners on the *Alice Lake* group; by the Coast Copper Company on the *Jeune* group; by the Quatsino Gold and Copper Mines, Limited, on its holdings adjoining the Coast Copper Company on the south; by the Spooner Bros. on the *Millington* group in from Holberg. The property of the Caledonia Mines Company near Quatse lake was under bond to the Consolidated Mining and Smelting Company, which did a lot of surface and underground work.

On the Mainland a number of properties have been under development throughout the year. The Cambria Copper Company's property on Knight inlet was developed. On the *Doratha Morton* on Phillips arm a 200-foot crosscut tunnel is being driven on contact, while prospecting-work has been done on the *Enid* group adjoining. A trail has been built from the beach and a tunnel started on the *Douglas Pine* under bond to a Vancouver syndicate. The Thurlow Gold Mines put in a plant and worked part of the season. The Nimrod Mining Company did some surface prospecting. The Colossus Copper Company cleaned out the old workings and built a trail from the beach. The Romana Copper Company on Goat island, Powell lake, did a couple of hundred feet of underground work in addition to surface open-cut and stripping. On Texada island some surface work was done on the old *Marble Bay* holdings and diamond-drilling was started on the *Stromberg* group on the south-west side of the island. The magnetite-iron showings on the west coast were thoroughly tested by diamond-drilling this season. A little work was done by the Mount Diadem Mines at Britain river on Jervis inlet. The Pacific Copper Company had a Radiore survey of its claims up from the head of Salmon arm, built a trail from the beach, and built camps. Near Squamish the Radiant Copper Company had its ground prospected by Radiore and afterwards did some surface-cutting, etc. McVicar, Manson, and Tocher, owners of three groups about 12 miles from Squamish on Goat creek, did a lot of surface work on the copper-showings.

On Pitt lake F. J. Johnson, owner of the *Katanga* group, has had three men on the ground all year prospecting and doing surface work. Marcus Cox, operating up from the head of the lake, built a trail to his molybdenum group on Canyon creek as well as doing considerable exploratory work on a number of groups at the head of Scott creek, which empties into the lake at the north-east end. The Sleese Creek Mining and Development Company did some tunnel-work on its holdings in Sleese Creek basin, a tributary from the south of the Chilliwack river.

Besides these there are many claims on which individuals have done at least assessment-work and more when financially able. This gives a sort of bird's-eye view of the development end of mining and shows that there is a very great amount of mining-work being carried on throughout the district.

The stock-market slump of the last few months is not having the depressing effect on mining, as yet, that might be expected to naturally follow, for the reason that during the stock-

flurry many companies availed themselves of the opportunity to adequately finance themselves and thus are able to carry on development-work. New financing might, however, be rather difficult at present.

The mining outlook in this district for 1930 is as good if not better than last year. A great deal probably depends on the successful development of the *Kinman* property, which would not only stimulate prospecting and mining on Vancouver island, but would very probably be a deciding factor in the establishment of a Coast smelter by the Consolidated Mining and Smelting Company.

PRODUCTION.

The following table shows the metalliferous production of No. 6 District:—

Mine.	Ore.	Gold.	Silver.	Copper.	Lead.
Vancouver Mining Division—	Tons.	Oz.	Oz.	Lb.	Lb.
Britannia.....	1,920,905	14,290	199,544	41,988,115	967,594
Nanaimo Mining Division—					
Hope.....	2	4	6	.....	.....
Marble Bay.....	264	21	206	10,678	.....
Romana.....	8	.....	4	797	.....
Caledonia.....	1	.....	15	146	.....
Alberni Mining Division—					
Island Copper.....	185	4	26	12,584	.....
Totals.....	1,921,367	14,319	199,801	42,012,270	967,594

"IRON-ORE SUPPLY ACT."

Under the provisions of this Act the Government of British Columbia undertakes to supply iron ore free of charge for experimental purposes. There has been no request for such this year in this district.

ESQUIMALT & NANAIMO RAILWAY.

The Esquimalt & Nanaimo land grant, covering about a third of Vancouver island, is shown on all Government maps. The conditions covering the minerals contained in this area are apparently not familiar to the prospector, and the following is therefore given:—

All the base metals, copper, lead, and zinc, within the area belong to the railway company, leaving only the precious metals, gold and silver, belonging to the Government. The area is, however, open for prospecting and mineral claims may be staked under the regulations of the "Mineral Act," but they are also subject to the regulations outlined by the railway company. The locator of mineral claims on unsold areas may, for \$1 paid to the railway company, procure an option for one year to purchase the surface rights and timber at \$5 an acre, which would be \$260 for a full claim of 52 acres; also the timber may be purchased at \$1.50 a thousand in excess of 8,000 feet an acre; this timber to be used for mining purposes and not to be moved from the claims.

The railway company places the following royalties on the base metals mined: On lead, $\frac{1}{10}$ cent a pound of lead; that is, on a 10-per-cent. lead ore the company would collect 20 cents a ton. On zinc the royalty is $\frac{1}{20}$ cent a pound of zinc up to 40 per cent. and $\frac{1}{10}$ cent a pound above that; a 40-per-cent. zinc ore would therefore have to pay 40 cents a ton and a 50-per-cent. ore 60 cents a ton. On copper ores the royalty is $\frac{1}{10}$ cent a pound up to 2 per cent., or 4 cents a ton; on an ore assaying from 2 to 5 per cent. the royalty is on a sliding scale, a 5-per-cent. ore paying 10 cents a ton; over 5 per cent. the royalty is $\frac{3}{10}$ cent a pound, making the charge against a 10-per-cent. ore—about what a prospector would sort out to ship—46 cents a ton.

A copy of the regulations may be procured from the Land Agent, Esquimalt & Nanaimo Railway, Victoria.

MINING DIVISIONS.

The district will be reviewed under the separate Mining Divisions and sections, as follows:—

Victoria Mining Division—Sooke section; Jordan River section; Cowichan Lake section; Mount Sicker section.

Alberni Mining Division—Alberni Canal section; Barkley Sound section; Sproat and Great Central Lakes section.

Clayoquot Mining Division—Kennedy Lake and Elk River section; Clayoquot Sound section; Bedwell Sound section; Sydney Inlet section; Nootka Sound section; Esperanza Inlet section.

Quatsino Mining Division—Kyuquot Sound section; Quatsino Sound section.

Nanaimo Mining Division—Port Hardy section; Nimpkish Lake section; Sayward section; Campbell River and Buttle Lake section; Courtenay section; Islands and North Coast section; Powell River section; Texada Island section; Lasqueti Island section.

Vancouver Mining Division—Jervis Inlet section; Howe Sound section; Pacific Great Eastern section.

New Westminster Mining Division—Pitt Lake section; Harrison Lake section; Chilliwack section.

VICTORIA MINING DIVISION.

This Division, comprising the southern portion of Vancouver island, has had a considerable amount of mining activity this year. Office statistics show an increase in the number of assessments done, which is always a good sign, and some interest is being taken in placer-mining by individuals in the old Leech River area and at the mouth of the Sombrio river on the west coast. Statistics also indicate a considerable prospecting interest in the Little Nitinat River area, where several groups were staked, and also up the Robertson river.

SOOKE SECTION.

Attention was drawn in last year's report to these two groups on Mount Willow Grouse and Margaret. Some ore has been mined and shipped from the surface exposures on these groups, but little or nothing has been done toward a systematic prospecting and exploration of the apparently extensive mineral-zone in each group. I think these groups justify a little investigation.

This company was incorporated in May, 1929, with its registered office at 303 Canadian Ochre-Rogers Building, Vancouver. It is capitalized for \$600,000, divided into Alum Mines, Ltd. 600,000 shares at \$1 each. The company acquired 280 acres, more or less, of ground on Demaniel and Stony creeks in Sections 14 and 6 of the Otter Land District. This ground contains a deposit of ochre, evidently extending over a considerable area and proven in places to a depth of 50 to 60 feet, indicating a large deposit of the material. It is too high in silica, 30 per cent., and too low in alumina, about 28 per cent., to be utilized for the manufacture of aluminium, which is produced from bauxite having a silica content of about 10 per cent. and alumina of about 75 per cent.

Recent laboratory tests and experiments have shown that satisfactory paint and stain pigments of any colour can be made from the dried material, the darker shades being obtained by calcining. Aluminium sulphate, or pure alum, can be precipitated by the addition of diluted sulphuric acid. If a market can be had for the products obtainable from this material it might be developed into a profitable and important industry.

JORDAN RIVER SECTION.

The holdings of this company were acquired late in 1928 by the Pacific Tidewater Mines, Limited, a subsidiary company to the British Metals Corporation, of London, England, incorporated in February, 1928, with a capitalization of 5,000,000 shares of no par value, with its registered office in the Pemberton Block, Victoria. Early this year a Radiore survey was made of the property, resulting in picking up two favourable indications on the *San Juan* and *Uglow* groups. Diamond-drilling was later undertaken to test the electrical survey reactions, but I am informed that the drilling was very unsatisfactory and difficult because of the broken-up nature of the ground. Low-grade ore-bodies were encountered, but work was suspended pending further arrangements with the Gabbro Copper Mining Company.

Sunloch Mines, Limited, was incorporated in 1917 with a capitalization of \$1,000,000, divided into \$1 shares, and is controlled by the Consolidated Mining and Smelting Company, Limited. The *Sunloch* is situated on Jordan river, adjoining the Gabbro Copper Mining Company's holdings, in the formation



Windsor Lake, Nanaimo B.C.



Producers Sand and Gravel Co. (1929), Ltd., Victoria B.C.



Producers Sand and Gravel Co. (1929), Ltd.—Royal Bay Quarry.

known locally as the "Metchosin" volcanics. Within a width of 700 to 800 feet three major shear-zones have been proven, mineralized with pyrite and chalcopyrite.

Approximately a mile of diamond-drilling and an equal footage of underground work have demonstrated the existence of large deposits of milling-grade copper ore. The property has not been under operation for several years, but is at the stage where it can be placed on a producing basis in a comparatively short time.

This company has a capitalization of \$500,000, divided into 2,000,000 shares at Kootenay Central 25 cents each, with its office at 603 Vancouver Block, Vancouver. The company's holdings consist of eleven placer leases situated across the mouth of Sombrio river on the west coast of Vancouver island, about 8 miles below Port San Juan. The width of gravel has been estimated at 400 yards and extends up the Sombrio for a couple of miles. At the beach the gravel-banks show a depth of from 100 to 300 feet. The whole deposit has been cut up and gullied by small surface creeks, but I judge there would be an average depth of gravel of between 200 and 300 feet. The ground has been prospected for many years, shallow pits here, there, and all over showing a distribution of gold throughout the whole gravel-bed from top to bottom. Engineers have estimated an average of from 7 cents a yard up, which with a hypothetical working-cost of from 2 to 5 cents a yard would give substantial profit for hydraulicking operations. It is conceded that the property has all the requisites for an ideal hydraulicking operation, plenty of water for piping and sluicing, a good pressure for piping, a good bed-rock as demonstrated above the beach by former workings, plenty of workable gravel, and all kinds of dumping-ground. The only information lacking is the average gold content of the gravel, which cannot be definitely estimated from work done so far. The values could be arrived at by a systematic drilling of the gravel-bed or by the installation of a small "pilot" hydraulicking plant, which would enable actual operations to be carried on along the faces of the gravel-banks facing the beach across a width of from 1,000 to 1,200 feet. Such a preliminary operation would work a large yardage of gravel from a sufficient number of pits to determine the average gold values obtainable and at the same time give a good idea of the working-costs, which would be improvable, of course, with larger operations. The latter method would no doubt initially cost the most, but the greater information obtained and the possibility of even making it a paying undertaking make it preferable to the drilling method. Some preliminary work was done this season by way of test-pits, surveying the route for a pipe-line, and some topographical work.

Pannings obtained wherever test-pits have been dug indicate favourable possibilities of the whole bed making pay-dirt, and I think are sufficiently encouraging to justify the installation of a small "pilot" plant.

COWICHAN LAKE SECTION.

This group consists of the mineral claims *Alpha*, *Beta*, *Taboga*, and others.

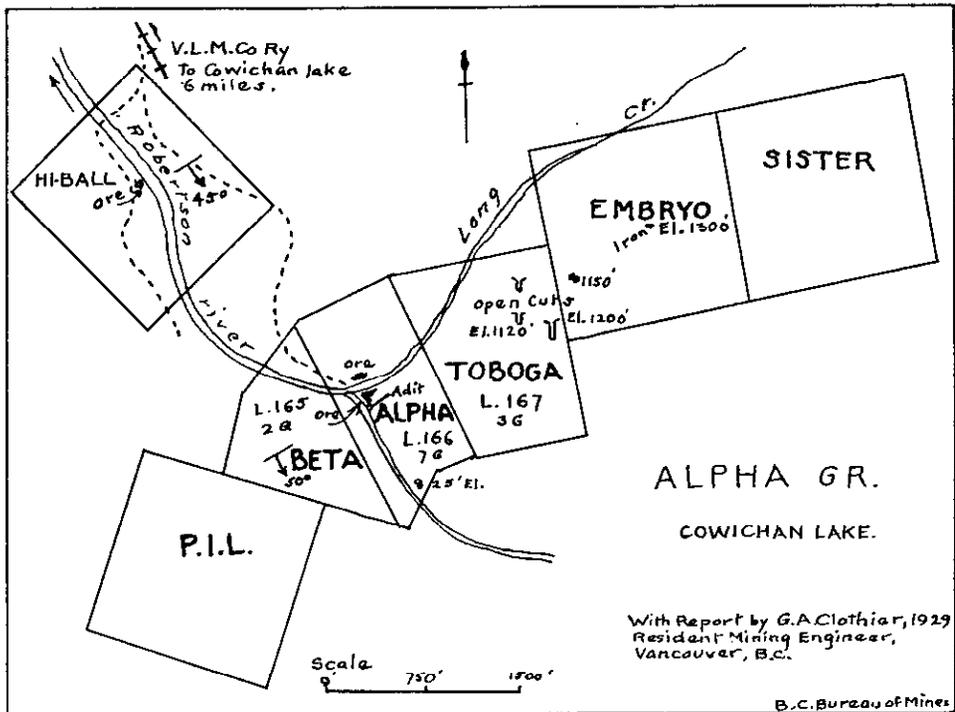
Alpha-Beta. The *Alpha* and *Beta* were staked on May 19th, 1904, by C. H. Dickie and C. Terrain and the *Taboga* on May 22nd, 1904, by H. Marsh. These three

claims have been bonded by Pearson and Long, who have staked several other adjoining claims. The claims are situated about 6 miles up Robertson creek, which flows into the lower end of Cowichan lake from the south, on its East fork. The logging-road of the Victoria Logging and Manufacturing Company, of Chemainus, runs from Cowichan lake to within a short distance of the mineral showings and workings, thus assuring transportation in the event of developing into a shipper. Assistance was granted this year by the Department of Mines towards building a trail from the railway to the property, and it is now easily reached from Lake Cowichan Station on the Canadian National Railway.

The ore, a mixture of chalcopyrite, pyrite, and, in places, magnetite, lies in an apparently extensive contact-metamorphic zone between a wide limestone-belt and intrusive granodiorite. The gangue is mainly garnetite and epidote. The mineralization occurs in masses, small veins, and disseminated through the gangue.

Work has been carried on all season with a crew of from four to eight men and under the guidance of Pete Pearson has proven very encouraging. Operations will continue through the winter.

Much open-cutting, trenching, and stripping has been done, exposing so far two ore-bodies. The work has not conclusively shown just what the strike and dip of the mineralized zone is.



Several dykes intrude the zone and these, striking about N. 75° E. (mag.), seemed to indicate the general strike of the contact. However, a crosscut tunnel, about 100 feet long and about 300 feet north of the ore-exposure on Robertson creek, was not in the contact-zone and it therefore must strike nearly east-west (mag.) and dip flatly to the south.

Trenching along the zone on the north bank of Robertson creek and across the mouth of Long creek, emptying in at this point from the north, shows a width of about 75 feet, of which 40 feet is estimated to average 4 per cent. copper. Four hundred feet east of this showing, and at an elevation of about 125 feet above the main creek, the side-hill has been stripped between a small dyke on the west side and a wider dyke on the east, a distance of over 100 feet, showing mineralization throughout. While at the property a row of holes were shot, exposing about 50 feet across this stripping, which could not be sampled, but I judge will average over 3 per cent. copper. Two or three short tunnels into the hill here will show the width of the ore-body.

Ore has also been exposed in places on the south side of Robertson creek, but the zone here apparently dips under an overlying igneous rock. Prospecting up the hill in the contact-zone has disclosed ore indications and altogether it is a decidedly interesting property with more than ordinary possibilities.

(See the 1928 Annual Report.) This group was under option last year to the **Blue Grouse**. Pacific Tidewater Company, Limited, which obtained a lease on the base metals in Lot 107, containing the principal copper-ore showings, from the owners, the Empire Logging Company. The Tidewater Company repaired the old road, reconditioned the camp, installed a small compressor, and drove 83 feet of crosscut tunnel along a diamond-drill hole towards an ore-body indicated at a depth of 220 feet in the hole.

The option and bond was dropped and the base metals are owned by the Empire Logging Company and the precious metals are owned by Herbert Carmichael. Considerable ore was shipped during the war and the ore possibilities for the property are very favourable.

(See the 1928 Annual Report.) These groups, on the north side of Cowichan lake at the head of Cottonwood creek, were not under operation this year. **El Capitan and Cottonwood**. They are owned by a Duncan syndicate headed by E. F. Miller, Duncan, which proposes organizing a company on the *El Capitan* group to furnish finances for its further development. The property has responded favourably to what development-work has been done and fully warrants the continuation of the exploratory work.

MOUNT SICKER SECTION.

(See the 1928 Annual Report.) I understand that the *Tyee* group, the **Tyee, Richard III.**, property of the old Tyee Copper Company, is now owned by the Ladysmith and **Lenora.** Tidewater Smelters, Limited, a subsidiary of the British Metals Corporation, of London. Last year the company had a lease and option to purchase the *Richard III.* above the *Tyee*, and the *Lenora* lying below. No work was done on any of the properties during 1929, although development-work in 1928 apparently opened up ore-bodies of great promise. The above-mentioned leases have been dropped.

ALBERNI MINING DIVISION.

Last year there was a very marked reawakening of mining interest and operations in this Division in comparison with the past fifteen to twenty years. This year's Government office statistics show that this interest continues to increase; in fact, this Division has the distinction this year of appearing on the shipping-list in the name of the Island Copper Company, Limited, of Port Alberni.

Figures show that where 39 free miners' certificates were issued in 1927 there were 140 in 1929, and against 7 claims recorded in 1927 there were 85 in 1928 and 118 in 1929; assessments done in 1929 were 21, against 6 in 1927.

Prospecting was apparently distributed fairly well over the Division, with somewhat more staking around Alberni canal and Barkley sound, and adjacent to Great Central lake and the *Big Interior*.

It is probably one of the most accessible Divisions in the Province. Great Central, Sproat, Nahmint, and Henderson lakes afford access to all the interior, while Alberni canal and Barkley sound contain many miles of coast-line, all reached by way of Port Alberni at the head of the canal.

ALBERNI CANAL SECTION.

This section is reached by launch from Port Alberni.

Dauntless.—The reader is referred to the 1927 Annual Report for a description of this property. Only necessary assessment-work has been done since.

There were thirteen claims in this group, but this year the owners, H. Dendoff and W. Philpott, of Nanaimo, cut down the number to *Copper King Nos. 1, 4, and 6; Florence;* and *Copper Queen Nos. 1, 2, and 3.* They are situated on the east side of Alberni canal, about 5 miles up Coleman creek from the start of the trail at the Island Copper Company's camp. This year the *Copper King* trail was repaired by the Department of Mines an additional 6 or 7 miles to the east side of Francis lake, and recommendations will be made to have it completed through to Cowichan lake next year, another 10 miles if put straight across the divide by way of Tuck lake.

The showing on the property consists of a vein of solid pyrrhotite with traces of chalcopyrite for a width of from 6 to 8 feet where exposed in an open-cut. It occurs in a contact-metamorphic belt of hornblende, garnetite, and epidote, the mineral gangue being mainly hornblende. The frequent occurrence of masses of pyrrhotite with masses of chalcopyrite in the same vein, along the west coast, suggests that further work might be justified, but it is difficult to make much progress in this formation by hand-drilling.

The copper-showing reported last fall on another portion of the claims did not prove very encouraging and nothing further has been done on it.

Alberni Mines, Ltd.—This company has the old *Hayes* property. The reader is referred to a description of this property in the 1928 Annual Report. So far as I can learn nothing has been done on it this year.

This company was incorporated in April, 1929, with its registered office in **Island Copper Co., Ltd.** Port Alberni. It is capitalized at \$250,000, divided into 1,000,000 shares at 25 cents each. The company's holdings consist of the two old Crown-granted claims, *Modoc* and *Kitchener*, adjoining the *Ogilvie* group of seven claims purchased from the original staker, A. Ogilvie, and nine more staked by the company, making eighteen claims in all. They are situated along the east side of Alberni canal, about 12 miles down from Port Alberni.

The company, employing a crew of from six to ten men under the supervision of Harry Scovil, has been operating all year and has done a very creditable amount of work. The old

"headquarters camp," where the Canadian National Railway grade leaves the canal to cut across country to Cowichan lake, was reconditioned and made serviceable to accommodate ten to fifteen men. A road was built from the beach to the showings on the *Modoc* and also from the beach to the showings on the *Ogilvie* group, from which 20 tons of 7-per-cent. copper was shipped early in the season, and a very serviceable dock constructed.

The mining-work consists of much surface work in open-cutting and trenching, from which 160 tons was shipped to the Tacoma smelter, and a crosscut tunnel 80 feet long.

The general rock formation consists of alternate bands of volcanics and limestone, termed the "Vancouver series," lying south-west of an extensive granodiorite-belt which extends up the canal for a distance of 8 to 10 miles.

The ore, consisting of pyrite and chalcopyrite, is exposed on the *Bell* claim in a cut along the Canadian National Railway grade at an elevation of about 300 feet. Here the ore occurs as a small mass within a shear in the volcanics and, as stated, about 20 tons was shipped from this cut. A shallow tunnel under this does not encounter any ore, but probably is not in far enough. West of this shear ore-croppings have been found in small parallel shears, but as yet nothing of importance has been exposed. There are possibilities of finding other ore-masses, but the shearing has not been extensive and the bodies will probably be small.

Seven or eight hundred feet north-west of this considerable work was done a number of years ago in tracing and exposing an extensive vein of magnetite, which, so far as examined, carried no copper content.

Between this and the beach across a width of over 1,000 feet the bands of limestone appear, and on the *Modoc* and *Kitchener* claims the most promising showings have been uncovered along the contact between the limestone and the volcanics, in a gangue of mainly hornblende, as replacements in the limestone. There appears to be little evidence of contact metamorphism. The work so far has disclosed mineralization along three or four contacts, and shows, where any depth has been obtained, that the contacts dip easterly at a steep angle.

The farthest west showing on the *Modoc* on the edge of a small bluff has been exposed by two or three open-cuts, showing some good chalcopyrite. This is on the west side of a 100-foot belt of limestone. Up the hill on the east side of the same belt a number of cuts and trenches has disclosed good copper ore at intervals for a length of between 600 and 700 feet and farther up the hill on the "shaft vein" some promising showings have been uncovered. From all this work about 160 tons of ore was shipped, 13 tons of sorted ore which assayed 12.6 per cent. copper, and the balance of 150 tons of general-run ore assaying about 3 per cent. copper.

A crosscut tunnel below the west showing about 25 feet starts in the volcanics and enters the limestone about 40 feet from the portal, but shows no downward extension of the ore above. The tunnel has been continued about 40 feet in the limestone, showing masses of magnetite and hornblende within the limestone. I think this tunnel should be swung to the left about 30° to 40° and continued through the limestone to its east wall, on which the No. 2 vein occurs as indicated on the surface. This will obtain a depth of about 75 feet and will permit of drifting on the vein if ore is encountered at that depth; in fact, some drifting should be done along the contact whether ore is encountered or not. The tunnel could eventually be driven through to cut No. 3 or shaft vein. On the results of this work will depend the deeper development of the property, which will necessitate sinking a shaft, as no more depth can be conveniently obtained by tunnel-work.

The last shipment proved disappointing, in that lot 1, containing 151 tons, did not pay freight and treatment charges; lot 2, containing 13 tons running 12.6 per cent. copper, saved the shipment from being a financial loss. Work was stopped at the end of the year, but it is hoped that financial arrangements may be made to continue development, for the property no doubt has a fair chance of making a mine.

BARKLEY SOUND SECTION.

Sunshine.—(See the 1928 Annual Report.) This property was bonded in 1928 to the Canada British Finance Corporation, Limited, of Vancouver, but I have no information of any work being done on it in 1929.

Torse. This group, owned by Mrs. Weedon and H. H. Jones, is situated a short distance by trail up the hill from Snug cove on Uchucklesit harbour. Some work was done on the claims this year by leasers, but no information is available as to the extent of the work or results obtained.

Forfarshire. This old Crown-granted group on the west side of Henderson lake, about 2 miles up from the lower end, was bonded early in the year by Wm. McNair and associates. The old trail was repaired from the beach to the showings, the old cabin at the showings reconditioned, and some surface prospecting done.

This company was incorporated in August, 1928, with a capitalization of **Canadian Quick-** \$250,000, divided into 1,000,000 shares at 25 cents each. Its holdings consist of **silver Co., Ltd.** three claims—one Crown-granted, *Sechart* (Lot 3), and two others, *Sechart No. 2* and *Sechart No. 3*, owned by the Mercury Mines, Limited (see the 1927 Annual Report), and situated about a mile from the beach at Sechart, on Barkley sound.

This year assistance was granted by the Department of Mines toward repairing the old trail from the beach to the showings. A comfortable camp was built at the beach. Some further surface work consisting of open-cuts was done on the showings, and the shaft, about 35 feet deep, was dewatered preparatory to further sinking. It was planned to sink to 100 feet and to do some exploratory work at that depth, but lack of funds prevented.

J. Boss, whose office is in the Vancouver Block and who was interested in the property several years ago, is manager of the company. He states that with the new type rotary furnace quicksilver can be produced profitably on the ground from an ore carrying 3 lb. of mercury to the ton. The present market price is \$121 for a 76-lb. flask.

Samples from the old dump of the shaft average about 0.4 per cent. or 8 lb. of quicksilver to the ton of ore. The property would seem to have considerable merit and, as there is no quicksilver produced in the British Empire, deserves sufficient support to prove it one way or the other.

SPROAT AND GREAT CENTRAL LAKES SECTION.

The trail from Sproat lake up the Taylor river for about 4 miles, thence across the low pass and down the Elk river to Kennedy lake, was finished from the lake to the summit in 1929. It will be recommended that the Sproat Lake end of the trail be completed in 1930.

(See the 1927 Annual Report.) This group originally consisted of three **Morning.** claims, *Morning*, *Morning No. 1*, and *Apea*, owned by A. L. Smith, of Alberni, and associates, but I understand that three more claims have been added to the group this year. It is situated 4 miles up the Taylor river on a good foot-trail from the head of Sproat lake.

The rock formation is andesite in which, on this property, two quartz veins occur, striking N. 60° E. (mag.) and dipping about 85° W. The mineralization consists of pyrite, pyrrhotite, and chalcopyrite, carrying appreciable gold and silver values. The veins vary up to 6 feet in width and are well defined and continuous. A mine sample sent to Ottawa for concentration tests assayed: Gold, 0.34 oz. to the ton; silver, 1.06 oz. to the ton; copper, 1.22 per cent.; insoluble, 76.5 per cent.; this is about an average sample of the sulphide ore. Straight flotation gave a recovery of 98.77 per cent. of the copper and 89.77 per cent. of the gold, making a concentrate of 4.67 per cent. copper and 1.12 oz. gold to the ton, with a ratio of concentration of 4 into 1.

Some further work was done this year on the upper showings with encouraging results. This property is worth investigating as a medium-sized undertaking.

Great Central Mines. About thirty claims were staked this year near the east end of the Great Central lake, about 12 miles from Alberni. The Great Central Mines property is comprised of the eight claims, *Nellie Gray Nos. 1* to 8, inclusive, situated along the logging-railway of the Great Central Saw Mills, Limited. The remainder of the claims, *Nellie Gray Nos. 9* to 30, inclusive, are adjoining the first group, but I do not know whether they are included in the company's holdings. The manager is J. Benjamin, of Parksville.

The area covered by these claims is flat, heavily timbered and overburdened, and therefore difficult to prospect, and any mining depth obtained will necessitate sinking. The general rock formation as shown in the cuts along the railway is a wide shear or schistose belt in the Vancouver volcanics, striking in a general north-westerly direction. The schists are crossed by many dykes, but whether they are conducive to mineralization is not known.

Some indications of mineral have been found in the schists. One of the railway-cuts has exposed an 18-inch quartz vein fairly well mineralized with chalcopyrite striking with the

schists. This has been traced across the grade and a small creek paralleling the track. Two short crosscut tunnels have been driven into the opposite bank of the creek, the upper one showing a sparse mineralization, mainly pyrite, across about 10 feet of the schists, while the lower tunnel, about 35 feet farther down the creek, has apparently not been driven far enough to encounter the mineralization which dips into the hill. A winze could be sunk in the upper tunnel by diverting the small creek, to prove the showing a little at that point, and some open-cutting was advised on the upper side of the railway. Some further prospecting is warranted by the present ore indications.

There are four claims in this group, owned by Joe Drinkwater and M. Tebo, of Alberni, and situated about 10 miles from the head of Great Central lake.

Big Interior. The claims occupy a basin surrounded by precipitous bluffs, and judging from the description in the 1916 Annual Report there is an immense mineralization of low-grade copper ore in the basin and exposed in the cliff forming the south wall of the basin. The basin is at an elevation of 3,525 feet, 175 feet higher than Della lake. The situation of this property and transportation difficulties have apparently been the main reasons for its non-operation.

Other properties in the Alberni Mining Division and the Annual Reports in which they may be found are as follows: *Thistle*, 1927; *Cascade*, 1928; *W.W.W.*, 1927; *Gretna Green*, 1921; *Southern Cross*, 1928; *Monitor*, 1916, 1917, 1918; *Happy John*, 1916, 1918; *Rainy Day*, 1928.

CLAYOQUOT MINING DIVISION.

This Division comprises the central 100 miles of the west coast of Vancouver island, accessible only by Coast boats from Victoria or Port Alberni. An important mining-trail was built this year from the head of Kennedy lake up the Kennedy river to Taylor river, giving access to a promising prospecting area containing gold-bearing quartz veins. The contemplated road following the same route through to Alberni would make the west coast accessible by land throughout the year and would be of inestimable benefit.

Although there have been no important mining operations this year, the Government office statistics show that, inasmuch as there were more claims staked and more assessments done than last year, prospecting and mining interest is increasing.

KENNEDY LAKE AND RIVER SECTION.

This section is reached by launch from Tofino, the port of call of the C.P.R. boats from Victoria. A launch can go as far as the foot of the rapids on lower Kennedy river, the outlet of Kennedy lake. A small boat can be lined up the rapids a few hundred feet, and from the head of the rapids can be taken up the river to the lake and to the beginning of the Kennedy River trail at the head of the lake.

Properties on which more or less development-work has been done and the Annual Reports in which they are described are as follows: *The Jo Jo*, 1927; *Rose Marie*, 1927; *Gold Queen*, 1927; *O.K.*, 1928; *Northern Crown*, 1928.

On Kennedy lake and a short distance up the river the basic volcanics of the Vancouver Island formation prevail and are essentially copper-bearing. East of that, up Kennedy river, the formation is predominantly a light grey, siliceous, somewhat porphyritic rock, in which gold-bearing quartz veins occur, and I think is well worth prospecting.

CLAYOQUOT SOUND SECTION.

The many inlets from this sound make hundreds of miles of safe inland water. Any part of the section is accessible by launch from Tofino.

This group, consisting of four mineral claims—*Alpha No. 1*, *Norman*, *Douglas*, and *Omega No. 1*—was referred to in the 1927 Annual Report under the name **Douglas Group** (Walton Claims). “Walton’s Claims.” The claims are situated about 2 miles up Tofino creek from the head of Tofino inlet and are owned by Wm. Walton, of Tofino, and Duncan McMillan, of Vancouver. The property is at present under bond to E. Brown, Birks Building, Vancouver, and associates, who are arranging to repair the old trail from the beach, install a small compressor plant, and proceed with exploratory work. The showings are at an elevation of about 800 feet.

As described in the 1927 Annual Report, the general rock formation is Vancouver volcanics, within which is a belt about 50 feet wide of metamorphosed rock consisting of garnetite and epidote, the gangue rock carrying chalcopyrite disseminated and in bunches. The belt has

broken down to form a deep canyon, at the foot of which, in the slide-rock, a considerable amount of float-copper is found, indicating a possible important deposit above.

At the top of the face of the canyon bunches of ore can be seen across a width of 30 to 40 feet, indicating a very favourable point at which to start development-work. The ground rises abruptly above this and depth would be obtained quickly. So far as I know, no prospecting has been done above this, and there is therefore, judging from the quantity and quality of ore found in the slide, a good chance of finding ore-bodies higher up. Altogether this is a rather attractive prospect.

Ormond. This is another promising prospect, situated at the head of Matilda creek on the east side of Flores island. The showings are at an elevation of 1,050 feet, about 1½ miles from the beach. The mineralization of pyrite, pyrrhotite, and chalcopyrite occurs in a shear-zone about 25 feet wide in the andesitic rocks of the Vancouver series. The lenses of pyrite-chalcopyrite are up to 6 feet in width and several have been exposed by surface-cutting. They impressed me as worth deeper development, which can be obtained by drifting in on the belt from the south side of the hill. A sample of the better-looking ore gave 8.8 per cent. copper with \$1.60 in gold and 6.6 oz. silver to the ton.

Craigellachie and Copper King.—These groups, which are the restakings of the old *Hetty Green* and *Crow* groups respectively, are owned by D. A. Grant, of Tofino, and were described in the 1928 Annual Report.

BEDWELL SOUND SECTION.

Some prospecting has been done up the valley of the Bedwell river this year. The old *Ptarmigan* road was built part way up the valley and continues as a trail to the property, about 10 miles from the beach. Recommendations will be made that the bridges be restored and the road and trail cleared to make this area accessible again.

Seattle. This group of seven Crown-granted claims—*Grey Mule, Tacoma, Rebecca Frac., Omaha, Seattle, New York, and Brooklyn*—had reverted to the Government. Last year they were redeemed by a Vancouver company, but so far as I know nothing has been done on them.

Ptarmigan. This group is owned by the Ptarmigan Mines Company, Limited, of London, England, and was last worked in 1914. It adjoins the *Big Interior* group on the west and from old reports it is evident that it contains the extension of the *Big Interior* low-grade copper-belt. The property is reached by way of Bedwell sound and up Bedwell river. Reports would indicate that the property is favourable for extensive development.

You Group. This group of four claims is situated at 3,000 feet elevation, about 3 miles up the valley from the head of Bedwell sound. From old reports (1921) the showing is a gold-bearing quartz vein in a shear-zone in the Vancouver volcanics. A 78-foot tunnel discloses an ore-shoot 40 feet long, of an average width of 8 inches, assaying from \$17 to \$70 to the ton in gold.

SYDNEY INLET SECTION.

The only two properties in this section of note are the *Indian Chief* on Sydney inlet and the adjoining property, the *Prince* group. Last year (*see* the 1928 Annual Report) the former was under bond to the Pacific Tidewater Mines, Limited, but the bond is now dropped.

The company did considerable work in reconditioning the old camp at the beach, rebuilding the dock, and putting the tramway into condition. Diamond-drilling was carried out with reported satisfactory results, but work was stopped and has not since been resumed.

The *Prince* group is owned by the Copper Hill Mines, Limited, of Vancouver, which company has done a little development.

NOOKA SOUND SECTION.

This area is reached by Coast boats to Nootka cannery, where a launch is procurable for other points.

Shannon. (*See* the 1928 Annual Report.) This is a group of three claims on the north side of Muchalat arm, opposite Gore island, about 14 miles from Nootka cannery. The showing is mainly zinc, on a contact between limestone and an igneous rock occurring as replacement in the limestone. This is a prospect worth investigation.

(See the 1928 Annual Report.) This group of three claims is owned by Star of the West. Wm. Poole, of Nootka, and is situated at the head of Tasis canal, about 22 miles from Nootka cannery. The mineralization, consisting of pyrrhotite, magnetite, chalcopyrite, and zinc-blende, occurs in bunches in a belt of altered limestone of garnetite and epidote in contact with granodiorite. Bunches of good ore are found here and there within the garnetite, but not enough work has been done to indicate whether the occurrences are sufficient to make the property commercially valuable.

ESPERANZA INLET SECTION.

This section is reached either by launch from Nootka by inside waters or by big boat to Hecate cannery. Considerable prospecting was done in the Zeballos River area during 1929 and about forty claims were staked.

Marks Gold and Copper Mines, Ltd. This company was incorporated in November, 1928, with a capitalization of \$3,000,000, divided into 3,000,000 shares at \$1 a share. The office of the company is in the Hall Building, Vancouver. The company's holdings consist of thirteen claims—namely, *Ehatset Nos. 1 to 13*, inclusive—staked by T. H. Marks along the North fork of the Zeballos arm. The claims are staked two abreast, 500 feet on the east side of the river and 2,500 on the west side. The east bank of the creek is a steep wall of limestone, the creek-bed marking the contact of the limestone with the altered volcanics on the west. The mineralization occurs in a schistose belt up to 200 feet wide, which is a shear-zone in the Vancouver volcanics. In places there have been some replacement deposits in the limestone-belt on the east. The ore, pyrite and chalcopyrite, occurs in lenses, bunches, and disseminated in the schists, mainly within a width of 60 to 100 feet west from the limestone wall. Small quartz stringers were also noted within the belt and where mineralized, especially with zinc-blende, carry high gold values, but they are so small and their occurrence and mineralization so irregular that they cannot be considered of importance.

Work so far has been confined wholly to the surface, resulting in finding a number of small masses and veins of chalcopyrite and indications of larger low-grade bodies of disseminated sulphides. These are encouraging indications of ore possibilities throughout the belt, calling for extensive, systematic, deep exploration. There is a good trail from the beach to the showings, which could be comparatively inexpensively converted into a road.

Tagore. This claim, owned by H. Malmberg and C. Nordstrom, is situated about 2 miles up the Zeballos river from tide-water, on the trail to the claims of the Marks Gold and Copper Mines, Limited. At the time of my examination Malmberg was working on a small stringer, up to 3 or 4 inches wide, carrying galena, zinc-blende, pyrrhotite, and chalcopyrite, assaying up to 40 oz. gold to the ton. He then had six sacks sorted out which he estimated would run about 20 oz. gold to the ton.

An option was later taken by A. B. Trites, of Vancouver, more claims were staked, and a couple of tons of high-grade ore was shipped. I am informed that further development will be undertaken.

QUATSINO MINING DIVISION.

This is the north-western portion of Vancouver island contiguous to Kyuquot and Quatsino sounds. There has been greater mining activity in this Division than for many years. Over 100 mineral claims were recorded and assessment-work was done on 143 claims, compared with 32 in 1927 and 89 in 1928. The majority of the claims were staked in from the head of Kokshittle arm.

KYUQUOT SOUND SECTION.

This portion of the Division is reached by Coast boats from Victoria or Port Alberni to Cachalot cannery, where a launch is procurable for any trip in the sound.

Canada Copper Co., Ltd. This company was incorporated in 1928 with a capitalization of \$5,000,000, divided into 20,000,000 shares of 25 cents each. Its registered office is at 416 Standard Bank Building, Vancouver. The company's holdings consist of an old group owned by F. Devroe, to which was added a number of claims by staking, making a total of some forty-three claims. I understand that some work has been done on the old group, but apparently the balance is just ground, unprospected as yet. There therefore seems little to justify the immense capitalization.

This company was incorporated in July, 1929, with a capitalization of 1,000,000 shares of no par value. The company's registered office is 504 Dominion Bank Building, Vancouver. Stock was offered at 15 cents a share. The property consists of fifty-two adjoining mineral claims situated north from the head of Kokshittle arm, off Kyuquot sound. The claims were staked this year and turned over to the company by bill of sale.

Work this season consisted of building a trail from tide-water up the Kaowinch river to the claims, and surface prospecting, the results of which I have no information.

QUATSINO SOUND SECTION.

Practically all the mining activity in the Quatsino Mining Division is tributary to Quatsino sound, which extends through Vancouver island to within 12 miles of the east coast at Port Hardy. It is therefore easily accessible from either coast, the west coast boats calling at Quatsino, Jeune Landing (Coast Copper Company's dock), Port Alice at the south end of the Neroutsos arm, and Holberg at the north end of the North-west arm; and from Port Hardy over 12 miles of auto-road to Coal Harbour. There are hotel accommodations at Coal Harbour and Quatsino, where gas-boats can be obtained for any trip in the sound. There is also mail-boat service from Coal Harbour.

(See previous Annual Reports.) This group of six claims is owned by the Millington. Spooner Bros., of Holberg, a settlement at the head of the North-west arm of Quatsino sound. The claims are situated about 3 miles up the valley and about half a mile off the main road on the west side of Spruce creek, which empties in at the head of the arm. There is a good road and trail, with a cable across the river from the main road to the cabin on the claims, making the property very accessible. The main road is a good motor-truck road for several miles up the valley.

Considerable work has been done on this property by the owners, who have held it for about fifteen years. The ore occurrence is bornite in a basic volcanic, classed by V. Dolmage as amygdaloidal basalt. The bornite is found in small bunches and veins, as well as disseminated through small areas.

This year some work on the Creek showing disclosed about a foot of clean bornite, from which it is proposed to ship some ore this winter. Two years ago two diamond-drill holes were drilled by the Consolidated Mining and Smelting Company—one under the Creek showing and another under the West showing, neither finding any ore. Further work this year on the West showing indicates that the diamond-drill hole was short of its objective; that is, the downward extension of the surface ore-exposure. These outcrops have been opened up farther west this year by open-cutting, proving the continuity of the mineralization for several hundred feet and exposing some promising ore. It is now apparent that the "vein," or mineralized belt, dips into the hill at a much flatter angle than before indicated and the diamond-drilling therefore cannot be considered as conclusive.

I consider the property worth careful investigation, with the possibility of developing a tonnage of milling-grade ore.

(See the 1927 and 1928 Annual Reports.) There are seven claims in this Alice Lake. group, which is owned by W. Clancy and W. D. Kinsey, of Quatsino, the former living on the property. The claims consist of the *Alice Lake, Galena, Pay-streak, Lucky Strike, Cedar, Hornet, and Iron Knob*, and are situated about 4 miles from Jeune Landing, half a mile off the Coast Copper Company's road, at an elevation of 1,000 feet, or 700 feet above the road. Transportation therefore presents no difficulties.

The mineralization consists of galena, zinc-blende, and pyrite, occurring as a replacement in crystalline limestone. The limestone-belt is from 3 to 4 miles wide, extends across the South-east arm of Quatsino sound, and contains many intrusions of diorite and post-mineral dykes, which strike in all directions, dip from flat to vertical, and apparently do not affect the mineralization in any way.

During 1929 the tunnel has been extended to 55 feet, of which about 35 feet is in ore of about the same grade throughout—namely, \$12 in gold to the ton, 8.5 oz. silver to the ton, 14 per cent. lead, and 12 per cent. zinc. The present face has 18 inches of ore dipping flatly to the right. The ore could be hand-sorted to a shipping grade.

June. This is an old group located about 1900. Four of the claims—*Amazon, Helen, June, and Olga*—were Crown-granted. They are situated about a mile west of Alice lake and reached by a trail from the lake, starting about half a mile south of the landing at the terminus of the Coast Copper Company's road from Jenne Landing. The camp is at an elevation of 500 feet, or about 300 feet above Alice lake.

A considerable amount of work has been done on the property, first by the Copper Mountain Mining and Development Company, of Tacoma, which drove a tunnel 450 feet long, after which it lay idle until 1916, when some Seattle people took it up and did extensive surface-trenching.

The Crown-granted claims which had reverted to the Government were last year leased by the Coast Copper Company and several adjoining claims staked. This year the company repaired the old trail up from the lake, reconditioned one of the buildings for a cook-house and dining-room, and built a new bunk-house and change-room.

A thorough geological examination was made and several diamond-drill holes put down for information as to structure, etc., from which the present exploration programme was planned.

The mineralization of pyrrhotite, magnetite, and chalcopyrite occurs in a belt of metamorphic rocks, of mainly epidote, but showing some garnetite, dipping about 30° north, lying on the granodiorite to the south and overlain by limestone to the north. Farther west, up the hill and above the old workings, there is a belt of diorite lying on the granodiorite between it and the metamorphic rocks. The dip of the granodiorite of 30° north governs the dip of the other formations.

The old workings, consisting of open-cuts along the epidote-belt, exposed promising bodies of magnetite and pyrrhotite carrying a percentage of chalcopyrite. The 450-foot crosscut tunnel was driven to cut this belt, but failed to find the ore and work was discontinued.

The surface examination and diamond-drilling demonstrated that the dip of the mineral-belt exposed on the surface is much flatter than formerly supposed, which would throw the 450-foot crosscut under the foot-wall of the ore.

The Coast Copper Company has installed a portable air-compressor and steel-sharpener and is now driving a tunnel in the epidote-belt. At the end of this year this had been driven 335 feet, with 100 feet of crosscutting, encountering small bunches of pyrrhotite and associated chalcopyrite. Altogether about 4,500 feet of diamond-drilling was done. Eleven men were employed in this work, which is handled from the Coast Copper Company's office under the supervision of C. A. Seaton.

Coast Copper Co., Ltd. (Old Sport). (*See previous Annual Reports.*) This company was incorporated in 1916 with a capitalization of \$1,000,000, divided into 200,000 shares at \$5 each, with its head office at Trail, it being a subsidiary of the Consolidated Mining and Smelting Company of Canada. Operations at the mine have been carried on continuously throughout the year with a pay-roll of between sixty and seventy men in addition to the crew at the *June* group. It has been a year of much construction and many improvements and additions to the camp, plant, and equipment, both surface and underground.

A new office was built at the mine, with a convenient warehouse provided in the basement. A new assay office was built at the mine, a very comfortable staff house was added to the camp buildings, and a recreation-hall will be built at once. Eleven pupils are in attendance at the school.

The telephone system covering the camp and plant and connected with Jenne Landing, the port of call of the west coast boats, was extended to Quatsino, giving direct communication with the outside. New equipment was added to the machine-shop and practically everything necessary can now be made in the company's own shop, a very important item at an isolated property.

The power plant at Raging river was increased by the installation of a 187-k.v.a., 60-cycle, 47-ampere, 2,300-volt a.c. generator. The current is carried to the mine through a 3-conductor lead and steel-covered cable. At the mine it is stepped down to 550 and 110 volts for operation of motor-generator set, 75-horse-power hoist, and for lighting. The electric-haulage locomotives on the 800- and 1,000-foot levels are operated by a 250-volt a.c. current from the motor-generator set located underground. The power plant across the lake at the mouth of Raging river requires oiling and checking over only once or twice a day, taking about an hour of one man's time. The power cost is therefore very low. About 450 horse-power is now in use.

Underground, a 75-horse-power electric hoist was installed on the eighth level, electric haulage provided on the eighth and tenth levels, and the mine electric-lighted on the eighth or adit level. The shaft was lengthened 2 feet, giving two hoisting compartments and a stairway between levels. Two skips are used of $1\frac{1}{4}$ tons, each with a hoisting capacity of 50 tons an hour.

Owing to the many improvements, new installations, etc., the underground work was necessarily curtailed. During April little was done, with no underground work at all in May and only partially resumed in June.

The development-work for the year consisted of 871 feet of drifting, 308 feet of crosscutting, 445 feet of raising, and 388 feet of sinking, a total of 2,012 feet. In addition there was 1,395 feet of underground diamond-drilling. Altogether there are about $4\frac{1}{2}$ miles of underground workings. The shaft was sunk to the fourteenth level, 100 feet below sea-level, giving a depth of 1,800 feet on the dip of the vein. It will be continued to the sixteenth level, another 200 feet, and drifts run on the fourteenth and sixteenth levels; a station is already cut on the fourteenth.

About 3,300 feet of drifting has been done on the eighth level, the same on the tenth, and about 2,000 feet on the twelfth level, demonstrating the existence of satisfactory ore-bodies on each level.

As before stated, there is nothing spectacular about the Coast Copper Company's ore-bodies either in quantity or values, but just a steady increase in ore reserves as each level is opened up, with a noticeable increase in values at greater depth. I judge that the company can see the return of its investment with a satisfactory margin of profit when production is reached. The staff at the property consists of C. A. Seaton, superintendent; P. T. Bloomer, foreman; and J. H. Burrows, accountant.

(See the 1928 Annual Report.) This company was incorporated in 1928 with a capitalization of \$3,000,000, divided into 3,000,000 shares of \$1 each. Its registered office is 432 Standard Bank Building, Vancouver. The company's holdings consist of about fifty claims lying on the west side of Elk river, south of and adjoining the Coast Copper Company's property. Of these, twenty-five have been Crown-granted and several others surveyed and ready for Crown-granting. The property is reached by trail from the terminus of the Coast Copper Company's road at its mine. This trail is passable at present as a foot-trail and adequate for assessment-work, but will have to be rebuilt if any extensive development of the property is undertaken.

As before stated, the general geological conditions are the same as on the Coast Copper Company's ground, where the ore occurs in lenticular bodies within a contact-metamorphic zone, 40 to 80 feet wide, between diorite and crystalline limestone. The limestone lying west of and up the hill from the diorite is intruded by many dykes striking in all directions. The mineralized belt of the Coast Copper Company's property obviously extends southward through the *Independent* group of the Quatsino Gold-Copper Mines. The southerly limit of the Coast Copper Company's workings is approximately 3,000 feet from the northern end line of the Quatsino Company's ground. It therefore cannot be inferred that any of the known ore-bodies of the former extend into the Quatsino Company's ground, though they are in the same belt.

Some work was done on the property this year. Two shed-connected buildings, one for cook-house and the other for bunk-house, were built at 1,000 feet elevation. A powder-house was built a short distance along the trail above the old camp. About half a mile of new trail was built from the old camp up to the new one and beyond to the tunnel. This tunnel, at 1,075 feet elevation, was driven from the south bank of Bean creek on a course of S. 15° E. (mag.) for 15 feet, then S. 35° W. (mag.) for 60 feet, all in limestone towards its contact with volcanics, in which mineral indications were found on the surface. The object of this work is not apparent, as no great depth is obtained and the contact can be drifted on from the surface both ways from the creek-bed. This "vein" shows traces of cobalt and copper and is sparingly mineralized with iron sulphides for a width of about 8 feet. This is leached and soft on the surface, but is worth getting some depth on by drifting into either bank of the creek. About 200 or 300 feet farther up the creek a wider contact with mineral indications has been exposed which also is worth exploration. There are a number of such outcrops on the property worth opening up, but as yet no systematic exploration has been done.

The fact that the Coast Copper Company's property on the same belt is being successfully developed, though at a large expenditure, will give some assurance as to the potentialities of the Quatsino ground.

A thorough examination was made this year and I am informed that a plan of systematic exploration both by surface-prospecting work and diamond-drilling has been recommended and is under consideration by the company.

NANAIMO MINING DIVISION.

This is the largest Mining Division in the district and one of the largest in the Province. It covers about a third of Vancouver island, taking in about 180 miles in length along the east coast, and also includes 40 per cent. of the Mainland coast-line of the Province, and therefore is the most ideally situated Division in the Province.

This has been somewhat of a banner year from a mining standpoint, for there has been an unprecedented amount of prospecting and development as evidenced by the Government office statistics. This is due mainly to the discoveries and staking in the Nimkish Lake section, the *development on the Islands and North Coast section, and the exploratory work in the Texada Island section.*

The year 1928 was an active one, with 360 mineral claims recorded and 229 assessments done; but 1929 is a record, with 628 claims staked and recorded and 343 assessments. Of the old reverted Crown-granted claims, sixteen were redeemed this year.

PORT HARDY SECTION.

(See the 1927 and 1928 Annual Reports.) This company was incorporated in 1926 with a capitalization of \$250,000, divided into 2,500 units of \$100 each, with its registered office at 403 Pacific Building, Vancouver. The company's holdings consist of the three original claims, *Caledonia, Cascade, and Blue Bell*, to which were added the *Scotia, Maple, and Thistle*. They are situated near Quatse lake and about 5 miles north of the 6-Mile post on the Port Hardy-Coal Harbour auto-road, from which point there is a road to the property. A caterpillar tractor and trailers are used. The company has equipped the property with good camp buildings, compressor plant, and mining equipment. The property was bonded during 1929 by the Consolidated Mining and Smelting Company, but later the bond was relinquished.

At that time the company (*Caledonia*) had done an extensive amount of work, both surface and underground. Several long deep open-cuts had exposed a well-mineralized vein or zone from 5 to 25 feet wide on the upper side of the granodiorite, between it and the limestone-belt above. This contact-belt was well mineralized with a zincblende-galena and chalcopyrite ore which looked very promising. Also over 400 feet of underground work had been done, consisting of a crosscut tunnel through the granite into the formation beyond, a drift from the crosscut to a point under the best surface exposure, and a raise through to the surface at that point, encountering the ore at the top of the raise above the granite. From the top of the raise a short drift west, then turning abruptly north, was all in granite.

The Consolidated Company did considerable underground work, consisting of a drift east from the main crosscut for 180 feet, showing a mixed formation of granite, dykes, limestone, and altered limestone, sparsely mineralized. From this a short crosscut south was all in limestone. Opposite this another drift was run west for 50 feet, following a small seam of zinc in the granodiorite, but which did not amount to anything.

This underground work would seem to demonstrate the existence of alternating bands of volcanics and limestone intruded by granodiorite, with the ore occurring only on the contact between the limestone and the granodiorite, and not on the contact of the volcanics and granodiorite. In open-cut 3-A, where the raise comes through, the ore is seen on the contact, dipping at this point about 23° south, or with the hill. A shaft was sunk, about 100 feet up the hill from 3-A cut and 35 feet higher elevation, to a depth of 25 feet, but was all in limestone, but I think further depth would encounter the contact and ore.

As the contact is very irregular on such a flat dip, the only conclusion I could arrive at was that the ore should be followed from the surface instead of trying to locate the contact underground.

Above 350 feet (vertical) up the hill twelve open-cuts were put in by the Consolidated Company across a magnetite vein of from 2 to 5 feet wide, exposing it for several hundred feet, defining its strike as east-west and dip about 80° south, or with the slope of the hill. The vein lies on a belt of volcanics and is overlain by the limestone-belt, which extends down the hill

to the lower showing at the granodiorite. The magnetite apparently does not carry sufficient copper to be worth while.

I understand that it is the intention of the Caledonia Company to proceed with operations again in the spring of 1930.

NAMPKISH LAKE SECTION.

This area is contiguous to Nimpkish lake and is reached from Englewood, on the north-east coast of Vancouver island, a port of call for Coast boats. The sawmill of the English-Wood Logging Company is located here and a good logging-railway runs back to the north end of Nimpkish lake, a distance of about 12 miles. The company's boat plies on the lake to two logging camps.

The mineral area so far known lies east of the south end of the lake, extending from the lake back for several miles. The area was brought into prominence by the discovery in 1928 by E. L. Kinman of very promising copper-showings about $4\frac{1}{2}$ miles up Lime creek. This year some 200 claims were staked in that vicinity. Very little prospecting has been done so far, but several croppings rivalling the Kinman showings have been found.

The general formation consists of andesite or greenstone and belts of limestone, comprising the Vancouver series, which predominates on the island. This series has been intruded by an extensive mass of granodiorite extending south-easterly from the east side of the lake, about $3\frac{1}{2}$ miles down, for 5 or 6 miles so far as known.

The mineralizations consist of magnetite, pyrite, zinc-blende, and chalcopyrite occurring as replacements in the limestone where in contact with the mass of granodiorite. The accompanying sketch will give an idea of the groups staked—namely, *Hemlock*, *Surprise*, *Cypress*, *Galena*, *Granite*, and *Copper Contact*—and the approximate location of the granodiorite-limestone contacts.

There are six groups altogether containing about fifty claims, the majority **Kinman Property**, of which were staked in 1928 by E. L. Kinman, of Vancouver, and associates.

They start about a mile from the south-east side of Nimpkish lake and extend about 3 miles up on both sides of Lime creek. Late in 1928 assistance was granted by the Department of Mines towards building a trail from the lake to the camp, about $4\frac{1}{2}$ miles.

Kinman and partners built a cabin, took in winter's supplies, and worked all winter and up to June on the showings, mainly in open-cutting and stripping the ore-bodies. Four main ore-exposures were made; the upper one, at 3,000 feet elevation, was stripped for a width of 60 feet, the lower portion of this showing 15 feet of chalcopyrite, assaying 20 per cent. copper. Fifteen feet in width above this was not so solid chalcopyrite, but good shipping-ore, and the balance showed bunches of chalcopyrite. This showing is about 200 feet north-east of the granodiorite. About 3,000 feet south-west of this showing an open-cut along the top of the canyon shows 25 feet of fine chalcopyrite. Between these two extreme showings are several open-cuts and two large strippings, the latter showing very promising bodies of chalcopyrite. It is generally conceded by all who have seen the surface exposures that they indicated every probability of a very important mine at depth.

Negotiations for the property were started by several of the large companies, the Consolidated Mining and Smelting Company finally succeeding in procuring a bond in September. Intensive operations were immediately started; a gas-boat was put on the lake; a dock built at the south end, where the supplies were taken for the mine; a road was built from the lake to the camp, which was built to accommodate seventy men; a compressor plant and two diamond-drills were taken in; and work started in November in extensive surface work and diamond-drilling.

By the end of the year 4,000 feet of diamond-drilling had been done, which proved very discouraging so far as the finding of ore-bodies was concerned, but gave valuable information as to structure, etc.

It has demonstrated that instead of the contact dip being nearly vertical, as indicated on the surface, it dips at a low angle, about 20° , into the hill. A hole drilled under the big surface showing on the north end failed to find any downward extension of ore. It is, of course, possible that this deposit may represent a replacement along a flat seam in the limestone, thinned down by erosion. Some ore-bodies, mainly iron sulphides and magnetite, have been encountered where the drilling has crossed the contact of limestones and granodiorite and underground work will be necessary to prove their importance.

(See sketch-map). These five groups—namely, *Nahmint*, *Summit*, *Nimkish*, **Larson No. 1.** *Nitinat*, and *Kokish* groups—adjoin the Kinman property on the south and include several thousand feet along the granodiorite-limestone contact. There are thirty-five claims in the groups. Like the other ground staked this year, practically no prospecting has been done other than the croppings found in tracing the contact.

(See sketch-map.) There are five groups consisting of thirty-five claims in **Lennie.** this property. Some interesting discoveries have been made along the contact as in the other properties, but it remains to be proven what exploratory work will disclose. Besides these principal stakings there are a number of others in the area. The interest taken in these other groups in the area will no doubt be governed by the outcome of the exploratory work being carried on by the Consolidated Company on the Kinman property.

SAYWARD SECTION.

This group of three claims is situated on Adams river, which empties into **Lucky Jim.** Johnstone strait about 15 miles above Sayward, which is at the mouth of the Salmon river. The property is reached by road up the Salmon river for 7 miles, thence by trail about 10 miles across to the head of Adams river. The trail was put in good repair two years ago, when the property was under bond to the Consolidated Mining and Smelting Company.

From old reports I understand that there are promising showings of pyrite, arsenopyrite, and chalcopyrite in a gangue of hornblende and calcite. The Consolidated Company did some diamond-drilling, but found the property did not meet its requirements.

There are five claims in this group, situated about a mile back from Humpback **Copper Queen.** bay, on Johnstone strait, on the north-east coast of Vancouver island. There is a good trail from the camp on the beach in a small bay south of Humpback bay to the showings at 675 feet elevation. Assistance was granted by the Department of Mines towards making the trail along a steep side-hill.

The showings consist of a number of small parallel veins of chalcopyrite cutting across the face of a steep gulch. A big open-cut was made in the face of the gulch and a tunnel driven 45 feet toward the right or north wall of the gulch. The last 20 feet showed well-defined walls with a filling of more or less broken-up material carrying no mineralization. Below the open-cut and in the south wall of the canyon are several small stringers of chalcopyrite. I advised abandoning the tunnel and doing some prospecting up the hill on the strike of the small veins of chalcopyrite.

CAMPBELL RIVER AND BUTTLE LAKE SECTION.

This section takes in the Campbell lakes and the Strathcona Park areas and is reached from Campbell River by auto-road to half-way up Upper Campbell lake, 22 miles, passing Forbes Landing at 10 miles. From the Sutherland Bros. camp on Upper Campbell lake the head of the lake is reached by boat using a kicker. From the head of the lake it is 9 miles by good horse-trail to the north end or outlet of Buttle lake. The Sutherland Bros. have pack and saddle horses at Upper Campbell lake and a boat with a kicker for Buttle lake, which is about 25 miles long.

The logging-railway from Campbell River is being extended through to timber limits around the north end of Buttle lake, and will eventually furnish transportation for that section. There are a number of old properties in the vicinity of the Campbell lakes. Some prospecting and work has been done this year, but I did not have time on my way out from Buttle lake to make any examinations.

In looking over the old reports I find two properties which may interest the reader and excerpts are given here.

From the 1916 Annual Report I gather that the *Big G.* group is situated at **Big G.** Little Campbell river, on Greenstone creek, reached from Forbes Landing by launch to the corduroy road at Campbell river, from which point the road was built 6 miles to the mine. In 1916 40 tons of chalcopyrite was shipped. Quoting from the Annual Report: "The mine-workings are on the side of a deep precipitous canyon through which the Little Campbell (Greenstone creek) flows and about 100 feet above the river-bed. They consist of several large open-cuts and two adits; one of the latter is 60 feet long, with an upraise about 30 feet high at the face of the adit, and the other is 30 feet long. Outcroppings

of considerable extent made up of gossan and pyrrhotite with some chalcopyrite form the summits of bold bluffs. The occurrence of ore exposed by the workings has the appearance of being a blanket outcrop, covering a bluff, rather than a deposit filling a fissure in a shear-zone in igneous rock. The country-rock resembles andesite, but is very much altered and fractured. In the first-mentioned adit no well-defined ore-body occurs, but the country-rock is mineralized to some extent with iron pyrites, some chalcopyrite and pyrrhotite. In the other adit there is a lens of ore that is about 3 feet wide at the entrance, but this width gradually contracts until at the face of the adit the ore is only a few inches wide. This ore is an association of pyrrhotite and chalcopyrite."

Sumpter. This group is situated on the north-westerly shore of Upper Campbell lake, near the north-east end of the lake. The Annual Report for 1916 states in part: "An occurrence of mineral, made up chiefly of copper carbonates developed between two limestone walls in a gangue chiefly composed of garnetite with some iron-stained, crushed limestone, occurs at a slight elevation above the lake, and within 300 feet from the shore the width of mineralized material is about 9 feet.

"On another claim there is a lens of copper ore that outcrops in limestone at a point about 300 feet from the shore and about 200 feet elevation. There is a shaft sunk on this outcrop 25 feet deep, on the bottom of which is a stringer, 18 inches wide, of bornite mixed with chalcopyrite. After the shaft was sunk the owners drove an adit 150 feet long from a point about 60 feet lower elevation in the hope of intersecting the ore below the bottom of the shaft, but no ore had been exposed at the time of the writer's examination: A sample from the bottom of the shaft assayed: Gold, trace; silver, 2.8 oz. to the ton; copper, 3 per cent."

The general geological structure at the south end of Buttle lake consists of wide belts of highly altered schists resulting from intense shearing action in the volcanics of the Vancouver series of rocks, comprising nearly all of Vancouver island. These schists are loose and leached on the surface, the iron contents giving them a yellow to red colour. Smaller zones within the big belts are mineralized with pyrite, galena, zinc-blende, chalcopyrite, and arsenopyrite, in a gangue of quartz calcite and barite. The big belts are therefore good prospecting areas.

This is a private partnership owning two groups of six mineral claims each, on the west side of Price creek, which empties in at the south end or head of Buttle lake. The *Cross* group comprises the *Cross*, *DuBois*, *Barrett*, *Wakeman*, *Atkinson*, and *Knight* claims. The *Revercomb* group comprises the *Revercomb*, *DuBois*, *Eleanor*, *McIrving*, *Patrick*, and *Cross No. 1* claims. The upper showing is at 2,080 feet elevation, or 1,360 feet above the lake. Here the steep bank at the head of a gulch has been cut back for 10 to 15 feet in one of the mineralized siliceous belts, exposing a width of about 50 feet across it. It strikes N. 46° W. (mag.) and dips 62° north-east.

Mineralization is improving as the loose, leached surface material is penetrated and some extensive systematic exploration and development might give very satisfactory results. A sample across 18 inches at the bottom of the face, about 6 feet from the hanging-wall, gave: Gold, trace; silver, 1 oz. to the ton; zinc, 27.9 per cent.; copper, 2.4 per cent. The intervening 6 feet to the hanging-wall is soft, leached schist. Another sample across this vein near the top of the face assayed: Gold, trace; silver, 1 oz. to the ton; zinc, 28.7 per cent.; copper, 3.3 per cent. West of this vein a sample across 26 inches of mineralized soft vein-matter gave: Gold, trace; silver, 0.3 oz. to the ton; zinc, 9.8 per cent.; copper, 1.5 per cent. This is not high-grade ore and would not pay under present transportation conditions, but the samples indicate that for the amount of work done the values and ore-bodies are substantial and the area worth serious prospecting and development work.

Below this showing, at 1,400 feet elevation, a few shots have exposed a strong vein of calcite and barite, paralleling the schist-belt above. The 4 to 5 feet of width exposed is well mineralized with galena, zinc-blende, and arsenopyrite. A grab sample taken from the broken rock in the cut gave assay returns as follows: Gold, 0.04 oz. to the ton; silver, 4.8 oz. to the ton; copper, trace; lead, 2 per cent.; zinc, 12 per cent. The vein is apparently about 20 feet wide and certainly merits opening up a little. A depth of 25 to 30 feet could be obtained with a short open-cut.

The lower showing, at 850 feet elevation at the foot of the hill, is a 6-foot vein of practically solid iron sulphides carrying some chalcopyrite. Only a few shots have been put in here, but it shows a well-defined vein of solid mineral and is worth further exploration. It also strikes N. 60° W. (mag.).



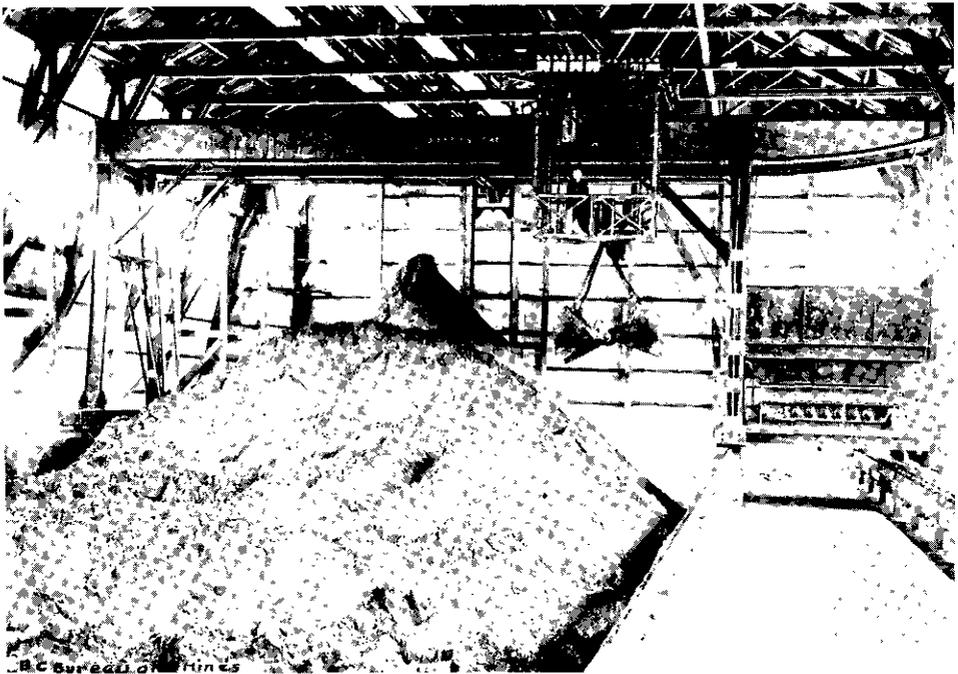
Qutsum Lake, Nananimo M.D.



Mouth of Salmon River, Nananimo M.D.



Adams River, Nanaimo Mining Division.



Britannia Mining and Smelting Co., Ltd.—Concentrates.

From the above it will be seen that there are very favourable possibilities in this area which has had comparatively little prospecting.

(See the 1927 Annual Report.) This group of seven claims is situated on the north side of Myra creek, which empties into Buttle lake at its south-west corner. The claims are owned by Jos. Cross, of Victoria, and associates. Since my 1928 report some work has been done on the higher showings and further prospecting done, which has improved the possibilities of the property. It needs, however, sufficient capital to drive in on the best showings and see what happens underground. There are good camp buildings and, with efficient handling, development-work could be cheaply done.

(See the 1928 Annual Report.) This company owns a group of claims on the south side of Myra creek and adjoining the *Lynx* group. J. Errington, of Mining Co., Ltd. Toronto, and Eastern associates control the company. Some diamond-drilling was done on it in 1920, but nothing has been done since, except to comply with the necessities to protect the title of the property. The mineralization is in the same belt as the *Lynx* group and conditions are the same.

COURTENAY SECTION.

As stated under "Prospecting," the old "Forbidden Plateau" trail has been put in repair this year to the Mount Albert Edward section, where mineral discoveries were made this year. Samples submitted of alleged platinum-bearing rock were tested but were found wanting. This trail may eventually be continued through to Buttle lake, and would provide not only a good prospecting-trail but a horseback route for tourists from Courtenay to Buttle lake.

There are extensive clay-banks exposed along the east coast of Vancouver island out from Sandwick, north of Courtenay. Samples submitted by G. R. Clay. Bates seemed to have all the requisites for a metal-polishing material, but screen tests showed a small percentage of too coarse silica or grit, the cost of removal or grinding of which would be prohibitive. No doubt these clays will some time be utilized for bricks, tiling, etc.

This is a group of twenty claims staked by E. Pirodi, of Cumberland, and situated about 2½ miles out on a small creek that flows through the town. The claims are staked *en bloc*, four wide and five deep. The formation is a basic volcanic underlying the Comox coal-measures, which are here eroded to the volcanics. There is a small area of coal-measures above this and the main coal formation east of it.

The mineralization consists of small veinlets of native copper in the volcanic rock running in all directions and best exposed in the bed of the creek for several hundred feet; the volcanic at this place appears to be a later flow and carries the greater amount of copper. Where broken into by a few holes, sheets of copper up to 3 to 4 inches square can be pulled off the broken rock.

Assays show that the rock contains no copper whatever except the veinlets; that is, there is none disseminated, nor any sulphides. There is a similar deposit near the coal formation at Squash, on the north coast of Vancouver island, near Port McNeill and Port Hardy, except that in the latter case the native copper is disseminated in small beads through the basalt. I advised some work on this to see whether the distribution of copper is sufficient to make it a commercial ore.

Farther down the creek there are shears in the basalt carrying chalcopyrite, in which it is worth doing some exploratory work. Altogether the area warrants close prospecting in the hope of finding a concentration of copper, either native or chalcopyrite, sufficient to constitute a commercial deposit.

ISLANDS AND NORTH COAST SECTION.

This group consists of three claims—*River*, *Eagle*, and *Copper Island*—owned respectively by Maisonville, S. A. Husen, and I. M. Stauffer. The claims are situated on Pearce island, east of Alert Bay. A good log cabin has been built on the *Copper Island* claim and the most of the work has also been done on that claim. The other claims adjoin on small islands to the south-east. The mineral is bornite occurring in a basaltic rock. Open-cuts on the *Copper Island* claim show a width of mineral up to 5 feet, contained mainly in a coarse-grained basalt containing epidote, directly under an overflow of finer-grained basalt which carries no mineral. The vein is flat and about 12 feet above tide-

water and can be traced for a considerable distance. In places there are crystals of bornite through the rock 12 feet below the vein, but, as stated, the chief mineralization is confined to a width up to 5 feet.

The only work done has been some open-cuts at intervals along the face of the vein. If a sufficient tonnage of the class of ore exposed on the surface could be developed it would pay to concentrate.

(See the 1927 Annual Report.) This company was incorporated in 1928 with **Cambria Copper Co., Ltd.** a capitalization of \$1,500,000, divided into 1,500,000 shares of \$1 each, with its registered office at 52-53 Exchange Building, Vancouver. The company's holdings, consisting of seventeen claims, are situated on Matsin river, on the north side of Knight inlet, a little below and on the opposite side of the Knight Inlet cannery, which is a port of call of the Coast boats once a week during the cannery season. The claims cover a portion of one of the included belts or roof-pendants so frequent in the Coast Range granodiorite batholith. The general rock formation therefore consists of belts of limestone, altered limestone, volcanic rock, and dykes.

Work was started by the company early in the spring and a very creditable amount and class of work done. This first consisted in extending the old tunnel, at 1,250 feet elevation, to 370 feet. This tunnel is all in limestone, paralleling the contact of the limestone with the volcanics. The only ore found was a replacement deposit about 220 feet from the portal after turning southward, but it proved only a small bunch. The face of the tunnel shows that it is approaching the wall of the limestone. This work was unsatisfactory as it exposed no ore, so was abandoned and a tunnel started lower down the hill at 1,000 feet elevation in the volcanics. This had been driven 40 feet at the time of my examination (June 14th), showing small patches of altered limestone mineralized with chalcopyrite. This has now been advanced to about 100 feet, crossing a small seam of pyrrhotite at about 70 feet from the portal. A short crosscut a few feet from the face again cuts this vein, showing here 2 feet of pyrrhotite carrying a trace of copper and silver.

An old tunnel above the camp at 1,800 feet elevation is in 15 feet across a silicified belt of limestone lying between the volcanics and the main limestone-belt. In this are small patches of altered limestone, epidote, and garnetite, carrying some chalcopyrite, but nothing to indicate any commercial quantities.

East of this is a belt 20 to 30 feet wide of iron-stained rock consisting of altered limestone disseminated with small crystals of pyrrhotite, the oxidation of which gives the belt a red colour on the surface.

Altogether the surface prospecting has not disclosed any ore-cropping worth deeper exploration, nor has any underground work found any ore of possible importance.

This is an old group of claims situated on the north side of Knight inlet about 10 miles north of the cannery. The **Great Northern (Union Group)**, **Union Copper Company, Limited**, did considerable work on them about fifteen years ago. A tunnel from the beach was driven 280 feet, with a crosscut of 60 feet, and surface-cutting done higher up the hill, none of which showed any indications of ore with any possibilities.

(See the 1927 and 1928 Annual Reports.) This company was incorporated in 1925 with a capitalization of \$500,000, divided into 1,000,000 shares of 50 cents each. The registered office is at 905 Credit Foncier Building, Vancouver. **Alexandria Mining Co., Ltd.** The company's holdings are composed of seven Crown-granted claims situated on the north side of Cordero channel at the entrance to Phillips arm. The nearest port of call for the Coast-plying boats is across the channel at Shoal Bay (Thurlow Post-office).

The company built its own dock at the mouth of the tunnel on the beach and this is used for the discharge of any heavy equipment. Ordinary supplies are brought from the Government dock by launch.

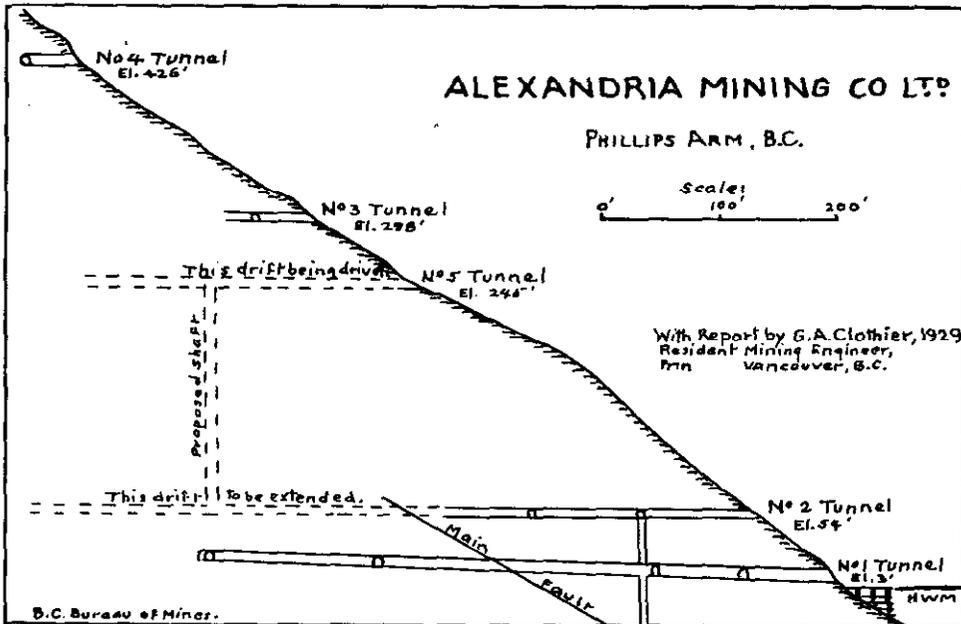
The property is equipped with accommodation on the beach for thirty men, blacksmith-shop, and this year a new compressor was installed of 600-foot air capacity, powered with a 125-horse-power Crossley engine. This gives ample power for the continuation of the shaft and shaft levels, where no doubt the greater part of the development will be carried on and which no doubt will require considerable pumping.

Under the able administration of T. S. Davey, the company's consulting mining engineer, work has progressed satisfactorily during the year. Further work was done on the surface and

upper tunnels, but the important development consisted in sinking the shaft from the lower tunnel as was outlined in the 1928 Annual Report. The shaft is now down 100 feet and the vein drifted on from the bottom of the shaft for 37 feet to the west, or into the hill. An average sample across the face of the drift at this point gave \$14 in gold to the ton. Selected samples show gold values up to \$75 or more to the ton. As the ore is pyrite in a gangue of quartz it will be an ideal one for flotation concentration. Soundings have been taken on the eastward extension of the vein, which indicate that a very appreciable length of drift can be run on the vein, under tide-water, from the present depth of the shaft. The shaft is about 300 feet in from the portal of the tunnel and there is therefore room in that distance for substantial bodies of ore.

Work was somewhat retarded by lack of power while sinking, but the present installation will assure continuous work. This year's work has doubtless greatly increased the probabilities of the property making a profitable undertaking.

I am informed that the company is now considering not only drifts on the veins from the present level, 100 feet, but also sinking another 100 feet and opening up the vein on that level. The property is ideally located for low-cost operation.



These groups lie north of the *Alexandria* and are owned by the Morton Enid and Woolsey Consolidated Mines, Limited, which has a capitalization of 3,000,000 shares of \$1 each. Some surface prospecting is being done each year on the Doratha Morton. *Enid* group and a contract is now being carried out for 200 feet of crosscutting from the surface on the *Doratha Morton* group. The latter is an old property from which 10,000 tons of \$12 ore was mined and cyanided many years ago.

The ore occurrence was a pocket or chimney and comparatively little exploratory work has been done since toward the possibility of finding others.

This group of nine claims—namely, the *Douglas Pine* group of three Crown-granted claims, *Gold Exchange*, *Cone Fraction*, and *Douglas Pine*, and the *Rand* group of six claims recently staked—is situated on the north-east corner of Thurlow island, just up the hill from Shoal Bay. It was acquired this spring by A. C. Gerhardi and associates, of Vancouver.

A trail was built from the beach to a new tunnel-site, from which it is planned to drive a 650-foot crosscut to intersect veins whose surface croppings give encouraging values in gold. Up to the end of the year 70 feet of this tunnel had been driven, cutting two blind veins—that is,

they do not appear on the surface—one 29 inches wide and assaying \$8.60 in gold to the ton, and the other 21 inches assaying \$6 in gold to the ton.

This property and all the others in this particular area are in the same general belt as the *Alexandria* and have the same character of veins—namely, quartz carrying pyrite containing gold values. Work was closed down early in the fall, but it is expected that financial arrangements can be made to permit of the installation of a small portable compressor plant and equipment which would greatly facilitate development-work.

White Pine. This group, owned by Seymour Campbell and associates, is situated south-west of Shoal Bay and is possibly the extension of the *Alexandria* shear. I have not examined it, but am informed that the surface showings of gold-bearing pyritized quartz are attractive and that work will be started early in the year.

Thurlow Gold Mines, Ltd. This company was incorporated in 1928 with a capitalization of \$500,000, divided into 2,000,000 shares of 25 cents each, with its registered office at 804 Dominion Building, Vancouver. The company's holdings consist of the *Hope* group of three claims—*Hope*, *Hope No. 1*, and *Hope No. 2*—acquired from the owners, to which were added, by staking, twelve adjoining claims, all situated on the east end of Thurlow island, about a mile south-east of Shoal Bay.

The showings, at an elevation of 300 feet, consisting of pyritized quartz carrying gold values in a granodiorite country-rock, are about half a mile from the beach. Last year considerable work was done by way of building camps, installation of a compressor plant, building a road from the beach to the tunnel, and the continuation of the tunnel to a fault where the vein was cut off. Some work was done in the tunnel as well as surface stripping and prospecting in an endeavour to locate the vein ahead, but without success.

However, there is 1,500 feet of vein from the fault down to the beach which is worth opening up anywhere, so development of the vein beyond the fault could be left in abeyance at the present time. The old shaft on the vein between 200 and 300 feet from the face of the tunnel shows good ore and indicates an ore-body for that distance. This shaft should be dewatered and sunk to 100 feet and from the bottom a drift run under the present tunnel. This will prove the best portion of the vein so far exposed and decide whether the property has a chance or not.

The vein is up to 5 feet wide, averaging probably 2½ feet, and could develop sufficient ore to make a small profitable mine. The sinking of the shaft and drifting are fully justified from the ore exposed in the tunnel.

Sonora Gold Mines, Ltd. This company was organized in March, 1929, with a capitalization of \$625,000, divided into 2,500,000 shares of 25 cents each, with its registered office at 804 Dominion Building, Vancouver. The holdings consist of twenty-one adjoining claims situated on the north-west of Sonora island, across Nodales channel from the Thurlow Gold Mines property. The claims cover a width of about 1,000 feet of a belt, included in the granodiorite, of altered sedimentaries and volcanics, with bands of limestone. Within this belt there have been discovered on this property a number of small quartz veins, or probably better described as long thin lenses of quartz carrying pyrite in which are gold values. Several of these "veins" have been exposed to some extent, but none of them show much continuity or inclination to widen into anything important, nor is the pyrite, which carries the gold values in the quartz, well enough distributed to give commercial values in any quantity. It is probably true, as stated in stock-selling advertising matter, that values up to \$200 to the ton have been obtained, but it means nothing if there is only enough of that class of ore to make up a sample of a few pounds. Such values are found only where there has been a concentration of the iron sulphides and probably some oxidation, but so far as I could see these places were scarce.

Two tunnels from the beach, another at 300 feet elevation, 74 feet long, and farther up the hill a couple of shafts about 60 feet deep, have been driven on small quartz "veins," but none have exposed ore of importance.

This work shows that there has been a wide distribution of mineral and values, but unfortunately, so far as known, not sufficient in any one place to constitute a commercial deposit. The only procedure would seem to be to carry on as before; that is, careful surface prospecting, followed by some developing of promising discoveries, with the hope of disclosing an ore-body on which extensive development is warranted.

Channe Island Showings. This island is situated in Cordero channel off the north-east end of Thurlow island. Claims on the island are owned by Messrs. Whelan and Morrison, of Shoal Bay (Thurlow Post-office). Some work was done on these claims years ago, exposing three showings of ore. Two of these consist of banded quartz veins up to 20 feet wide, sparsely mineralized with iron sulphides, and the other, on the north end of the island, of quartz containing masses of sulphides. None of them, however, carry any values of consequence and it is therefore doubtful whether more work is justified.

Nimrod Mining & Development Co., Ltd. This company, incorporated some years ago, is capitalized for \$1,000,000, divided into 4,000,000 shares at 25 cents, with its head office at 612 Standard Bank Building, Vancouver. The company's seven Crown-granted claims lie south of the old *Blue Bell* group on the west of the entrance to Frederick arm and extend to tide-water at Owen point. Only some surface work was done this year, under the direction of R. F. Hill, in tracing the continuation of the *Blue Bell* vein down the hill to the beach. An open-cut here exposes a quartz vein mineralized with arsenical iron carrying gold values. Further work is planned at this point.

Colossus Copper Co., Ltd. This company was incorporated in May, 1929, with a capitalization of \$1,000,000, divided into 1,000,000 shares at \$1 a share. The registered office of the company is at 311 Rogers Building, Vancouver. The holdings consist of four Crown-granted and two un-Crown-granted mineral claims comprising the old *Colossus* group, which have been increased by recent stakings, bringing the total, I understand, up to fifteen claims. They are situated about a mile up from the north shore of Estero basin, which is entered at the head of Frederick arm.

The old *Colossus* group was first worked in 1899 and altogether some 3,000 feet of underground work had been done when acquired by the present company. The work consists of three adit-tunnels at 1,300 feet, 1,460 feet, and 1,550 feet elevations respectively; raises between the different levels; and an intermediate level between No. 2 and No. 3 levels. The two upper levels are in the ore-zone, but the No. 3 or lowest level did not intersect the ore-body, as it was cut off by a flat fault a short distance above the tunnel, but there should be no difficulty in locating it on this level.

This underground work shows a shear-zone in the granodiorite in which were many diorite dykes. The shearing action has created a broken-up belt, up to 40 to 50 feet wide, of granodiorite and dykes, the latter displaced in all directions. This was later impregnated with siliceous mineral-bearing solutions, which also infiltrated into the granite and diorite in the zone, as well as along the borders of the "vein." The crushed material in the zone has naturally caused an irregular mineralization, making conclusive sampling rather difficult.

The chief mineral is chalcopyrite carrying very little gold or silver. In some sections of the zone there are indications of molybdenite which as yet cannot be considered other than a possible value. A great number of samples have been taken, resulting in averages of from 1.5 to 3.5 per cent. copper. It has been found in sampling that during the many years the property has been opened up there has been a leaching action on the exposed ore, forming a coating which, when included in sampling, gave a lower average than if this outside coating were removed and deeper sampling done.

The No. 1 or top tunnel starts in the mineralized belt and crosscuts it for about 50 feet before entering the solid granite on the north side. East-west drifts in the belt from the main crosscut prove the extension of the mineralization along its strike for about 100 feet.

The No. 2 tunnel, 80 feet vertically lower, was driven from the surface through the granite to the mineralized belt, in which east-west drifts prove its length for over 200 feet, with a width in places of 40 feet or more. The extension of the north-east drift on this level runs out of the mineral-belt on the north side, but about 100 feet farther in has encountered another ore-body which may prove important. This is called the "north ore-body" and may be the downward extension of surface exposures in that direction from the main body.

From the No. 2 tunnel a winze was sunk 80 feet, from which depth an intermediate level was driven. The winze follows the ore-body down for 40 feet, where it runs out of it. The intermediate level, a crosscut from the winze, again entered the ore-belt, showing it to be about 20 feet wide. No drifting has been done on the belt on this level. The winze extending down to No. 3 level shows the mineral-belt to be cut off by a rather flat fault. The lowest level has

been driven 1,600 feet from the surface well under the ore-body, which, as stated, should be located without difficulty.

So far as opened up, the mineral-belt has been proven for a depth of 340 feet below the surface and about 200 feet in length in No. 2 tunnel. The limits of mineralization have, however, not been reached either east or west in the two upper tunnels and therefore the probabilities of the extension of the ore-bodies have not been exhausted. With the indicated available ore and its probable extension and the average copper content, it is evident that the possibilities warrant extensive development.

The work this year has consisted of cleaning out the old workings to facilitate examinations and, with assistance from the Department of Mines, repairing the old trail from the beach to the showings.

This group of five claims—namely, *Bonnie Jean Nos. 1 to 5*, inclusive—is owned by J. W. Morrison, of Shoal Bay (Thurlow Post-office), and A. J. Bell. The claims lie at the head of Fanny bay, which is around the point from Church House, south of the entrance to Bute inlet. An open-cut just above high tide on the right or east side of the head of the bay shows a "vein" or dyke about 16 feet wide in granodiorite country-rock, with perfect smooth walls. The filling or "vein" is a quartz diorite showing a little mineralization of pyrite only on the north side of the face of the cut; the balance is barren. On the west side of the head of the inlet the same "vein" has been opened up with an open-cut at 50 feet elevation, showing the same conditions—a perfect vein-dyke in structure and appearance, but with slight mineralization, no ore, no values, and little possibilities.

This group of claims is a restaking of an old group situated up the hill on the west side of Fanny bay, about half a mile down from the head. At an elevation of 500 feet an open-cut was driven 40 feet and extended as a tunnel a further 10 feet on a perpendicular vein in the granodiorite about 8 to 10 feet wide. The vein consists of about 16 inches of quartz on one wall and the balance of quartz diorite in which are small quartz veinlets mineralized with galena and pyrite. The quartz portion is sparingly mineralized. Judging from the dump, the mineral content of the 50 feet of vein drifted on has been very small and altogether the appearance and possibilities are unattractive. I understand that several diamond-drill holes were drilled by the Granby Company several years ago without encouraging results. The vein is clean-cut, strikes south-west, and stands about perpendicularly. A small quartz vein on its strike shows on the beach, but it is too small to warrant any work.

This group, owned by T. Noble, of Quathiaski Cove, is situated about 500 feet from Hyacinthe bay, on Quadra island, at 100 feet elevation. The property is reached either from Hyacinthe bay or by road to within a short distance of the showing from Quathiaski cove, just opposite Campbell River.

The showing consists of pyrite and chalcopyrite in a quartz gangue in an andesitic country-rock. The vein on the surface is about 2 feet wide, of which bunches of ruby quartz on one wall carry a fair mineralization with chalcopyrite; the remainder is pyritized white quartz. The only values are the copper contents.

A shaft was sunk from the bottom of an open-cut to a depth of 15 feet, in the bottom showing about 5 feet of vein, the ruby quartz having widened to 3 feet, but very sparsely mineralized. An open-cut is being driven to cut the vein, from which a drift will give a depth on the vein of 35 to 40 feet.

The vein is well defined and of good workable width, but so far the values are small; however, I think the crosscut and drift are justified to arrive at any conclusion as to the merit of the property.

This syndicate has a capitalization of \$300,000, divided into 3,000 units of \$100 each, with its office at 574 Howe Street, Vancouver. John McConville, one of the old-time prospectors on the Coast, was the owner of the original seven claims, called the *Santa Anna* group, reported on in the 1919 Annual Report. The old claims were abandoned and restaked as the *Santana* groups, consisting of twenty-six claims and situated about a mile from the beach at Bold Point dock on Quadra island. The syndicate owns the property outright.

The showings are at an elevation of about 500 feet, to which there is a good road from the beach. The mineralization consists of pyrite and chalcopyrite contained in a narrow belt of metamorphic rocks on the contact between limestone and granodiorite. The ore apparently

occurs in masses or short lenses, the shipment of 174 tons made in 1917 having been taken from an open-cut above the portal of the tunnel. This tunnel is about 85 feet long, driven along the contact, but showing only small bunches of ore, of which none has been mined.

About 200 feet east of this tunnel another has been driven 165 feet on a bearing of N. 60° E. (mag.), or across the strike of the contact, which varies between S. 30° to 50° E. At a point 115 feet from the collar a drift was run S. 50° E. for 50 feet, showing no ore.

The contact can be traced for two or three claim-lengths on the surface, showing patches of ore at intervals, but nothing of any important size has been exposed. However, the ore indications are such that the contact is worth exploration of some kind, whether surface stripping, trenching, and open-cutting, or diamond-drilling or drifting underground on the contact. I am informed that work is to be resumed on the property early in the coming year.

This group comprises eleven claims—*Hercules Nos. 1 to 10*, inclusive, and the Hercules. *Gowland*—situated at Gowlland harbour, Quadra island. It was formerly the *Ingersoll-Copper Mountain* group, owned by the Valdez Island Copper Company, which shipped a considerable tonnage of copper ore from the surface prior to 1919. The properties were reported on in the Annual Reports for 1916, 1917, and 1918.

The *Hercules* group is a portion of the holdings of the Hercules Consolidated Mining, Smelting, and Power Corporation, Limited, whose head office is in the Birks Building, Vancouver. From the old Annual Reports it would seem that the showings are attractive and very accessible.

POWELL RIVER SECTION.

This group consists of some twenty-five claims and fractional claims, situated about 5 miles up Theodosia river from the head of Theodosia arm of Malaspina inlet. The property was owned by the Revenue Mining Company, Limited, but I understand that it has been acquired by the Detroit Western Mining Company, whose office is at 510 Hastings Street West, Vancouver. It has not been in operation this year. I have not examined the property, but am informed that there are substantial indications of important zinc-copper deposits.

(See the 1926 Annual Report.) The three claims in the group—namely, *John Bull*, *Bull*, *Hematite*, and *Estension*—are owned by Wm. Uzzell, Powell River. They are situated north of and adjoining the Malaspina Mines, Limited, holdings, about 11 miles north of Powell River, and reached from there by automobile to the camp. The property was under bond last year by Winnipeg interests, who built a road and camps and then stopped work. Nothing further was done this year.

(See the 1927 and 1928 Annual Reports.) This company was incorporated in 1927 with a capitalization of \$1,500,000, divided into 1,500,000 shares of \$1 each. Its head office is at 10 McGregor Block, Victoria. The company owns six mineral claims situated 10 miles north of Powell River, from which there is an auto-road to the mouth of the tunnel. The camp is on the beach about half a mile from the tunnel.

An appreciable amount of work has been done, nearly 1,000 feet of underground work and several diamond-drill holes from the surface. The mineralization consists of zinc-blende and chalcopryrite, carrying small silver values, occurring as replacements in limestone near its contact with a mass of granodiorite. No appreciable depth has been obtained anywhere yet. Several bodies of ore were encountered in the underground work, but apparently none were large enough to supply continuous shipments of ore. The property has not been under operation this year.

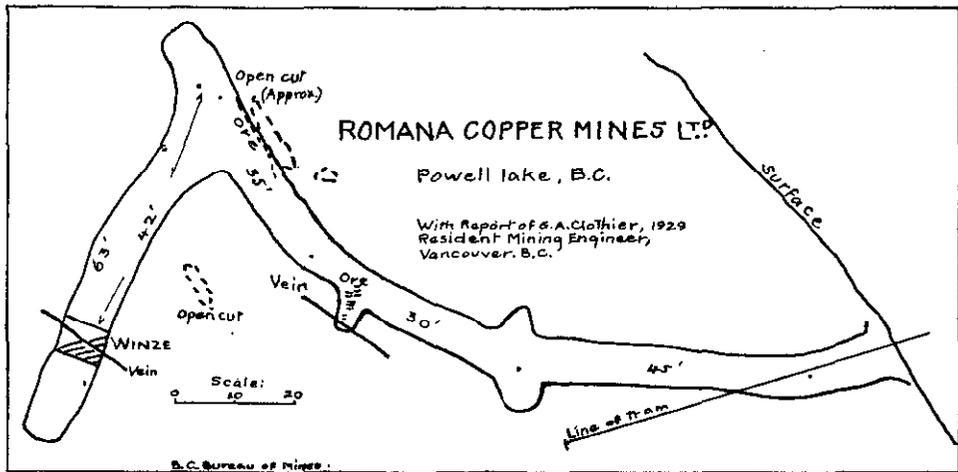
This company has its office at 615 Hastings Street West, Vancouver. It was incorporated in 1928 with a capitalization of \$500,000, divided into 2,000,000 shares at 25 cents each. Its holdings consist of nine mineral claims—*Victoria*, *Romana Copper Mines, Ltd.*, *Paul*, *Jessie*, *Joan*, *Betty*, *Peter*, *X Fraction*, *Hope*, and *Humming Bird*—all surveyed except the *Betty* and *Hope*. The *Humming Bird* is the only one Crown-granted. The claims are situated on Goat island in Powell lake, about 15 miles up from Powell river. The lower end of Powell lake is about half a mile from the dock and transportation therefore is simple.

The property covers a wide belt of highly altered volcanics and sedimentary rocks contained in the Coast Range granodiorite. Within this belt is a contact-metamorphic belt of 100

feet or more in width of garnetite, epidote, etc., in which occur small masses and lenses of iron sulphides and chalcopyrite. One such lense, mined and shipped some years ago, produced 140 tons of 8 to 11 per cent. copper ore. The present company therefore started exploratory work in the hope of disclosing similar bodies of commercial ore.

Camps were erected, a single-cable tramway put in from the beach to the edge of the bluff near the workings at 1,000 feet elevation, and a new trail built. Exploratory work on the surface succeeded in exposing several showings of chalcopyrite and it was decided to start a tunnel in from the side of the bluff, which would obtain about 80 feet depth below the surface ore-exposures. This work has been carried on all summer with a small crew, resulting in finding ore indications which warrant some further development. The tunnel has been driven about 130 feet (*see sketch*), with short crosscuts east and west at 50 feet in from the collar, another short one to the east at 80 feet in, and another 63 feet long to the east a few feet back from the main face.

The second crosscut east shows some fair ore across about 8 feet, with a well-defined vein in the face which should be drifted on both ways. On the west side of the tunnel, between Nos. 2 and 3 east crosscuts, there is also some mineralization which may be connected with this and is probably the downward extension of the ore showing in the big surface cut.



In the No. 3 east crosscut more or less mineralization was found all the way, but not enough to constitute a low-grade ore. At 42 feet a small vein was cut showing a few inches of chalcopyrite. A winze was sunk 5 feet, in the bottom of which is a foot or more of good ore. This vein parallels the vein encountered in No. 2 crosscut east and is about 25 feet east of it. Drifts should be driven both ways on it from the crosscut level and the winze sunk a further 15 to 20 feet.

Altogether the underground work has been encouraging and warrants continuation. I would not advise a lower tunnel until sufficient ore has been proven in the present one to justify deeper work.

TEXADA ISLAND SECTION.

There seems to have been more mining activity on this island in 1929 than for some years past. The revival of the old properties at Vananda and the diamond-drilling of the west coast iron properties are evidences of the mining interest being taken in this section.

(*See the 1927 Annual Report.*) This company has been steadily operating Pacific Lime Co. throughout the year, employing nearly 200 men and turning out about 900 barrels of lime a day and by-products, practically all of which are shipped to San Francisco by the company's own boats. The Granby Company at Anyox uses from 1,200 to 1,500 tons of limestone a month from here for smelting operations.

This company, operating one of the largest pulp and paper mills on the Powell River Co. Pacific coast, uses from 500 to 600 tons of limestone a month in its Powell River plant. This is mined from the company's own quarry at Vananda.

The pure white limestone is used, analysing: Calcium carbonate, 95 per cent.; magnesium carbonate, 3.6 per cent.; iron and alumina, 0.3 per cent.; silica, 1.1 per cent.

(See the 1928 Annual Report.) This company was incorporated in 1928 with a capitalization of \$500,000, divided into 2,000,000 shares of 25 cents each. **Central Copper and Gold Co., Ltd.** The head office is at 1104 Standard Bank Building, Vancouver. The company has for the past three years been investigating the old Van Anda Copper Gold Company's properties, consisting of the *Copper Queen*, *Little Billie*, and *Cornell*, at Vananda, on the east side of Texada island.

Operations have been continued throughout the year under the direction of Arthur Lakes, consulting engineer, of Vancouver. Further Radiore surveying followed by a number of diamond-drill holes and a great amount of surface-trenching has been done, all of which is demonstrating to the satisfaction of the company that there is every reason to expect large ore-bodies, of at least milling-grade ore, in the limestone along its contact with the diorite intrusive.

Each of these mines has several hundred feet of depth to go yet before attaining the depth, 1,600 feet, to which the old *Marble Bay* mine was worked, and it seems only reasonable to suppose that similar ore-bodies will be found along the same ore-zone.

This company was incorporated in May, 1929, with a capitalization of \$1,000,000, divided into 2,000,000 shares of 50 cents each. The head office is **Marble Bay Copper Mines, Ltd.** at 771 Dunsmuir Street, Vancouver. The company acquired the old *Marble Bay* mine at Vananda, owned and operated for years by the Tacoma Steel Company. The last shipments of importance were made in 1918 from the 1,600-foot level, although in 1919 small shipments were obtained from the 1,600-foot level and from cleaning up the stopes in the upper levels. In 1919 the mine was opened to the 1,700-foot level by continuing the winze from the 1,600-foot which was started from the 1,500-foot level. The mine has not been under operation since 1919.

The work in 1929 consisted of surface work along the *Cornell-Marble Bay* ore-zone. The results of this work are reported to have been satisfactory in exposing indications of ore-bodies. About 260 tons of \$12 ore was sorted from the dump and shipped to the Tacoma smelter. This was mainly of an experimental nature to ascertain the possibilities of profitably milling the old dumps containing many thousand tons.

It is proposed to unwater the old workings, first to the 300-foot level, from which exploratory work will be carried on, and this will decide the feasibility of deeper work.

This company's property consists of about 3,000 acres extending for about 3 miles north-west from Gillies bay on the south-west coast of Texada island. **Puget Sound Iron Co.** It is reached by auto-road from Vananda. The property contains three distinct deposits of magnetite ore: The *Prescott*, from which some 30,000 tons was mined and shipped to Irondale, Wash., for iron smelting between 1885-1908; the *Paxton* ore-body, about three-quarters of a mile east of the *Prescott*; and the *Lake* ore-body, about one-third of a mile east of the *Paxton*.

These ore-bodies are described by McConnell as typical examples of contact-metamorphic deposits, occurring along lime-diorite contacts. The tonnage in sight has been variously estimated up to 700,000 tons and the probable ore up to 2,500,000 tons.

This year two diamond-drills were operated on the ground, the results of which are said to be very satisfactory and to have greatly increased the probable tonnage.

Rumour has it that strong financial manufacturing interests have been investigating these deposits, which, with the proximity of coal on Vancouver island, might yet develop an iron industry on the Coast.

There are four claims in this group, two of which are staked along the contact of diorite and limestone. They are reached by auto-road from Vananda. **Burdett's Claims.** The minerals are iron sulphides, with a fair percentage of chalcopyrite, in a contact-gangue of garnet and epidote. Where exposed, the vein is from a few inches up to 3 feet wide and merits obtaining some depth on it. This, on account of the flat ground, would have to be done by sinking. Farther west there are patches of mineralized garnetite on which a little surface work has been done.

(See the 1927 Annual Report.) This group of six Crown-granted claims is about three-quarters of a mile from the beach and also reached by auto-road from Vananda. **Nancy Bell.** The property was tested this year by Radiore survey, but

nothing further has been done. No information is available as to the results of the Radiore work. The property is controlled by H. McMillan, of Nanaimo.

(See the 1927 Annual Report.) This group of seven claims is situated on the west side of Texada island, opposite the north end of Lasqueti island, and owned by Wm. Stromberg, of Vananda. The ore is bornite, occurring in veinlets and more or less disseminated in a porphyrite stock across a width of 60 feet or more. This year an option was taken by a Vancouver syndicate, which drilled one hole and then suspended operations.

LASQUETI ISLAND SECTION.

Lasco Development Co., Ltd. (Venus).—(See the 1927 and 1928 Annual Reports.) This company, with its head office at 701 Vancouver Block, Vancouver, was incorporated in 1928 with a capitalization of \$200,000, divided into 200,000 shares of \$1 each. It acquired the *Venus* group of five claims. No work was done on the property this year.

This group of six Crown-granted claims—*Juneau, Juneau Fraction, Ohm, Morore, Kim, and Bayview*—is situated adjoining the *Venus* group and owned by Kurtzhals Bros., False Bay. Considerable work has been done by the owners in open-cutting, stripping, and shallow shafts, which has disclosed a series of three parallel veins in diorite. There are several promising ore-exposures on this ground that might develop sufficient tonnage to warrant a small concentrator. The ore is the same as the *Venus*, iron and copper sulphides in quartz, carrying gold values.

VANCOUVER MINING DIVISION.

This Division includes the drainage areas of Burrard inlet, Howe sound, and Jervis inlet. It has the distinction of containing one of the great copper-mines and plants of Canada in the *Britannia*, which in 1929 produced a record output of copper.

Government office records for the year are interesting, in that they indicate where the interest in mining is taken by the public. Of the 191 claims staked this year, 75 were on Howe sound, 40 up the Pacific Great Eastern Railway, 33 on Jervis inlet, and the remainder along the coast. The number of free miners' certificates (both individual and company) issued were greater than last year. Claims recorded and assessments were about the same as 1928.

JERVIS INLET SECTION.

(See the 1928 Annual Report.) This company was incorporated in 1928 with a capitalization of \$1,000,000, divided into 1,000,000 shares of \$1 each. The holdings include the *Red Mountain* group of twelve claims owned by Phil White, of Vancouver, and situated on the west side of Britain river, which empties into Jervis inlet from the north at the head of Prince of Wales reach. With assistance from the Department of Mines, a good foot-trail has been built from the beach to the top of the mountain at 4,000 feet elevation, giving access not only to this property, but to this mineral-belt which extends north to Powell lake. Considerable work was done in 1928 on the property, but as nothing has been done during 1929 the reader is referred to last year's Annual Report.

This company was incorporated in 1928 with a capitalization of \$400,000, divided into 4,000,000 shares at 10 cents each. Its holdings are three claims adjoining the Britain River Mining Company's claims; the same trail serves both properties. This year a camp was built on the claims at 2,325 feet elevation and a little work done on a galena-showing found the previous fall. This was opened up a little by an open-cut, which showed the ground to be badly shattered with small oxidized seams running in all directions, across a width of from 4 to 5 feet. The galena, carrying good silver values, was about a foot wide at its best.

A short cross-tunnel was driven about 25 feet under this, which apparently crosses the seam carrying the galena above, but here showing nothing. Further work was advised in the open-cut, which I am informed has proven a little more encouraging.

This company was incorporated in 1923 with a capitalization of \$500,000, with its registered office in Vancouver. Its property of eight claims is situated about a mile up from the head of Hotham sound, a north arm of Jervis inlet. I followed an old trail, which had been cleaned out this year, for about a mile up the creek and then turned off "straight up" the mountain to the east.

At about 1,500 feet elevation I found the old camp and blacksmith-shop. East of this, about 220 feet, a short tunnel of 12 feet had been driven on a flat vein about 5 feet wide, mineralized with disseminated iron, which gave it a rich red colour on the surface. Another tunnel on the level of the camp had been driven 125 feet, with a 12-foot crosscut to the east, about 30 feet back from the face. No ore was found in the tunnel and the only mineral on the dump was a little magnetite showing traces of chalcopyrite. About 200 feet lower than the camp another tunnel at the head of a gulch was in 192 feet, the face of which is in granite. No ore shows in the tunnel or on the dump. The tunnels were all driven in a hard, fine-grained, grey rock, probably andesite.

Also a tunnel had been driven 80 feet at a small elevation above the beach. This, I am sure, is on the Baramba Company's ground, but I am not at all sure whether I saw the Baramba workings or those on the adjoining claims called the *Jolley* group. At any rate, I did not see enough ore to warrant any work other than prospecting. An old calendar in the upper camp indicated that nothing had been done since 1916. The Baramba Company's property and the *Jolley* group were reported on in the 1917 Annual Report.

(See the 1927 Annual Report.) This company was incorporated in 1928 with Pacific Copper Mines, Ltd. a capitalization of \$1,000,000, divided into 4,000,000 shares at 25 cents each. The holdings consist of two old Crown-granted lots of land—No. 353, containing 320 acres, and No. 354, containing 40 acres—granted to Alexander Donaldson in 1877; the remainder of the property of thirty-six full mineral claims and three fractional claims were staked in 1928 around the old Crown grants. They are situated up from the head of Salmon arm at an elevation of 4,500 feet and about 2½ miles from tide-water.

In the winter of 1928 much credence and advertising were given some old reports on this property and high assays were quoted. This year's investigations have confirmed the opinion expressed in the 1928 Annual Report, that these samples might prove specimens only.

Early this year, as soon as conditions allowed, a trail was started at the beach and built 7 miles to the camp-site near the old workings and a camp constructed. Examinations this year by different engineers did not substantiate the conclusions drawn from the old reports as to the amount of ore in sight and the shipments to be made. The company therefore decided to have a Radiore survey made. This was done, but was not at all encouraging and nothing further was done.

The company's financial condition is good and the directors have decided to procure the services of a few prospectors to thoroughly examine the claims next spring in the hope of discovering something worth development.

HOWE SOUND SECTION.

This is one of the older companies, incorporated in 1913 with a capitalization of \$1,000,000, divided into 1,000,000 shares of \$1 each. The company's office is in that of C. M. Oliver & Co., Commerce Building, 640 Hastings Street West, Vancouver. The holdings consist of eleven claims on the east side of Bowen island in the entrance to Howe sound. The claims in the property are *Snug Cove*, *Neptune*, *Beach*, *Emerald No. 1*, *Emerald*, and *Peacock* along the beach, and *Nellie*, *Bowena No. 1*, *Pearl*, *Peacock No. 1*, and *Topsy* adjoining them above.

The property has had considerable work done on it from time to time exploring chalcopyrite-showings that occur in shears in the volcanic country-rock. The main tunnel has been driven about 250 feet, from which a crosscut was started at 75 feet in from the collar and driven 50 feet west toward another vein showing on the surface, on which a shaft has been sunk about 40 feet. Several open-cuts have also been put in on these veins, but none of the work has developed enough ore to warrant the construction of the mill some years ago.

This year a Radiore survey was made on the *Emerald* and *Emerald No. 1* claims, resulting in the location of more promising mineralizations than those on which the work has been done. One conductor shows for a length of 2,650 feet, the axis of which varies from 50 to 350 feet deep. Two other conductors were located, one east and the other west of the main one, all parallel. It will necessitate some diamond-drilling now to test the mineral contents of the various conductors.

Britannia Mining and Smelting Co., Ltd. This company has a capitalization of \$2,500,000, divided into 100,000 shares of \$25 each, and is a subsidiary of the Howe Sound Mining Company, capitalized for 600,000 shares of no par value, of which 496,000 have been issued. The Britannia Company's holdings are situated at Britannia Beach, on the east side of Howe sound, about 35 miles from Vancouver. The production of 1928 was supposed to have set a record hard to equal, but in 1929 this was substantially exceeded in tonnage mined and milled, pounds of copper and ounces of silver produced, the gold alone being slightly less than last year.

It is interesting to compare the production figures of the past five years and note the methodical "stepping-up" each year, as the mine has been opened up, improved methods of ore-handling used, additions and improvements made to the concentrator, and greater efficiency in milling practice attained.

In 1925 the mine sent 904,113 tons to the concentrator, which produced 27,490,854 lb. copper, 8,231 oz. gold, and 131,744 oz. silver; in 1929, 1,983,769 tons was mined, of which 1,920,339 tons was milled, producing 41,469,337 lb. copper, 14,130 oz. gold, and 197,526 oz. silver; surely a substantial progress in five years. In addition the precipitation plant produced 502,674 lb. copper; making the total output of copper 41,972,011 lb. (recovered content); in addition 160 oz. gold, 2,017 oz. silver, and 16,104 lb. copper was recovered from residues after burning off sulphur from pyrite.

The company now employs about 1,100 men, segregated into 625 underground, 245 surface-men at the mine camps, and 225 at the beach, which includes millmen, surfacemen, and office. The underground work in 1929 was somewhat greater than in the previous year and was divided into 6,050 feet of drifts, 2,657 feet of crosscuts, 6,806 feet of raises, 879 feet of winzes, 5,040 feet of stope-development, and 193 feet of waste-filling raises, a total of 21,635 feet, or nearly 4 miles of work. The company itself also did 8,965 feet of diamond-drilling. At the mine camp a new bunk-house was constructed during the summer that will accommodate 112 men.

The important features of the work in the mines were the sinking of the No. 4 shaft in the *Bluff West* deposit from the 2,700-foot to the 3,100-foot level, and the *Victoria* mine was further opened from the 2,650-foot level down to and on the 2,800-foot level.

Equipment improvement consisted of replacing the old hopper-bottom ore-cars, which had been used for years on the tunnel railway, by heavy-type, 20-ton, gable-bottom cars, which eliminates the rotary tippie formerly used for dumping the cars.

The precipitation plant at the portal of the 2,200-foot level of the mine was operated successfully during the year. This plant consists of a series of small flumes through which the mine-water runs. Scrap-tin is spread in the flumes and precipitates the copper from the mine-water, requiring about 1.7 lb. of tin to produce 1 lb. of copper. The process requires comparatively little attention and is highly profitable.

In the concentrator some changes and additions have added to the efficacy of the plant. Early in the year an additional flotation unit was installed and later two tube-mills were added to the fine-grinding department. Alterations were made in the roll plant permitting additional washing of the ore before crushing.

The following is the personnel of the staff: General manager, C. P. Browning; mine superintendent, J. I. Moore, Jr.; assistant, E. F. Emmons; mill superintendent, A. C. Munro; metallurgist, H. A. Pearce; chief engineer, exploration department, C. V. Brennan; purchasing agent and secretary-treasurer, W. A. Matheson; chief accountant, E. C. Gillingham.

PACIFIC GREAT EASTERN SECTION.

This section includes the country contiguous to the railway from Squamish at tide-water at the head of Howe sound to the summit of the Coast range at Alta lake, the eastern limit of District No. 6. The railway and Howe sound give a cross-section of the Coast range from the main coast to its summit, a distance of 55 miles.

Geological surveys have located many belts similar to that containing the *Britannia* property, which is one of the great mines of the continent. This section therefore offers a very desirable field for prospecting, with the additional feature of assured transportation.

Radiant Copper Co., Ltd. This company, with its office at 515 Rogers Building, Vancouver, was incorporated in 1928 with a capitalization of \$2,000,000, divided into 4,000,000 shares at 50 cents each. The company acquired for stock considerations three groups—*Radiant*, owned by O. W. Rafuse, and the *Bruce* and *McKinnon*

groups, situated on Ray creek, a tributary of the Stawamus river, and reached by a fairly good horse-trail about 10 miles from Squamish. The claims had some diamond-drilling done by one of the large companies before the present company was formed.

This year it was decided to have a Radiore survey made of the "basin" portion of the claims. This work indicated a number of mineral conductors with reactions ranging from a trace to weak. These indications were interpreted by the Radiore Company of Canada (in charge of the survey) that the weak conductors evidently were wide belts carrying disseminated sulphides.

Later work in open-cutting across conductor "M" verified this, showing an iron sulphide of about 15 per cent. across a width of 60 feet or more. There is a trace of chalcopryrite in the iron sulphides. A shaft was sunk about 50 feet through the overburden on "L" conductor and had just reached the greenstone bed-rock. Some lateral work will now be necessary to locate the mineralization indicated by the Radiore.

These three groups, consisting of thirty-two adjoining claims altogether, have McVicar, Manson, and Tocher, been grouped for assessment and sale purposes. They are situated about 12 miles from Squamish at the head of Goat creek, a tributary of the Mamquam river. They are reached by good horse-trail from Squamish. There is a good comfortable cabin on the claims at 2,800 feet elevation, from which there is a good trail to the showings, extending to the top of the hill at 4,300 feet elevation.

The general rock formation consists of a wide belt of altered volcanics and sedimentaries, contained in the Coast Range granodiorite. In this there is a width of from 2,000 to 3,000 feet of schistose structure due to shearing action; within this zone are lesser zones of more intense shearing and alteration, mainly silicification accompanied by iron and copper sulphides, galena and zinc-blende, forming probably important lenses of ore. These conform in general to the strike and dip of the schistosity, though on the top of the hill there has possibly been some cross-fissuring.

At the upper showings, at 4,300 feet elevation, there appears to be a convergence of the shearing with a resultant convergence of the mineral lenses. An open-cut has been made across the formation here, exposing over 100 feet of mineralization in which are important widths of chalcopryrite, galena, and zinc-blende, yet I am informed that two diamond-drill holes under these surface exposures were disappointing. Down the hill several open-cuts have exposed promising showings to 4,000 feet elevation, where two open-cuts expose ore-showings well worth opening up.

Again at 3,800 feet elevation two more cuts show good widths of promising-looking ore. From 3,300 feet elevation down, three or four open-cuts show an ore-shoot apparently over 200 feet long on the surface of good chalcopryrite ore varying in width from 2 to 12 feet, in one place assaying 6 per cent. copper across a width of 10 feet. However, diamond-drilling under the lower cuts failed to find anything at depth comparable with the surface showings.

Some 400 or 500 feet east of these showings is the "iron-showing" in the creek, where from 2 to 5 feet of ore carrying good chalcopryrite content has been open-cut.

Again east of this are two small veins which I did not see, but said to be about 4 feet wide, carrying a workable percentage of copper, which have been traced several hundred feet up the hill. There are, therefore, at least five mineralized smaller shears across a width of 1,000 feet of general shearing, any one of which I would consider a good prospect worthy of exploration.

In 1925 the Britannia Mining and Smelting Company did some diamond-drilling, and again last year took another option, had an electrical survey made, the findings of which were tested by further diamond-drilling. This work satisfied the company that the property did not meet with its requirements and the option was again dropped.

The property is therefore in the position of having a number of attractive surface showings on which comparatively little work has been done, but which do not appear to have much continuity as indicated by the diamond-drilling. I would suggest that development be concentrated on one or two of the most promising showings, from which information would be gained applicable to all of them, and which might result in the development of several of these lenses from the surface.

Fitzsimmons. This group consists of six Crown-granted claims on Fitzsimmons creek, situated about 4 miles from the station at Rainbow Lodge on Alta lake, which is the summit of the Coast range. The property has not been active since it

was diamond-drilled by the Consolidated Mining and Smelting Company two years ago. The reader is therefore referred to the 1928 Annual Report, page 387.

Astra.—This group of eleven claims is situated on the north side of the Brandywine and is owned by Messrs. Falconer and Price, who have done considerable work on it.

Venus.—Eleven claims constitute this group, which adjoin the *Astra* group on the north side. It is owned by Dan McKinnon, who brought in some promising-looking ore this year.

Brandywine and Blue Jack.—These groups are also on the Brandywine river and are owned respectively by W. Barclay, of Maguire, and partners, and A. E. Snow, of Vancouver. These properties adjoin the *Astra* group on the south and were described in the 1927 Annual Report.

Golden King.—This group of eight claims is situated 10 miles up Ashloo creek, a tributary of the Squamish river. I understand that further work was done on this property this year by the owners. (See the 1925 Annual Report.)

NEW WESTMINSTER MINING DIVISION.

This Division comprises the drainage area of the Fraser river on the north side from Point Grey to near Hope, which includes the areas of Pitt, Stave, and Harrison lakes, and on the south side to the International boundary.

There has been a remarkable increase in mining interest in this Division during the past two years and especially during 1929. Two years ago only eighty-five claims were staked and eighty-four assessments done; this year there were 428 claims staked and 148 assessments. Several reverted Crown-granted claims were leased this year. The majority of the staking was done around Pitt lake, where 158 claims were recorded, while in the vicinity of Harrison lake there were fifty-eight claims recorded, and about eighty-five up the Chilliwack river, including Pierce mountain, Sleese creek, and Chilliwack lake.

PITT LAKE SECTION.

(See the 1927 and 1928 Annual Reports.) This company was incorporated in June, 1921, with a capitalization of \$250,000, divided into 250,000 shares of \$1 each. The company's office is at 511 Randall Building, 535 George Street, Vancouver. The property, consisting of eight Crown-granted mineral claims, is situated on the east side near the south end of Pitt lake and ideally located for operation and shipping.

The mineralization consists of pyrite, pyrrhotite, and chalcopyrite in a breccia gangue of granite, calcite, and quartz in a shear-zone in the granodiorite country-rock.

There are two such veins, the "north" and "south," the latter having only a little work done on it. The tunnel on the north vein has been driven 550 feet, a raise of 180 feet put through to the surface, and two short levels opened up from the raise. The average of several hundred samples gives \$1.20 in gold to the ton, \$2.40 in silver to the ton, and 3.9 per cent. copper. (Due to a typographical error the gold assay was printed in the Annual Report for 1928 as \$12 a ton.) There appears to be plenty of ore available from the main level and the intermediates to supply a 75-ton mill for a considerable time.

It was expected to have the property in production this year, but difficulties encountered in the construction and installation of the hydro-electric plant has retarded the work. Construction-work has occupied practically the whole season, with the exception that underground work was started late in the year. The hydro-electric plant was completed, a 600-cubic-foot compressor installed at the mine, concentrator building put up, and it only remains to set the concentrator machinery, which I understand has been purchased and partially delivered.

The hydro-electric plant is a very creditable piece of work. A small dam was built at the foot of a lake, a flume constructed for 550 feet, 1,470 feet of 14- to 12-inch extra heavy wood pipe laid to a 36-inch Pelton wheel, giving a head of 650 feet. The Pelton wheel is direct-connected to a 312-k.v.a., G.E. generator running at 600 r.p.m. The unit will develop 300 horse-power. The compressor is belt-driven by a 100-horse-power, 220-volt Westinghouse motor.

A full mine equipment of cars, rails, machines, drill-sharpener, blacksmith outfit, etc., has been provided. From twenty to thirty men have been employed during the summer. The work and finances of this company have been competently handled by the management under W. H. Wooley. There is every reason to expect the property to make a profitable producer.

Katanga. This group of sixteen claims is situated on the east side of Pitt lake near the mouth of Scott creek. They are owned by F. W. Johnson, 424 Ninth Street East, North Vancouver. The property includes the old *Maple Leaf* group of four claims owned by Wagner Bros., who drove a tunnel about 70 feet on a feldspathic vein in the granodiorite country-rock. There is a little chalcopryite showing at the mouth of the tunnel and a few feet in, and also in an open-cut above, but nothing of an encouraging size.

This year F. W. Johnson discovered several promising copper-showings and did some work towards opening them up a little. The minerals, pyrite and chalcopryite, are contained in dykes or veins of a fine-grained, feldspathic rock up to 20 feet in width. One of these showings at 925 feet elevation had an open-cut put across it, showing about 20 feet of milling-grade ore. On the foot-wall there is about 18 inches of fairly clean chalcopryite, the remainder consisting of small veins, bunches, and disseminated chalcopryite; altogether it is a promising surface showing. This could be crosscut from the gulch below for further depth or traced down the hill and drifted on.

At 1,500 feet elevation another similar "vein" was exposed by open-cutting, but did not show as promising a copper content. I am informed that other copper-croppings were found later on the opposite side of Scott creek.

Altogether a very creditable amount of work was done on these prospects this season and the results have been very encouraging.

(See the 1928 Annual Report.) There are twenty-one claims on this belt, **Cox Molybdenum Claims.** in which are small veinlets of molybdenite and molybdenite-bearing quartz. The formation is a wide belt, 4,000 feet or more, of light-coloured, pyritized feldspathic rock, schistose in places, contained in the granodiorite of the Coast range. Not enough molybdenite has been exposed at any place to call for much work, but the many croppings show it to be widely distributed and makes the belt worth systematic prospecting.

The property is reached from the head of Pitt lake to within half a mile of the Dominion hatchery, from there 5 miles to Canyon creek and 5 miles of trail up the creek.

HARRISON LAKE SECTION.

This is an old mining section that has had some very interesting showings not only contiguous to the lake, but farther north on Fire mountain and along the old Cariboo road up the Lillooet river. That there has been a pronounced revival of interest in this section is evidenced by the fact that over ninety mineral claims have been staked this season north of the Fraser river in the Chehalis and Harrison Lake areas. Several old properties are under investigation as well.

The Fire Mountain trail, reconditioned this year by the Department of Mines, gives access to a large area, attractive for its free-gold quartz possibilities.

The nickel and other mineral showings on the Hope side of the Coast range have resulted in considerable prospecting east from Harrison lake.

F.E.W. This group of twelve claims is situated along the Canadian Pacific Railway near Harrison Mills. It is a restaking of an old group adjoining the Crown-granted claim *Fairplay*. The owners are Frank E. Woodside, of Vancouver, and associates. Some years ago a long tunnel was driven on some copper-showings occurring in an igneous formation. The mouth of this tunnel has been covered in grading for a road above it.

This year a short tunnel was run from the level of the Canadian Pacific Railway track and a shaft sunk about 20 feet at the end of the tunnel on a small stringer showing a little zinc, but carrying no gold or silver values. It is the intention to clean out and examine the old tunnel in the expectation of finding ore indications worth exploration.

Harrison Gold Mining and Development Co., Ltd. This company was incorporated in April, 1929, with a capitalization of \$500,000, divided into 1,000,000 shares at 50 cents each. Its office is at 590 Richards Street, Vancouver. The property is the *Providence*, on the west side of Harrison lake, about 28 miles up from Harrison Hot Springs. It is an old property, having had considerable work done on it in 1898 and 1899, from which 350 tons of ore was shipped, averaging about \$34 a ton. There are four tunnels and considerable open-cutting. The main tunnel was driven about 575 feet, with crosscuts both

ways from it, following a pyritized feldspathic vein-filling, but apparently encountering no ore of importance as there are no indications of stoping. A shaft has evidently been sunk to some depth near the mouth of the tunnel and there must have been a considerable plant on the beach here at one time.

Farther around on the beach toward the cabin two other tunnels about 60 feet long were driven on separate parallel veins of ribbon or banded bluish quartz carrying pyrite and, in places, gold values. A shaft, said to be over 100 feet deep, was sunk on the south one of the two veins just mentioned, a short distance back from the beach. A short tunnel just above the cabin and south of the shaft was also driven on this vein. The dumps from the shaft and the two short tunnels on the beach show vein-matter, but no ore of any account.

I followed the old trail for some distance up the hill, but it seemed to branch in all directions and without a guide who knew the property I found nothing up the hill. I understand that the company is undertaking some prospecting farther up the hill along the main vein.

CHILLIWACK SECTION.

For the purposes of this report this section includes that area south of the Fraser river, east of Chilliwack to the summit of the Coast range, just west of Hope, on the Canadian Pacific Railway, and east of Chilliwack lake at the International boundary.

There has been a great deal of staking throughout this section this year. Along the Chilliwack river and tributaries, mainly Slease creek, and in the vicinity of Chilliwack lake, about ninety claims were recorded this year. A number were also staked in the Cheam range and around Jones lake.

The only area examined this year was the Slease Creek basin. This is reached by auto-road from Chilliwack, 12 miles to the "packers' camp" on the Chilliwack river. From here supplies are packed into and bullion brought out from the property of the Boundary-Red Mountain Mines, situated at an elevation of 4,900 feet and south of the International boundary. From the "packers' camp" the trail follows the Chilliwack river through to Chilliwack lake, a distance of over 20 miles; at 7 miles the Slease Creek trail turns off and from there is 8 miles to the Boundary-Red Mountain Mines power-house in the Slease Creek basin. This trail was originally built to take in machinery to the *Lone Jack* mine on the United States side of the boundary.

The Boundary-Red Mountain Mines property is at present being worked under lease by five men, who have been operating it for the past two or three years with a crew of about fifteen men and making good wages. It is free-milling gold ore extending a limited depth, when sulphides are encountered. I understand that a tunnel driven several years ago about 900 feet below the upper workings cut 4 feet of sulphides carrying good values. Transportation, however, has so far prohibited any operation except for free-milling gold. There are now about fifty claims in good standing in the basin on the British Columbia side.

This company was incorporated in June, 1929, with its head office at 1109 Slease Creek Hornby Street, Vancouver. The capitalization is \$100,000, divided into 1,000 Mining and Development Co., Ltd. shares of \$100 each. The property consists of sixteen claims situated about half a mile off the main Slease Creek trail, turning off up the hill a short distance after crossing the bridge at Lentz's cabin. The predominating formation is granodiorite and diorite in which occur small pyritized quartz veins carrying gold values. The cabin is at 2,400 feet elevation and a short distance up Canyon creek an old tunnel was driven 50 feet into the bank with the object of cutting the vein supposedly exposed in the bluffs above. At 2,475 feet elevation a new tunnel has been driven 90 feet on a bearing of N. 22° W. (mag.), from which a crosscut will be driven into the hill to intersect the vein, which presumably strikes north-south, the same as the general formation. The vein in the bluffs was supposed to be exposed in an open-cut, but I could find no indication of it in the bluffs, and when the top was reached it was found that the open-cut was filled with heavy slide-rock from the cliffs. I therefore saw no vein nor ore of any kind.

Another vein was mentioned higher up, but after climbing to 3,600 feet elevation I found that a couple of shots had been put in a yellowish-stained belt of limestone, which showed no mineral anywhere. I was therefore not favourably impressed with the possibilities of this property.

Wissota and
Zenith.

This property consists of two groups of claims, one on Boundary creek, a small creek east of Canyon creek, and the other below Canyon creek along Slease creek. On the *Wissota* group, up Boundary creek, Mr. Lentz, of Sardis, the owner, showed me two alleged ore-croppings at 4,300 feet elevation where there is a small cabin. In the bed of a creek an open-cut of 10 feet continued as a tunnel a further 94 feet starts on a small seam of soft gouge along the east wall of a belt of diorite. The gouge widens in the tunnel to 4 feet, necessitating timbering all the way, as there is a heavy flow of water through it from the creek above. With the exception of a slight copper-stain near the mouth of the tunnel, there is no mineral of any kind, nor has any been discovered on the surface above. East of this, about 100 feet in another canyon, a similar gouge-seam can be traced up along the west wall, showing in one place a few crystals of zinc-blende, but nothing to warrant any work.

Below Mr. Lentz's main cabin, which is on the bank of Slease creek at 1,900 feet elevation, on the *Zenith* group, there is an exposure of slaty rock 6 to 8 feet wide, stained red from the oxidation of a small content of pyrite. The owner has started a tunnel in the creek-bank, which he proposes driving at least 100 feet to intersect this belt. There is no indication of copper where it is exposed, and I therefore advised that he should put in several open-cuts on the surface to find out whether there was anything worth driving for.

Judging from what I saw, I did not consider the area very attractive, but it might be worth some surface prospecting.

INSPECTION OF MINES.

REPORT BY JAMES DICKSON, CHIEF INSPECTOR OF MINES.

I have the honour to submit my annual report as Chief Inspector of Coal and Metalliferous Mines for the year ended December 31st, 1929. Appended thereto are the reports of the District Inspectors relative to the production of coal and number of persons employed; reports of the District Inspectors on metalliferous mines; reports of Instructors at Mine-rescue Stations; report of the Secretary to the Board of Examiners for coal-mine officials; and a list of the accidents reported under the provisions of section 71, subsection (1), "Coal-mines Regulation Act," and section 19, subsection (1), "Metalliferous Mines Regulation Act." A list of prosecutions carried out under the "Coal-mines Regulation Act" is also appended.

PERSONNEL OF STAFF OF INSPECTORS, INSTRUCTORS, AND BOARD OF EXAMINERS, AND THEIR ADDRESSES AT HEADQUARTERS.

Inspectors.

James Dickson.....	Chief Inspector, Victoria.
James Strang.....	Inspector, Victoria.
Robert Strachan.....	Senior Inspector, Fernie.
Henry E. Miard.....	Inspector, Fernie.
John MacDonald.....	Inspector, Fernie.
H. H. Johnstone.....	Inspector, Rossland.
James W. Jemson (now deceased).....	Inspector, Nanaimo.
George O'Brien.....	Inspector, Nanaimo.
Thomas R. Jackson.....	Inspector, Nanaimo.
John G. Biggs.....	Inspector, Merritt.
Thomas J. Shenton.....	Inspector, Prince Rupert.

Instructors, Mine-rescue Stations.

John D. Stewart.....	Nanaimo Station.
John Thomson.....	Cumberland Station.
John T. Puckey.....	Fernie Station.
William C. Stone.....	Middlesboro Station.

Board of Examiners for Coal-mine Officials.

James Dickson.....	Chairman, Victoria.
James Strang.....	Secretary, Victoria.
H. E. Miard.....	Member, Fernie.

Messrs. Strang and Miard and the Inspector of Mines of the district in which an examination is being held form the Board for granting certificates of competency to coal-miners. An Inspector of Mines is empowered to grant provisional certificates to miners for a period not exceeding sixty days between regular examinations.

INSPECTION DISTRICTS.

The Province is divided into six Inspection Districts, as follows:—

Inspection District.	Mining Divisions covered by Inspection Districts.
Vancouver Island.....	Victoria, Alberni, Clayoquot, Quatsino, and that portion of the Nanaimo Division situated on Vancouver Island.
Southern Coast.....	Vancouver, New Westminster, and that portion of Nanaimo Division situated on the Mainland.
Northern.....	Atlin, Liard, Stikine, Portland Canal, Nass River, Omineca, Peace River, Skeena, Bella Coola, and Queen Charlotte Islands.
Nicola-Princeton.....	Cariboo, Quesnel, Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, Similkameen, and Osoyoos.

Inspection District.	Mining Divisions covered by Inspection Districts.
West Kootenay and Boundary.....	Revelstoke, Lardeau, Trout Lake, Ainsworth, Slocan, Arrow Lake, Slocan City, Nelson, Trail Creek, Greenwood, and Grand Forks.
East Kootenay.....	Fort Steele, Windermere, and Golden.

The Inspectors inspect both the coal and metalliferous mines in their respective districts.

PRODUCTION.

The total tonnage produced by the coal-mines of the Province for the year ended December 31st, 1929, was 2,251,252 tons, being a decrease of 275,450 tons or 10.9 per cent. below the production of 1928.

The Coast District, which includes Vancouver Island, Nicola-Princeton, and Northern Districts, produced 1,364,546 tons, a decrease of 160,633 tons or 10.53 per cent. from 1928.

Vancouver Island collieries produced during 1929 1,120,805 tons, a decrease of 156,728 tons or 12.26 per cent. from 1928.

The Northern District produced 1,505 tons, a decrease of 163 tons compared with 1928.

Nicola-Princeton District produced 242,236 tons, a decrease of 3,742 tons or 1.52 per cent. from 1928.

East Kootenay District produced 886,706 tons, a decrease of 114,817 tons or 11.5 per cent. under 1928.

The coal companies producing during the year were: The Crow's Nest Pass Coal Company, Limited, and Corbin Coals, Limited, in East Kootenay District; the Coalmont Collieries, Limited, Middlesboro Collieries, Limited, Tulameen Valley Coal Company, Blue Flame Colliery (formerly Lynden Coal Company), Normandale Collieries, Limited, Ashington Coal Company, Limited, Canadian Coal and Briquetting Company, Limited, Gem Domestic Coal Company, Limited, Black Coal mine, and Pleasant Valley Coal-mine, in the Nicola-Princeton District; Telkwa Collieries, Limited, in the Northern District; and on Vancouver Island the Western Fuel Corporation of Canada, Limited, Canadian Collieries (Dunsmuir), Limited, Granby Consolidated Mining, Smelting, and Power Company, Limited, at Cassidy, Lantzville Colliery, Fiddick mine, Little Ash mine, Richardson mine, and Biggs' mine.

The following table shows the output and *per capita* production daily and for the year of the various mines:—

Colliery and Mine.	Gross Tons of Coal mined during Year.	Days worked.	Total No. of Employees.	Tons of Coal mined per Employee daily.	Tons of Coal mined per Employee for Year.	No. of Employees Under-ground.	Tons of Coal mined per Underground Employee daily.	Tons of Coal mined per Underground Employee for Year.
Nanaimo—								
No. 1 mine.....	307,755	255	761	1.54	404	561	2.20	549
Reserve mine.....	148,349	251	306	1.93	485	193	3.05	763
Wakesiah mine.....	60,228	265	125	1.79	482	83	2.73	725
South Wellington, No. 5 mine.....	36,816	100	59	6.24	624	44	8.36	836
Extension Colliery.....	104,211	176	325	1.81	320	239	2.45	431
Wellington, No. 9 mine.....	4,327	34	146	0.85	29	114	1.12	38
Comox Colliery.....	274,264	283	745	1.80	368	595	1.63	461
Granby Consolidated M.S. & P. Co.....	170,767	275	229	2.71	745	169	3.67	1,010
Lantzville Colliery.....	4,420	192	19	1.20	232	13	1.77	340
Fiddick mine.....	2,998	273	11	1.00	272	9	1.22	333
Little Ash mine.....	5,464	284	12	1.60	455	8	2.40	683
Richardson mine.....	766	154	6	0.82	127	3	1.65	255
Biggs' mine.....	440	127	3	1.14	146	2	1.73	220
Middlesboro Colliery.....	43,373	272	112	1.42	387	80	2.00	542
Coalmont Collieries, Ltd.....	149,750	257½	365	1.41	410	241	2.41	621
Tulameen Valley Coal Co.....	37,435	272	111	1.24	337	86	1.60	435
Pleasant Valley Coal Co.....	3,445	157	54	0.40	64	29	0.79	118
Ashington Coal Co.....	22	.....	19	.....	1	12	.....	2
Canadian Coal & Briquetting Co.....	200	.....	.....	.....	.....	.....	.....	.....
Blue Flame Colliery (Lynden Co.).....	6,360	87	71	1.02	89	45	1.62	141
Normandale Collieries, Ltd.....	183	.....	9	.....	20	6	.....	31
Gem Domestic Coal Co.....	538	73	8	0.91	67	6	1.22	89
Black Coal mine.....	928	.....	.....	.....	.....	.....	.....	.....
Telkwa Collieries, Ltd.....	1,505	162	8	1.16	188	6	1.55	251
Coal Creek Colliery.....	376,304	217	728	2.38	518	565	3.07	666
Michel Colliery.....	342,143	214½	584	2.26	585	421	3.78	812
Corbin Colliery.....	168,259	261	191	3.37	881	130	4.96	1,295

COLLIERIES OF VANCOUVER ISLAND INSPECTION DISTRICT.

The output of the Vancouver Island collieries was 1,120,805 tons. Of this amount, 90,226 tons or 8.05 per cent. was lost in preparation for the market; 86,544 tons or 7.72 per cent. was consumed by producing companies as fuel; and 941,108 tons or 83.96 per cent. was sold in the competitive markets.

Of the amount sold in the competitive markets, 851,921 tons or 90.52 per cent. of the amount sold and over 76.09 per cent. of the total output mined was sold in Canada, and 89,187 tons or 9.58 per cent. of the amount sold and 7.95 per cent. of the total amount mined was sold in the United States.

COLLIERIES OF THE NICOLA-PRINCETON INSPECTION DISTRICT.

Of the gross output of 242,236 tons produced by the collieries of the Nicola-Princeton District, 18,257 tons or 7.53 per cent. was consumed by producing companies as fuel and 223,289 tons or 92.16 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 222,212 tons or 99.51 per cent. of the amount sold and 91.73 per cent. of the total amount mined was sold in Canada, and 1,077 tons or 0.49 per cent. of the amount sold and 0.44 per cent. of the total amount mined was sold in the United States.

COLLIERIES OF THE EAST KOOTENAY INSPECTION DISTRICT.

Of the gross output of 886,706 tons produced by the collieries of the East Kootenay District, 39,953 tons or 4.50 per cent. was consumed as fuel, 103,109 tons or 11.51 per cent. was made into coke, and 706,824 tons or 79.60 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 474,607 tons or 67.13 per cent. of the amount sold or 53.41 per cent. of the total output was sold in Canada, and 231,655 tons or 32.87 per cent. of the amount sold and 26.12 per cent. of the total output was sold in the United States.

The following table shows the output and the *per capita* production of the various districts for the past twelve years:—

OUTPUT AND PER CAPITA PRODUCTION OF VARIOUS DISTRICTS.

Year.	District.	Gross Tons of Coal mined during Year.	Total No. of Employees at Producing Collieries.	Tons of Coal mined per Employee for Year.	No. of Men employed Underground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
1918	East Kootenay District	732,864	1,327	532	814	900
	Coast District.....	1,845,860	4,100	450	2,844	645
	Whole Province.....	2,578,724	5,427	475	3,658	705
1919	East Kootenay District	558,806	1,369	409	1,000	559
	Coast District.....	1,850,142	4,597	402	3,145	588
	Whole Province.....	2,408,948	5,966	404	4,145	581
1920	East Kootenay District	847,389	1,582	536	1,062	798
	Coast District.....	1,840,385	4,767	388	3,129	591
	Whole Province.....	2,696,774	6,349	425	4,191	643
1921	East Kootenay District	759,755	1,774	428	1,207	629
	Coast District.....	1,809,884	5,111	354	3,515	515
	Whole Province.....	2,569,639	6,885	373	4,722	544
1922	East Kootenay District	554,361	1,538	360	1,063	521
	Coast District.....	2,026,554	5,106	396	3,649	551
	Whole Province.....	2,580,915	6,644	388	4,712	547
1923	East Kootenay District	740,531	1,434	516	965	767
	Coast District.....	1,802,456	4,715	395	3,377	546
	Whole Province.....	2,542,987	6,149	413	4,342	585
1924	East Kootenay District	273,518	1,147	238	797	343
	Coast District.....	1,714,015	4,271	401	3,097	553
	Whole Province.....	1,987,533	5,418	366	3,894	510
1925	East Kootenay District	854,480	1,466	582	989	864
	Coast District.....	1,589,812	3,977	399	2,839	559
	Whole Province.....	2,444,292	5,443	449	3,828	639
1926	East Kootenay District	848,448	1,431	592	962	881
	Coast District.....	1,481,588	3,891	380	2,795	530
	Whole Province.....	2,330,036	5,322	437	3,757	620
1927	East Kootenay District	907,519	1,494	607	1,033	876
	Coast District.....	1,546,308	3,731	414	2,613	592
	Whole Province.....	2,453,827	5,225	469	3,646	673
1928	East Kootenay District	1,001,523	1,621	617	1,153	886
	Coast District.....	1,525,179	3,713	411	2,661	573
	Whole Province.....	2,526,702	5,334	473	3,814	662
1929	East Kootenay District	886,706	1,503	589	1,116	794
	Coast District.....	1,364,546	3,525	387	2,559	533
	Whole Province.....	2,251,252	5,028	447	3,675	612

The following table shows the production and distribution of coal by the various collieries and districts, compiled from returns furnished by the owners:—

COLLIERIES OF BRITISH COLUMBIA—PRODUCTION, 1920.

MINE.	SOLD.			Total Sales.	Lost in Washing.	Used in making Coke.	Used under Companies' Boilers, etc.	Total for Colliery Use.	STOCKS.		DIFFERENCE.		Output for Year 1920.
	In Canada.	In U.S.A.	Elsewhere.						First of Year.	Last of Year.	Added to.	Taken from.	
Vancouver Island.													
Canadian Collieries (D.), Ltd.—	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
South Wellington No. 5 mine.....	31,731	.....	.....	31,731	2,476	.....	2,609	5,085	.....	.....	.....	.....	(2,240 lb.) 36,816
Extension Nos. 1, 2, and 3 mines.....	52,175	27,042	.....	79,217	17,787	.....	7,632	25,399	405	.....	.....	405	104,211
No. 8 mine, Wellington Extension.....	3,924	.....	.....	3,924	280	.....	123	403	.....	.....	.....	.....	4,327
Comox Colliery.....	246,568	2,061	.....	248,629	24,296	.....	4,389	28,685	9,901	6,851	.....	3,050	274,264
Western Fuel Corporation of Canada—													
No. 1 mine.....	227,735	54,492	.....	282,227	6,202	.....	38,950	45,152	19,624	.....	.....	19,624	307,755
Reserve mine.....	108,386	.....	.....	108,386	4,829	.....	13,812	18,641	.....	21,322	21,322	.....	148,349
Wakesiah mine.....	41,925	.....	.....	41,925	4,724	.....	9,289	14,013	4,290	4,290	4,290	.....	60,228
Granby Cons. M.S. & P. Co., Ltd.....	126,318	5,592	.....	131,910	29,652	.....	8,811	38,463	597	991	394	.....	170,767
Lantzville Colliery.....	3,491	.....	.....	3,491	.....	.....	929	929	.....	.....	.....	.....	4,420
Fiddick mine.....	2,998	.....	.....	2,998	.....	.....	.....	.....	.....	.....	.....	.....	2,998
Little Ash mine.....	5,464	.....	.....	5,464	.....	.....	.....	.....	.....	.....	.....	.....	5,464
Richardson mine.....	766	.....	.....	766	.....	.....	.....	.....	.....	.....	.....	.....	766
Biggs' mine.....	440	.....	.....	440	.....	.....	.....	.....	.....	.....	.....	.....	440
Totals, Vancouver Island.....	851,921	89,187	.....	941,108	90,226	.....	86,544	176,770	30,527	33,454	26,006	23,079	1,120,805
Nicola-Princeton District.													
Middlesboro Collieries, Ltd.....	42,585	.....	.....	42,585	.....	.....	1,101	1,101	536	223	.....	313	43,373
Coalmont Collieries, Ltd.....	137,609	.....	.....	137,609	.....	.....	12,141	12,141	.....	.....	.....	.....	149,750
Tulameen Valley Coal Co., Ltd.....	32,317	452	.....	32,769	.....	.....	3,663	3,663	1,003	1,003	.....	.....	37,435
Pleasant Valley Coal Co.....	3,015	268	.....	3,283	.....	.....	162	162	.....	.....	.....	.....	3,445
Ashington Coal Co.....	22	.....	.....	22	.....	.....	.....	.....	.....	.....	.....	.....	22
Canadian Coal & Briquetting Co.....	.....	.....	.....	.....	.....	.....	200	200	.....	.....	.....	.....	200
Blue Flame Colliery (formerly Lynden).....	5,077	357	.....	5,434	.....	.....	926	926	.....	.....	.....	.....	6,360
Normandale Colliery.....	185	.....	.....	185	.....	.....	.....	.....	.....	.....	.....	.....	185
Getu Domestic Coal Co.....	474	.....	.....	474	.....	.....	64	64	.....	.....	.....	.....	538
Black Coal mine.....	923	.....	.....	923	.....	.....	.....	.....	.....	.....	.....	.....	923
Totals, Nicola-Princeton District.....	222,212	1,077	.....	223,289	.....	.....	18,257	18,257	536	1,226	1,003	313	242,236
Northern District.													
Telkwa Collieries, Ltd.....	1,505	.....	.....	1,505	.....	.....	.....	.....	.....	.....	.....	.....	1,505
Totals, Northern District.....	1,505	.....	.....	1,505	.....	.....	.....	.....	.....	.....	.....	.....	1,505
Grand totals, Coast District.....	1,075,638	90,264	.....	1,165,902	90,226	.....	104,801	195,027	31,063	34,680	27,009	23,392	1,364,546
East Kootenay District.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery.....	110,984	212,838	.....	323,822	.....	40,439	13,321	53,760	1,609	331	.....	1,278	376,304
Michel Colliery.....	263,446	.....	.....	263,446	.....	62,070	18,027	78,697	.....	.....	.....	.....	342,143
Corbin Coals, Ltd.....	100,177	18,817	562	119,556	24,039	.....	10,605	34,644	53,051	87,110	14,059	.....	168,259
Totals, East Kootenay District.....	474,607	231,655	562	706,824	24,039	103,109	39,953	167,101	54,660	67,441	14,059	1,278	886,706
Coal.													
Grand totals for Province.....	1,550,245	321,919	562	1,872,726	114,265	103,109	144,754	362,128	85,723	102,121	41,068	24,670	2,251,252

LABOUR AND EMPLOYMENT.

During the year 1929 there were 5,028 persons employed in and about the coal-mines of the Province, a decrease of about 5.7 per cent. compared with 1928.

The collieries were practically free from labour disputes during the year, the only time lost being through lack of trade.

Taking the average of all the mines in the Vancouver Island District, about 20 per cent. of the working-days were lost through lack of trade. Extension mines, No. 5 mine, South Wellington, and No. 9 mine, Wellington, were closed for the greater part of the year.

In the Nicola-Princeton District the different collieries worked from 84 to 90 per cent. of the working-days, averaging for the district about 88 per cent. of the working-days.

The mines in the East Kootenay District worked from 72 per cent. at the lowest to 87 per cent. at the highest of the working-days during the year and worked for an average for the whole district about 77 per cent. of the time.

The table on page 407 shows the number of persons ordinarily employed in and about the mines, distinguishing the persons and different classes employed underground and above ground, compiled from returns furnished by the owners, as required by section 66 of the "Coal-mines Regulation Act."

FUEL-OIL COMPETITION.

The coal production of British Columbia accelerated by fairly regular yearly increases until 1912, when the output was over 3,000,000 tons; since that time the use of coal has not kept pace with the expansion of general industries, but has steadily lost ground. This is due to the steadily increasing amount of power produced from hydro-installations and from the use of fuel-oil.

The effect of fuel-oil competition was first felt in the great reduction in the amount of coal exported from British Columbia to United States, as shown by the following percentages of total sales: 1910, 46.2 per cent.; 1915, 33.4 per cent.; 1920, 20 per cent.; 1925, 20 per cent.; 1926, 16 per cent.; 1927, 19.2 per cent.; 1928, 15.7 per cent.; 1929, 17.3 per cent. This loss of export trade due to the increasing use of fuel-oil in United States was aggravated by the importation of fuel-oil into British Columbia, cutting into the domestic market.

For a number of years this was directly imported as fuel-oil, but with the establishment of refining of crude-oil in British Columbia most of the fuel-oil now used is produced from this refining. There is a Dominion import duty of $\frac{1}{2}$ cent a gallon on fuel-oil imported as such, but crude oil imported by the oil-refining companies is not subject to any import duty, with the result that most of the fuel-oil at present displacing British Columbia coal in the home market is duty-free.

The following table shows the amounts of fuel-oil imported and produced in British Columbia:—

Year.	Imported Fuel-oil subject to $\frac{1}{2}$ Cent Gallon Duty. Gallons.	Fuel-oil produced in B.C. from Duty-free Crude Oil. Gallons.
1924	98,351,000	.....
1925	108,836,000	.....
1926	62,214,000	42,000,000
1927	42,954,000	79,000,000
1928	38,124,000	96,000,000
1929	35,697,000	110,000,000 to 120,000,000 (est.)

COMPETITION OF IMPORTED AND ALBERTA COALS IN BRITISH COLUMBIA.

During 1929 the imports from United States to British Columbia amounted to 18,849 short tons of anthracite and bituminous coal and 12,171 short tons of lignite; 207 tons were imported from other sources.

The sale of Alberta coal has increased greatly in recent years, as shown by the following table:—

Year.	Tons.	Year.	Tons.
1915	54,860	1923	108,326
1916	86,413	1924	114,186
1917	76,397	1925	117,037
1918	101,189	1926	127,858
1919	95,461	1927	187,028
1920	128,850	1928	262,198
1921	116,089	1929	247,060
1922	107,920		

The total tonnage of coal brought into British Columbia during the year was 278,287 tons.

HYDRO-ELECTRIC DEVELOPMENT.

There is at present in British Columbia 559,729 horse-power developed by water-power, most of which has been installed since 1910.

In the years 1910 and 1912 the gross output of the coal-mines in the Province reached 3,000,000 tons and at that time the developed water-power was 64,000 horse-power.

There is steadily increasing development of hydro-installations in British Columbia, as shown by the following table:—

Year.	Water-power developed. Horse-power.	Year.	Water-power developed. Horse-power.
1900	9,366	1923	355,718
1905	29,334	1924	355,718
1910	64,474	1925	414,702
1915	254,065	1926	460,562
1920	309,184	1927	473,142
1921	309,762	1928	523,902
1922	329,057	1929	559,792

In addition to the above developed hydro-power, new installations are nearing completion that will provide a further 149,000 horse-power, and when fully developed these new hydro-installations will generate 895,000 horse-power.

For purposes of comparison it may be stated that 1 developed horse-power a year is equivalent to the power value of 6 tons of coal.

PULVERIZED COAL.

During the year much information was gathered by this Department on the use of pulverized coal. Visits were made by the Inspection staff to the pulverized-coal plants of the British Columbia Sugar Refinery, Vancouver; Bamberton cement-works; the 7,500-kw. plant of the East Kootenay Power Company at Sentinel; the Washington wood-preserving plant at Spokane, Washington; and in August the Minister of Mines, accompanied by the Deputy Minister and other members of his staff, visited the pulverized-coal heating plant of the new James Madison School in Seattle in order to gain first-hand information of the value of coal used in this form.

While the use of coal in the pulverized form has become well established in large power plants where steam-generation is in use, the same cannot yet be said in regard to smaller plants.

The installation which was visited at Spokane consists of two boilers, each rated at 150 horse-power, and the plant at the Madison School in Seattle consists of two boilers, each of 125 horse-power.

It is worthy of note that the Spokane plant was operated for a number of years on fuel-oil and changed over to pulverized coal early in 1929. The main reason for the change was to reduce power costs and this has been accomplished.

This plant uses British Columbia coal from Coal Creek mines, and was formerly using fuel-oil at \$2.25 per barrel delivered.

As a result of the information gained regarding the economic and efficient operation of above-mentioned pulverized-coal plants and for the purpose of demonstrating the value of this system in moderately powered plants, the Minister of Mines, in conjunction with the Department of Public Works, has been instrumental in having a pulverized-coal unit provided in the new power-installation in the New Westminster Mental Hospital. This boiler is rated at 125 horse-power and will be given thorough tests to establish the relative merits of pulverized coal for steam-generation.

Arrangements have also been made by the Department of Mines, in conjunction with the Coyle Navigation Company, to install a pulverized-coal system on one of the largest tug-boats on the Pacific coast.

At the present time 1,000 tons of coal a week is being shipped to the Regina power plant for use in pulverized form.

It is confidently anticipated that there will be an increase in the use of coal in the pulverized form for steam-generation even in face of the present intense competition from fuel-oil.

ACCIDENTS IN AND AROUND COAL-MINES.

During 1929 there were 5,028 persons in and around the coal-mines. Twelve fatal accidents occurred during the year, as compared with fourteen for 1928.

The ratio of fatal accidents per 1,000 persons employed was 2.38, as compared with 2.64 in 1928. In 1927 the ratio was 2.10; in 1926, 1.88; in 1925, 1.10; in 1924, 1.66; in 1923, 7.32; in 1922, 4.66; in 1921, 1.45; in 1920, 2.67; the average for the ten-year period being 2.86.

The number of fatal accidents per 1,000,000 tons produced during 1929 was 5.33; during 1928 the fatalities per 1,000,000 tons mined was 5.54; in 1927, 4.48; in 1926, 4.3; in 1925, 2.45; in 1924, 4.52; in 1923, 1.76; in 1922, 12.01; in 1921, 3.98; in 1920, 6.30; the average for the ten-year period being 6.76 per 1,000,000 tons of coal mined.

The following table shows the collieries at which the fatal accidents occurred during 1929 and comparative figures for 1928:—

Name of Company.	Name of Colliery.	1929.	1928.
Western Fuel Corporation, Ltd.....	No. 1 mine.....	2	....
Western Fuel Corporation, Ltd.....	Reserve mine.....	....	4
Canadian Collieries (D.), Ltd.....	Extension mine.....	1	1
Canadian Collieries (D.), Ltd.....	Comox.....	2	....
Granby Consolidated M.S. & P. Co.....	Cassidy, No. 1.....	....	1
Coalmont Collieries, Ltd.....	No. 3 mine.....	2	....
Coalmont Collieries, Ltd.....	No. 4 mine.....	2	....
Crow's Nest Pass Coal Co.....	Coal Creek.....	2	7
Corbin Coals, Ltd.....	No. 4 mine.....	....	1
Lantzville Colliery.....	No. 2 slope.....	1	....
Totals.....		12	14

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for 1928:—

Cause.	1929.		1928.	
	No.	Per Cent.	No.	Per Cent.
By blowouts of coal and gas.....	....	.....	8	57.15
By falls of roof and rock.....	6	50.00	2	14.28
By mine-cars and haulage.....	6	50.00	2	14.28
Miscellaneous.....	....	.....	2	14.28
Totals.....	12	100.00	14	100.00

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the year 1929 and 1928:—

Cause.	1929.		1928.	
	No. of Fatal Accidents.	No. of Tons of Coal mined per Fatal Accident.	No. of Fatal Accidents.	No. of Tons of Coal mined per Fatal Accident.
By blowouts of coal and gas.....	.....	.....	8	315,837
By falls of roof and rock.....	6	375,208	2	1,263,351
By mine-cars and haulage.....	6	375,208	2	1,263,351
Miscellaneous.....	.....	.....	2	1,263,351
Totals.....	12	187,004	14	180,479

The number of tons mined per fatal accident during 1929 was 187,604 tons, compared with 180,479 tons for 1928. The average for the last ten years was 147,781 tons.

The following table shows the fatalities from various causes in coal-mines during the year 1929, compared with 1928, according to Inspection Districts:—

District.	NUMBER OF DEATHS FROM ACCIDENTS.						TOTAL.		ACCIDENT DEATH-RATE.				
	Explosions of Fire-damp.	Falls of Ground.	Blowouts of Coal and Gas.	Haulage and Mine-cars.	Miscellaneous (Underground).	On Surface.	1929.	1928.	Per 1,000 Persons employed.		Per 1,000,000 Tons of Coal mined.		
									1929.	1928.	1929.	1928.	
Vancouver Island.....	3	.....	3	.....	.....	.....	6	6	2.18	1.04	5.35	4.69
Nicola-Princeton.....	2	.....	2	.....	.....	.....	4	.....	5.19	.....	16.51	.....
East Kootenay.....	2	.....	.....	.....	.....	.....	2	8	1.33	4.93	2.25	7.98
Northern.....
Province (1929).....	7	.....	5	.....	.....	.....	12	.....	2.38	.....	5.33	.....
Province (1928).....	14	.....	2.64	.....	5.54

The following table shows the ratio of accidents per 1,000 employees and per 1,000,000 tons of coal mined in the Coast and East Kootenay Inspection Districts for the ten-year period ended December 31st, 1929:—

District.	No. of Fatalities.	ACCIDENT DEATH-RATE.	
		Per 1,000 Employees.	Per 1,000,000 Tons of Coal mined.
Coast.....	142	3.33	8.4
East Kootenay.....	23	1.53	2.8
For Province.....	165	2.86	6.76

The details regarding the occurrences of the fatal accidents in coal-mines during 1929 are as follows:—

The fatal accident which occurred to Edward Marche, timberman, No. 3 mine, Coalmont Collieries, Limited, on March 23rd was due to his being crushed between a mine-car and a stringer on the Main slope. Deceased was unloading timber from a trip on the Main slope and owing to some mistake the trip was moved, crushing Marche, with fatal results.

The fatal accident which occurred to Edward Gibson, timberman's helper, No. 2 mine, Coal Creek Colliery, on April 11th was due to a fall of roof. Deceased and his partner were retimbering a roadway when part of the roof caved without warning and partly buried both men; Gibson was dead when extricated.

The fatal accident which occurred to John Smith, electrical repairman on the surface haulage, Coalmont Collieries, Limited, on April 26th was due to his being run over by an electric motor and some mine-cars. Deceased was riding on front of the motor, which was travelling at a low speed, when apparently a jerk threw him on to the track, with above results. Deceased should have known that riding in the position he did was both unnecessary and dangerous.

The fatal accident which occurred to John Adamski, bratticeman, No. 1 East mine, Coal Creek Colliery, on June 15th was due to a roof cave which buried him. He had been told to put in a new set of timber on which to erect a ventilating-door and was instructed not to remove any of the existing timber. Deceased, contrary to orders, started to take out a post when the cave occurred which killed him.

The fatal accident which occurred to H. Yamanaka, driver, No. 4 mine, Comox Colliery, on June 17th was due to his being crushed by part of a runaway trip of loaded cars.

The fatal accident which occurred to Felix Doumont, miner, Lantzville Colliery, on June 27th was due to being struck by an empty car near the foot of the Main slope. Due to a lack of system on the surface, a car attached to the haulage-rope was pushed over the brow of the slope while the hoistman was absent. The car struck Doumont, who died two days later.

The fatal accident which occurred to James McWhirter, fireboss, No. 4 mine, Coalmont Collieries, Limited, on September 16th was due to being struck by a runaway trip on the Main slope.

The fatal accident which occurred to Chew Gah Ken, miner's helper, No. 4 mine, Comox Colliery, on September 23rd was due to being crushed between a loaded car and the side of the haulage incline. Deceased should not have been on this incline and was warned of the danger shortly before he was killed.

The fatal accident which occurred to Robert McLaren, miner, No. 3 mine, Coalmont Collieries, Limited, on September 26th was due to a part of the roadway near his working-place caving without warning and burying deceased with fine coal; death was due to suffocation.

The fatal accident which occurred to Alexander Rowan, fireboss, No. 1 mine, Western Fuel Corporation of Canada, Limited, on October 26th was due to a fall of rock. Deceased had fired a shot and on returning to the face to make his examination was caught by a fall of rock; he was in the act of examining the roof when killed.

The fatal accident which occurred to A. Badavinac, miner, No. 1 mine, Extension Colliery, on December 23rd was due to a large fall of rock. Deceased and his partner were engaged in timbering their working-place when the roof gave way without warning.

The fatal accident which occurred to Nazareno Casillo, miner, No. 1 mine, Western Fuel Corporation of Canada, Limited, on December 18th was caused by a fall of rock at a machine-cut face. Deceased had loosened some coal, which in falling displaced some posts and allowed the roof-rock to fall on him.

In addition to above, a man died on July 3rd, supposedly from the results of a scratch sustained in No. 3 mine, Coal Creek Colliery, on March 18th; no report was made by deceased until some considerable time after the presumed accident.

EXPLOSIVES.

The following table shows the quantity of explosives used in coal-mines during 1929, together with number of shots fired, how shots were fired, tons of coal produced per pound of explosive used, and the average pounds of explosive per shot fired (these quantities include all explosives used for breaking coal and rock-work in coal-mines):—

VANCOUVER ISLAND DISTRICT.

Colliery.	Quantity of Explosive used in Pounds.	Tonnage for Mine.	Total No. of Shots fired.	Tons of Coal per Pound of Explosive used.	Average Pounds of Explosive per Shot fired.
No. 1 mine, Nanaimo.....	80,895	307,755	135,819	3.80	0.59
Reserve mine, Nanaimo.....	56,005	118,349	74,688	2.65	0.75
Wakesiah mine, Nanaimo.....	22,045	60,228	36,155	2.72	0.69
South Wellington, No. 5 mine.....	19,014	36,816	26,872	1.93	0.70
Wellington Extension mines.....	45,180	104,211	55,711	2.30	0.81
No. 9 mine, Wellington.....	6,075	4,327	5,100	0.71	1.18
Comox Colliery.....	78,725	274,264	92,401	3.48	0.85
Granby Cons. M.S. & P. Co.....	38,410	170,767	37,708	4.44	1.01
Lantzville Colliery.....	4,400	4,420	4,450	1.00	0.99
Fiddick mine.....	2,050	2,998	3,250	1.46	0.63
Little Ash mine.....	2,850	5,464	5,700	1.91	0.50
Richardson mine.....	200	766	375	3.80	0.53
Biggs' mine.....	300	440	500	1.46	0.60
Totals for district.....	356,159	1,120,805	478,727	3.14	0.74

NICOLA-PRINCETON DISTRICT.

Middlesboro Collieries.....	9,750	43,373	16,550	4.45	0.59
Coalmont Collieries, Ltd.....	22,656	149,750	42,000	6.61	0.54
Tulameen Valley Coal Co.....	4,450	37,435	7,925	8.41	0.56
Ashington Coal Co.....	1,135	22	1,403	0.01	0.80
Pleasant Valley Coal Co.....	3,450	3,445	3,238	1.00	1.06
Can. Coal & Briquetting.....	1,000	200	700	0.20	1.42
Blue Flame Colliery.....	100	6,360	2,100	6.36	0.47
Normandale Colliery.....	160	185	200	1.15	0.80
Gem Domestic Coal Co.....	600	538	800	0.88	0.75
Black Coal mine.....	600	928	.....	1.54	.....
Totals for district.....	44,801	242,236	74,916	5.40	0.59

NORTHERN DISTRICT.

Telkwa Collieries, Ltd.....	950	1,505	875	1.58	1.08
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EAST KOOTENAY DISTRICT.

Coal Creek Colliery.....	2,373	376,304	2,332	116.43	1.01
Michel Colliery.....	17,568	342,143	16,525	19.47	1.07
Corbin Colliery.....	12,709	168,259	12,200	13.24	1.04
Totals for district.....	32,650	886,706	31,057	27.15	1.05
Totals for Province.....	434,560	2,251,252	585,575	5.18	0.54

QUANTITIES OF DIFFERENT EXPLOSIVES USED.

Monobel of different grades	Lb.
Miner's Friend	371,487
Permissible rock-powder	23,778
Dynamite	37,295
	2,000
Total.....	434,560

The following is a list of explosives permitted for use in coal-mines by the Honourable the Minister of Mines under the provisions of section 101, General Rule 11, clause (2), "Coal-mines Regulation Act":—

Nobel Monobel.	Miner's Friend No. 6.
Polar Monobel No. 3.	Miner's Friend No. 9.
Polar Monobel No. 4.	Polar CXLite.
Polar Monobel No. 6.	Polar CXLite No. 2.
Coalite "C" L.F.	

MACHINE-MINED COAL.

During the year 1929 mining-machines produced approximately 256,000 tons of coal or 8.8 per cent. of the total.

The following table gives the district, number of machines, how driven, and type of machine used:—

District.	NUMBER DRIVEN BY		TYPE OF MACHINE USED.			
	Electricity.	Compressed Air.	Mavor and Coulson.	Siskol.	Sullivan.	Rand.
Vancouver Island.....	4	20	8	9	7	....
Nicola-Princeton.....	....	14	....	12	....	2
East Kootenay.....	....	....	....	....	....	....
Northern.....	....	....	....	....	....	....
Totals.....	4	34	8	21	7	2

SAFETY-LAMPS.

There were 4,417 safety-lamps in use in the coal-mines of the Province. Of this number, 314 were flame safety-lamps of the Wolf type and 4,103 were electric lamps of various makes, as follows: Edison, 3,749; Wheat, 354. No open lights are allowed in the coal-mines of British Columbia.

The following table shows the distribution of lamps by district, method of locking, and illuminant used:—

VANCOUVER ISLAND DISTRICT.

Colliery and Mine.	METHOD OF LOCKING LAMP.		ILLUMINANT USED.	
	Magnetic Lock.	Screw or Automatic Clip.	Naphtha Gasoline.	Electricity.
No. 1 mine, Nanaimo.....	53	576	48	581
Reserve mine, Nanaimo.....	8	223	8	223
Wakesiah mine, Nanaimo.....	6	80	6	80
No. 5 mine, South Wellington.....	6	123	6	123
Wellington Extension Colliery.....	20	231	20	231
No. 9 mine, Wellington.....	5	140	5	140
Comox Colliery.....	35	715	35	715
Granby Colliery.....	9	170	9	170
Lantzville Colliery.....	6	24	6	24
Fiddick mine.....	1	6	1	6
Little Ash mine.....	2	7	2	7
Richardson mine.....	9	....	9	....
Biggs' mine.....	3	....	3	9
Totals for district.....	163	2,295	158	2,300

NICOLA-PRINCETON DISTRICT.

Colliery and Mine.	METHOD OF LOCKING LAMP.		ILLUMINANT USED.	
	Magnetic Lock.	Screw or Automatic Clip.	Naphtha Gasoline.	Electricity.
Middlesboro Collieries.....	7	60	7	60
Coalmont Collieries, Ltd.....	10	261	10	261
Tulameen Coal Co., Ltd.....	6	95	6	95
Pleasant Valley Coal Co.....	3	38	3	38
Ashington Coal Co.....	2	24	2	24
Canadian Coal & Briquetting.....	2	12	2	12
Blue Flame Colliery.....	3	56	3	56
Normandale Colliery.....	1	6	1	6
Gem Domestic Coal Co.....	1	6	1	6
Black Coal mine.....	1	7	1	7
Totals for district.....	36	565	36	565

NORTHERN DISTRICT.

Telkwa Collieries, Ltd.....	8	8
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EAST KOOTENAY DISTRICT.

Coal Creek Colliery.....	72	655	72	655
Michel Colliery.....	27	465	27	465
Corblin Colliery.....	13	118	13	118
Totals for district.....	112	1,238	112	1,238
Totals for Province.....	319	4,098	314	4,103

The following is a list of safety-lamps permitted for use in the coal-mines of British Columbia:—

APPROVED (ELECTRIC) SAFETY-LAMPS.

No. 1.—The electric lamp manufactured by the Edison Storage Battery Co., Orange, N.J., U.S.A., under approval No. 10 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD-17. The only bulbs approved for use with this lamp are the symbol BM-10 bulbs, manufactured by the National Lamp Works of the General Electric Co., Cleveland, Ohio; the symbol BM-10 bulbs, manufactured by the Edison Works of the General Electric Co., Harrison, N.J.; the symbol 26-V bulbs, manufactured by the Miniature Incandescent Lamp Corporation, 95 Eighth Avenue, Newark, N.J.; and the symbol BM-10 bulbs, manufactured by the Westinghouse Lamp Co., Bloomfield, N.J.

No. 2.—The Concordia approved portable electric (hand-lamp) mine-lamp, manufactured by the Concordia Electric Co., Pittsburgh, Pa., under approval No. 12 of the United States Bureau of Mines. The only bulbs approved for use with this lamp are the symbol Osram 08510 bulbs, sold by the Concordia Electric Company.

No. 3.—The Wico approved portable electric mine-lamp, manufactured by the Witherbee Igniter Co., Springfield, Mass., under approval No. 14 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD-43. The only bulbs approved for use with the lamp are the symbol BM-14 bulbs, manufactured by the Edison Lamp Works of the General Electric Co., Harrison, N.J.

No. 4.—The Concordia approved permissible portable electric mine-lamp, manufactured by the Concordia Electric Co., Pittsburgh, Pa., under approval No. 12 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD-17. The only bulbs approved for use with this lamp are the BM-15 bulbs, manufactured by the National Lamp Works of the General Electric Co., Cleveland, Ohio.

No. 5.—The Pioneer approved portable electric mine-lamp, manufactured by the Pioneer Electric Mine Lamp Co., Philadelphia, Pa., under approval No. 16 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification No. CD-31, and with battery-plates manufactured by the Electric Storage Battery Co., Philadelphia, Pa. The only bulbs approved for use with this lamp are the BM-16 bulbs, manufactured by the Edison Lamp Works of the General Electric Co., Harrison, N.J.

No. 6.—The Wheat approved portable electric mine-lamp, manufactured by the Koehler Manufacturing Co. (Inc.), Marlboro, Mass., under approval No. 17 of the United States Bureau of Mines. This lamp shall be used with a flexible cord identified by the Bureau's specification CD-31, and with battery-plates manufactured by the General Lead Battery Co., Newark, N.J. The only bulbs approved for use with this lamp are the BM-17 bulbs, manufactured by the National Lamp Works of the General Electric Co., Cleveland, Ohio.

(Unless otherwise specified, all lamps are cap-lamps.)

APPROVED (FLAME) SAFETY-LAMPS.

No. 12.—The bonneted, double-gauze lamp, with magnetic lock, known as the Wolf lamp.

No. 13.—The flat-wick steel-frame lamp, as specified in approval No. 201 of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 14.—The round-wick steel-frame lamp, as specified in approval No. 201-A of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 15.—The flat-wick steel-frame lamp, as specified in approval No. 202 of the United States Bureau of Mines, manufactured by Ackroyd & Best, Ltd., Arrott Power Building, Pittsburgh, Pa., U.S.A.

No. 16.—The flat-wick aluminium-frame lamp, as specified in approval No. 203 of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

No. 17.—The round-wick aluminium-frame lamp, as specified in approval No. 203-A of the United States Bureau of Mines, manufactured by the Koehler Manufacturing Co., Marlboro, Mass., U.S.A.

Approvals Nos. 201, 201-A, 203, and 203-A apply to magnetic-lock lamps that are equipped with steel gauzes. The only glasses approved for use with these lamps are marked "Macbeth No. 2100 High Speed." The only igniter approved for use with these lamps is the Koehler pyro internal igniter, 1915 model, using a cerium-zinc-copper alloy for igniter-points.

Approval No. 202 applies to a magnetic-lock lamp. The only glasses approved for use with this lamp are marked as follows:—

ACKd
BEST
A-1

This lamp is relighted electrically. The only relighter approved for this lamp is the Ackroyd & Best underground relighter.

NOTE.—While the use of flame safety-lamps is permitted, it is the policy of the Department of Mines to encourage the use of approved electric safety-lamps for all persons underground in the coal-mines, except such flame-lamps as may be required by the officials of the mines in the carrying-out of their duty.

ELECTRICITY.

Electric power is used for various purposes on the surface at thirteen mines and underground at six mines. The purpose for which it was used, together with the amount of horse-power in each instance, is shown in the following table:—

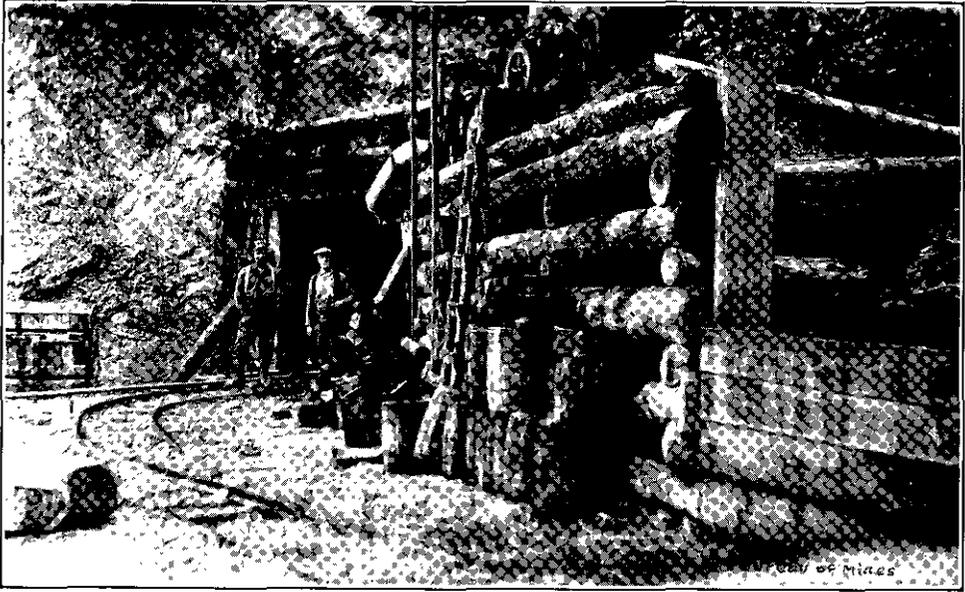
Above ground—	Nature of its Use.	Aggregate H.P.
Winding or hoisting		1,372
Ventilation		2,553
Haulage		425
Coal-washing		1,727
Miscellaneous		3,852
Total horse-power		9,929



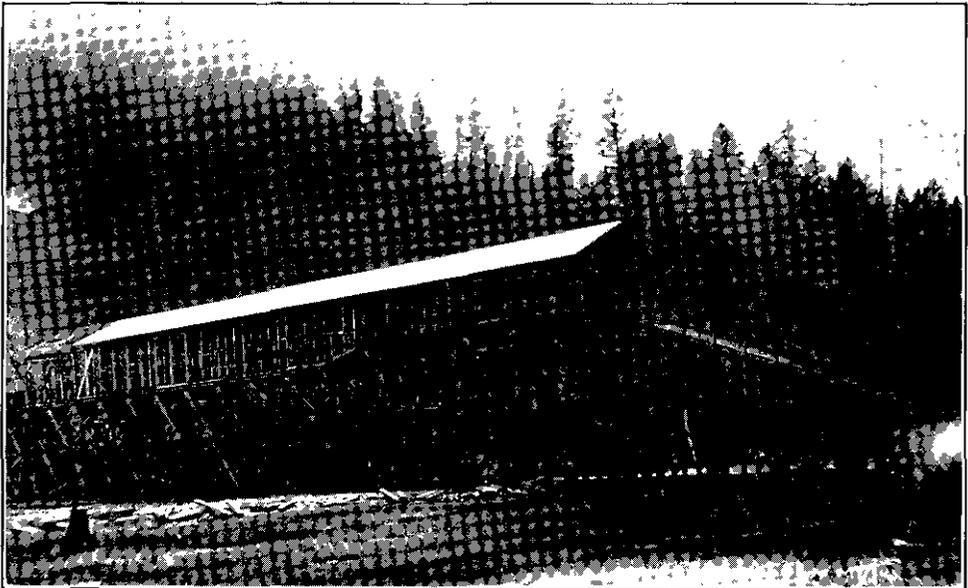
Coalmont Collieries, Ltd., Coalmont.



Crow's Nest Pass Coal Co., Ltd., Coal Creek.



Pleasant Valley Coal Co., Ltd.—Portal.



Pleasant Valley Coal Co., Ltd., Princeton.

Nature of its Use.	Aggregate H.P.
<i>Brought forward</i>	9,929
Underground—	
Haulage	1,940
Pumping	1,365
Coal-cutting	140
Miscellaneous	10
Total horse-power	3,455

Total horse-power above and under ground 13,374

Of the above amount, approximately 2,250 horse-power was operated as direct current and 11,124 as alternating current.

The electrical regulations passed in 1925 prohibits the use of electric locomotives by the open trolley-wire system after the 1st day of April, 1930; power being given to the Minister of Mines to grant exemption in special circumstances.

VENTILATION.

The District Inspectors' reports give details regarding the ventilation in the splits and main returns of the various mines. In one or two instances demands had to be made during the year for increases in the amount of air being circulated in a few of the splits in a few mines, but on the whole the provisions requiring adequate ventilation were generally well observed at the different mines.

USE OF THE BURRELL GAS INDICATOR.

The Burrell Gas Indicator is used in practically every ventilating-split at least once a month and continues to be the approved method of determining the CH₄ content in the mine atmosphere where the percentage is too small to be detected by means of the flame safety-lamp.

MINE-AIR SAMPLES.

Mine-air sampling was carried out as usual during the year and 130 samples were collected in the various coal-mines of the Province; of this number, twenty were spoiled in transit and accidents in the laboratory. While samples were taken in all the mines at intervals, this method is carried out most intensively in the mines of the Crowsnest Pass District, where the gas-outflow is much higher than in other mining districts of the Province. In Vancouver Island and also in the Crowsnest Pass Districts a large number of samples were taken in old workings and near the seat of fires.

The following table shows the analyses of mine-air samples taken in the various splits and main returns of the coal-mines in the Province during 1929 (the detailed analyses of mine-air samples taken in other portions of the various mines are on file in the office of the Chief Inspector of Mines):—

RETURNS FROM MINE-AIR SAMPLES TAKEN IN THE VARIOUS SPLITS AND MAIN RETURN AIRWAYS OF THE COAL-MINES OF THE PROVINCE DURING THE YEAR 1929.

Sample No.	Date	Mine.	Ventilating District.	Working or Idle.	Tonnage per Day.	Tonnage of Split per Day.	Chemical Analysis.			Velocity of Air in Feet per Minute.	Quantity of Air in Cubic Feet per Minute.	Barometer.	Hygrometer.			Cubic Feet of Methane per Day.	Cubic Feet of Methane per Ton.	Tons of Methane per Day.		
							CO ₂ .	O.	CH ₄ .				N.	Wet Bulb.	Dry Bulb.				Humidity.	
Vancouver Island.																				
115	March 12	No. 4, Comox (C.C.)	Main return, No. 1 slope.	Working	450	367	0.43	20.11	0.05	79.41	40,000	29.8				20	28,800	64	0.61	
116	" 19	No. 4, Comox (C.C.)	Main return, No. 2 slope.	Working	350	1,166	0.20	20.63	0.06	79.11	87,500	29.8				52	75,880	217	1.62	
117	April 12	No. 4, Comox (C.C.)	Main return, No. 1 slope.	Working	450	345	0.40	20.00	0.07	79.47	37,500	29.5				26	37,440	83	0.80	
118	May 14	Wakelash.	Main return.	Working	200	845	0.05	20.92	0.05	78.98	16,000	29.8	54.0	100.0		8	11,520	39	0.24	
119	May 14	Wakelash.	Long-wall return.	Working	150	300	0.08	20.32	0.18	77.44	15,000	29.8				324	466,560	3,110	9.98	
133	" 16	No. 5, Comox (C.C.)	Main return.	Working	450	685	0.16	20.88	0.08	78.90	30,000	29.5				54	77,760	172	1.66	
136	Sept. 22	No. 1, Cassidy	No. 4 Slope return.	Working	100	800	0.13	20.83	0.17	78.89	60,000	29.5				51	73,440	734	1.57	
137	" 27	No. 5, Comox (C.C.)	No. 3 Slope return.	Working	100	800	0.03	20.77	0.65	78.55	60,000	29.5				416	599,040	5,990	12.81	
138	" 27	No. 6, Comox (C.C.)	No. 1 Main return.	Working	450	400	0.37	20.21	0.05	19.37	42,000	29.5				21	30,240	467	6.65	
139	" 27	No. 4, Comox (C.C.)	Main return.	Working	600	800	0.34	20.51	0.30	78.95	65,000	30.0				195	280,800	448	6.01	
133	Oct. 8	Reserve mine.	17 Incline return.	Working	270	17,000	0.26	20.57	0.05	78.12	30,550	30.0	93.0			9	12,960	48	0.28	
122	Nov. 25	No. 2, Extension.	Main return.	Working	230	14,000	0.14	20.64	0.14	79.02	14,000	29.7	57.0	94.0		20	28,800	135	0.61	
125	Dec. 13	Wakelash.	Main return.	Working	145	26,000	0.22	20.61	0.05	78.12	26,000	29.9	55.0	93.0		13	18,720	130	0.41	
126	" 16	No. 5, South Wellington.	Main return.	Working	145	26,000	0.22	20.61	0.05	78.12	26,000	29.9	55.0	93.0		13	18,720	130	0.41	
Coal Creek Colliery.																				
1653	Jan. 4	No. 2 mine.	Main return.	Working	400	1,900	0.13	20.70	0.22	78.95	104,500	28.0	62.0	97.0		280	331,200	828	5.93	
1654	" 4	Nos. 1 and 2 mines.	Main Return fan-drift.	Working	700	470	0.21	20.51	0.25	79.03	154,000	28.0	60.0	100.0		390	561,600	1,135	10.09	
1655	" 5	No. 2 mine.	No. 2 split.	Working	400	200	0.31	20.64	0.27	78.94	42,500	26.1	63.5	84.0		115	163,600	828	5.08	
1657	" 5	No. 2 mine.	No. 1 split.	Working	400	200	0.16	20.61	0.39	78.84	45,000	26.1	60.5	61.0		176	253,440	1,217	4.69	
1658	" 8	No. 3 mine.	No. 1 split.	Working	400	150	0.14	20.49	1.23	78.12	22,400	27.0	57.0	58.0		280	403,200	896	7.40	
1659	" 12	No. 1 East mine.	No. 4 split.	Working	883	480	0.10	20.34	1.23	77.19	17,100	25.8	49.0	49.0		397	571,680	717	6.67	
1663	March 18	No. 1 East mine.	North return.	Working	800	100	0.14	20.52	1.10	78.24	14,000	25.0	51.0	51.0		1,386	995,840	339	9.82	
1664	" 18	No. 1 East mine.	No. 1 split.	Working	800	460	0.12	20.53	1.19	78.20	25,000	26.0	56.0	56.3		306	440,640	1,296	8.15	
1665	" 19	No. 1 East mine.	No. 2 split.	Working	800	340	0.23	20.26	1.27	77.95	45,500	25.0	70.0	70.5		667	960,480	557	17.76	
1668	" 31	No. 3 mine.	No. 2 split.	Working	400	270	0.23	20.26	1.27	77.30	260	25,400	26.0	49.0	50.0		509	747,360	471	13.82
1677	April 4	No. 1 East mine.	No. 4 split.	Working	800	300	0.11	20.46	1.37	77.76	350	28,000	25.0	48.0	49.0		468	673,920	2,461	12.47
1678	" 4	No. 1 East mine.	No. 3 split.	Working	800	210	0.18	20.20	2.04	77.09	400	28,000	26.0	57.0	59.0		722	1,039,680	931	19.23
1691	Nov. 8	No. 1 East mine.	North return.	Working	930	345	0.18	20.28	1.59	77.95	450	103,600	26.2	55.0	56.0		1,646	2,270,240	6,780	43.85
1693	" 8	No. 1 East mine.	North return.	Working	930	345	0.18	20.28	1.59	77.95	450	103,600	26.2	55.0	56.0		1,646	2,270,240	6,780	43.85
Michel Colliery.																				
646	Feb. 2	No. 3 mine.	Nos. 2 and 3 splits.	Working	750	550	0.18	20.52	0.75	78.55	27,500	25.8	54.0	54.0		206	296,640	539	5.49	
647	" 2	No. 3 mine.	No. 4 split.	Working	750	130	0.13	20.51	1.12	78.24	20,400	25.8	52.0	52.0		228	328,320	2,736	6.07	
648	" 2	No. 3 mine.	No. 5 split.	Working	750	80	0.08	20.75	0.63	78.51	260	13,000	25.8	48.0	100.0		86	123,840	1,548	2.29
649	" 2	No. 3 mine.	Main return.	Working	750	1,150	0.11	20.53	0.81	78.75	11,500	15,000	25.8	50.0	51.0		701	1,009,440	1,346	18.67
650	May 23	No. 3 mine.	No. 1 split.	Idle	750	1,140	0.12	20.69	0.87	78.82	140	10,640	26.1	50.0	51.0		39	56,160
653	" 27	No. 3 mine.	No. 2 split.	Idle	750	550	0.10	20.77	0.86	78.77	550	22,000	26.1	43.0	44.0		224	113,760
654	" 27	No. 1 mine.	Main return.	Working	750	850	0.10	20.75	0.68	78.47	350	35,910	26.1	44.0	100.0		779	351,360
655	" 27	No. 3 mine.	Main return.	Idle	750	1,200	0.09	20.77	0.39	78.75	1,200	80,400	26.1	47.0	47.0		314	452,160
Corbin Colliery.																				
49	March 11	No. 4 mine.	"A" Level return.	Working	100	520	0.14	20.84	0.23	78.79	18,720	24.3	45.0	45.0		43	61,920	619	1.14	
51	" 12	No. 6 mine.	"A" Level return.	Working	525	300	0.09	20.85	0.21	78.85	16,800	24.3	38.0	38.0		35	50,400	163	0.93	
52	" 12	No. 6 mine.	2 Level return.	Working	525	225	0.04	20.94	0.04	79.98	10,920	24.3	38.0	38.0		4	5,760	25	0.11	

INSPECTION COMMITTEES.

Practically all the mines throughout the Province have had inspection committees, appointed by the workmen under General Rule 37, section 101, "Coal-mines Regulation Act," who made monthly inspections on behalf of the employees.

The courtesy is acknowledged of many of the inspection committees in forwarding copies of their reports to this office. The different operations were reported by the above inspection committees to be in good condition generally.

COAL-DUST.

During 1925 regulations for precautions against coal-dust were put into force pursuant to the provisions of the "Coal-mines Regulation Act."

The floor, roof, and sides of every road or part of a road which is accessible must now be treated in one of the following ways: Either they shall be treated with incombustible dust in such manner and at such intervals as will ensure that the dust on the floor, roof, and sides respectively shall always consist throughout of a mixture containing not more than 50 per cent. combustible matter; or they shall be treated with water in such manner and at such intervals as will ensure that the dust on the floor, roof, and sides respectively is always combined throughout with 30 per cent., by weight, of water in the intimate mixture.

Tests of samples of dust, so taken as to be representative of the normal composition of the dust throughout the roads of the mine on the floor, roof, and sides respectively, shall be made as often as may be necessary, but not less frequently than once a month.

The results of the tests shall be posted at the entrance to the mine and recorded in a book to be kept at the mine for the purpose.

Since the passing of the regulations for precautions against coal-dust the operating companies have been giving this matter great attention, and through courtesy from them the Chief Inspector of Mines' office is furnished with copies of all tests made.

Practically all the coal-mines in the Province have now got their roadways up to standard required by the regulations.

VANCOUVER ISLAND COALS.

In the latter part of 1928 the Inspection Department, upon orders from the Honourable the Minister of Mines, took samples of different coals in the Nanaimo and Ladysmith districts and forwarded them to the "Low Temperature Carbonization, Limited," Barnsley, England, for testing in this low-temperature carbonization plant. Samples of 100 lb. each were sent and the results obtained are given in the Annual Report for 1928.

In addition, all available information regarding the different carbonization systems has been obtained. The information so far tends to the belief that there can be no standardized system and that what may be a success in one area would not be suitable for other areas.

In some cases the object in view is the more profitable utilization of the smaller sizes of coal which are sometimes difficult to dispose of at a profit; in other cases the production of a smokeless fuel is the main issue.

Many of the different processes produce the carbonized coal in such form that it must be crushed and used as pulverized fuel or else briquetted.

At the present prices prevailing on the Pacific coast of 5 to 6 cents a gallon for the tar-oils and 2 cents a gallon for the ammoniacal liquor recovered from ordinary coal, it would appear that some further advance is necessary before low-temperature carbonization can be accepted generally as a commercial success in this Western area.

There is no doubt that the vast amount of research being carried on at present in all coal-producing countries will result in more definite knowledge of the possibilities of this potential help to the coal industry.

DANGEROUS OCCURRENCES.

During 1929 there were reported, as provided for by section 71, subsections (c) to (h), twenty-two occurrences, as follows: Five blowouts of gas and coal; three bumps; ten under-

ground fires; three ignitions or explosions of gas and coal-dust, or both combined; and one case where the solid workings met a body of sand and water at depth. No lives were lost in the above occurrences.

EXPLOSIONS AND IGNITIONS.

EXPLOSION IN NO. 1 MINE, WESTERN FUEL CORPORATION OF CANADA, LTD., ON SEPTEMBER 27TH, 1929.

An explosion occurred in No. 1 East section, South side of No. 1 mine, Western Fuel Corporation, Limited, Nanaimo, on September 27th; this occurred a few minutes after the day shift had descended and none of the men had reached this area at the time of the explosion.

This section had been sealed off for a considerable time on account of a fire, and on September 22nd the fire seals were broken and a crew equipped with the oxygen rescue apparatus explored the section and found no signs of fire or heat. A team, also equipped with oxygen apparatus, examined the section again on September 23rd and found no signs of heat. The atmosphere showed a high percentage of methane and it was decided to remove this gradually by restoring the ventilation from crosscut to crosscut on the intake.

The work of restoring the ventilation was carried on until the morning of 27th; the fireboss had examined this district about 6 a.m. as far as the ventilation had been restored and reported same to be in good condition.

While only a few repairmen were employed in this district, a number of men were on day and afternoon shifts in another section inby from the entrance to No. 1 East. No one except the night-shift fireboss was in this part of the mine on night shift.

A number of men had reached a point some 2,000 feet outby from the point where the two sections diverge when an explosion occurred. They were alarmed by the shock and a following cloud of dust and immediately retreated and reported the occurrence. The manager and officials at once withdrew all men from the mine and with a small crew made an examination as far as the entrance to No. 1 East section. Some brattice and part of the frame of a trap-door was found burning; this was extinguished and seals built at once in the intake and return of this section and have not since been broken.

While no material damage was done outside of No. 1 East by this explosion, there was evidence of considerable violence for about 1,000 feet outby from the entrance to the section, and as the seat of the fire, the original cause of sealing off this section, was 1,800 feet from the entrance to the section, there is no doubt that the flame of the explosion travelled at least this distance.

When the seals were broken on the 22nd the precaution had been observed of treating with inert dust the area adjacent to the entrance to No. 1 East, and this doubtless helped to prevent the explosion from travelling farther. The cause of ignition was probably due to the fire not being completely extinguished, and reviving due to the restored ventilation.

FIRE IN NO. 1 EAST MINE, COAL CREEK COLLIERY, ON MARCH 25TH, 1929.

On March 25th indications of fire were discovered coming from a caved roadway in No. 1 East mine, Coal Creek Colliery, and operations were started with a view to loading out the heated material. The seam is exceptionally thick at this point and the roof had caved heavily so that the advance of this work was slow. Emergency water-lines were laid and track was laid to both ends of the caved area to facilitate the work, which was carried on continuously. By April 12th the actual fire was reached and late that night a small explosion occurred which slightly burned B. Caufield, the manager, and one of the men.

On the 13th a fall or slide of ground occurred above the fire, and while everything within reach had been saturated with water this fall was no doubt accompanied by a quantity of dry coal-dust. This immediately ignited and exploded. The resultant flame travelled some 200 feet and seriously burned ten men who were dealing with the fire. All the men excepting those engaged in fighting the fire had been withdrawn some days previously as a matter of precaution.

John Caufield, overman, who was supervising operations when the explosion occurred, made his way to the nearest telephone and gave the alarm, and then, in spite of his serious injuries, immediately returned to assist his men pending the arrival of help.

Air samples had been taken in the vicinity of the fire and none of them showed a methane content of 1 per cent., so that while there was some small amount of gas present, this explosion must have been practically a coal-dust explosion.

This mine in general is well treated with rock-dust and the area contiguous to the fire had been given a particularly general coating as an extra precaution; some men were engaged in further rock-dusting at the moment the explosion reached them.

While this occurrence reached serious proportions, there can be no doubt that the precautionary rock-dusting prevented it from developing into a disaster of magnitude. The work of dealing with the fire was carried on continuously until all the heated material was loaded out.

AN IGNITION OF GAS IN NO. 3 MINE, MICHEL COLLIERY.

An ignition of gas by an improperly fired shot occurred in No. 3 mine, Michel Colliery. This shot-hole was started in rock, but penetrated a small seam of coal and was charged with rock-powder. Previous heavy blasting had probably produced cracks which retained some gas in the vicinity of this hole. The gas ignited when the shot was fired and burned for some time; no one was injured and no damage was done.

ORDER STOPPING WORK UNDER AUTHORITY OF SECTION 87.

During 1929 the workings in a part of No. 4 mine, Comox Colliery, tapped a body of sand, clay, and water. This was in new workings and was apparently an underground channel that intersected the seam. Further advance was prohibited in this immediate area until some precautionary advance drilling, to determine the nature of the ground ahead, was carried out. This area has not been operated since.

PROSECUTIONS.

During 1929 there were five prosecutions made for infractions of the "Coal-mines Regulation Act" and special rules, all of which resulted in convictions.

MINE-RESCUE AND TRAINING.

The successful use of mine-rescue machines depends on having trained men to use them, and for the purpose of attracting the best men for this purpose mine-rescue and first-aid competitions are held in the different mining centres of the Province. During the year such competitions were held in Nanaimo (twice), Cumberland, Fernie, Merritt, Princeton, and Britannia.

The interest aroused by above competitions is of much value in bringing the best men in contact with the practical training given at the Government Rescue Stations situated in Nanaimo, Cumberland, Merritt, and Fernie.

The first demonstration at Princeton was held last Dominion Day and resulted in an efficient Mine-rescue and First-aid Association being formed by the mining men of this growing mining district.

Regular training in the use of self-contained rescue apparatus has been carried on through the year by the Government Rescue Stations at Nanaimo, Cumberland, and Fernie by experienced crews, and a large number of men went through the training course to qualify for certificates in this work.

In addition to the use of the oxygen apparatus, instructions are given in the use of the Burrell all-service gas-mask. In regard to the latter, while there is a wide field for its practical use there have been instances of improper use. This machine does not supply oxygen, but simply protects the wearer from noxious gases that may be present in the atmosphere.

In coal-mines it must not be used where a flame safety-lamp will not burn and in metaliferous mines a lighted candle should be used as a guide. In either case the light will show whether there is sufficient oxygen present to support life (a carbide-lamp will burn in an atmosphere that is dangerously low in oxygen and must not be used for this test).

In addition to the trained rescue crews that maintain a training schedule throughout the year, the following new men completed the mine-rescue training course and received certificates of competency for this work:—

Cert. No.	Name.	Where trained.	Cert. No.	Name.	Where trained.
621	Walter McKay.....	Michel.	639	Ernest Ramsell.....	Nanaimo.
622	Albert Parsons.....	Michel.	640	Archibald Courtney.....	Nanaimo.
623	Paul Williams.....	Michel.	641	John Christie.....	Nanaimo.
624	Jos. Kennedy.....	Michel.	642	Mathew Brown.....	Cumberland.
625	William Gregory.....	Michel.	643	William Bennie.....	Cumberland.
626	Jonathan Jenkinson.....	Michel.	644	Benjamin Horbury.....	Cumberland.
627	Steve Lazruk.....	Michel.	645	George Harvie.....	Cumberland.
628	David Litherland.....	Michel.	646	James Strang.....	Nanaimo.
629	J. T. Phillips.....	Michel.	647	Albert E. Rear.....	Fernie.
630	William H. Adams.....	Michel.	648	Wm. J. Lewis.....	Cumberland.
631	John C. McInnes.....	Michel.	649	Geo. I. Guy.....	Cumberland.
632	Albert Clare.....	Michel.	650	Thos. Monks.....	Cumberland.
633	John Johnston.....	Michel.	651	Campbell Morgan.....	Cumberland.
634	Taylor Jenkinson.....	Nanaimo.	652	Harry Taylor.....	Cumberland.
635	Hannes Maki.....	Nanaimo.	653	Alexander Dunsmuir.....	Cumberland.
636	William Pashley.....	Nanaimo.	654	Harry Bachelor.....	Michel.
637	James M. Good.....	Nanaimo.	655	Clement Stubbs.....	Michel.
638	John E. Anderson.....	Nanaimo.			

MINE-RESCUE AND FIRST-AID COMPETITIONS.

A successful and instructive demonstration of first-aid and mine-rescue work was held at Princeton on Dominion Day. Some eighty competitors took part in the first-aid problems and there was keen competition between teams from the coal and metalliferous mines of the district.

Splendid trophies for annual competitions were donated by Charles Bocking, Granby Consolidated Mining, Smelting, and Power Company; Blake Wilson, Coalmont Collieries, Limited; and Charles Hunter, Tulameen Coal Company.

To encourage this valuable work in this rapidly expanding mining area the Department of Mines provided appropriate prizes to the winning competitors and presented a pocket first-aid kit to all taking part in the demonstration.

A trained team from Coalmont Collieries gave a practical demonstration of the work capable of being performed by the use of the oxygen mine-rescue apparatus.

The Department of Mines cup for first aid was won by Blakeburn "B" team, with Blakeburn "A" team and Middlesboro team in second and third places respectively.

The Hunter challenge cup was won by Copper Mountain "A" team, with Blakeburn "A" team and Copper Mountain "B" team in second and third places respectively.

The Blakeburn shield was won by Copper Mountain "A" team, with Allenby in second place.

A notable feature was the number of juvenile teams of boys and girls who showed a marked proficiency in first-aid work and methods of resuscitation. The first prizes for both boys' and girls' team were won by Blakeburn, with Princeton teams in second place.

Much credit is due to the medical men of the district, who devoted much of their time to the instruction of the different first-aid classes and also filled the difficult position of judges at this competition.

The prizes were presented by the Honourable the Minister of Mines, who pointed out the value of first-aid and mine-rescue work to all employed in mining and allied industries.

The annual competition of the East Kootenay Mine Safety Association was held at Fernie on August 3rd. Six mine-rescue teams entered the mine-rescue problem, the first, second, and third places being won by Coal Creek team (J. Caufield, captain), Fernie No. 1 team (J. Hamer, captain), and Fernie No. 2 team (Wm. Hynds, captain) respectively. The other three teams represented Michel Collieries; there were only four points between the winning team and the lowest competing team.

In the first-aid competition nine teams entered for the Mines Department cup and nine for the confined competition; there were also three ladies' teams and four boys' teams.

The Mines Department cup was won by Captain A. Hilton's team from Fernie, with Captain J. Grundy second and Captain A. Arrowsmith third.

The senior confined prize was won by Captain J. Hamer's team, Fernie; with Captain H. Wheeler second and Captain W. Glanville, Kimberley, in third place.

A team of ladies from Michel, captained by Mrs. I. Causey, won the ladies' competition, with a Fernie team led by Mrs. J. Wilson in second place.

The work shown by the boys' team showed how thoroughly the first-aid movement is being appreciated by the younger generation. The fine demonstration of first-aid work by the teams of boys shows the value of juvenile first-aid training.

The prizes were presented by H. P. Wilson, general manager of the Crow's Nest Pass Coal Company, who has done much to further this work.

The fourteenth annual mine-rescue and first-aid competition of Vancouver Island and Coast District Branch, Mine Safety Association, was held at Nanaimo on September 2nd and attracted trained men from all the mining areas on the Coast.

The judges in the mine-rescue work were John G. Schoning, United States Bureau of Mines, who has had a wide practical experience in this work; Robert Strachan, Senior Inspector of Mines, Fernie; and James Strang, Inspector of Mines, Victoria.

Four mine-rescue teams, representing the Cumberland, Nanaimo, and Cassidy mining districts, took part in this competition, in which the Cassidy team, captained by George Hoggan, took first place, with Captain Watson's Cumberland team in second place; Captain Broderick's Nanaimo team and Captain Jackson's Cumberland team were in third and fourth place respectively.

In the first-aid work thirty-eight teams took part and gave practical demonstrations of the value of first aid to the injured. Two teams of boys and two of girls gave the first demonstrations and very clearly showed the value of early training in this work.

The McKenzie cup for novices was won by Captain T. Chapman and team. The Department of Mines cup was won by Captain Beveridge, of Cumberland, while Captain Williams, also of Cumberland, was second. A Nanaimo team captained by R. Reid, Nanaimo, won the Coulson cup, with Cassidy team, led by Captain McLaughlin, in second place. In addition to above, there were problems set for one- and two-men competitions.

The prizes were presented by Colonel C. W. Villiers, who emphasized the value of the service rendered by trained first-aid men to industry.

During the winter first-aid demonstrations were held at Nanaimo, Cumberland, and Britannia, which were of much value, not only in showing what trained men could do, but in arousing general interest in this work, which is of vital importance in mining and other industries.

During the year the Department of Mines distributed some 500 first-aid kits to competitors in the different mining centres in the Province.

EXAMINATIONS FOR CERTIFICATES OF COMPETENCY.

Two examinations for certificates of competency for coal-mine officials were held during 1929; details of these examinations are dealt with in the report of the Secretary to the Board.

Examinations for certificates of competency as coal-miners were held regularly during 1929 at the various mines.

SUPERVISION OF COAL-MINES.

During 1929 nineteen coal companies operated twenty-one collieries, with forty-five mines, employing 3,675 men underground.

In the supervision of underground employees there were sixteen managers, two safety engineers, twenty overmen, 114 firebosses and shotlighters, a total of 152, or one official for every twenty-five persons employed underground.

METALLIFEROUS MINES.

PRODUCTION.

The output from the metalliferous mines for 1929 was 6,977,681 tons, an increase of 736,371 tons over the tonnage for 1928. This tonnage was produced from 106 mines, of which forty-eight shipped 100 tons or more.

ACCIDENTS.

There were fourteen fatal accidents in and about the metalliferous mines in 1929, being the same as the figures for 1928.

There were 4,978 persons employed in and about the metalliferous mines in 1929.

The ratio of fatal accidents was 2.81, compared with 2.70 for 1928. The ratio for the last ten-year period was 2.71.

The tonnage mined per fatal accident was 498,406, compared with 445,807 tons per fatal accident for 1928.

The tonnage mined per fatal accident for the last ten-year period was 433,624 tons.

The following table shows the mines at which fatal accidents occurred during 1929 and comparative figures for 1928:—

Mining Division.	Mine.	No. OF ACCIDENTS.	
		1929.	1928.
Vancouver.....	Britannia.....	7	4
Nanaimo.....	Caledonia.....	....	1
Slocan.....	Mammoth.....	1	....
Ainsworth.....	Whitewater.....	1	....
Fort Steele.....	Sullivan.....	1	1
Similkameen.....	Copper Mountain.....	....	1
Kamloops.....	Aberdeen.....	....	1
Nass River (Northern).....	Hidden Creek.....	1	3
Portland Canal (Northern).....	Lakeview.....	....	1
Portland Canal (Northern).....	Premier.....	....	2
Portland Canal (Northern).....	Big Missouri.....	2	....
Skeena.....	Bonanza.....	1	....
Totals.....		14	14

The following table shows the cause, the percentage to the whole of the fatal accidents, with comparative figures for 1928:—

Cause.	1929.		1928.	
	No.	Per Cent.	No.	Per Cent.
By blasting.....	3	21.43	3	21.43
By falling into chutes, raises, and shafts.....	4	28.57	5	35.71
By falls of ground.....	4	28.57	6	42.86
Haulage.....	3	21.43	....	.....
Totals.....	14	100.00	14	100.00

The fatal accident which occurred to R. Lukich in *Britannia* mines on January 11th, 1929, was due to falling through a grizzly. Deceased and partner were attending to passing ore through this grizzly when a piece of ore from the chute rebounded across the grizzly and struck deceased in the stomach, causing him to double up and fall forwards into grizzly, where he was killed.

The fatal accident which occurred to Frank Norman, miner, and John Stohlberg in the *Big Missouri* mine on February 11th was due to their being blasted by a round of shots in their working-place. As Stohlberg was killed instantly and Norman died without regaining consciousness, the actual cause of their being at the face at the time of the blasting is unknown.

The fatal accident which occurred to Sam Markovitch, nipper, *Britannia* mines, on February 28th, 1929, was due to falling into a chute from a bulldoze chamber which was under construction. Deceased had been sent to another part of the workings for some drill-steel and had no legitimate reason for going to the place where he was killed.

The fatal accident which occurred to Lawrence Watt, barman, *Bonanza* mine, on March 6th, 1929, was due to a fall of ground. Deceased was barring down a slab of rock from the roof and when the rock fell it struck him, with fatal results.

The fatal accident which occurred to Edward Kemp, miner, *Sullivan* mine, on March 9th, 1929, was due to a fall of ground. Deceased was engaged in block-holing when a large rock fell from the back and rolled down on deceased, instantly killing him.

The fatal accident which occurred to Charles Walstrom, miner, *Britannia* mines, on March 12th, 1929, was due to falling from a ladder. Deceased was at work replacing ladders that had been damaged by blasting and apparently trusted himself to some of the damaged ladders in this work. Other members of the crew suggested that he should use safety-ropes, but he continued to work without this precaution.

The fatal accident which occurred to Andrew O. Westerbacka, miner, *Whitewater* mine, on April 25th, 1929, was due to blasting. It would appear that deceased had experienced trouble in spitting a round of holes and had delayed too long at the face.

The fatal accident which occurred to Marko Blazevich, mucker, *Hidden Creek* mine, on May 4th, 1929, was due to deceased being carried into a chute when the ore on which he was standing moved unexpectedly.

The fatal accident which occurred to Severin S. Mosti, miner, *Mammoth* mine, on June 13th, 1929, was due to a fall of ground at the face of a raise where deceased was at work.

The fatal accident which occurred to John Hawrluk, mucker, *Britannia* mine, on June 22nd, was due to being struck by some ore which had "hung up" in a chute and which later came down with sufficient violence to wreck the chute-doors. Some pieces of the ore struck deceased, with the result that he died four hours later.

The fatal accident which occurred to William Downie, motorman, *Britannia* mines, on July 16th, 1929, was due to a head-on collision of the motor driven by deceased and another train. This haulage system is provided with an electric block system, but deceased disregarded the signals.

The fatal accident which occurred to E. W. Wilkinson, trackman, *Britannia* mines, on August 27th, 1929, was due to his being crushed between a motor-train and the side of the haulage-tunnel. There is good clearance to walk on the opposite side of the track where deceased was killed, but for some unknown reason he crossed in front of the train to the narrow side and was crushed. The train was moving at the rate of 2 to 3 miles an hour at the time.

The fatal accident which occurred to Samuel Thompson, nipper, *Britannia* mines, on September 6th, 1929, was due to his being pinned by some drill-steel that was loaded on cars which he was pushing ahead of his motor. The steel had projected over the side of the cars and the front end of the steel caught against the side of the tunnel, with the result that the other end of the steel impaled deceased against his motor. It is directly against the rules of this company for employees to convey long steel ahead of the motors.

MINE-AIR SAMPLING.

During the year mine-air samples were taken in all mines where it was thought necessary to ascertain the conditions of the atmosphere. The samples were sent to the Mines Branch, Ottawa, for analyses, and only in a few cases was the oxygen content found to be below normal and no appreciable amount of noxious gases was found.

MINE-RESCUE WORK.

At *Britannia* mines, *Sullivan* mine, *Copper Mountain* mine, *Hidden Creek* at Anyox, *Premier*, and several others, mine-rescue apparatus have been purchased and men selected for training in the use of same.

The Burrell all-service gas-mask has been found particularly satisfactory for this work, as it is seldom that an emergency will arise where there is not sufficient oxygen to sustain life, provided that the men dealing with such emergency are protected against the effect of poisonous gases.

FIRST-AID AND ACCIDENT-PREVENTION WORK.

All the larger operating companies have carried on or inaugurated accident-prevention work during the year.

In the case of the larger mines a safety-first engineer devotes all his time to the promotion of safety methods of performing the work both underground and above.

Meetings are held and every effort made to interest the employees in taking an individual share in this work, as it is realized that a very large percentage of accidents is due to some act of commission or omission on the part of the injured party.

It is only by complete co-operation on the part of all concerned that greater safety, with a consequent reduction of accidents, can be attained.

Second only to accident-prevention, the first-aid work carried on by the different companies and employees has made distinct advances during the year. The service rendered by qualified first-aid men is often of vital importance to injured men, particularly in the more isolated camps, where a considerable time may elapse before the services of a medical man can be secured.

CONCLUSION.

I desire to express my appreciation of the faithful co-operation and assistance afforded during the year by the District Inspectors and Instructors in mine-rescue work. I also wish to thank the management and employees at the various collieries for the assistance and support given in making operations as safe as possible and look forward to a continuation of the same during the coming year. It is only by the closest and efficient co-operation of all parties concerned that we can keep down the number of accidents and make the mining industry a safer and more congenial occupation.

I am much indebted to the Director of the Mines Branch at Ottawa for co-operation in the work of mine-air sampling, and the Dominion Government for furnishing the sample-bottles and making all analyses free of charge.

REPORTS OF METALLIFEROUS MINES INSPECTORS.

NORTHERN INSPECTION DISTRICT.

REPORT BY THOMAS J. SHENTON, INSPECTOR.

I have the honour to submit my annual report for the year 1929 on the Northern Inspection District, including the following Mining Divisions: Atlin, Portland Canal, Liard, Nass River, Omineca, Stikine, Bella Coola, and Queen Charlotte. Conditions generally at the various mines and prospecting operations in this district were found to be satisfactory and in compliance with the provisions of the "Metalliferous Mines Regulation Act." In some instances certain matters were not quite satisfactory, but in such cases ready compliance was made with requests for changes or improvements.

ATLIN MINING DIVISION.

Engineer.—This mine is operated by the Engineer Gold Mines, Limited; Chas. V. Bob, president, New York; L. P. Jubien, secretary; C. H. Herscham, manager, Engineer, B.C.; R. Roxborough, superintendent; D. McKay, foreman. This mine is situated on the east side of Taku arm, Tagish lake, some 65 miles from Carcross.

Operations ceased temporarily in the fall of 1928 and recommenced early in June, 1929. The lower workings of the mine had been allowed to fill with water, which was pumped out again during June. Operations for the year were suspended in September. An average of twenty men was employed during operations. No ore was milled or shipped during the year.

PLACER OPERATIONS.

Rose Lease.—This is an underground and surface placer operated by P. Matson and L. Shultz, of Atlin. An average of five men was employed during the year. During my inspection of this property I found first-aid supplies satisfactory and transport provided for; also found the ventilation of underground workings to be good.

Ophir Group.—Owned by F. Fitch, Atlin. This underground placer was operated throughout 1929 with an average of two men. During my visit of inspection provisions for first aid were found to be satisfactory and camp accommodation good. Also found timbering, ventilation, and general conditions of the mine satisfactory.

Jack Lease.—Owned and operated by E. Turnquist and R. Roxborough, Atlin. This operation has a tunnel 800 feet in, which was found to be well timbered. During the year there were five men employed. During my visit of inspection I found provisions for first aid to be satisfactory, powder properly cared for, and camp accommodation to be good. Ventilation was fair and general conditions satisfactory.

Boulder Creek.—Operated by the Consolidated Mining and Smelting Company; E. E. White, manager, Atlin; H. P. Pearse, superintendent, Atlin. Operations commenced early in the spring of this year. This is a hydraulic operation with one large monitor in use. Twelve men were employed during the year. No shipment of gold or clean-up had been made up to the time of my visit. Provisions for first aid were satisfactory and camp accommodation good. General conditions were found to be satisfactory.

Boulder Creek Placer.—Owned by A. Nelson and Axel Nelson, Atlin. Lease includes *Mable, Clinton, Hardscrabble, Edward,* and *Enemclaw* claims. This property is worked only during the summer months. Five men were employed at the time of my visit and I found first-aid supplies satisfactory, explosives properly cared for, camp accommodation good, and conditions in general satisfactory.

Otter Creek.—Owned by Compagnie Française des Mines d'Or du Canada; J. E. Moran, manager; N. Chapman, superintendent. This is a large open placer hydraulic operation with three large monitors in use; employing an average of twenty-six men. In addition to the placer-work the company operates a small sawmill for cutting timber for building flumes, etc. The company is now installing a new "Economy" flume, which is expected to effect a very considerable saving. I found camp accommodation to be in good order, storing of powder and supply of first-aid apparatus satisfactory, and the operations to be in good condition generally.

Wright Creek.—Operated by Moran & Hodge. Operations are carried on by means of one large hydraulic monitor, with an average employment of two men. During my inspection I found camp accommodation to be good and general conditions of the mine to be satisfactory.

Discovery Group.—Operated by Discovery Mining and Development Company; A. Sostad, manager; G. Holmgans, foreman. Three large monitors are kept in constant operation and seventeen men were employed. Camp accommodation was found to be ample and sanitary. First-aid supplies are kept on hand and conditions in general were found to be good.

Link Lease.—Owned by Maurice Bride, Atlin. This is partly an open placer and partly underground. The owner works continuously throughout the year, part time in open placer and the balance underground. Only one man is employed here. I found the operation to be in fair order.

Hardscrabble Lease.—Operated by J. R. Cay, Atlin. This is an open placer, employing two men. General conditions in camp, first-aid supplies, and explosives were found to be satisfactory.

Gladstone Lease.—Owned by J. Cole and J. Beaton, Atlin. This operation is entered by a shaft 90 feet deep, but owing to high water prevailing here I was unable to enter the workings. Operations commenced in the early part of the year, but at the time of my visit the workings were inundated by water. Camp accommodation, first-aid supplies, and blasting materials were all found to be in good order.

Storm Lease.—Operated by J. Brown, Atlin. The workings of this operation are entered by a shaft 80 feet deep, which is furnished with ladders and platforms for travelling, but owing to high water in the workings I was unable to inspect same. On previous inspections I have found timbering in shaft and roadways good, ventilation rather sluggish, but all other matters satisfactory.

Clydsdale Lease.—Operated by Benton & McPherson, Atlin. This is an underground placer entered by a shaft 80 feet deep. Owing to the workings being filled with water it was impossible at the time to make an inspection. Camp accommodations were found to be good, first-aid supplies, powder, and blasting material satisfactory and in good order.

Joker, Poker, and Croker Lease.—Owned by Isaac Matthews, Atlin. This operation is entered by an 80-foot shaft with a slope to bed-rock. Owing to the workings being filled with water I was unable to make an inspection. Five men were employed installing machinery in readiness for subsequent early operation when the water had subsided. Camp accommodation was good, explosives were properly stored, and conditions in general satisfactory.

McKee Creek.—This placer is operated by the Delta Gold Mining Company, Limited. One large hydraulic monitor is in operation with an average employment of five men. Camp accommodation was found to be good and general conditions satisfactory.

Dorothy Lease.—Operated by Morris & Kotticher, Atlin. This is an underground placer entered by a slope to hard-pan 75 feet long, with a drift of 300 feet to the face-workings. During the year there were four men employed. I found timbering and ventilation to be fair, camp accommodation good, provisions made for first-aid satisfactory, and general operating conditions good.

OMINECA MINING DIVISION.

USK SECTION.

Shenandoah.—Owned by A. A. McDonald, Usk. The property is now under option to R. W. Seelye, of Seattle, Wash. G. Glover, mining engineer; D. McLarty, mine superintendent. Operations for the year commenced on June 24th, the chief work of the season was installing machinery. A crew of nineteen men was employed and some little tunnelling was carried out until October 20th, when operations were again suspended for the winter.

Valhalla and Kleanza.—Operated by the Columario Gold Mines, Limited; J. Willman, superintendent; J. Bell, mine foreman. This property is situated 7 miles from Usk in a south-westerly direction. It has been worked continuously throughout the year with an average crew of sixteen men. The management has installed a portable Ingersoll-Rand compressor of 45 horsepower and a steel-sharpener. No shipment of ore has been made during the year, but much development-work has been done.

PACIFIC SECTION.

M. & M.—Operated under option by the Consolidated Mining and Smelting Company, Limited; G. Giegerich, superintendent; A. Newman, mine foreman. This operation is 12 miles

from Pacific in a southerly direction and is at an elevation of 4,456 feet. The chief work carried on during the year was stripping and tunnelling.

CEDARVALE SECTION.

D.W.—Operated under option by the Consolidated Mining and Smelting Company, Limited; G. Shannan, superintendent. The original owner is Steve Young, of Cedarvale, and I have been informed that the option held by the above company has been dropped. Operations in the inclined shaft were discontinued in February and some stripping was started which continued until October 14th with an average employment of twelve men. No ore was shipped during the year. Camp accommodations were found to be in good order.

HAZELTON SECTION.

Rocher Deboule.—Operated by the Aurimont Mines, Limited; Nichol Thompson, president; G. L. Salter, secretary-treasurer; D. Harris, manager. Operations continued here until April 11th, 1929. The production for the year, which amounted to 80 tons, was shipped to Trail. I did not visit the mine owing to the short period of operation making it impossible.

Silver Cup.—Operated by the Duke Mining Company, Limited; W. Dornberg, managing director; Gus Kvist, superintendent; E. Bertlin, mine foreman. Operations at this mine continued from the beginning of the year until the month of December with an average crew of forty men. I had occasion to request several matters to be remedied during the year, and on my last inspection found this operation to be in reasonable compliance with the requirements of the "Metalliferous Mines Regulation Act."

Mohawk.—D. Harris, manager; H. Harris, superintendent. This mine, with a crew of ten men, has operated throughout the year with the exception of about two weeks. The work consisted chiefly of development by tunnel. No ore was shipped during the year. The power plant consists of a portable compressor of 45 horse-power. The camp buildings are adequate and sanitary.

SMITHERS SECTION.

Duthie.—Operated by the Atlas Mining Company, Limited; O. Banks, managing director; C. B. North, assistant manager; A. G. Hattie, superintendent; A. Nelson, mine foreman. Operations were continuous throughout the year with an average employment of ninety-six men; the development of the ore-body being the chief work. A 2-compartment shaft 100 feet deep has been put down from No. 5 level, and a large amount of drifting and crosscutting has also been done. The mill was idle for the first five months of the year while new machinery was being installed, but commenced operations during the month of June and continued until the end of the year. A modern camp has been completed, including an emergency first-aid room in charge of a qualified first-aid man. During my inspections I found the management always willing to co-operate with me in all matters for the welfare of the workmen.

Duchess.—Operated under option by the Consolidated Mining and Smelting Company, Limited; S. Giegerich, superintendent; G. Bell, foreman. Operations at this mine were carried on from the beginning of the year until August 8th with an employment of eighteen men; work then closed for the year.

TOPLEY SECTION.

Richfield.—Operated by the Topley-Richfield Mining Company, Limited; J. C. McCutcheon, superintendent; W. W. McDowal, mine foreman. Operations here were carried on throughout the year with a crew of thirty-seven men until the end of October, when the mine was closed down. On my last visit in October I found that the rails and equipment had been removed to the surface from No. 2 level.

Golden Eagle.—Operated by the Topley Silver Mining Company, Limited; T. D. Pickard, managing director; A. Beaton, mine foreman. This property was under option and operated in the early part of the year by this company. In the month of April, however, the option was dropped. Several buildings on the surface had to be changed during the year to more fully comply with the regulations.

SIBOLA SECTION.

Emerald.—Operated by the Consolidated Mining and Smelting Company; H. C. Hughes, superintendent; B. D. Gallagher, mine foreman. This property is some 65 miles from the

railway and is reached by water, 23 miles on Ootsa lake and 42 miles on Ootsa river, for about nine months of the year. In winter sleds have to be used. The elevation of this mine is 6,000 feet. Throughout the year there was a crew of eighteen men employed.

Swannell.—Operated by the Tahtsa Mining Company, Limited; C. L. Copp, manager; H. Gillis, mine foreman. This operation commenced early in July and worked continuously throughout the year. The mine is about the same distance from Ootsa Landing as the *Emerald*, and 3 miles from the latter, at an elevation of 5,000 feet.

HOUSTON SECTION.

Owen Lake.—Operated by the Owen Lake Mining and Development Company, Limited; F. H. Taylor, general manager; L. Foss, superintendent; J. Dean, mine foreman; C. Cox, mining engineer. This mine is situated 32 miles in a southerly direction from Houston. Operations have been continuous throughout the year with a crew of forty-two men. Inspections of the mine were made during the year and operations were found to be satisfactory.

SKEENA MINING DIVISION.

COAST SECTION.

Surf Point.—Operated by J. Paterson & Associates, Refuge Bay; J. S. Woodsworth, manager; M. Shaughnessy, mine foreman. This mine is located on Porcher island, some 30 miles south of Prince Rupert. Operations have been continuous throughout the year with an average employment of thirteen men. Two inspections were made during the year and operations were found to be satisfactory.

DOUGLAS CHANNEL SECTION.

Los Angeles-Vancouver.—Operated by the Los Angeles-Vancouver Mining Company, Limited; F. Rannells, manager. Operations here recommenced during the month of April and continued until the end of the year with an average employment of thirty-two men. Work is being carried on at a new lower tunnel to tap the No. 1 tunnel-workings about 100 feet higher up the hill. In my inspection of the operation I found all matters to be in accordance with the "Metalliferous Mines Regulation Act."

KHUTZE INLET SECTION.

Western Copper.—Operated by the Detroit Western Mining Corporation; W. B. Smith, manager; S. Bryant, superintendent. This mine operated, with a few minor stops, from the beginning of the year until the end of October. There were thirty-three men employed at this mine. During July 72 tons of ore was shipped. In my inspections I found the operation to be in good order.

BELLA COOLA MINING DIVISION.

Beale's Lime-quarry.—Owned and operated by J. F. Beale, Bella Bella. The work in this operation is conducted by J. Coulter, who has had considerable experience in such work and who supervises the blasting operations. In accordance with the new "Quarries Act" I visited this operation during the year, at which time camp buildings were found to be in good order, the storage of powder properly cared for, operations of excavating of limestone also executed in a practical and safe manner, and all matters of operation in safe condition.

NASS RIVER MINING DIVISION.

ANYOX SECTION.

Hidden Creek.—Operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited; C. Bocking, president and general manager; R. Healy, assistant general manager; W. R. Lindsay, general superintendent; P. S. McNicholas, superintendent; J. Hindmoor, mine foreman. Operation of the *Hidden Creek* mine has been continuous throughout 1929, producing an average tonnage a month of 123,000 tons, involving the use of 1,913,000 lb. of explosives, 454,250 detonators, and 3,261,000 feet of fuse. An increased number of men have been employed, the maximum number being 487. The number and severity of accidents during the year has been comparatively light and general conditions were found on my different inspections to be satisfactory.

Bonanza.—Operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited; W. R. Lindsay, general superintendent; W. Maxwell, assistant general superintendent; E. Merrill, mine superintendent. This is a new mine which commenced in the latter part of the year 1928 and which has operated continuously throughout 1929. This operation consists of two separate parts; the eastern portion entered by a tunnel and the western portion by an inclined shaft. An aerial tram 3 miles long conveys the ore to the smelter. The present output a day is about 500 tons with a crew of seventy men. A first-aid man is kept at the mine and a well-equipped first-aid room, also a special ambulance carrier, is provided, whereby any injured man can be quickly and safely taken to Anyox by means of the aerial tram. In my inspections during the year I found conditions satisfactory.

Golskeish.—Operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited; W. R. Lindsay, general superintendent; C. C. Hollister, assistant superintendent; J. D. Ferguson, mine superintendent. Operations at this mine ceased about the middle of February of the present year. All entrances to mine were fenced off and a copy of the mine survey sent to the Chief Inspector of Mines, as required when a mine is abandoned.

Granby Point.—Operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited; W. R. Lindsay, general superintendent; J. D. Ferguson, mine superintendent. This operation commenced April 24th of this year and made the first shipment of fluxing material to the smelter on March 1st. The operation is that of extracting pillars; this is performed in a retreating order as the vein is practically flat. From date of commencement operations were continuous throughout the year with an employment of thirteen men. During my inspections first-aid supplies were found to be satisfactory, powder properly stored, ventilation of mine good, and all other matters satisfactory.

HASTINGS ARM SECTION.

Saddle.—Operated by the Silver Crest Mining Company, Limited; P. E. Peterson, consulting engineer; A. Knox, mine superintendent; E. Olson, mine foreman. Operations commenced in June and were continued throughout the year with a crew of twenty-four men. An aerial tram from tide-water to the mine was completed and during the latter part of the year 3 tons of ore was shipped.

ALICE ARM SECTION.

Esperanza.—Operated by the Esperanza Mines, Limited; A. E. Mortimer, secretary, Prince Rupert; N. Fraser, mine superintendent. Continuous development of the mine has been carried on throughout the year with a crew of four men. In my inspections I found all matters in general to be satisfactory.

North Star.—Owned by the Alice Arm Silver Mining Company. This property was under option to Gustaf Pearson & Associates, of Alice Arm. Operations were continued throughout the winter of 1928 and into the early months of this year, when the property was closed down. Two men were employed at this mine.

Toric.—Operated under option by the Britannia Mining Company, Limited; J. Sleeman, mine superintendent; B. B. Brock, engineer. Operations on this property have been continuous since the early part of the year with a crew of twenty-eight men. The work carried on is that of general development and diamond-drilling. In my inspections operations were found to be satisfactory.

Tiger.—Operated by the Utility Mines (Number One), Limited; W. McDonald, president; W. Brewer, vice-president; E. C. Picket, superintendent. Operations on this property began early in the year and were suspended at the end of August. Twelve men were employed. General conditions were found to be satisfactory.

ILLIANCE RIVER SECTION.

Sunrise.—Operated by the Kitsault-Eagle Silver Mines, Limited; W. G. McMorris, managing director; H. McGuire, superintendent. This property is situated on McGrath mountain, a distance of 7 miles from tide-water at Alice Arm. Work here has been continuous throughout the year with an employment of ten men. No ore has been shipped during the year. In my inspection conditions were found to be satisfactory.

PORTLAND CANAL MINING DIVISION.

SALMON RIVER SECTION.

Outland Silver Bar.—Operated by the Outland Silver Bar Mining Company, Limited; F. C. Outland, manager; C. L. Hibbard, superintendent. During the summer months this mine was operated for three months with a crew of fifteen men. The camp was in poor condition and this matter was taken up with the owners with a view to improving the same.

Silver Crest.—Operated by the Silver Crest Mining Company, Limited; J. V. Clegg, general superintendent. This property operated for a period of three months during the summer season with a crew of six men, closing down in the early fall. During my inspections accommodation in camp buildings were found to be adequate and sanitary; also ventilation of the mine to be good, being assisted by a small fan.

Big Missouri.—Operated by the Buena Vista Mining Company; A. W. Aitchison, superintendent; T. Thomas, mine foreman. Operations here have been continuous throughout the year with a crew of twenty men. To improve the ventilation the management has installed a fan and at the time of my last visit ventilation was found to be fair. A fatal accident involving the loss of two lives occurred in this mine on February 12th. Two men had been spitting a round of holes and it is surmised that they had experienced some difficulty and stayed too long at the face, and both were caught by the blast. During my inspection I found the timbering of roadways good and camp accommodation ample for the present stage of development.

Unicorn.—Owned by J. Hovland & Associates; J. Hovland, managing director. Operations began here about the month of July and were continuous to the end of the year with a crew of five men. Some tunnel-work had been accomplished at the time of my last visit, a new camp was under construction, and arrangements for a powder-magazine site were made. In my inspection of the operation I found timbering and ventilation good, first-aid provisions and all matters satisfactory.

Sebakwe.—Operated by the B.C. Silver Mines, Limited; D. Rae, superintendent; G. Creighton, mine foreman. This operation has been continuous throughout the year with a crew of sixteen men, but no ore has been shipped. During my inspections ventilation in the mine was found to be fair, powder properly stored, first-aid provisions and operations in general satisfactory.

B.C. Silver.—Operated by the B.C. Silver Mines, Limited; D. Rae, superintendent; G. Creighton, mine foreman. This operation has been continuous throughout the year with a crew of thirty-four men. The *Sebakwe* and *B.C. Silver* mines are connected and this facilitates the managing of both mines with one foreman and several shiftbosses. Timbering and ventilation were found to be good, first-aid provisions satisfactory, and adequate camp accommodation for the men. During my inspections I have always found the operations to be conducted satisfactorily.

Premier.—Operated by the Premier Gold Mining Company, Limited; D. L. Pitt, general manager; B. Smith, assistant general manager; H. MacDonald, superintendent. Operations here have been continuous throughout the year with an average crew of 277 men. During the year 346,000 lb. of explosives and 775,000 feet of fuse were used in this mine. Accommodation consists of large and modern bunk-houses which afford every comfort and convenience. In my different inspections of this mine I have found the ventilation, timbering, and operations in general to be satisfactory.

Northern Light.—Operated by the Northern Light Mining Company, Limited; G. H. Bancroft, general manager; A. McKenzie, mine foreman. This property is situated about 2 miles from the *Premier*, on the roadside leading to the *Big Missouri*. Operations have been continuous throughout the year with an average employment of eleven men. The camp buildings are adequately built and sanitary. The mine is properly timbered and ventilated and powder properly stored. During my inspections general conditions in and about the mine were found to be satisfactory.

Woodbine.—Operated by the Woodbine Mining Company, Limited; M. McKenzie, superintendent. Operations were suspended in the latter part of July and were resumed again on October 24th, in the form of diamond-drilling, with a crew of twelve men. In all my inspections I found the mine well timbered, fairly well ventilated, first-aid provisions and general conditions satisfactory.

BEAR RIVER SECTION.

Independence.—Operated by the Independence Gold Mining Company, Limited; S. Fitzgerald, general manager. Operations were continuous with a crew of twenty-four men until about October 25th, when work was discontinued. During this time a large amount of development-work was accomplished. I found timbering good, but ventilation poor; this I ordered to be remedied by the installation of a fan. As the camp accommodation was found to be poor the owners were requested to build a more adequate camp for the ensuing year.

A. & T.—Owned by Armour & Tooth, Stewart. An option was taken on this property by the Consolidated Mining and Smelting Company and during the year diamond-drilling was carried on.

Mountain Boy.—Operated by the Pat Daly Mining Company, Limited; W. Tolam, superintendent; N. Matheson, mine foreman. Operations were continuous up to the time of my visit in September. A new compressor had been installed during the spring and it was the intention of the management to continue work throughout the year. I found operating conditions to be very satisfactory; also camp accommodation reasonable and adequate.

Terminus.—Operated by the Terminus Mining Company, Limited; H. A. Heywood, manager. Operations were continuous from the spring to the fall of the year. Two men were employed.

Argenta.—Operated by the Argenta Mines, Limited. This mine was under option to J. F. Duthie in the early part of the year. Six men were employed during the late winter and early spring, and since this time the option has been dropped by Mr. Duthie. Further work was resumed by the owners later in the year.

Red Top.—Owned by J. J. McNeil and J. Conners, Stewart. This property is under option to the Red Top Mining Company; H. D. Cameron, superintendent. Work was commenced in the early part of July with an employment of seven men and continued until October, when operations ceased for the winter.

George Enterprise No. 1.—Operated by the George Enterprise Mining Company, Limited; W. Smitheringale, manager; J. Curtis, mine foreman. Operations were carried on here during the summer months and closed down in the month of October. At the time of my inspection there were thirteen men employed. The work was chiefly development by tunnelling. I found operating conditions in reasonable order, camp accommodation ample and sanitary, and first-aid provisions satisfactory.

George Enterprise No. 2.—Operated by the George Enterprise Mining Company, Limited; W. Smitheringale, manager. At the time of my visit there were five men employed, work being chiefly that of development and stripping. Camp accommodations were found to be sanitary and adequate and all matters respecting operations to be in fair order.

George Copper.—Operated by the George Gold Copper Mines, Limited, which is controlled by the Consolidated Mining and Smelting Company, Limited. At the time of my last visit in October diamond-drilling was in operation from the surface and six men were employed. A fatal accident occurred to a diamond-driller on the day prior to my visit; while repairing a water-hose this man had slipped and fallen over a bluff, a distance of some 70 feet, and was dead when reached. I found general conditions to be in fair order.

Ore Mountain.—Owned by John Conway, Prince Rupert. At the time of my visit two men were employed in stripping, but no work has been done underground for a period of three years.

Mayou.—Operated by the Mayou Gold Copper Company, Limited; W. Thompkins, superintendent. This mine is situated on Bitter creek, a distance of 7 miles in a north-easterly direction from Bear river and at an elevation of 4,950 feet. The work here is development by tunnelling and crosscutting; several tunnels were in operation, with an employment of five men. I found the mine properly timbered, ventilation fair, camp accommodation adequate, and sanitary and first-aid material provided.

Dunwell.—No work was done underground in this mine, but a programme of diamond-drilling, following geophysical prospecting, was carried on.

Ruth-Francis.—Owned by J. Nesbitt & Associates, of Stewart. This mine is situated alongside of Glacier creek at an elevation of 4,000 feet. Two men were employed in the mine at the time of my visit and a large amount of work in stripping had been accomplished. I found camp accommodation and workings of the mine to be satisfactory.

Black Mountain.—Operated by the Black Mountain Mining Company, Limited. Operations here began in the early part of the year under the management of J. J. Haahti, of Stewart, when eight men were employed. I did not make a visit to this mine during the year.

Silverado.—Operated by the Premier Gold Mining Company, Limited; D. L. Pitt, manager; B. Smith, assistant manager; C. Chapman, mine foreman. Operations here were continuous throughout the year, the work carried on being mainly development by tunnels and raises. The mountainous nature of this area creates great difficulty in selecting sites for the necessary bunk-houses and other mine buildings, but the management has spared no effort to make conditions as safe and comfortable as possible. During my inspections I found operating conditions to be satisfactory.

MARMOT RIVER SECTION.

Prosperity and Porter-Idaho.—Operated by the Premier Gold Mining Company, Limited; D. L. Pitt, manager; B. Smith, assistant manager; G. Anderson, mine foreman. Operations here have been continuous throughout the year. During this time a 200-horse-power Ingersoll-Rand cross-compound compressor was installed and a modern type of aerial tram completed and put into operation. This tram is 5 miles long and the lower end is at tide-water. All the towers are of steel and the buckets make the round trip in two hours. In this connection it may be mentioned that the management has designed a special ambulance carrier for use on this aerial tram in case of an accident at the mine. In winter any other means of travel would be extremely difficult, if not impossible. The mine is kept well timbered, ventilation fair, powder is properly stored, and conditions in general satisfactory.

Engineer.—Owned by H. Bunn, Stewart. On my way to the other properties of the Marmot River district I visited this operation. There is a small compressor of the portable type and a small camp which I found to be adequate for the employment of five men. Only one man was employed at the time of my visit and I found conditions to be satisfactory.

Marmot River.—Operated by the Marmot River Gold Mines, Limited; G. Bancroft, manager; J. Prout, superintendent. This mine is at an elevation of 5,000 feet. Work has been carried on from the beginning of the year until the end of July, when operations were suspended. Eight men were employed.

Melvin.—Operated by the Melvin Mining Syndicate; C. Hogan, superintendent. This operation is situated near the *Prosperity* and commenced work early in the year. At the time of my visit there were five men employed in crosscutting and development-work. I found general conditions to be satisfactory.

PORTLAND CANAL AND GEORGIA RIVER SECTION.

Big Mike.—Operated by the Davidson Syndicate; J. D. McDonald, Stewart. Some work was done on this property in the early part of the year, since which time the operation closed down. In my inspections I found the operation generally satisfactory.

North Country.—Operated by the North Country Mines, Limited; A. Linke, superintendent, Hyder, Alaska. Work has been continuous during the winter at this property with a crew of four men. I was unable to visit this property during the year.

Georgia River.—Operated by the Georgia River Gold Mining Company, Limited; J. F. Coates, manager; R. G. Mellin, superintendent; C. Anderson, mine foreman. This mine is about 8 miles from tide-water and is reached by a very poor trail. Work has been continuous throughout the year. The camp was found to be adequate and sanitary and general conditions satisfactory.

SOUTHERN COAST INSPECTION DISTRICT.

REPORTS BY JAS. STRANG AND THOS. R. JACKSON, INSPECTORS.

VANCOUVER MINING DIVISION.

REPORT BY THOS. R. JACKSON, INSPECTOR.

Britannia Mining and Smelting Co.—C. P. Browning, general manager; James I. Moore, superintendent; J. Emmans, assistant superintendent; Michael Curran, foreman; C. G. Dobson, mine foreman of *Victoria* mine. The mines operated by this company are situated near Howe sound, about 30 miles north of Vancouver, and are several miles inland.

The system of mining and timbering is varied in the different mines to suit the exact conditions met. In the older operations the work is carried out largely on the shrinkage system, while in the *Victoria* mine, where the ground is not so strong, the square-set system of support is in force, the waste being filled as soon as possible after timbering.

The different operations comprise the *Fairview*, *Bluff*, *Barbara*, *Empress*, and *Victoria* mines and employ about 870 men in all.

The output of ore a working-day amounts to approximately 6,000 tons. The ore broken for the year 1929 was 1,025,189 tons and the ore drawn amounted to 1,983,769 tons, a difference of 958,580 tons.

The new work during the year consisted of: Drifts, 6,060 feet; crosscuts, 2,657 feet; raises, 6,806 feet; winzes, 879 feet. No. 4 shaft on a 58° pitch has reached a point 400 feet vertically below the 2,700-foot level.

The main transportation in this operation is on the 2,700-foot level, 11,222 feet long; near the portal of this level the ore is discharged into a chute and descends by gravity for 1,400 feet to a point in a tunnel at the same elevation as the storage-bins at the concentrator. The above tunnel was finished in June, 1928, and has been the means of greatly concentrating and simplifying the haulage problems. The main living camp is situated near the 2,200-foot tunnel, by which most of the men travel to their work. This camp, which is some 3½ miles from the beach, is quite conveniently reached by means of an inclined rope-haulage system in connection with an electric railway.

During the year a new bunk-house was erected for the accommodation of the employees. It is equipped with good, comfortable sleeping-quarters, wash-house, shower-baths, toilets, and clothes-lockers. Cement and gyproc figure largely in the construction of this building. Like the other bunk-houses, it is electrically illuminated and steam-heated. Fire-escapes are located at suitable places in the building. This new unit makes the third large bunk-house situated at the tunnel camp. In addition there are nearly 100 dwelling and four large apartment houses for accommodation of employees with families.

For recreation there is a gymnasium, a reading-room and library, as well as tennis-courts, and swimming-pool for outdoor sports. The company also maintains two hospitals, one at the beach and the other at the tunnel camp. These are under the supervision of two doctors and a nursing staff. The injured and sick are treated in these institutions; serious cases are immediately shipped for treatment to the Vancouver General Hospital.

The Safety Councils have met each two weeks throughout the year to offer suggestions for safety welfare and efficiency. Safety-belts have been adopted for use in bulldoze chambers and other places where men are exposed to falls. Hard-boiled hats, safety shoes, and screen-goggles are also in use in the endeavour to render the different operations as safe as possible.

A novice first-aid competition and safety mass meeting was held on April 10th, 1929. Prizes for this event were donated by the Vancouver Island and Coast District Branch of the Mine Safety and First Aid Association, and a silver cup given to the winning team by the Britannia Mining and Smelting Company, Limited.

More than 300 men registered for classes in first aid. A slogan of 100 per cent. first aid has been adopted.

During the visits of inspection in 1929 I found the general welfare of the various camps to be good. The conditions of the mine, generally speaking, were good. Ventilation generally was fairly good and the timbering well carried out. The use of caps and powder were well handled and looked after and the mining regulations relating to safe blasting were carefully attended to. A considerable number of incidental blasting and blasters' certificates were issued during the year.

The hoisting-ropes on skips and cages are kept in good condition and replaced as soon as signs of wear or a few broken wires are reported.

The engineers in charge are required to note and enter in a daily report-book every broken wire found in any hoisting-rope, together with its exact location. The fencing-off of bulldoze chambers was reasonably attended to. As a rule the provisions of the "Metalliferous Mines Regulation Act" were fairly well adhered to during the year.

I regret to report the occurrence of seven fatal accidents during the year.

REPORT BY JAMES STRANG, INSPECTOR.

Clayburn Co., Ltd.—Head office, Vancouver; J. W. Ball, manager; Edward Wilkinson, mine manager. The company's kilns and pits are situated about 50 miles east of Vancouver. The mines are at Straiton and Kilgard. All the work at Straiton mine consists of pillar-extraction; the Kilgard mines are all development-work, with one quarry at Kilgard for the production of shale.

The new factory at Kilgard is still under construction. The mines have worked steadily throughout the year, there being a good demand for brick and other manufactured products of this company. The total tonnage of all clays mined underground for the year ended December 31st, 1929, was 19,677 tons and from the open-work 13,520 tons.

The total number of men employed underground averaged twenty-three for the year round. These mines are well timbered and ventilation is good. No accident occurred in 1929 at any of these mines.

Coast Quarries Co., Ltd.—The operations of this company are situated at Granite falls on Burrard inlet, about 18 or 20 miles from Vancouver. Granite rock is quarried here, crushed and screened to various sizes for general construction-work. Auto-trucks are used to convey the material from the quarry-face to the bunkers. One power-shovel is used to load the trucks. In all about thirty men are regularly employed. Conditions were found to be very satisfactory.

NEW WESTMINSTER DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Pitt Lake Mining Co.—Head office, 25 Hastings Street East, Vancouver. The holdings of this company are situated on the east side of Pitt lake, about 15 miles from Coquitlam. This company has installed a small hydro-electric power plant. The water to drive a 36-inch Pelton wheel comes from lakes situated at an elevation of 1,500 feet above the main tunnel. The water is conveyed through 500 feet of flume and 1,500 feet of 14- to 12-inch heavy wood pipe, giving a head of 600 feet to the Pelton wheel. The Pelton wheel is directly connected to a generator developing 300 horse-power. A 600-foot compressor is installed at the mine to supply power for development-work. Only the main tunnel was being worked during my last visit, the majority of the men being engaged on construction-work on the surface.

Gilley Bros.' Quarry.—Several visits of inspection were made to Gilley Bros.' quarry on Pitt river. Granite is being quarried here, a crushing and screening plant is installed at the river-side, and rock of various sizes shipped for general construction-work. Conditions were found to be satisfactory at this operation.

Port Haney Brick and Tile Co., Port Haney.—This company operates a clay-bank for the purpose of obtaining clay for manufacturing bricks, tiles, etc. On my first visit the clay was obtained by the old pick-and-shovel method, but later on a power-shovel was introduced with much better results. Mr. Burnett is in charge.

VICTORIA MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

B.C. Cement Co.—This company operates at Bamberton a large limestone-quarry. Adjacent to the quarry the company has a very up-to-date plant for the manufacture of cement. One point worthy of comment is that this company consumes about 40,000 tons of British Columbia coal a year in the form of pulverized fuel, in preference to fuel-oil. At the quarry power-shovels are used to load the limestone into the cars and gasoline-locomotives transport the material to the bunkers. Every precaution is taken at this plant for the safety of the workmen. A safety-first committee with representatives from different parts of the plant hold regular meetings and discuss safety measures. First-aid classes are also regularly held. The whole operations are under the able supervision of H. Anderson, manager.

Rosebank Lime Co.—This company operates a small quarry at Colwood, a few miles from Victoria. Several visits were made and conditions found to be satisfactory.

Pioneer Sand and Gravel Co.—This operation is located at Songhees Reserve, a few miles from Victoria. The sand and gravel is washed from the bank by the hydraulic method and passes along a flume to a screening plant, where the gravel and sand is screened to various sizes.

Producers' Sand and Gravel Co.—This quarry is at Royal bay, near Victoria. Methods employed are similar to the operations at Songhees Reserve. Conditions at both of these operations were satisfactory.

NANAIMO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

PHILLIPS ARM SECTION.

Alexandria Mining Co.—Head office, 905 Credit Foncier Building, Vancouver. This company's property is situated on Phillips arm. Four tunnels have been driven on this property, but work is only carried on in the lower one at present. A shaft is being sunk in this lower tunnel. On my last visit of inspection the shaft was down about 100 feet, but as the compressor plant had broken down there was about 20 feet of water in the bottom of the shaft. The shaft was well secured and a good ladder-way provided. There were seven men employed at this mine.

FREDERICK ARM SECTION.

Colossus Copper Co., Ltd.—Head office, Vancouver. This company's property is situated on Estero basin, near the head of Frederick arm. Three tunnels have been driven in this property, with about 3,000 feet of underground workings, when it was first worked, but at present no work is being done underground. Three men were repairing the surface roads to the mine.

HARDY BAY SECTION.

Calcedonia Mines, Ltd.—This property is situated about 1½ miles east of Quatse lake. It was bonded by the Consolidated Mining and Smelting Company. During the period of its option this company did about 250 feet of underground work and put in about twelve open-cuts. This mine closed down in September. There were seven men employed.

TEXADA ISLAND SECTION.

Pacific Lime Co.—This company owns and operates a large limestone-quarry at Blubber Bay. About 180 men are employed in the quarry, lime-kilns, and sawmill. About fifty men are employed in the quarry alone. In this operation the material is now conveyed from the quarry to the lime-kiln bunkers by an aerial tramway system very much similar to the high-rigging system employed in lumber camps. The bucket holds about ¾ ton of loose rock.

This company has laid out a very nicely planned village, the houses having all the modern conveniences. Every precaution is taken for the safety of the workmen. The whole of the operations are under the general supervision of O. N. Walker.

Western Lime Co.—This quarry is adjacent to that of the Pacific Lime Company, but at present it is not operating.

The B.C. Cement Company has opened a limestone-quarry on the opposite shores of the bay from the Pacific Lime Company and has installed a very modern plant. To handle the material in the quarry there is a 70-horse-power gasoline electric shovel and a 60-horse-power gasoline-locomotive to transport the material to the bunkers. At the bunkers there is a No. 6 Allis-Chalmers crusher. The power for the crusher is supplied by a 160-horse-power Crossley-Diesel engine through a texrope drive. The Diesel engine also drives a Holman single-stage compressor for the drilling-machines in the quarry.

A 32-inch conveyor-belt with a loading capacity of 500 tons an hour carries the crushed limestone to the wharf. The belt is driven by a 60-horse-power Climax gasoline-engine. All the stationary engines are built on good cement foundations. The quarry is under the supervision of R. Hamilton.

Vancouver Granite Co., Quarry Bay, Nelson Island.—Superintendent, George Donohue. This is a dimension stone-quarry, the stone being used for building and monumental purposes. At the loading-wharf there is a 60-horse-power return-tubular boiler generating steam to drive a single-stage compressor for the drilling-machines and for a 8¼ by 10 steam-hoist for the loading-derrick. At the quarry there is a 25-horse-power vertical boiler supplying steam for a 7 by 10 hoist for the quarry-derrick. Nine men are employed and conditions are very satisfactory.

B.C. Monumental Co., Granite Island.—The stone from this quarry is used for building and monumental purposes. The equipment consists of one vertical steam-boiler of 75 horse-power

supplying steam for two hoists, one hoist for the loading-derrick and one for the quarry-derrick. One single-stage compressor is used to supply air for the drills. George Fraser is in charge of the operations. Conditions were found to be satisfactory.

QUATSINO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Coast Copper Co., Ltd.—This company operates the *Old Sport*; C. A. Seaton, superintendent. This mine is situated on the south-west shore of Elk lake, in the Quatsino Mining Division. During the year the power at Raging river was increased by the installation of a new 187-k.v.a., 50-cycle, 47-ampere, 2,300-volt a.c. generator; the current from this machine being carried to the mine through a lead- and steel-covered cable. At the mine it is stepped down to 550 volts and 110 volts for operating the motor-generating set and for lighting.

The electric haulage-locomotives in the 800- and 1,000-foot levels are operated by a 250-volt a.c. current from the motor-generator set located underground. Quite a number of improvements have been made on the surface. New offices and store-rooms were built at the mine. Machine-shops were moved from the camp to the mine, a staff house was built at the camp, and several improvements were made in accommodation for families. Every effort is made here to live up to safety regulations and the "Metalliferous Mines Regulation Act" is well adhered to.

It is a matter of great satisfaction to report that no serious accidents took place at this operation during the year.

Development footage for the year was as follows: Drifting, 881.5 feet; crosscutting, 303 feet; raising, 445 feet; sinking, 388.5 feet; diamond-drilling, 1,395 feet. From fifty to sixty men are employed.

Jeune.—During the year the Consolidated Mining and Smelting Company acquired the *Jeune* property, located near Alice lake. So far only exploratory work has been done, consisting of the following: Drifting, 335.5 feet; crosscutting, 100 feet; diamond-drilling, 4,288.5 feet. On the surface a 310-cubic-foot portable gasoline-driven air-compressor supplies air for the operation of two drills, drill-steel sharpener, and water-pump. A small bunk-house, cook-house, dry-house, and blacksmith-shop have been erected. About eleven men are employed.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

I have the honour to submit my report as Inspector of the Metalliferous Mines operating in the Nicola-Princeton Inspection District for the year ended December 31st, 1929.

It is gratifying to report that there has been no fatal accident at any of the operating mines in this district during the year, but five of rather a serious nature have been reported to this office. One case occurred where the owner, aged 80 years, of an old disused tunnel went underground without a light and fell down a winze into some water. He died from shock some hours later.

Copper Mountain.—H. C. Smith, resident manager; John A. McLaughlin, general superintendent; R. G. Anderson, mine superintendent. This mine is operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited, and is the largest and most important metalliferous mine in the district, also provides employment for a large number of men. It is situated 12 miles south of Princeton and is accessible by a good wagon-road.

During the present year a large amount of development-work has been done and improvements made to the surface plant. The chief development underground during the year was the sinking, from the No. 6 or lowest level, of a large 3-compartment operating shaft, situated 400 feet south-east of the present shaft. This shaft has two working compartments, 6 by 6 feet inside the timbers, and one compartment, 3 by 6 feet, provided with the necessary staging and ladders for use as a manway. It is timbered throughout by 10- by 10-inch framed sets and well lagged behind by heavy timbers. It has reached a depth of 450 feet, with two stations broken off above, and present plans are to sink to a depth of 500 feet, where a crosscut drift will be driven towards the present shaft.

Development, drifting, and raising amounts to 1,800 feet. About half of the present ore-supply is obtained from the surface glory-holes and the remainder from underground stoping and development.

The haulage-roads of the mine are of ample cross-section for the electric-trolley system of haulage that is in use throughout this mine; the block system of signals is in use on the main haulage-levels. The chute-platforms are well protected and attended to and all dangerous openings throughout the mine fenced off. Blasting is done at specified times at the glory-holes, and before doing so blasting-signals are given by whistles operated by compressed air. The various stope walls and roofs are in all cases barred down, scaled, and cleaned by experienced men after each round of shots has been fired.

Alterations have been made at the coarse-crushing plant, situated near the entrance to the No. 6 or lowest level of the mine, during the year by the installation of a 7-foot Symons cone crusher, which has replaced two gyratory crushers; this is giving satisfactory service and crushing a fine mill-feed.

The mine office, machine-shop, blacksmith-shop, steel-sharpening shops, etc., situated near the entrance to the No. 2 level and on the same elevation as the camp, which formerly consisted of old wood buildings, have been replaced by large modern buildings. A large modern steel-framed steel-sharpening shop has been erected near the entrance to the shaft; this is well equipped with oil-burning furnaces and steel-sharpeners and is now in use. The old machine-shop has been replaced by a large modern, well-equipped steel-frame machine and blacksmith shop; while modern general offices have been built near the entrance to the mine.

The social life of the camp has been by no means neglected during the year, which is well demonstrated by the number of new residences that have been built. Six of these fine houses have been occupied by the mine officials during the year, and it is gratifying to note that a large modern community hall is at present under construction, containing a large auditorium, a gymnasium, library, and reading-room.

Accommodation for the employees is well provided for. Large modern steam-heated bunk-houses are built with all necessary facilities for the convenience of the employees, while a large and well-furnished mess-house is in use at the camp. A well-equipped first-aid room, under the supervision of a first-aid man, is provided, and a doctor pays several visits to the camp during each week should his services be required.

During my visits of inspection I have found the mining operations well supervised and in good condition.

Nickel Plate.—Operated by the Hedley Gold Mining Company, Limited; G. P. Jones, general manager; W. B. Knowles, mine superintendent. This mine is located at an altitude of 5,600 feet, approximately 4,000 feet above and 4 miles from the town of Hedley, where the mill, town, and power plant are located. It is accessible by a tramway operated in two sections, having an aggregate length of 10,000 feet, with a difference in elevation between top and lower terminal of 3,500 feet, upon which are operated skips having a capacity of 6 tons. The grades vary from 10° to 65° and have an average of 49°.

The mine is situated about 1½ miles south of the top terminal of the tramway, from where an electric-trolley system of haulage is in use into the No. 4 tunnel to the collar of the Dixon slope. This is a 9- by 18-foot 30° slope, provided with double tracks and a manway, and has been driven a distance of 1,500 feet. Skips having a capacity of 2 tons are used on this incline and are operated by a double-drum compressed-air hoist.

Most of the operations during the present year have been from between the 800-foot and the 1,500-foot levels. The ground is very hard and as a result practically no timber is used in the levels or the stopes. Underhand stoping is in practice; the roof being well cleaned and barred down before it is left.

Power for the mine and the mill is generated at a 1,600-horse-power hydro-electric plant situated on the Similkameen river, 3 miles below the town of Hedley. This is supplemented by a high-head plant supplied with water from 20-Mile creek, which during the summer supplies about 300 horse-power. A transformer-station at Hedley steps the Similkameen plant voltage down from 6,000 volts to 2,200 volts for distribution to the mill and the mine.

Motor-driven air-compressors at the mill power-house supply air to the mine through a 6-inch main, 4 miles in length. An auxiliary steam plant is situated near the mill and is used in case of water-shortage. Unfortunately during the last few years there have been several dry seasons in the Similkameen district, causing the rivers to run low and making it necessary to revert to the use of the steam plant. For this reason the management has decided, for the past

few years, to suspend operations during the fall and reopen the mine during the spring, at which time there is sufficient supply of power provided by the river.

During my inspections I have generally found the conditions of this mine to be very good, about sixty men being employed underground and about eighteen at the surface.

Aurum.—Fred Bradley, superintendent. This mine is situated about 6 miles from Jessica, a small station on the Kettle Valley Railway, on the South fork of Ladner creek, in the Yale Mining Division. It is accessible by a fair wagon-road constructed during the year 1928 from the *Emancipation* mine. A tractor is used for hauling the necessary material.

Work generally is of an exploratory nature and consists of three levels driven into the side of the mountain and known as Nos. 2, 3, and 4 levels. During the early part of the year a new power plant was installed near the entrance to the lower tunnel; this consists of a 95-horse-power Petters oil-engine coupled by a belt drive to a 500-foot Gardiner Denver air-compressor. A Gardiner Denver steel-sharpener and the necessary 4-inch air-line has been laid from the power-house to the inside of the lower tunnel of the mine.

The camp is well provided with accommodation for the employees and consists of a bunk-house and cook-house, which appear to be quite satisfactory for a mine of this description. Six men were employed in the mine during my last visit and four at the surface.

Thelma.—William Campbell, superintendent. This mine is situated on Swakum mountain, 10 miles north of the town of Nicola, at an elevation of 5,000 feet, and is reached by a wagon-road. Work has been continuous throughout the year on the *Thelma* shaft with a small crew of men. This is a 2-compartment inclined shaft and has reached a depth of 250 feet, where a crosscut is being driven for the purpose of intersecting the vein system.

The power plant consists of an 8-horse-power Petters oil-engine connected by belt gearing to a 2-cylinder single-stage air-compressor and provides power for operating the shaft-pump and the drills, while a 6-horse-power engine is used for hoisting in the shaft.

The mine is provided with good camp buildings, consisting of a large bunk-house, dining-room, kitchen, and a small house erected for the use of the superintendent. During my last visit work appeared to be conducted in a good workmanlike manner, four men being employed underground and four at the surface.

Pioneer.—Robert Sloan, superintendent. This mine is situated 50 miles north of the Pacific Great Eastern Railway and is accessible by a good wagon-road from the railway. It has been operated continuously throughout the year, with the most important development-work being the sinking of the operating shaft from the 600-foot level to the 1,000-foot level, with the intervening stations broken off. This is a 7- by 8-foot 2-compartment vertical shaft, in which is operated a steel cage provided with safety-catches and running in 4-inch wood guides, operated by a 10- by 12-inch second-motion Ingersoll-Rand air-driven hoist.

Water-power is derived from Cadwallader creek, which runs in close proximity to the mine, and is conveyed by 6,000 feet of 3-foot wood-stave pipe down the side of the mountain from the creek above the mill to where the power plant is located, and provides a head of 250 feet. This operates four water-wheels for running the mill; and a 72-inch Pelton wheel, coupled direct to a 1,700-foot Ingersoll-Rand 2-stage air-compressor, which provides power for the mine hoist, pumps, and machines; while an electric generator provides power for the coarse crusher, located in the mine, and also provides current for the electric lights in and around the mine, in the mill, and in various buildings around.

The camp accommodations are fairly well taken care of. Several houses for the families, a double-story bunk-house provided with spray-baths, drying and change room, and a fairly large dining-room and kitchen are located at the camp, while the office staff is accommodated by a fairly large office. During my last visit to this mine I found twenty men employed underground and seven at the surface. The condition of the mine was very good.

Lorne.—N. H. Atkinson, superintendent. This mine is situated on Cadwallader creek, about 3 miles south of the *Pioneer*. The camp-site is located in close proximity to the entrance to the mine. A sawmill having been erected, provided the necessary lumber for the camp buildings and the mine. The living accommodations have been well attended to, several houses, a large bunk-house, and a large two-story dining-hall and kitchen having been erected.

Ample power is provided for this operation by Cadwallader creek, and throughout the year 6,500 feet of new 30-inch wood-stave pipe-line has been fabricated at the local mill and laid from the creek above along the side of the hill. This provides a head of 200 feet of water at the

power-house and is at present used for driving a 3-foot Pelton wheel coupled by a belt to a 2-stage Ingersoll-Rand compressor and an electric generator.

The underground operations chiefly consist of a long adit-level, driven into the side of the hill, for the purpose of intersecting the vein system which was exposed and operated in a small way at the side of the mountain several years ago. These veins are being followed by adit-drifts and a small amount of raising has been done.

Ventilation is produced by a small electric-driven fan situated near the entrance to the mine, and coupled to an air-line which extends to the faces of the drifts, assisted by "booster" fans installed in the same line. A small storage-battery motor is in use for haulage on the main level. The ground in the tunnel is of a hard nature and as a result little timbering is required. During my inspections I found this mine to be in good condition.

Planet.—Joe Vickelich, superintendent. This mine is situated in the Stump Lake district, 30 miles from the town of Merritt, and is accessible by a good road. Active developments have continued at this mine during the year and the flotation-mill, situated at the foot of the hill, has been put into operation.

These operations have been greatly facilitated by the completion of the 750-foot 6 by 7 adit-tunnel, situated on the same elevation and in close proximity to the ore-bin of the mill, and simplifies the haulage and the ventilation of this mine. All the operations are being conducted above this main level, which provides backs of some 350 feet to the surface at the top of the hill.

The mill has continued to operate fairly successfully during the year; the concentrates are hauled by motor-truck to the station at Nicola, a distance of about 25 miles. The camp accommodations are fairly good; a new bunk-house being erected during the early part of the year. During my last visit I found forty-two men employed at the mine, twenty-seven of whom were employed underground. Also found conditions around the mine to be satisfactory.

White Elephant.—Wm. Holdsworth, superintendent; John Matthews, mine foreman. This mine is situated a few miles west of Ewings Landing on Okanagan lake. It has been acquired by the Pre-Cambrian Gold Mines, Limited, and has been developed during the last two years. Probably the most interesting feature is the large showing of quartz which is said to contain some tellurides.

During the early part of the year the small mill was put into operation and power provided for it by a 50-horse-power Petter oil-engine, while a 14-horse-power Petter engine is in use for operating the crushing-plant. During my last visit a crosscut was being driven on the 45-foot level of the shaft which was sunk several years ago; a gas-engine coupled to a small hoist by a clutch is used for operating the shaft skip and a small Gardiner Denver air-compressor.

The camp is fairly well provided with accommodation for the employees, fourteen men being employed, six of whom are underground. The general conditions of the mine and the camp are good.

EAST KOOTENAY, WEST KOOTENAY, AND BOUNDARY INSPECTION DISTRICTS.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit the annual report covering the inspection of metalliferous mines during the year 1929 in the East Kootenay, West Kootenay, and Boundary Inspection Districts. These districts include the Mining Divisions of Ainsworth, Arrow Lake, Fort Steele, Golden, Grand Forks, Greenwood, Lardeau, Nelson, Revelstoke, Slocan, Slocan City, Trail Creek, Trout Lake, and Windermere.

During the year, owing to the large increase of new mines or the reopening of old mines, and with a view of spreading the work of inspection over as many as possible, H. E. Miard, Inspector of Mines and member of the Board of Examiners, kindly covered the districts around Kaslo and Sandon and also a part of the Fort Steele Division. H. H. Johnstone, Inspector of Mines, covered all the other parts of the West Kootenay and Boundary districts, while the writer supervised the whole district. The reports of H. E. Miard and H. H. Johnstone cover the work of inspection in more detail and are attached.

The mines are widely scattered and in some places difficult of access, making the work of inspection rather difficult, but the improvement in the present system of roads and also the construction of new roads is making the work of reaching them better each year. During the

present year 104 mines were inspected under the "Metalliferous Mines Regulation Act" and 246 visits of inspection were made. Many of the larger operations were visited regularly, in some of the smaller operations the visits were less frequent, but the conditions prevailing at the mine generally determined the number of visits. In the larger mines the regulations are generally very well complied with; in the smaller operations we have sometimes occasion to call attention to some points, and we generally find them very willing to comply with the requirements of the "Metalliferous Mines Regulation Act."

AINSWORTH DIVISION.

Fourteen mines were in operation at some time of the year or other, mining lead, zinc, and silver, and one under the "Quarry Act" at Marblehead, working on marble. About 240 men were employed in and around these mines.

ARROW LAKE DIVISION.

In this Division only one mine was in operation, the *Hailstorm*, where the Consolidated Company did a considerable amount of work, principally prospecting and development on a lead, zinc, and silver vein.

FORT STEELE DIVISION.

In this Division six mines were working on lead, zinc, and silver, two on phosphate, and one on gypsum. Over 1,000 workmen were employed; almost 900 of these were employed in or around the *Sullivan* at Kimberley. Forty men were employed on the development of phosphate, either at Lizard creek near Fernie or at Crownsnest. Five men were engaged at *Mayook* quarrying gypsum. Twenty-five men were engaged during the summer at the *Kootenay King* near Fort Steele, where the Britannia Mining and Smelting Company did a considerable amount of work, but late in the year I understand it had abandoned its option on this property. Considerable work was done on the *Aurora* at Moyie by the St. Eugene Extension Company, which purposes developing the *Cambrian* under Moyie lake by driving levels from the old *St. Eugene* shaft. The other operations were small, principally prospecting.

GOLDEN DIVISION.

In this Division two mines were in operation, the *Giant* at Spillimacheen and the *Monarch* at Field. Forty-three men were employed at these and the work on the *Giant* was principally prospecting. At the *Monarch* a large body of ore was developed, pending the erection of a concentrator, which was completed and in operation at the end of the year. At both these mines the ores are lead and zinc with silver values.

GRAND FORKS DIVISION.

Six mines were in operation in this Division, employing about 120 men; three mined lead, zinc, and silver; two gold; and one, the *Rock Candy*, fluorspar. The largest operation was at the *Union* at Franklin camp, where sixty-four men were employed; the next was the *Rock Candy*, where thirty-three were employed; the others were small prospects.

GREENWOOD DIVISION.

Twelve mines were in operation during the year, employing about 120 workmen, and all engaged in mining lead, zinc, and silver. The greater number of these were in the Beaverdell section and only a few around Greenwood.

LARDEAU DIVISION.

Only two mines operated during the year in this Division, employing about twelve workmen.

NELSON DIVISION.

Eighteen mines were in operation in this Division during the year, employing over 200 workmen. These were mining either lead, zinc, silver, copper, or gold.

REVELSTOKE DIVISION.

Three mines were operated during the year in this Division, employing about sixty workmen, and the ores mined were lead, zinc, and silver.

SLOCAN DIVISION.

Twenty-four mines were in operation in this Division during the year, giving employment to over 330 workmen. The ores mined were lead, zinc, and silver. A great number of these mines were small prospects, and work was curtailed to a great extent at the end of the year owing to low prices of metals.

SLOCAN CITY DIVISION.

The *Enterprise* was the only mine in operation in this Division during the year, mining lead, zinc, and silver. The work was development, and unfortunately at the end of the year operations were curtailed owing to a fire which destroyed the concentrator and some of the other buildings.

TRAIL CREEK DIVISION.

Six mines were in operation during the year, employing about fifty-four workmen. Four of these were mining gold and two copper. With the exception of the Rossland mines, the others were small operations. In the Rossland mines about thirty-six men were employed, taking out material as active mining has been suspended.

TROUT LAKE DIVISION.

In this Division only one mine was in operation, employing about seven workmen.

WINDERMERE DIVISION.

The *Paradise* was the only mine working in this Division during the year. The working-force was reduced early in the year and only a small force retained to do development, and at the end of the year this was reduced to a watchman, work being suspended for an indefinite period.

ACCIDENTS.

Nine accidents were reported during the year, as provided for by section 19 of the "Metalliferous Mines Regulation Act"—two under subsection (a) and seven under subsection (b). All of these accidents were investigated and where death resulted the inquest was attended. Eight of these accidents occurred underground and one on the surface. Ten persons were either killed or seriously injured in the nine accidents. Falls of roof or sides caused five accidents, including two which proved fatal. Blasting accounted for two accidents, involving one man killed and two injured.

One man was injured through his machine-bar falling out and carrying him along with it to the chute, and the other was the case of a man getting an injury to his eye through a flying piece of rock, which was supposed to come from the wheels of a moving train. Five of the accidents occurred in the *Sullivan* at Kimberley, two involving three men at the *Noble Five* at Sandon, one at the *Whitewater* at Retallack, and one at the *Mammoth* at Silverton. The greatest number of accidents, including the number of men killed or injured, was due to falling sides or roof, and would seem to indicate that greater care should be exercised both by those making the daily inspection as provided for by section 31, Rule 16, of the "Metalliferous Mines Regulation Act," and also by the workmen engaged in this occupation.

Injury to the eyes of machinemen and muckers using hammers to break rocks is very common, and a very good example is being set at the *Sullivan* by making it compulsory for these men to wear goggles, provided by the company, and I feel that this example could be followed to advantage by all the other mines in the district.

VENTILATION.

In the majority of cases ventilation is produced by natural means, with the result that the air-currents underground are much affected by outside temperatures. In tunnels such as the *Yankee Girl* at Ymir and the *Kootenay-Florence* at Ainsworth small auxiliary fans are in use and have given very good results.

In the *Sullivan* at Kimberley a large ventilating-fan is being installed with a view to producing positive ventilation. The capacity of the fan is about 100,000 cubic feet a minute, with a 5- or 6-inch water-gauge. While fans of this capacity are common around coal-mines, it will seem quite an innovation to the metal-mines. The *Sullivan* is a large mine and probably will become larger as time goes on and development to the dip continues. I consider the instal-

lation of an up-to-date ventilation system will repay amply all the time, effort, and money spent on it.

Twenty-three samples of mine-air were taken at various mines throughout the district, and, with the exception of two, every one showed fairly good conditions and over 20 per cent. oxygen.

WELFARE-WORK.

I regret to have to report that very little of either first aid to the injured, mine-rescue work, or even safety-first efforts are being carried out at any of the mines, except the *Sullivan* at Kimberley. Here a safety engineer is in charge of the safety-work, splendid classes are held in first-aid work, and regular practices are held in mine-rescue work with the all-service mask.

At the end of the year classes of instruction were commenced at the *Sullivan* in the use of self-contained breathing apparatus; the apparatus used was the McCaa and the work was under the charge of John Puckey, of the Fernie Mine-rescue Station. At this mine also, the means of dealing with fires either inside or outside the mine are maintained on a high level, fire hoses and hydrants being installed at all strategic points. Fire-hazards are reduced by eliminating all inflammable material, not more than one day's supply being maintained underground, and this applies to mine timbers and planks. In many of the smaller mines a lesson could be taken with advantage in these matters, both on the score of efficiency, safety, and economy. Careful inspection of the cook and bunk houses are maintained and we have generally found these to be safe and sanitary.

I again wish to thank the workmen, the officials, and the companies for their assistance and co-operation during the year in our work, and trust to have a continuation of the same in the year we are now entering, realizing that it is only through such co-operation that we can expect to reduce accidents and maintain safer and healthier conditions in and around the mines.

EAST KOOTENAY DISTRICT.

REPORT BY H. E. MIARD, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines on the operations visited during the year 1929 in the Fort Steele, Ainsworth, and Slocan Mining Divisions. In the course of these inspections 144 certificates of competency as blaster and five substitute certificates of the same class were granted. Three special prospectors' permits and two approvals covering recently constructed powder-magazines were also issued.

FORT STEELE MINING DIVISION.

Sullivan.—Consolidated Mining and Smelting Company of Canada, Limited; general superintendent, E. G. Montgomery; mine superintendent, William Lindsay. This well-known operation, the largest single producer of lead and zinc in the world, maintained throughout the year a daily output of 5,400 tons (which average will soon be brought up to 6,000) and employed at the time of the last inspection 472 men underground and 294 on the surface. It must be borne in mind that only the mine itself and its attendant services are taken into consideration here. A couple of months ago there were some 1,400 names on the company's pay-roll at Kimberley.

The method of working and the nature of the deposit have been described at various times and in an exhaustive manner, particularly in a paper by D. L. Thompson, assistant mine superintendent, presented at the annual meeting of the Canadian Institute of Mining and Metallurgy held at Vancouver in 1928 and reproduced in the report of the Resident Engineer for the same year. Recently, Jos. R. Giegerich, of the engineering staff attached to the mine, contributed a highly interesting dissertation on the same subject to a meeting of the Alberta Branch of the Canadian Engineering Institute held at Lethbridge. Several excerpts of this paper are embodied in the present report, for which I desire to acknowledge indebtedness to Mr. Giegerich. At the same time, I desire also to thank all members of the official staff of the *Sullivan* for the courteous manner in which any information desired is always supplied.

Mining.—There are five working-levels—namely, the 3,900, 4,250, 4,400, 4,500, and 4,600; these numbers in each case representing actual elevation above sea-level. The largest percentage of the output comes from stopes in the 3,900 level, where the ore-body has reached its maximum thickness. The 4,500 and 4,600 levels constitute the upper mine and the 4,250 and 4,400 intermediate levels have been opened since the completion of raises connecting the 3,900 level with

the older workings of the 4,500 and 4,600. The present aggregate length of all development-work is approximately 21 miles. The average dip of the ore-body varies from 10° in the south-west part of the mine to 35° in the north-east section. However, irregularities are common and either wall may be found in a vertical position, or may even assume the form of an overturned fold.

There are full crews of miners, muckers, motormen, and ore-loaders on the morning and afternoon shifts. On the third shift roadways are cleaned, supplies taken in, etc. Owing to the open nature of the workings, all blasting is done at the conclusion of the second shift, upon a signal given by shutting off the compressed air, allowing the pipes to drain and then turning the air on again. The resulting hissing sound constitutes the signal agreed upon. Accidents due to blasting have been practically eliminated by this method.

The sides of the pillars and the backs of the stopes are continually examined by the barmen. These are all miners of considerable experience and are looked upon as future "shifters." Where bad ground is encountered in the stopes they are responsible for its cleaning. Thirty-candle-power storage-battery portable lamps, equipped with powerful reflectors, provide them with excellent light. The work of trimming backs and sides is naturally attended with some risk and, formerly, accidents to barmen were rather frequent. Through a careful study of the subject and the resultant introduction of appropriate precautions the management has succeeded in reducing them to a minimum. Barring from benches, however, is still a prolific source of accidents to miners.

Under the present method of working, about 30 per cent. of the ore is being left in pillars, the recovery of which constitutes a problem of considerable magnitude. During the past year it has been attacked in a thoroughly practical manner and the construction of artificial pillars, permitting the extraction of the ore left in place to support the superincumbent strata, has been undertaken. One such pillar, covering an area of 2,400 square feet and 60 feet in height, has already been completed and the erection of another is now in progress. They consist of an outer concrete shell 3 feet thick, heavily reinforced with old rails, disused wire rope, etc., and an interior filling of mine waste through which lean concrete is run at intervals. Where the thickness of the ore-body does not exceed 100 feet, this is thought to afford the safest and most economical method through which the eventual recovery of the ore left in pillars can be assured.

Roadways.—These are of very generous dimensions, always well drained, kept surprisingly clean, and lighted by electricity wherever practicable. The ground requires little artificial support and where this is needed concrete and steel sets are put in. Every trackman employed at present is a former railway section foreman, which fact may account in part for the excellent condition of the mine-tracks.

Ventilation.—Up to the present time natural ventilation has met the requirements of the mine during the greater part of the year, but in summer, and particularly during the months of July and August, the circulation of air ceases, nearly or even completely, towards the middle of the day, and in the afternoon the direction of the air-current is often reversed. To obviate this state of affairs a ventilating-shaft has been put through to the surface from a convenient point in the upper mine, and a fan will be installed as soon as the weather conditions permit outside work to be resumed advantageously. The machinery now on hand for the purpose consists of a 60- by 33-inch reversible Jaffray fan with steel casing, having a capacity of 62,000 cubic feet of air a minute, against a 3-inch water-gauge, and a 50-horse-power electric motor to be connected to the fan by a texrope drive. This installation ought to set aside all difficulties as regards ventilation for some time to come.

Explosives.—All blasting is done with Polar Forcite gelatin of 35, 50, or 60 per cent. strength, according to the nature of the work. The outside magazine, built of hollow brick, with a corrugated-iron roof, has a capacity of 5,000 cases, which greatly exceeds the present storage requirements. The cases are emptied in a separate building and the powder is replaced in them after the sawdust has been dumped out. The daily supply of explosives is taken in the mine on the night shift, in a specially designed car equipped with insulated couplings, and is divided between three well-appointed magazines, from which the powder is issued to the miners. All fuses are cut and crimped outside. I might add that, owing to the nature of the work, a great deal of incidental blasting (commonly known as "bulldozing") is necessary.

Safety and First-aid Work.—A very energetic safety-first committee was organized nearly two years ago and from a perusal of the minutes of its meetings one gathers immediately the impression that it has lost none of its pristine vigour. J. M. Wolverton, safety engineer, is the

chairman and H. A. Twells, superintendent of transportation, is secretary. The suggestion-boxes mentioned in the report for 1928 seem to have justified their existence here. Many matters of varying importance have received attention during the year.

Well-equipped ambulance stations and emergency first-aid boxes are found throughout the mine and are kept constantly supplied with all necessary requisites. An important addition to the equipment of each emergency station (which equipment must be used only in case of accident) was made in the form of about 50 yards of $\frac{1}{16}$ -inch lariat rope, which can be easily carried anywhere and can stand a stress of 1,100 lb.

Very accurate statistics of the nature of accidents and of the resulting loss of time are kept, and these drew the attention of the management to the prevalence of eye and foot injuries. As a result, the wearing of goggles when collaring holes has been made compulsory and this will eliminate many accidents of the former class. A special boot, made for the company at the Leckie works in Vancouver, and already used at the Tadanac zinc plant, is being tried. A weight of 200 lb. can be rolled over the toe without bending the fibre reinforcement giving it its rigidity. It was found somewhat clumsy and inconvenient for climbing, but the manufacturers are attempting to eliminate these defects and the new foot-gear may soon be adopted generally.

The inexplicable rupture of a trolley-wire on the 3,900 level decided the management to cover the special cars (known as coaches) in which the men are taken to and brought from their work. This will soon be completed.

The underground fire-protection system is very complete and water under pressure is available at all points where an accumulation of inflammable material may be found at any time. Chemical fire-extinguishers are also provided. On the surface a well-equipped fire-truck is kept in readiness at all times.

Towards the end of the year a mine-rescue team was organized and began training with apparatus borrowed from the Fernie Mine-rescue Station. The management has ordered six machines of the McCaa type and a part of the warehouse is being fitted to receive them, as well as the accessory equipment. The supply of oxygen will be obtained from the electrolytic plant attached to the machine-shop.

The necessary equipment to make air and water analyses has been installed at the laboratory attached to the concentrator. This will make possible the immediate analysis of samples of mine-air taken in suspected places. A part of the operations during the year was affected by noxious gases coming from some creviced ground and the above installation was designed in order to be able to determine at once the constituents of the atmosphere.

There are now fifty-nine qualified first-aid men employed in or around the mine and a list of their names is posted at every ambulance station. In addition, a class of forty-five is undergoing training in first aid at the present time under the direction of Dr. Haszard and Harry Parsons, Instructor.

Accidents.—One fatal and four serious accidents were reported during the year. They are described in another part of this report. I shall simply draw attention to the fact that, among the four accidents classed as serious, two occurred to miners barring loose ore from benches and in each case the injuries sustained necessitated the amputation of a foot. These cases, as well as other less serious injuries resulting from the same class of work, have induced a campaign, in which all officials participate, with the object of discovering and eliminating their possible causes.

Additions to Plant.—Two electrically driven, 3,000-cubic-foot, 2-stage Bellis-Morcom compressors were added to the power plant early in the year. An electric furnace, manufactured by the General Electric Company of Birmingham (England), with its attendant motor-generator set, has been received and will be installed in the mine, so that in the near future all drill-sharpening will be done underground. The old power-house and machine-shop have been replaced by brick and steel structures. A new ore-bin with a capacity of about 700 tons has been added to the rock-house, in which a second jaw-crusher is being installed at the present time.

Living Accommodation and Welfare-work.—The company's townsite, generally known as MacDougall's camp, is located at a distance of about a quarter of a mile from the mine entrance. There are to be found on it now an excellently managed cook-house with a seating capacity of 350, nine bunk-houses capable of accommodating 330 men, and twelve six-room apartments, all

provided with steam heat from the central heating plant. In addition, there are ninety-five six-room cottages, the residences of some of the officials, and the MacDougall Memorial Recreation Hall, erected and furnished at a cost of some \$40,000. A greenhouse is operated by the company and flowers and plants may be obtained by the employees at cost, in winter as well as in summer. Very good accommodation of the same type, but of course on a smaller scale, is also provided at the upper mine. The hospital, with fifty-two beds, is one of the finest in the interior of the Province. The staff consists of two resident doctors and ten nurses.

Conclusion.—From the foregoing it may be gathered that an interest, commensurate with the economic importance of the operations, is taken by the management of the *Sullivan* in all matters pertaining to the safety and welfare of its employees. A very important factor remains to be mentioned, however, and that is the spirit permeating the whole organization, officials and workmen alike, and making its influence felt everywhere. It is reflected in the perfect discipline maintained and in the conscientious manner in which all duties are discharged. Our congratulations are due to those who fostered it, as well as our thanks for their friendly and sincere co-operation.

PHOSPHATE-MINES.

During the year the work of proving and developing the phosphate-deposits discovered in the Cedar valley and on Alexander creek was pushed actively under the immediate supervision of F. B. Fuhr. Good roads were built and living accommodation was provided for the men by remodelling abandoned lumber camps, situated in the vicinity of the prospects. In the case of the *Lizard* mine this remodelling was so complete that there is now hardly anything left of the original camp but the site.

The two mines are 21 miles apart, in an air-line, and are at the same elevation above sea-level—namely, 4,500 feet. At the Crow mine, on Alexander creek, the phosphate-bed was reached by a crosscut adit 300 feet in length, and has now been followed by a drift over a distance of about 400 feet. The mine is ventilated by a small blowing-fan. A slope was also started on the site of the former quarry, but has been temporarily abandoned. At the time of the last inspection there were seven men employed underground and three on the surface.

At the *Lizard* mine, in Cedar valley, about 6 miles from Fernie, two prospect-drifts were driven in order to prove the deposit and some surface prospecting was done also. Considerable accessory work had to be undertaken, in the form of road-construction and the erection of suitable buildings.

At the time of the last inspection there were six men employed underground and nineteen on the surface. The mechanical equipment at each mine consists of a portable gasoline-driven compressor, supplying the motive power for the mine machinery, and a small forge. Powder-magazines have been built and, with the exception of some minor defects at the *Lizard* mine, the general conditions prevailing were satisfactory. A well-equipped laboratory in charge of W. D. Burgess, of the research department, is attached to the Fernie office of the Consolidated Mining and Smelting Company, Limited.

At the *Kootenay King*, situated on Wildhorse creek, about 16 miles from Fort Steele, and at an altitude of 7,500 feet, considerable prospecting-work was done by the Britannia Mining and Smelting Company, Limited, the operations being in charge of W. E. Selnes. There were ten men employed underground and fifteen on the surface at the time of inspection. The general conditions prevailing were good. Operations ceased towards the end of the year.

At the *Aurora*, on Moyie lake, exploratory and development work was carried on by the Saint Eugene Extension Mines, Limited, with Scott Price as superintendent. At the time of the last inspection there were eleven men employed underground and three on the surface. The conditions prevailing in the mine were satisfactory. The power plant consisted then of a small compressor driven by a gasoline-motor, but a fairly large oil-engine and a new compressor were being installed. A very pleasant location has been selected for the camp and the living accommodation was good.

At the *Payroll*, on Nigger creek, a crew of three men, two underground and one on the surface, did a surprising amount of development-work for the Moyie River Mining Company.

At the *Royal Crown* some defects brought to the attention of the owners have been rectified, but work in the shaft has been abandoned and the intention to prove the property by drilling was expressed.

WEST KOOTENAY DISTRICT.

REPORT BY H. E. MIARD.

AINSWORTH MINING DIVISION.

At the *Cork-Province*, operated by the Cork Province Mining Company on Mansfield creek, about 7 miles by road from Nashton, a new power plant was erected to replace that destroyed by fire in the early part of 1928. This consists of a 390-horse-power, 3-phase Parkinson generator, driven by an impulse turbine working under a pressure of 165 lb. a square inch. At the mine a 720-cubic-foot Ingersoll-Rand compressor, driven by a 100-horse-power motor, supplies the power required by the underground machinery; i.e., one hoist, two Cameron pumps, four stoping-drills, and two drifters. The mill, entirely renovated, has a capacity of 100 tons in twenty-four hours and is equipped with crusher, one set of rolls, ball-mill, 20-cell flotation-machine, classifier, etc., all driven by alternating-current motors.

At the time of the last inspection there were twelve men employed underground and fifteen on the surface. The conditions prevailing in and around the mine were generally good and the men's living-quarters were well kept. A. W. MacPherson is the superintendent.

The *Revenue*, on Sturgis creek, was operated by the Sturgis Creek Mining Company, Limited, under the management of F. T. Harbour. High-grade ore was shipped on pack-horses from the mine to the Mansfield Creek road, and then conveyed by trucks to the nearest railway-station, at Nashton, 12 miles away. The vein crops out on a precipitous hillside and is developed by a series of levels driven from the surface, the lowest one being at an altitude of 6,400 feet. The ground demands only a moderate amount of artificial support and the timber-supply available in the immediate vicinity will cover all requirements for some time to come. The buildings in use at the camp are old and obviously too small, but they are well kept. The conditions prevailing underground were satisfactory in all respects. The very small quantity of explosives kept on hand is stored in a temporary magazine on the hillside.

The regular working-force consists of eleven men, six of whom are employed underground. At the time of the last inspection ten additional men were engaged in improving the trail leading to the mine, in order to permit the rawhiding of ore during the winter season.

At the *Utica*, on Paddy peak, operations during the year were limited to the driving of a crosscut adit intended to intersect the mineralized zone 350 feet below the former workings. Four men were employed underground and five on the surface. The ground is very wet and, notwithstanding the precautions taken, missfires were a frequent occurrence. In this and similar cases electric firing would eliminate many difficulties. The combined bunk and cook house is old but fairly comfortable. Most of the buildings, including the powder-magazine, will require some repairs during the coming season. Power for the present operations is supplied exclusively by a Holman compressor driven by a Pelton wheel. There is also a large Fairbanks-Morse semi-Diesel engine, set up some years ago to run a diminutive Canadian Rand compressor, the size of the one being quite out of proportion to that of the other.

The mine is situated at an altitude of 6,600 feet and is reached from the railway-station at Adamant (Keene), some 6 miles away, by a comparatively good road. It is operated by the Utica Mines, Limited, with James Robertson, of New Denver, as superintendent and Lafayette MacLellan as mine foreman.

The *Wellington*, at Retallack, is operated by the Wellington Mines, Limited, with W. G. Harris as superintendent. During the year the operations were limited to the driving of a crosscut adit at an elevation of 3,700 feet and some exploratory work. The general conditions prevailing, both underground and on the surface, were satisfactory. Three excellent buildings, cook-house, bunk-house, and office, have been erected close to the Retallack Station of the K. & N. Railway. The power plant, installed near the new mine opening, consists of a 70-horse-power Vickers-Petters semi-Diesel marine engine and a 520-cubic-foot Ingersoll-Rand 2-stage compressor. At the time of the last inspection there were eighteen men employed underground and eight on the surface.

The *Whitewater*, at Retallack, was operated throughout the year by the Whitewater Mines, Limited. Owing to various circumstances, among others the downward trend of prices on the metal market, the underground working-force decreased from thirty-three in May to seventeen towards the end of November; exploratory and development work claiming the services of a large proportion of these. Six or seven men were employed on the surface.

No important additions were made to the plant during the year, but the new hydro-electric installation, already almost completed in 1928, was brought into operation. A Pelton wheel operating under a head of 1,150 feet drives a Crompton-Parkinson a.c. generator having a capacity of 600 amperes at 220 volts. The two semi-Diesel engines of 90 and 200 horse-power respectively, each driving a separate alternator, which constitutes the former power plant, are available for use during periods of water-shortage. A single-stage compressor driven by a Pelton wheel and able to supply four drills completes the installation. Peter Price is the superintendent and Clarence Garrett is in charge of the mine.

SLOCAN MINING DIVISION.

The *Lucky Jim*, operated by the Lucky Jim Lead and Zinc Company, Limited, with Peter Price as superintendent and William Callin as mine foreman, employed sixteen men underground and seven on the surface at the time of the last inspection. No additions were made to the plant, which remains as described in A. G. Langley's report for 1927, and the mill was idle during the greater part of the year. The new raise connecting Nos. 5 and 6 levels, completed in the early spring, is a remarkably good piece of work in all respects and provides excellent ventilation. The conditions found to prevail in and around the mine were very good.

The *Noble Five*, at Cody, was operated throughout the year by the Noble Five Mines, Limited, with forty-seven men underground and eleven on the surface. The capacity of the mill has been increased to 100 tons in twenty-four hours, this corresponding to the enlarged activity of underground operations. The method of mining is overhand stoping with waste filling. Where timber is required, either square sets or stulls are used, according to circumstances. The ventilation was generally good everywhere, with the occasional exception of a part of the *Deadman* drift, where conditions in this respect will soon be improved. The remodeling of the blind shaft, begun in 1928, has now been completed and has proved quite satisfactory. The ore is brought to the head of the tram by a storage-battery locomotive. The men's living-quarters are comfortable and very well kept. John G. Shepard is superintendent, with R. S. Sanford as assistant and Wm. Findlay as mine foreman.

Two accidents, involving three men, were reported during the year. On April 27th Oscar Dalgren and Joseph Flatten were injured (the former more seriously than his partner) by a premature blast in No. 8 drift. The only explanation offered—i.e., a "running" fuse—seems improbable, as nothing of this kind has been brought to the writer's knowledge for a number of years, and the particular brand of fuse used at the *Noble Five* has been found highly reliable everywhere. It is true that a fuse may burn much faster than at its normal rate of combustion if it is strongly pinched or twisted at one point, which of course implies gross carelessness on the part of the person handling it.

On July 6th Stanley Duda lost his left eye through being struck by a small piece of rock, apparently thrown upwards with considerable force by one of the wheels of a moving train of empty mine-cars in which he was riding to his work.

The *Ruth-Hope*, at Sandon, operated by the Ruth-Hope Mining Company, employed forty-seven men underground and eight on the surface at the time of the last inspection. The method of working is a form of overhand stoping with waste filling. The workings were always found well timbered and the roadways and working-places were generally well kept, but some of the manways in the inner section are rather small. Conditions were good in all respects in the outer district, but in the inner section some difficulty is experienced in maintaining adequate ventilation owing to the fact that this part of the mine is isolated at the end of a long crosscut, without any other means of communication with the surface. In September the problem was solved by the establishment of an opening between these workings and the 910 level of the *Silversmith*, but owing to a disagreement between the two operating companies this was closed again towards the end of October, which meant a return to the conditions existing previously. However, the ventilating apparatus has been improved during the year and strenuous efforts will be made to maintain a sufficient amount of air in circulation. Naturally, only one exit from the inner part of the mine is available at present.

The bunk-house and cook-house, which were old buildings hardly suitable for their purpose, have been abandoned by the company and all employees, but two, are now living in Sandon. H. A. Rose is superintendent and Colin Stewart is the mine foreman.

At the *Silversmith* operations were limited to exploratory work and at the time of the last inspection there were five men employed underground and two on the surface. The conditions

prevailing in the mine were good in all respects. All employees live in Sandon. The mine is operated by the Silversmith Mines, Limited, with O. V. White, of New Denver, as superintendent and Andrew Olson as mine foreman.

At the *Slocan-Rambler*, situated at an elevation of 4,900 feet on McGuigan creek, operations were limited to development-work. There were seven men employed underground and five on the surface. A caterpillar tractor is used between the mine and the railway, over a fairly good but rather sinuous road consisting of an apparently endless succession of switchbacks. The accommodation at the mine is very good and satisfactory conditions were found to prevail both underground and on the surface. The mine is operated by the Slocan-Rambler Mining Company, Limited, with J. M. Robertson, of New Denver, and Bruce Kirk as superintendent and mine foreman respectively.

At the *Bluebird*, in Jackson basin, development operations were conducted by the Bluebird Mines, Limited, with a working-force of eleven men, six of whom were employed underground. All efforts were concentrated on the driving of an adit intended to intersect the vein below the former workings. Some highly unfavourable ground was encountered, badly crushed shale and a strong inflow of water forming a rather disheartening combination, but at the time of inspection these difficulties were being skilfully overcome. Nothing was done in the level started from the Sandon side in 1928.

A new camp was built at the head of Jackson basin and close to the present workings a little more than a year ago and good accommodation is provided for the men. The mine, situated at an altitude of 6,700 feet, is reached from Retallack by a road some 6 miles in length. The operations were under the immediate supervision of John H. Wilson, with W. H. Burgess as superintendent.

At the *Colonial-Slocan*, situated on Cody creek at an altitude of 5,500 feet, development-work was begun under apparently very promising conditions during the month of July. A car-load of ore was shipped, but the current price of metals held but little inducement to enlarge the scale of operations. The surface installation was of a temporary nature at the time of inspection, but the erection of suitable buildings was then contemplated. Necessary repair-work had received due attention and the conditions prevailing underground were good. Eight men were employed in the mine and one on the surface. The property is operated by the Colonial Slocan Mining Company, with A. L. MacPhee as superintendent.

The *Leadsmith*, on Cody creek, employed seven men during the greater part of the year in prospecting operations and development-work, partly underground and partly on the surface. The general conditions prevailing were satisfactory on the whole, but the immediate removal of various kinds of inflammable material from the vicinity of the temporary powder-magazine was ordered. The property is operated by the Leadsmith Mines, Limited, with E. A. White as superintendent and A. Stonier as mine foreman.

At the *Carnation*, on Tributary creek, operations were resumed towards the end of the year by the Carnation Silver Lead Mines, Limited, with W. G. Clark as superintendent. A 90-horse-power Petters semi-Diesel engine, a 326-cubic-foot Canadian Rand 2-stage compressor, and a drill-sharpener were installed, and at the time of the last inspection nine men were employed underground and eight on the surface. The conditions prevailing were satisfactory in all respects. The mine is situated at an altitude of 6,400 feet and is reached from Sandon by a fairly good road.

At the *Silver Bell*, situated at the head of McGuigan creek and at an altitude of 7,100 feet, four men were engaged during part of the summer in driving a crosscut adit, on contract, for the owner, the late W. E. Zwicky. At the *Sovereign*, operated by the American Boy Mining Company, with John Vallance in charge, development-work was carried on by a very small crew during the whole year.

Late in the year various Spokane interests resumed work on the *Mary Ryan* and began operations with small crews at the *Wonderful* and the *Black Colt*, in the Sandon district.

In concluding, I must express my sincere thanks to the officials in charge of these mines for the friendly manner in which I was always received, and chiefly for their evident desire to comply with all the requirements of the "Metalliferous Mines Regulation Act" and their willingness to accept any suggestions tending to assure the safety or the welfare of their employees.

I am also glad to state that, at the operations visited, the men appeared to be well conversant with their respective occupations and seemed to understand that under all circumstances safety must always be the first thing considered.

WEST KOOTENAY DISTRICT.

REPORT BY H. H. JOHNSTONE, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for the West Kootenay District for the year 1929. This report does not include properties in the Kaslo and Sandon section, which were inspected from the office in Fernie.

TRAIL CREEK MINING DIVISION.

The Rossland properties owned by the Consolidated Mining and Smelting Company were operated for only a few months. Salvaging of all underground equipment was completed and the mines are now being allowed to fill with water. The *O.K.*, *I.X.L.*, *Midnight*, and *Snowdrop* in the free-gold belt on Little Sheep creek were operated by small forces of leasers. The *Mayflower*, in the south belt, was operated for a few months by S. J. Hackney. Three men were employed.

NELSON MINING DIVISION.

The *Yankee Girl*, at Ymir, was operated throughout the year by the Yankee Girl Consolidated Mining Company, Limited (G. L. Thompson, superintendent). The work consisted of the continuation of the long low-level crosscut tunnel driven from the Wildhorse side of the mountain. Satisfactory progress has been made and the work done in a workmanlike manner. Accommodations for the men are commodious, comfortable, and kept in a clean and sanitary condition. An average crew of twenty-nine was employed.

The *Goodenough*, on Wildhorse creek, was reopened in the latter part of the year by the original owners. Ore is being extracted and they are continuing the lower crosscut tunnel to the intersection of the vein. Eight men are employed.

The *Howard*, on Porcupine creek, owned and operated by the Howard Mines, Limited (F. W. Holzheimer, superintendent), was operated throughout the year. An average crew of ten men was employed.

The *Hunter V.*, on Porcupine creek, owned and operated by the Consolidated Mining and Smelting Company (George Terhune, superintendent), was operated for the greater part of the year. In September the property was shut down, the crew and equipment being moved to the *Iva-Fern* property on Cultus creek. Fourteen men were employed.

The *Silver Dollar*, at Salmo, was operated for part of the year by the Consolidated Mining and Smelting Company under lease and bond. The shaft was sunk another 100 feet and considerable drifting done both ways on the lead. Ten men were employed.

Reeves-McDonald.—In the first half of the year work was carried on in both the *McDonald* and *O'Donnel* properties. The work in the *O'Donnel* was drifting on the vein for the purpose of development. This was discontinued and a crew of men was put to work on the surface, stripping and trenching. The average number of men employed was seventeen. This work was finally discontinued and a programme of diamond-drilling was started.

The principal work on this group was the driving of a new tunnel on the *McDonald* property. This tunnel is 8 by 9 feet in the clear and timbered, where necessary, with 14-inch square timber. A mechanical mucker is employed and all the work is done in a very substantial and workmanlike manner. New bunk and cook houses, office buildings and residences, blacksmith-shop, and buildings for the housing of machinery have been erected and are all of a very substantial character. An electrical storage-battery locomotive is employed for transportation in the tunnel. The average crew of men was thirty-five.

The Salmo Consolidated Company's property on Elk creek was operated for part of the year, with P. F. Horton as superintendent. The work was entirely development. Eight men were employed.

The *Perrier*, located near Apex, on the Nelson & Fort Sheppard Railway, was operated for some months by the Perrier Development Syndicate (A. H. W. Crossley, superintendent). The shaft was sunk for an additional 50 feet and a drift driven on the vein. Thirteen men were employed.

On the *Granite-Poorman* work was started on a long crosscut tunnel from the mill level by Smith & Fox, contractors. Good progress was being made, when for some reason work was discontinued. Fourteen men were employed.

The *Euphrates*, on Elsie mountain, was worked by the Euphrates Mining Company. The work consisted of drifting on the ledge and crosscutting. Eight men were employed.

The *Golden Age* was operated late in the year by leasers. A new tunnel was started between the Great Northern Railway and the Ymir motor-road.

The *Relief*, on Erie creek, was operated by the Relief-Arlington Mines, Limited (P. E. Oscarson, superintendent). Ore was milled until the shortage of water compelled the closing of the mill. Nine men were employed.

The *Iolanthe*, at Ginol, on Kootenay lake, was operated by the Associated Mining and Milling Company, Limited. The work consisted more of the nature of assessment-work on the large number of claims controlled by this company. Five men were employed.

The *Reno*, located on Reno mountain at an elevation of 6,200 feet, owned and operated by the Reno Gold Mines, Limited (O. C. Thompson, superintendent), was worked continuously throughout the year. New bunk-house, cook-house, and office were built. A cyanide-mill was built and has been working successfully. The compressor plant at present in use being of too small capacity, a further addition has been ordered and is now being installed. An average crew of twenty-five men was employed.

AINSWORTH MINING DIVISION.

The *Kootenay-Florence*, on Princess creek, is owned and operated by the Kootenay-Florence Mining Company, Limited (H. C. Wilkens, superintendent). The principal work has been drifting to the south from the main crosscut tunnel and drifts to the west from the south drift. Ventilation continues to be a serious problem. The oxygen content of the air at the working-places is good, but the humidity is high. Thirty-one men constituted the average crew employed.

The *Banker*, at Ainsworth, was worked by leasers for part of the year. Five men were employed.

The *Spokane-Trinket* was also worked by leasers. Three men were employed.

Krao.—This is one of the old properties of Ainsworth camp. It had previously been worked by means of a shaft. Owing to the amount of water encountered it was closed down and has remained idle a long time. W. E. Zwicky conceived the idea of using the old *Crow-Fledgling* tunnel to come under the *Krao* and so drain it. This is the work that is being carried on now. Seven men are employed.

The *Bluebell*, situated at Riondel, on the east side of Kootenay lake, has taken on a new lease of life. The company, Bluebell Mines, Ltd., acquired the *Comfort* property, north of and joining the *Bluebell*, and is sinking a shaft, which when it reaches the required depth will be connected with one of the *Bluebell* levels by a drift. The old *Bluebell* shaft will then be the main working-shaft of the property. Eighteen men were employed.

Berengaria.—This property appeared in the 1928 report as the *Richard I*. It is situated at Deanshaven, on the east side of Kootenay lake, and a few miles south of Riondel. It is being operated under lease and bond by the Base Metals Mining Corporation. A crosscut tunnel is being driven into the hill. Five men are employed.

The *Riverside*, situated on the east side of the Duncan river, was operated by the Omo Mines, Limited, with a crew of five men. The work consisted of open-cuts and short tunnels.

Marblehead Quarry, situated at Marblehead, on the Lardeau branch of the Canadian Pacific Railway, running between Lardeau at the head of Kootenay lake and Gerrard at the foot of Trout lake, is owned and operated by the Canadian Marble and Granite Works, Limited. The stone is quarried, dressed, and polished at Marblehead and the product is shipped to Winnipeg.

SLOCAN (SLOCAN LAKE PROPERTIES).

The *Galena Farm*, operated by the Galena Farm Consolidated Mines, Limited (W. R. Sheiler, superintendent), had an average crew of twenty-two men. Considerable development-work has been done and quite an amount of ore milled. A tramway 9,000 feet long has been built connecting the mill with the east portal of the *Hewitt*, which is operated by the same company.

The *Hewitt* was formerly operated by the Victoria Syndicate and is now operated by the Galena Farm Consolidated Mines, Limited. The principal work consists of continuing the lower tunnel from the west side of the mountain and driving a new tunnel from the east side to connect with it. About 1,800 feet remain to be driven to make the connection. All ore produced will

then be shipped from the east portal to the *Galeña Farm* mill, which has been connected by an aerial tramway. Walter Tattrie is in charge of the work with an average crew of forty-one men.

The *Mammoth*, owned and operated by the Western Exploration Company (R. W. Grimes, superintendent), was worked continuously throughout the year on development. A long raise has been run from the bottom level to No. 2 level. By this means not only has a large tonnage of ore been developed, but the ventilation has been materially benefited. Having acquired the holdings of the old Standard Silver-Lead Company, the company has built an up-to-date mill on the shore of Slocan lake. A tramway about 16,000 feet long has been built connecting the mill with the lower portal of the mine. An average crew of twenty men was employed.

The *Standard* has been acquired by the Western Exploration Company, which has leased part of the mine to leasers. Four sets of leasers, consisting of two men each, were employed.

The *Bosun*, owned and operated by C. J. Campbell (W. S. Ellis, superintendent), worked at different periods, but is now idle. Nineteen men were employed.

The *Molly Hughes*, operated by the Tinto Mines, Limited, worked for part of the year. An average crew of twelve men was employed.

The *Enterprise*, situated on Enterprise creek, was operated by the Yankee Girl Consolidated Mines, Limited. The work consisted of development. Nine men were employed.

The *Van Roi*, operated by the Cunningham Mines, Limited (C. Cunningham, superintendent), started work in May and has been worked continuously since then. Considerable development-work has been done. Nine men were employed.

The *Lucky Thought*, on Silverton creek, owned by the Consolidated Mining and Smelting Company, was worked by leasers and some ore was extracted and shipped. Three men were employed.

TROUT LAKE, LARDEAU, AND REVELSTOKE MINING DIVISIONS.

The *White Eagle*, situated on Keen mountain at the head of Cascade creek, was operated by the Keene Mountain Gold and Silver Mines, Limited. The work consisted of drifting and cross-cutting. Seven men were employed.

The *Alma*, situated on Lexington creek, in the Camborne camp, was operated for a short time by the Paymaster Mines, Limited, on development-work. Three men were employed.

The *Teddy Glacier*, on Teddy Glacier mountain at an elevation of 7,500 feet, was worked by Bush & McCulloch. The trail was widened to allow the transportation of a portable compressor, which was used on development-work. Fourteen men were employed.

The *Wigwam*, situated on Akolkolex creek, north of Arrowhead, was operated by the Wigwam Mining Company (W. T. Dumbleton, superintendent). A large amount of diamond-drilling had been done in former years. Development was continued this year by means of crosscuts and drifts. Sixteen men were employed.

The *Snowflake*, on Silver creek, east of Revelstoke, on the main line of the Canadian Pacific Railway, was operated throughout the year by the Snowflake Mining Company, Limited (D. Loughheed, superintendent). The work consisted of drifts, crosscuts, and a raise. The property is well equipped with machinery and camp buildings. Sixteen men were employed.

The *Morton-Woolsey*, situated on Clabon creek, was operated throughout the year by the Regal Silver Mines, Limited (J. L. Swanson, superintendent). Development-work consisting of drifts and a raise was carried on. An average crew of twenty-seven men was employed.

ARROW LAKE MINING DIVISION.

The *Hailstorm*, on Canyon creek, at an elevation of 7,640 feet, was operated by the Consolidated Mining and Smelting Company (J. Hawes, superintendent). This property is on the divide between the Arrow lakes and Slocan lake. The showing is on the Slocan Lake side and the work consists of driving a long crosscut tunnel from the Canyon Creek side to intersect the vein. Good buildings had been erected, but owing to the elevation and the bare nature of the hillside, on which there is no timber, operations have been discontinued for the winter. A portable compressor was in use. Fifteen men were employed.

There was only one fatal accident in these districts. Conditions in and around the mines have been found to be good and the requirements of the "Metalliferous Mines Regulation Act" and regulations *re* blasting well complied with. Infringements have been corrected when pointed out to the operator.

BOUNDARY DISTRICT.

REPORT BY H. H. JOHNSTONE.

GRAND FORKS MINING DIVISION.

The *Union*, situated in the Franklin camp, was the largest operating property in the Grand Forks Division. It is being worked by the Hecla Mining Company (Paul H. Schulz, superintendent). New bunk-houses, cook-house, cottages, and mill have been built. Raises have been put up connecting the different levels and everything put in shape for ore production and milling. An average crew of forty-four was employed.

The *Rock Candy*, on Kennedy creek, owned and operated by the Consolidated Mining and Smelting Company (D. Matheson, superintendent), was operated for the greater part of the year. This fluorite ore is used by the company in its refining operations at Trail and only a limited quantity is mined. An average crew of thirty-two men was employed.

The *Molly Gibson*, at Paulson, owned by the Molly Gibson (Burnt Basin) Mining Company, Limited, of Rossland, was worked part of the year. Three men were employed.

The *Halifax*, owned by J. Grafton, of Rossland, was worked during part of the year. Three men were employed.

GREENWOOD MINING DIVISION.

The *Waterloo* is situated at Lightning peak, near the divide between the Kettle river and the Arrow lakes, at an elevation of 6,000 feet. A rough road fit only for a caterpillar tractor has been built from the Vernon-Edgewood motor-road to the camp, a distance of 18 miles. New bunk-houses and cook-house have been built and all preparations made for a winter's operations. At the time of my inspection ten men were employed and preparations were being made to increase the accommodations by at least 50 per cent.

The Wallace Mountain section was the most active in this Division.

The *Bell*, owned by McIntosh & Lee, was the most consistent producer. A new lower tunnel has been started farther down the hill near the *Highland Lass* line and development and production continued in the old workings. An average force of twenty-three men was employed.

Sally.—This property was operated during part of the year by the Sally Mines, Limited (E. Nordman, superintendent). Later it was acquired by interests represented by R. H. Stewart. P. E. Racey is engineer in charge and J. A. Hanna is superintendent. Fourteen men are employed.

Highland Lass.—This property adjoins the *Bell* on the north-east. It is operated by the Highland Lass, Limited (A. J. Finch, superintendent). A new low-level tunnel has been started and suitable progress is being made. An average crew of ten men was employed.

The *Wellington* is owned and operated by the Wellington Syndicate (A. J. Morrison, superintendent). No. 4 tunnel is now the main working-tunnel. The ore was picked up at this level and a raise driven through to No. 3. An average crew of ten men was employed.

The *Beaver*, owned and operated by the Beaver Silver Mines, Limited, was worked throughout the year. The principal work was done in the shaft on the second level, where they drifted toward the *Bell* line. A considerable amount of work, consisting of an open-cut across a large low-grade lead and considerable trenching, was done on the surface. Twelve men were employed.

The *Revenge* was operated for a few months by the Silver Star Mining Company (W. V. Somerville, superintendent). A compressor was installed, some retrimbering done in the tunnels, and a small amount of underground work done, when the operations ceased. Eight men were employed.

The *Providence*, at Greenwood, was operated for the greater part of the year by the Providence Mining and Leasing Company. Work was confined to drifting and stoping from the bottom of the shaft.

The *Anaconda*, at Greenwood, was worked for a short time by the Hercules Mining Company. The work consisted of surface-stripping and trenching. Three men were employed.

The *Crescent* and *Stemwinder*, in the Phoenix camp, were also under bond to the Hercules Mining Company. A small amount of work was done on each property. Three men were employed on each property.

The *Mogul*, situated on Horseshoe mountain, on the main Kettle river about 25 miles north of Westbridge, was worked by the Mogul Mining Company (A. F. Thomas, superintendent). A wagon-road was constructed from the main Kettle River road to the property and considerable development done. Work was discontinued in the latter part of the year. Eight men employed.

REPORTS OF COAL-MINE INSPECTORS.

The coal-mines of the Province are situated in four Inspection Districts—namely, Vancouver Island, Northern, Nicola-Princeton, and East Kootenay Districts.

In former Annual Reports figures of coal production and men employed have been shown for individual collieries in the District Inspectors' reports. As these figures are shown in full detail in tables on pages 406 and 407 they have been omitted this year from the Inspectors' reports.

VANCOUVER ISLAND INSPECTION DISTRICT.

THOS. R. JACKSON, JAS. STRANG, AND JAS. W. JEMSON, INSPECTORS.

The Canadian Collieries (Dunsmuir), Limited, operated Nos. 4, 5, and 6 mines, Comox Colliery, and Nos. 1, 2, 5, and 9 mines and Vancouver slope, Wellington Extension Colliery.

The Western Fuel Corporation of Canada, Limited, operated No. 1, Reserve, and Wakesiah mines, Nanaimo Colliery.

The Granby Consolidated Mining, Smelting, and Power Company, Limited, operated the Nos. 1 and 2 mines, Granby Colliery, Cassidy.

Lantzville Colliery operated its No. 1 mine at Nanaimo.

Fiddick mine was operated at South Wellington.

Little Ash mine was operated at Nanaimo.

Richardson mine was operated at South Wellington.

Biggs' mine was operated at Wellington.

NORTHERN INSPECTION DISTRICT.

THOS. J. SIENTON, INSPECTOR.

The Telkwa Collieries, Limited, operated the Goat Creek mine.

NICOLA-PRINCETON INSPECTION DISTRICT.

JOHN G. BIGGS, INSPECTOR (HEADQUARTERS, MERRITT).

The Middlesboro Collieries, Limited, operated Nos. 2 and 3 North, Nos. 2 and 5 South, Nos. 2 and 4 East, and No. 5 West mines, Middlesboro Colliery, Merritt.

The Coalmont Collieries, Limited, operated Nos. 3 and 4 mines, Coalmont Colliery, Blakeburn.

The Tulameen Valley Coal Mine Company operated its No. 1 mine.

Lynden Coal Company, Limited, operated its No. 1 mine (operated part of the year as Blue Flame Coal Company).

Normandale mine operated at Nicola.

Pleasant Valley Coal Company operated its mine at Princeton.

Gem Domestic Coal Company operated its mine at Princeton.

Black Coal mine operated at Princeton.

EAST KOOTENAY INSPECTION DISTRICT.

ROBT. STRACHAN, SENIOR INSPECTOR, AND JOHN MACDONALD AND H. E. MIARD, INSPECTORS
(HEADQUARTERS, FERNIE).

The Crow's Nest Pass Coal Company, Limited, operated No. 1 East, No. 1 South, No. 2, No. 3, and No. 9 mines, Coal Creek Colliery; No. 3, No. 3 East, No. 8, and "B" mines, Michel Colliery.

The Corbin Coals, Limited, operated Nos. 4 and 6 mines, Corbin Colliery.

VANCOUVER ISLAND INSPECTION DISTRICT.

REPORTS BY THOS. R. JACKSON AND JAS. W. JEMSON, INSPECTORS.

Western Fuel Corporation of Canada, Ltd.

Head Office—Nanaimo, B.C.

F. Perry, President, Montreal, Que.; Lieut.-Col. C. W. Villiers, Vice-President and Managing Director, Nanaimo, B.C.; P. S. Fagan, Secretary-Treasurer, Nanaimo, B.C.; John Hunt, General Manager, Nanaimo, B.C.

This company operated during 1929 the Nanaimo Colliery, which consists of No. 1, Reserve, and Wakesiah mines, all situated in the vicinity of the city of Nanaimo.

REPORT BY THOMAS R. JACKSON, INSPECTOR.

NANAIMO COLLIERY.

No. 1 MINE (SOUTH SIDE).

Arthur Newbury, Manager; John Sutherland, Overman, South Side No. 1 Mine; George Bradshaw, Wm. Halliday, Alex. Coombs, Wm. Neave, Fred Menzies, Matt Broderick, John Marrs, Wm. Frew, Jas. Dudley, A. Hannah, and Jonathan Pearson, Firebosses.

This mine is situated in the town of Nanaimo, on the shore-line of the bay. It is the oldest working-mine in Nanaimo district and has a large submarine area extending several miles in a seaward direction.

The mine has four openings. No. 1 shaft is used for hoisting coal and the screening plant is situated at this shaft; it also serves as a downcast shaft for the ventilation of the South side workings.

The men working in the South side portion of the mine are also raised and lowered at this shaft. No. 2 shaft, which is situated about 300 feet distant from No. 1, serves as an upcast shaft for the ventilation of the South side workings as well as part of the North side workings.

The power plant of No. 1 mine consists of two 530-horse-power Babcock & Wilcox water-tube boilers, coupled with two 208-horse-power return-tubular boilers which operated at a lower pressure than the Babcock & Wilcox; the steam from the Babcock & Wilcox passing through a No. 8 Locke pressure-reducing regulator, which works very satisfactorily. The Babcock & Wilcox boilers were installed during 1925 and are supplied with chain-grate stokers, induced and forced draught fans, Cope's feed-water regulator, and Cochrane steam-flow meter.

The boilers supply steam to the power plant, which consists of two cross-compound Ingersoll-Rand compressors, each supplying 2,500 cubic feet of air a minute, and two Robb-Armstrong Corliss-valve engines which are direct-connected to d.c. generators; also to fan, hoisting and washery engines, and mine-pump. The hoisting-engines at No. 1 and Protection shafts are steam-driven.

Electrical equipment consists of two generators driven by steam-engines. One generator is of the Westinghouse type, 250 kw., running at 150 r.p.m. and direct-coupled to a Robb-Armstrong steam-engine. These units supply power to all the electrically driven machinery above ground and underground. There are underground: One 10-ton Westinghouse motor, three 6-ton Jeffrey motors, and one 10-ton Edison motor, all of which are operated on the open overhead-trolley system; four electric hoists ranging from 30 to 140 horse-power; and a 3-stage centrifugal pump driven by a 125-horse-power motor running at 1,740 r.p.m. The power is carried into the mine by four armoured cables which enter the mine by way of the shafts; two of these are leads and two returns.

In connection with the washery plant, two centrifugal pumps of the Fairbanks-Morse type and capable of delivering 1,000 gallons of water a minute each are driven by two 40-horse-power motors. There is also a 90-horse-power motor for the sludge-pump and a 30-horse-power motor used for driving the coal-washers. Seven motors are in use at the coal wharves for raising and lowering the coal-chutes to facilitate loading scows or ships.

Underground.—Firebosses and shotlighters use the Wolf flame safety-lamp and workmen use the Edison electric safety-lamp. Operations are being conducted in the Newcastle and Douglas seams.

On the South side of the mine the Douglas seam has been worked exclusively until last year. A slope has been put down off No. 3 level motor-road to reach the Newcastle seam, which is now being developed and contributes largely to the tonnage obtained from the South side of the mine. On the North side of the mine coal is taken from both seams. Only permitted explosives are used for blasting; shots are fired by cable and electric battery. Compressed air and electricity are used as motive power for haulage and drainage purposes.

Haulage on the main levels on the North side of the mine is done by electric locomotives of the overhead-trolley type. Heavy steel rails are laid and a copper trolley-wire carried for approximately 3 miles on No. 1 level, extending from the shaft to a point beyond the foot of Lamb's incline.

Haulage on the South side of the mine is a combination of electric motor and direct rope-haulage on the main roads and drivers and horses are employed for the purpose of getting the cars to and from the workings to the main haulage.

Development-work.—The development done in the South side of No. 1 mine has been confined to the opening-up of the old Jemson's slope workings (Newcastle seam). The system of mining in this section is long-wall. There are three sets of conveyors working, with an average of 200 feet to the set. These old workings had to be dewatered; this was done by drilling a series of 3-inch holes, 15 feet long. An old fire area known as No. 1 West has been opened up for the extraction of pillars; this section has been sealed up for eighteen years.

Diagonal Slope Section.—There was 37,480 cubic feet of air a minute passing down the Main slope, which divides into three splits—namely, Diagonal slope, No. 5 North, and No. 3 Motor levels. Only 3,000 to 4,000 cubic feet of air enters the Motor level split and is used principally for ventilating the level in as far as No. 2 dip, Douglas seam workings.

Diagonal Slope Split.—There was 11,200 cubic feet of air a minute passing for the use of thirty-seven men and six horses. I found no explosive gas, but found a little touch of black-damp in the air of two places to the right of inside dip. Ventilation was found to be fairly good, roadways and timbering good, and sections fairly free from coal-dust.

This slope has been more or less affected by gob-fires during the year. Great care has to be exercised and constant vigilance maintained by all the managing officials in the matter of extracting the pillars and providing the necessary ventilation for operating purposes without causing a "heat-up" to occur.

The application of "flue-dust" and water as nullifying agents to "coal-dust" is still being carried out. On September 22nd and 23rd the sealed-off fire area in No. 1 East section was entered and the Gibbs apparatus was used in the undertaking. It was the intention of the management to resume coal-mining operations in this area, but on the morning of the 27th a slight explosion occurred, which resulted in the section near the Main tunnel being sealed off. Fortunately no one was in the district at the time.

No. 3 Level Section.—The ventilating air-current for this section comes from Protection shaft and, after supplying the Newcastle seam with fresh air, passes on into the return airway in the Douglas seam. About 200 tons of coal a day is obtained from a long-wall working under the "pan system." The wall is undercut by coal-cutters of the bar type, and pan-conveyors along the face conveys the coal to cars situated on the main haulage-road. Since its installation it has proved highly successful from an economic standpoint. The seam at this point was abandoned many years ago for various reasons. In this split there was 10,000 cubic feet of air a minute passing for the use of twenty-six men and four horses. Ventilation was fairly good. I found no gas, roads and timbering were good, and the section was practically free from coal-dust owing to heavy dampness and water being prevalent in the workings.

No. 5 North Slope Section.—This section is gradually finishing. The extraction of all the pillars has not yet been accomplished, but it is expected that this will happen in about another three months' time, when the pipes, pumps, rails, etc., will be withdrawn and the slope abandoned. In this split there was 4,000 cubic feet of air a minute passing for the use of thirteen men and three horses. Ventilation, roads, and timbering were good. I found no gas and sections were practically free from coal-dust owing to dampness and water prevailing in the workings.

Mine-air sample tests indicate methane percentage similar to last year, ranging from 0.01 to 0.03 per cent. The gas committee reports, which are submitted to this office every month, show that the general conditions of the mine were consistently good and well maintained. Several minor accidents occurred, but I am pleased to state there was no fatality or serious accident during the year.

REPORT BY JAS. W. JEMSON, INSPECTOR.

NANAIMO COLLIERY.

NO. 1 MINE (NORTH SIDE).

Mine Manager, A. Newbury; Overman, A. E. Courtney; Firebosses, T. J. Wood, T. Smith, F. Cope, G. Jardine, A. Bennett, W. Cass, G. Moore, G. Perry, D. Stobbart, J. Nichol, J. McMeekin, and J. Dean.

The most of the workings of this mine are submarine areas, having an average cover of 450 feet. The workmen employed on this side of the mine are transported to and from their work by ferry operated by the coal company; the distance across the bay to Protection island being about $1\frac{1}{4}$ miles. The main intake is Protection shaft, which is also used to raise and lower the workmen. Newcastle shaft, which is situated on Newcastle island about 3 miles from

No. 1 shaft, serves as an upcast for the major part of the North side workings; a ladder-way is provided in the shaft which affords another or third means of ingress or egress to No. 1 shaft workings. All the North side output is brought to No. 1 shaft by electric locomotives of the overhead-trolley type. Both the Douglas and Newcastle seams are operated, the greater part of the output being machine-mined and some of it loaded by shaker conveyors.

The following were the air measurements taken in December: Main intake, 45,000 cubic feet a minute; No. 10 South, 17,000 cubic feet; Lamb's incline, 14,000 cubic feet; No. 2 incline, 6,000 cubic feet.

No. 2 Incline.—The incline pillars are being extracted here, which will soon finish this district.

North-east Slope.—New tunnel to Newcastle seam. This slope is down about 500 feet with no coal showing yet, but it is expected to open up a large area of the Newcastle seam and eventually tie up with No. 5 long-wall and the old long-wall workings in Jemson's slope.

No. 10 South.—Long-wall work and partly machine-mined. Pillar-work being carried on in the Douglas seam.

No. 5 Long-wall (Newcastle Seam).—Practically all machine-mined, one section being loaded by shakers and conveyor, this being a new departure in this wall.

No. 6 Wall (Newcastle Seam).—All machine-mined and loaded by shaker conveyors.

Prospect off No. 1 Level.—This level is entered by a rock slope situated about 2,000 feet from No. 1 shaft bottom and has a splendid long-wall face about 400 feet long with three exits.

REPORT BY THOS. R. JACKSON, INSPECTOR.

RESERVE MINE.

Robert Laird, Manager; Clifford Dickinson, Overman; Ernest Kelly, Jacob Stobbart, Fred Bell, Harry Allsopp, Harry Meikle, and Joe Lane, Firebosses.

This mine is situated in the Cranberry district, about 5 miles south of Nanaimo. The first shaft sunk reached the seam at a depth of 1,162 feet. On account of folding in the measures and heavy pitching it was decided to drive a crosscut tunnel 7 by 12 feet in section across the measures at a point 950 feet from the surface, with the result the seam was struck at a distance of 180 feet from the shaft.

The second shaft was sunk to a depth of 950 feet and a tunnel driven across the measures for a similar distance and the seam struck. A level was then driven in the coal a distance of 300 feet, connecting the two tunnels. After considerable development-work had been done from this point a new tunnel was driven across the measures from No. 1 shaft at a point 200 feet higher, penetrating the seam at a point about 200 feet distant from the shaft. This tunnel is now the main haulage of the mine.

Operations are conducted in the Douglas seam, which is very much troubled with folds or overlaps, which tend to make operations difficult. At times the seam pinches out and may be found underlapping or overlapping. The coal, which varies from 3 to 20 feet in thickness, is fairly hard, with a fairly good roof. The quantity of sulphur produced from the seam evidently has appreciably lessened, there being fewer men affected than ever before.

The ventilation of the mine is produced by a pair of 90-inch Sirocco fans, connected to a 20- by 30-inch engine, rope-driven. On the engine is a drive-wheel 5 feet in diameter. These fans, running at an engine-speed of 16 r.p.m., are capable of producing 100,000 cubic feet of air a minute, against a 3-inch water-gauge.

A description of the surface plant at this mine has been given in former reports. The underground mechanical haulage is carried on by means of compressed-air winches.

Report of Development-work at Reserve Mine.—In No. 2 West section the Main level has been advanced to a point 3,000 feet in off the Main heading, with varying success. Good pockets of coal were found on both sides and a large area of virgin ground is now being opened up beyond the workings of the old West slant.

No. 5 section: Early in January all the water was drained out of old No. 5 mine. Two rock tunnels were driven up to the seam and a large area of good coal was found adjoining the old workings. The Main level on the right side was also advanced 600 feet, but the ground was badly broken up with faults.

In No. 10 section all the pillars have been drawn back to the winch. A rock tunnel has been driven in 500 feet on the right side of No. 10 heading to prospect the ground below the old

tunnel section and make a new return airway for No. 5 district; but so far no coal has been found.

In No. 9 section all the pillars have been taken out on the Main level in first left slant and prospect-work is being continued on the right side. The new rock slant driven up from the face of the Main level struck some very good coal and is still advancing in new ground.

In No. 8 section all the pillars have been taken out, the mine being finished in July.

REPORT BY JAS. W. JEMSON, INSPECTOR.

WAKESIAH COLLIERY.

W. H. Moore, Manager; Nat Bevis, Overman; Thos. Chapman, A. Dean, H. Carroll, Jas. Richards, and R. Reid, Firebosses.

This mine is situated on the Western Fuel Corporation of Canada's farm, about 2 miles from Nanaimo, and is operated in the Wellington seam.

The mine is entered by two shafts 320 feet in depth, one being used as a fan-shaft or upcast, the other being the main hoisting-shaft. The coal is hoisted by a 14 by 16 first-motion steam-hoist, and single cage with counterbalance being used. With the exception of the shaft-bottom pump, which is steam-operated, all other underground machinery and pumps are operated by compressed air. The shaft-bottom and stables are electrically lighted. The roof of the mine is sandy shale, often frail, and demanding careful attention and timbering. The mine is naturally damp. A 60-inch Sorocco fan, rope-driven, is used to ventilate the mine. It is a pleasure to report that no serious accidents occurred in this mine, although pillar-extraction is chiefly carried on.

It is expected that Wakesiah mine will be closed down early in 1930.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

F. Perry, President, Montreal, Que.; Lieut.-Col. Chas. W. Villiers, General Manager, Nanaimo, B.C.; H. S. Adlington, Secretary, Montreal, Que.; P. S. Fagan, Assistant Secretary, Nanaimo, B.C.; John Hunt, General Manager, Nanaimo, B.C.; T. H. Williams, District Superintendent, Cumberland, B.C.

The above company operated the following mines during 1929: The Comox Colliery, Nos. 4, 5, and 6 mines, situated in the vicinity of Cumberland; the Wellington Extension Colliery, Nos. 1, 2, and 3 mines, situated at Extension; No. 5 mine, situated at South Wellington; and No. 9 mine, situated at Wellington.

REPORT BY THOS. R. JACKSON, INSPECTOR.

COMOX COLLIERIES.

These mines are situated in the Comox district, 13 miles from Union Bay (by road). A railway 30 miles in length, over which the output is conveyed, connects the separate mines to a shipping-point at Union Bay.

The mines worked are Nos. 4, 5, and 6. The latter is a shaft acting as a means of drainage and intake air for No. 5 mine. No. 4 mine is located at the east end of Comox lake, about 3 miles from Cumberland. No. 5 mine is about a mile away from the city and No. 6 is close to the city.

The mine ventilation of Nos. 1 and 2 slopes, of which No. 4 mine is comprised, is produced by a Sullivan reversible fan, double-inlet, having a capacity of 180,000 cubic feet of air a minute, against a 6-inch water-gauge. This fan, which is located at the return end of No. 2 slope, is electrically driven by a 250-horse-power induction-motor, 2,200 volts, speed 250 r.p.m., directly connected to the fan-shaft. A 108-inch double-inlet reversible Sirocco fan is situated at the return end of No. 1 slope and is in operation.

The hydro-electric plant of this company, which has been described in previous reports, has been in constant operation during 1929. Sufficient electricity is generated at this plant to supply motive power for all the collieries, wharf at Union Bay, and for the lighting of Courtenay, Union Bay, and Cumberland.

No. 4 MINE.

T. H. Williams, Mine Superintendent; Harry Devlin, Mine Manager; Charles Parnham, Overman; Syd. Horwood, Chas. O'Brien, T. Lewis, A. W. Watson, Tom Shields, Watkin Williams, John Vaughan, Wm. Devoy, Robert Walker, Jack Devlin, Wm. Herd, A. G. Jones, and Wm. Keenan, Firebosses.

This mine consists of two slopes with one main entrance. There is also a manway part of the way. No. 1 slope runs due north; the lower workings below No. 12 West level are practically abandoned. No. 2 slope runs N. 45° E., and all work is practically finished for a hundred yards or so above No. 9 East level and filled with water.

These slopes diverge at a point about 75 feet from the main portal. The electric haulage-engine is so connected that trips can be run simultaneously on both slopes to a point where they converge to the main entrance.

The men are conveyed from the bottom and other sections of the slope in a man-trip at the end of each working-shift. A safety-car is connected to the rear end of the man-trip, which ensures the safety of the workmen while riding upon the slope. As a precaution against trips breaking away on these slopes the car is now used on all trips ascending the slopes. Electric head-lights of the Edison storage-battery type are used by the workmen and the firebosses use the flame safety-lamps of the Wolf type for testing purposes.

In No. 1 slope electricity is used as the motive power to operate all pumps, winches, and motors. A storage-battery locomotive is employed for haulage purposes in No. 11 West level, No. 1 slope. The extraction of pillars is almost general throughout the mine. The thickness of the seam varies from 3 to 7 feet. The coal is good and cokes well.

Some solid coal lies ahead of the present face of No. 1 incline, off No. 11 West level, No. 1 slope; entry into this area has commenced. A few months ago an electric pump was installed in No. 1 slope to assist the one located at the foot of No. 2 slope. This extra pump has solved the water problem completely. On the east side of No. 1 incline, off No. 11 West level, No. 1 slope, an area of solid coal will remain undeveloped on account of the shallow depth and inferior quality of strata overlying the coal and its proximity to surface water from swamps.

During my last inspection in December I found the following conditions to prevail: I found 145,000 cubic feet of air a minute passing into mine main portal and manway, ventilation was fairly good throughout, and no explosive gas was found. Roadways were in good condition generally, part of the Main slope being retimbered and made higher. Timbering was in good order generally and the sections practically free from coal-dust owing to heavy dampness and water on the roadways.

There was 5,000 cubic feet of air a minute passing in the West side split for the use of fifteen men and two mules, and in the East side split there were eighteen men and a mule employed. These sections are partly ventilated by fresh air entering from the Main slopes. Roadways and timbering were in good condition generally and the sections were fairly free from coal-dust owing to heavy dampness and water on roadways.

In No. 11 West split there was 16,000 cubic feet of air a minute passing for the use of sixty-two men and seven mules.

In the different sections on this slope there are ninety-one men employed on the day shift. The ventilation generally is fairly good and no explosive gas was found. The roadways and timbering were in general good order and the sections practically free from coal-dust owing to heavy dampness and water on roadways.

I measured 65,000 cubic feet of air a minute passing down the Main slope above No. 3 East level.

In No. 6 East level split there was 25,000 cubic feet of air a minute passing for the use of sixty-three men and nine mules. No explosive gas was found, but a gas-cap was detected in two working-places, also some black-damp in the vicinity of the abandoned areas.

Gas committee reports of the condition of Nos. 1 and 2 slopes have been received at this office every month. These reports contained statements of a generally satisfactory nature. The report-books required to be kept at the mine were duly examined and found to fill the requirements of the "Coal-mines Regulation Act."

I regret to have to report that two fatalities occurred in these mines during the year. The first fatality occurred on June 17th in No. 2 slope, where a Japanese driver was crushed between roadway and loaded car in No. 8½ East level. The other fatality occurred on September 23rd

in No. 1 slope, where a Chinese loader was crushed between side of bottom brushing and loaded car on No. 1 incline off No. 11 West level.

Mine-air sample analyses show in main return airways taken at the fan, No. 1 slope, variation from 0.03 per cent. of methane to 0.13 per cent. in mine atmosphere. At fan in main return airway, No. 2 slope, a trace only of methane is recorded in analysis.

No. 5 MINE.

T. H. Williams, Superintendent; J. S. Williams, Manager; Sam Jones, Overman; J. Brown, J. Quinn, Harry Taylor, J. D. Davies, and A. G. Davies, Firebosses.

The workings of this mine are reached by a shaft 280 feet deep and known as No. 1 seam. A short distance from the shaft-bottom slopes have been driven down through the measures to another vein of coal called No. 2 seam, 115 feet vertically below No. 1 seam. In this vein the slopes have been driven down a distance of between 3,000 and 4,000 feet, and the levels off the slope will be close on 5,000 feet from the main hoisting-shaft.

Electric head safety-lamps are used by all the workmen and the firebosses use the flame safety-lamp of the Wolf type for gas-testing purposes. These head-lamps have been recently replaced by a lamp of much greater illuminating-power, called the Model "H" Edison electric lamp, which is the very latest in miners' lamps. Only permitted explosives are used. No blasting is done without the use of cable and battery, and shots are fired under the supervision of certificated officials.

The engine used for hoisting purposes in this shaft, which is 280 feet deep, is a Wellman-Seaver-Morgan engine, coupled to a 300-horse-power motor. Line unit is 2,200 volts, 3-phase system, 25 cycles. The hoist is equipped with single drum having two ropes attached, each of which is $1\frac{1}{8}$ inches in diameter. An air-brake control is supplied with an overwinding prevention device.

The fan producing ventilation is a 100- by 100-inch double-inlet reversible fan, driven by a motor of 250 horse-power, speed of 250 r.p.m. The line unit is 2,200 volts, 3-phase, 25 cycles. The quantity of air produced is 200,000 cubic feet a minute, with a 6-inch water-gauge. This fan is automatically controlled with temperature relays on all bearings. This device does away with the necessity of an attendant, as any excessive temperature would at once be relayed to an electric contact, which would act in cutting off the electric current supplied to operate the fan.

At the present time the mine is producing from 200 to 250 tons of coal daily. Coal is obtained from the Upper (No. 1) and Middle (No. 2) seam. About 100 tons daily is obtained from No. 1 seam and the balance of tonnage from No. 2 seam. In the latter the advance levels are about a mile away from the shaft-bottom. The method of working No. 2 seam was changed about the middle of the year from long-wall to pillar and stall, and since this change was made the operations have consisted of development-work in No. 2 seam and the extraction of pillars in No. 1 seam. No. 2 seam does not make much water.

During my last visit of inspection in December to this mine I found conditions in No. 1 seam to be as follows: Ventilation, timbering, and roadways good; no gas was found and the workings were practically free from coal-dust. There were twenty men and four mules engaged in this seam.

In the No. 2 seam ventilation was generally good. No explosive gas was found, but a $\frac{1}{4}$ -inch gas-cap was detected at the face of the main and counter slopes. Roadways and timbering were in good condition and the sections fairly free from coal-dust.

I measured 90,000 cubic feet of air a minute passing into East side of the mine and 40,000 cubic feet of air a minute passing down the Main slope, near No. 4 level. There were fifty men and six mules engaged in this seam.

Mine-air sample analyses indicate that new broken ground will give off considerable gas. At the present time electrical coal-cutters are employed. For the purpose of safe working such conditions will necessitate a good supply of fresh air continually sweeping the faces so as to keep the percentage of methane in the air-current at a minimum.

Through development in No. 2 seam it is expected in the near future that a considerably greater working area will be exposed, so that a much larger daily tonnage will be obtained than at the present time.

The gas committee reports were regularly submitted to this office and as a rule showed general conditions of the mine to be good.

The various report-books required to be kept at the mine were duly examined and found to comply with the provisions of the "Coal-mines Regulation Act." I am pleased to state that no serious injury or fatality occurred during the year.

No. 6 MINE.

This mine is supervised by the manager and overman of No. 5 mine. Practically all the water entering Nos. 5 and 6 mines is hoisted from No. 6 shaft by specially constructed tanks capable of delivering 1,200 gallons a minute.

During December visit of inspection there was measured on the main intake roadway a volume of air equal to 50,000 cubic feet a minute passing in by from the shaft.

The roadways and timbering in this part of the mine were generally in good condition and the stoppings surrounding the Main heading of old workings were in good condition. No methane gas has been found during the year.

Ropeman Dacre is in charge of looking after the condition of the shaft, guides, ropes, and chains, and these were found to have received the best of care and attention. There are three hoisting engineers connected with this operation, each one having to hoist water almost continually during the rainy season. Most of the surface water percolates through the strata into the mine-workings and hence reaches the main sump, where the tanks lift it from.

REPORT BY JAS. W. JEMSON, INSPECTOR.

WELLINGTON EXTENSION MINES.

This division of the Canadian Collieries (Dunsmuir), Limited, mining properties comprise Nos. 1, 2, and Vancouver slope; No. 5 South Wellington, and No. 9 Wellington, which ceased operating during March, 1929.

The output of the Extension Colliery is brought to Ladysmith over the Wellington Extension Colliery Railway, which also affords means of transportation to and from their work for the employees residing at Ladysmith.

LADYSMITH.

The general shipping-point for the output of these mines is Ladysmith, where the coal is either loaded on vessels or sent to Mainland points on railway-cars by means of transfer-barges. The coal-washer is equipped with three washers, each having a computed capacity of 200 tons in twelve hours, 6-compartment jigs, and four 14- by 17-foot Mascoe tables taking care of the smaller-sized coal. Power for the washery is supplied by a Pelton wheel. A 40-kw., 240-volt Allis-Chalmers-Bullock generator furnishes the power for lighting purposes to the washery and wharves.

EXTENSION COLLIERY.

Thomas Wilson, Manager.

The workings of this colliery are situated partly in the Cranberry and partly in the Douglas districts. Here the Wellington seam underlies an area of some 2 miles in width at its south-east end, in the vicinity of the Nanaimo river, and extending about 4 miles in a north-westerly direction. The presence of the coal was accidentally discovered in the year 1895 and rapid development followed.

All the Extension mines are in the western limb of an important anticline, the axis of which is closely followed by the Extension valley. The field is traversed by several minor folds, all running in a north-westerly direction, as do the two major faults. The latter is by far the most important, both as to continuity and displacement, its throw sometimes approaching 500 feet. At some points it has a comparatively low dip to the south-west and there assumes all the characteristics of an overthrust. As a result of an intense folding the edges of the basin are turned up rather sharply and the highest dips are generally met in the vicinity of the outcrops.

The entire output of No. 1 and No. 2 mines is brought to the tipple through a rock tunnel, driven 14 by 7 feet in the clear on a 1-per-cent. grade, which meets No. 1 mine at a distance of three-quarters of a mile from the portal. It continues from there to No. 2 mine, a total distance of 1¼ miles. Haulage is done by electric locomotives of the overhead-trolley type. The underground employees are taken to and from their work by a man-trip hauled by a 15-ton Baldwin locomotive.

Power-house.—The boiler plant consists of four Goldie & McCulloch return-tubular boilers of 163 horse-power each. The electric power is supplied by three 250-volt d.c. generators. No. 1 is a Crocker-Wheeler of 112.5-kw. capacity, directly coupled to a 15 by 14 Ideal engine; No. 2 is a 150-kw. direct-connected to a 14 by 14 by 32 Flemming-Harrisburg compound engine; No. 3 is a 150-kw. General Electric, direct-connected to a 16 by 16 Robb-Armstrong engine. A Black fire-supply pump 12 by 18 by 10 is maintained in the boiler-house.

The Extension mines were closed down in the early part of March owing to the depression in the coal trade and reopened on August 25th. The New Vancouver slope was also closed in March and reopened in September only for the purpose of drawing out the material and dismantling the machinery, after which it was finally abandoned.

No. 1 MINE.

Thos. Wilson, Mine Manager; Robert Housten, Overman; David Gordon, Alex. Orr, and Joseph Wilson, Firebosses.

All development-work has been stopped in this mine and the output is obtained entirely from pillar-extraction, the work being confined to the Main Diagonal slope, No. 1 slope, and the West incline. The haulage equipment to handle this output consists of one Ottumwa hoist driven by a 100-horse-power d.c. motor and two smaller hoists driven by 50-horse-power d.c. motors.

The mine is ventilated by a twin Murphy fan driven by an Allis-Chalmers-Bullock d.c. motor and passing 65,000 cubic feet a minute, against a water-gauge of 0.75 inch. This mine is naturally damp and therefore practically free from coal-dust.

I regret to state that one A. Badovinac, a miner, was killed on December 22nd, due to a heavy cave of rock from the roof.

No. 2 MINE.

Thomas Wilson, Mine Manager; Robert Housten, Overman; Joseph Watson, Owen Dabb, J. Gillespie, J. McKinley, Thos. Strang, E. Heyes, J. Stewart, and R. Hamilton, Firebosses.

This mine is divided into four districts, consisting of No. 17 Incline, No. 2 Incline, East Incline, and Lower Motor Road.

In No. 17 incline some development-work has been continued during the year, but the seam here is very irregular and about 5 feet of rock separates the top and lower bands of coal, making the seam difficult to operate; this district is also very wet, which adds greatly to the difficulties and expense of mining this coal.

In the other districts the output is obtained by pillar-extraction, No. 2 incline and East incline being almost exhausted. All the lower workings of this mine were abandoned when Extension Colliery temporarily closed down in March.

I regret to report that a blasting accident occurred whereby a miner was blasted by a shot which was fired on the opposite side of a thin pillar; the shot blew through on the miner, who should have been withdrawn.

NEW VANCOUVER SLOPE.

This slope only worked the first three months of the year. It closed down on March and opened temporarily in September to withdraw the material and machinery.

REPORT BY JAS. W. JEMSON, INSPECTOR.

WELLINGTON EXTENSION No. 5 MINE, SOUTH WELLINGTON.

William Wilson, Mine Manager; Joseph Wilson and Hugh Davidson, Firebosses.

This mine, situated in the Cranberry district near the South Wellington Station of the Esquimalt & Nanaimo Railway, is operated in the Douglas seam and adjoins the old Alexandria mine. The seam is very variable in thickness; "pinches" and "wants" are often met with. The shipping facilities are excellent owing to its close proximity to the Esquimalt & Nanaimo Railway, to which it is connected by a spur. The coal is sent over this road to the Canadian Collieries shipping centre at Ladysmith. The tippie is provided with a revolving dump, chain car-haul, shaker screens, picking-table, loading-boom, and a scraper conveyor for boiler-fuel. The output is hoisted up the Main slope by a first-motion steam-hoist with 18 by 36 cylinders. The smaller winches underground are driven by compressed air.

The mine is ventilated by a Keith 60-inch single-inlet fan, having a capacity of 60,000 cubic feet of air a minute, against a water-gauge of 1 inch. At the time of the last inspection there

was 26,000 cubic feet of air for the use of thirty-two men. The mine is naturally damp and consequently free of coal-dust.

The lower workings of this mine were abandoned in the early part of the year and all work concentrated on driving a pair of levels through the barrier-pillar separating the Alexandria mine from No. 5 mine. As the Alexandria mine was known to be full of water, special precautions had to be taken and a vigilant watchfulness maintained by the mine officials. Centre and flank holes were constantly kept in advance of the levels. A connection was eventually made and the water to that level allowed to drain off.

A lower level was started and the same precautions taken till a hole was bored through the barrier. This hole allowed the bulk of the water to drain off, so that development-work could be proceeded with when found necessary by the company. To handle this water two Allis-Chalmers centrifugal pumps were installed, each capable of handling 1,400 gallons of water a minute at 250-foot head.

REPORT BY JAS. W. JEMSON, INSPECTOR.

WELLINGTON EXTENSION No. 9 MINE.

Geo. O'Brien, Manager; J. G. Hindmarch, George Stewart, John Michek, George Dinsdale, and John White, Firebosses.

This mine is operated by the Canadian Collieries (Dunsmuir), Limited, and lies about 6 miles north of the city of Nanaimo. The above operation is in the well-known Wellington Upper seam, and while it is a very thin seam (being on the average 22 inches thick) the coal is of good quality and a large percentage of lump is recovered.

All workmen are provided with Edison electric cap-lamps and officials with the Wolf flame safety-lamps for inspection purposes, and all shot-firing is done with single shot-firing batteries and cable.

During the month of March an attempt at machine-mining was made with a Mavor & Coulson Sampson mining-machine, the object being to introduce some form of conveyor at the face which would to a great extent eliminate costly brushing. The mining-machine appeared to be a success, but owing to a depression in the coal trade the mine closed down for an indefinite period about March 20th and is still closed. There were no serious or fatal accidents during the period of operation and timbering and ventilation was generally good.

REPORT BY JAS. W. JEMSON, INSPECTOR.

FIDDICK MINE, SOUTH WELLINGTON.

R. Fiddick, Operator; James Handlen, Fireboss.

This mine is situated on the site formerly worked by the Pacific Coast Coal Company, near South Wellington Station on the Esquimalt & Nanaimo Railway. The operation consists entirely of recovering pillars that had been left by the previous operators.

The enterprise has been fairly profitable and successful. The opening near the south boundary of this property has not been worked much during the summer months, the work having been concentrated on the openings on what is known as the Black road and partly underlying the Esquimalt & Nanaimo Railway and adjoining the Southfield mine boundary.

Considerable cogging has been done in the part underlying the railway. Large squared timbers were being used for cogs, which enabled the workmen to make a good solid job of filling the excavated parts where necessary. All the openings are near the surface; consequently they have been ventilated by natural means.

REPORT BY JAS. W. JEMSON, INSPECTOR.

Lantzville Collieries, Ltd.

Henry Shepherd, President, Lantzville, B.C.; J. E. Ryan, Secretary-Treasurer, Nanaimo, B.C.;
T. A. Spruston, Managing Director, Lantzville, B.C.

No. 1 MINE.

Thomas A. Spruston, Manager; Wm. Clifford and J. A. Challoner, Firebosses.

This mine is situated on Nanoose bay, about 9 miles north of Nanaimo. Coal is shipped to all points over the Esquimalt & Nanaimo Railway at present, but it is the intention of the company to put in a loading-wharf in the near future.

Development-work began in the early part of 1929 by driving a new slope on a 30° pitch down to the Lower seam. The coal was struck at a depth of 210 feet. A crosscut was driven to the east of the slope and a raise put up for ventilation. The coal averages about 3 feet, is of good quality, being the Old Wellington seam, and is operated on the long-wall system, with roads driven at 35-foot centres. The Main slope and main haulage-roads are laid with 30-lb. steel rails and the branch roads with 16-lb. rails.

Compressed-air lines are laid throughout the mine for the use of the jack-hammers, which are all of the Gardner-Denver type. The workmen are provided with Edison storage-battery cap-lamps and the officials with flame safety-lamps for inspection purposes.

No explosive gas has been found in this mine. The power plant consists of a steam-boiler, air-compressor, a 10-kw. lighting plant, Keith ventilating-fan with a capacity of 10,000 cubic feet of air a minute, one Cameron pump, and one Fairbanks duplex pump. A tipple is under construction to handle up to 300 tons a day of the various grades of coal.

REPORT BY THOS. R. JACKSON, INSPECTOR.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.

Chas. Bocking, President, Vancouver, B.C.; H. Harvey, Secretary, New York City; H. R. Plommer, Treasurer, Vancouver, B.C.; Robert Henderson, Superintendent, Cassidy, B.C.

No. 1 MINE.

Robert Henderson, Manager; Francis John, Overman; Tom Bullen, Albert Radford, James McCrath, and Alex. McLachlan, Firebosses.

Granby Colliery No. 1 mine is situated about 9 miles in a southern direction from Nanaimo. The main entrance to the mine is by a slope, 7- by 14-foot framed sets, 4-foot centre to centre. A separate manway is provided for a travelling-road and it at the same time forms an intake airway. The Douglas seam, which varies from 3 to 20 feet in thickness, is worked at this mine and the system of work adopted is pillar and stall.

The mine is ventilated by a Sirocco fan having a capacity of 150,000 cubic feet of air a minute, with a 3.5-inch water-gauge. This fan is driven by a 150-horse-power Westinghouse electric motor. The main hoist is a Vulcan 18- by 36-inch, double-drum, second-motion hoist. The mine-cars are large, having a carrying capacity of 1.75 tons of coal. No mules or horses are used in the mine. Compressed air is used underground for driving of drills, pumps, and winches. A Rand cross-compound condensing compressor, with capacity of 2,000 cubic feet of air a minute, furnishes the power. Electric power is supplied by an Allis-Chalmers 450-kw. generator, 2,300-volt, 3-phase, 60-cycle, 300 r.p.m., both direct-connected to vertical high-speed engines of the Goldie & McCulloch type. The remainder of the electric equipment is of the Westinghouse type. A Worthington fire-pump, capacity of 1,000 gallons a minute, size 18 by 10 by 12 inches, is kept in readiness for emergency.

Pillar-extraction has been continued during the year with very good success. In addition to the pillar-extraction, a new slope has been driven down a distance of 1,000 feet from the face of No. 1 South level with the hope of winning out the coal in the southern area of the property. Places have been driven to the north and south of this slope, which vary in height from 2 to 14 feet. A counter-slope for ventilation purposes is being driven parallel to the Main slope, with an 80-foot pillar between. The ventilation in this section is being carried to the workings by means of an intake and return airway and the construction of two overcasts. The opening-up of this section will no doubt increase the life of this mine and allow the property to be further developed.

A large hall is used by the miners for the purpose of changing their clothes. An attendant is in charge whose duty it is to keep the place clean, well ventilated and heated. The heat produced in the drying-room is sufficient to make the mine clothes perfectly dry and comfortable for the workmen to don before they go to work in the mine. The change-house is equipped with steel lockers, which are heated by steam-coils underneath. There are shower-baths and large lavatory, including every convenience for the workmen.

The intake air is heated by exhaust steam passing through radiators and allowed to travel down the mine, thus to some extent preventing the drying-out of the mine. Very fine fog sprays

are placed about 150 feet apart on the Main slope and these operate automatically for twenty minutes out of every hour.

Farther in the mine the main roads are liberally treated with inert dust and water to such extent that the sample tests for coal-dust show an incombustible content in compliance with the requirements of the "Coal-mines Regulation Act."

During the inspection in the month of December the following conditions were found to prevail: Ventilation generally good, roadways and timbering good, and sections practically free from coal-dust. The No. 1½ South level ventilation system is advancing towards completion. I found no explosive gas, but got an ⅛-inch gas-cap at face of Clarkson's place near bottom of No. 1½ South slope.

In the South side split 28,000 cubic feet of air a minute was passing into No. 1½ South level for the use of twenty-two men; in the North side split there was 12,000 cubic feet of air a minute passing for the use of twenty men. The total quantity entering the mine was 80,000 cubic feet a minute.

No. 2 MINE.

Robert Henderson, Manager; T. W. Scott, Overman; Matt Meek and Dan Morgan, Firebosses.

This mine is situated about 2,000 feet from No. 1 mine and is operating in the same seam—namely, the Douglas seam. A Main slope and counter-slope starting from the surface is driven down on the full pitch of the seam and levels turned off to right and left. A start was made to open up this mine in April, and in May coal was struck. The slope is down about 400 feet and there are four levels to the right and four levels to the left. The coal-seam varies in height from 2 to 20 feet and is of good quality.

A small Keith forcing-fan driven by a 25-horse-power a.c. motor produces the ventilation in this mine. The coal is hauled to the surface by a 6 to 1 geared hoist and back-switched to a track which runs through the timber-yard to the tippie, where all the coal from both mines is handled and prepared for the market.

Ventilation was fairly good generally. I found no explosive gas and roadways and timbering were in good condition. Sections were practically free from coal-dust owing to water on all the roadways.

I measured 12,000 cubic feet of air a minute passing in the mine for the use of twenty men. Mine-air sample tests showed a trace of methane in No. 1 mine and 0.07 per cent. in No. 2 mine, main return atmosphere.

The gas committee monthly reports submitted to this office showed the general condition of the mine to be good. The various report-books kept at the mine were carefully examined and found to comply with the requirements of the "Coal-mines Regulation Act." No "occurrence reports" were submitted to this office. I am pleased to state that no serious accident or fatality occurred during the year.

REPORT BY JAS. W. JEMSON, INSPECTOR.

BIGGS' MINE, WELLINGTON.

This mine is situated in Section 1, Range 2, Mountain District, near the Canadian Collieries, Limited, No. 9 mine. The operation consists of extracting a few pillars left by previous owners. The cover is very light; in fact, some of the coal has been obtained by open-cutting. The coal is of excellent quality and finds a ready market in Nanaimo and district.

The grade of the short slope is so slight that the coal is easily hauled by a horse; therefore no machinery for haulage purposes is necessary.

REPORT BY JAS. W. JEMSON, INSPECTOR.

LITTLE ASH MINE, WELLINGTON.

R. H. Chambers, Operator and Mine Official.

This mine is situated about a mile from Wellington and half a mile from the No. 9 mine of the Canadian Collieries, Limited. It was formerly known as the Jordan mine and operated under that name over thirty years ago, though very little mining was done. The coal was hauled over a wooden track to Nanoose Bay, the shipping-point being near the Indian reserve.

A new lease of the property was acquired by a few local miners, who commenced to clear up the place and dewater the mine in April, 1928. One slope was driven to the south boundary, with two levels going east, and a number of pillars were extracted from the old mine. The present workings are in 6 feet of clean coal of good quality.

The equipment at the mine consists of one gasoline hoisting-engine, one gasoline-engine driving a centrifugal pump on the surface, one steam-boiler, and two steam-pumps underground. The mine has operated fairly steady throughout the year, with about nine men employed.

REPORT BY JAS. W. JEMSON, INSPECTOR.

RICHARDSON MINE, SOUTH WELLINGTON.

Richardson Bros., Operators; Robert Wright, Fireboss.

This mine adjoins the Fiddick property and is a continuation of the old workings of the Pacific Coast Coal Company. It is situated on Section 13, Range 6, in the Cranberry District, near the South Wellington Railway Station on the Esquimalt & Nanaimo Railway.

The slope has been advanced about 270 feet from the surface, after passing through several old workings or gobs. The mine has worked intermittently during the year. The coal is of fairly good quality; the greater part of the output is shipped by railway-car to Victoria. A bunker was built to facilitate loading of cars and provide storage.

A converted automobile-engine supplies the power for hoisting from the slope. The mine is under the supervision of a certificated official, only permitted explosives are used, and all blasting done by battery and cable. Wolf safety-lamps are also used.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

I have the honour to submit my annual report as Inspector of Mines for the Nicola-Princeton District for the year 1929.

The coal companies operating in this district during the present year were as follows: The Coalmont Collieries, Limited; Middlesboro Collieries, Limited; Blue Flame Coal Company; Tulameen Valley Coal Company, Limited; Normandale Collieries, Limited; Pleasant Valley Mining Company, Limited; Haigh and Winter's Mining Company; Ashington Coal Company, Limited; Gem Domestic Coal Company; and Canadian Coal and Briquetting Company, Limited.

The Ashington Coal Company was incorporated during the year for the purpose of taking a lease on the Wilson and Gregory coal property, situated west of the town of Princeton, where considerable work has been done during the year. Haigh and Winter took a lease on the "Black and Glover" property, situated about 6 miles south of Princeton, and have shipped a small amount of coal. The Blue Flame Coal Company, under the supervision of Mr. Dyke, made some arrangement for operating the Lynden coal-mine during the latter part of the year. The Gem Domestic Coal Company had a lease on a section of the old Princeton Coal and Land Company, Limited, situated a short distance west of the Princeton Railway-station, and produced a small tonnage. The Canadian Coal and Briquetting Company, Limited, took an option on the Old Pacific Slope property, situated in the Nicola valley, and has done considerable work on this property during the year. The Normandale Collieries, Limited, has continued to do work of an exploratory character at the Normandale mine during the year.

Most of these mining operations are small and the work done more or less of an exploratory nature; the Princeton coal-basin lending itself to this class of work as there are numerous outcroppings.

ACCIDENTS.

There were ten accidents reported to this office during the year under section 71 of the "Coal-mines Regulation Act," resulting in the death or injury to the same number of employees. Eight of these occurred at the Coalmont Collieries, four of which unfortunately were fatal; and two at the new operations of the Pleasant Valley Mining Company at Princeton.

It is most unfortunate to find it necessary to report four fatal accidents at the Coalmont Collieries during the year. Three of these happened on the haulage-roads underground and one

at the foot of the chute on the surface. Upon investigation one is impressed with the fact that had only a little more care been taken by these unfortunate men, at least three of the accidents would not have happened.

INSPECTION ON BEHALF OF THE WORKMEN.

Inspection on behalf of the workmen, as provided for by General Rule 37, has been taken advantage of at the larger coal operations in this district during the year and regular inspections made by the employees during each month. In all cases these reports have been very favourable and no complaints made regarding the safety of the mines.

SPONTANEOUS COMBUSTION.

The operating mines in this district have been very free from explosive gas during the present year and it is only on very rare occasions that any trace of methane has been found. The coals in this district, and more especially the larger seams, are susceptible to spontaneous combustion and every possible precaution must be taken to guard against this source of danger.

With the exception of the No. 3 mine of the Coalmont Collieries, the mines in this district have been very free from heating during the present year; this seam is of an unusual thickness and subject to a great deal of minor faulting, which may be better described as a large number of seams intersected by small bands of shale and fireclay, with only a small portion of the whole, at present, of any commercial value. Caves in the old roads and gobs consist of this highly carbonaceous material, which is at all times subject to spontaneous heating, and more especially around any of the faulted areas where the coal is soft and friable.

While it is not possible to prevent this spontaneous heating, it naturally follows that these conditions compel a system of operation that makes it as easy and as safe as possible to deal with heated areas by sealing around the immediate areas as soon as heating is discovered. In the work of sealing off fire areas liberal use has been made of the Burrell all-service gas-mask.

AMBULANCE-WORK.

It is gratifying to report that a great deal of interest has been taken in first-aid work at the different mining camps in the district during the year. Local associations have been instituted and teams put into training, which resulted in the first ambulance competition to be held in this district for some years. This was held in Princeton on Dominion Day and attracted first-aid competitors from all the coal and metalliferous mines in the district. Much encouragement in this work, both financial and by means of trophies, was given by the Department of Mines and the managements of the different mining companies.

I again take this opportunity of thanking the employees and officials around the different operating mines in this district for the co-operation and assistance given me during the year.

Coalmont Collieries, Ltd.

W. J. Blake Wilson, President, Vancouver, B.C.; General J. W. Stewart, Vice-President, Vancouver, B.C.; A. H. Douglas, Secretary, Vancouver, B.C.; D. McLeod, Treasurer, Vancouver, B.C.; George Murray, Superintendent, Blakeburn, B.C.

This is the largest and most important coal operation in the Princeton district, situated on the main line of the Kettle Valley Railway, 170 miles east of the city of Vancouver and 12 miles west of the town of Princeton. It has been the scene of active operations during the whole of the year. The mine-yard, tipple, and power plant are situated close to the shipping-point on the railway and the mines are located at an elevation of 1,600 feet above the tipple and some 3 miles distant. The coal is carried from the mine to the tipple by an aerial tram which has a capacity of 60 tons an hour.

This company at present is operating the No. 3 and No. 4 mines, both of which have been developed by adit-levels driven into the side of the hill, the No. 3 mine from the surface croppings and the No. 4 mine by a long rock tunnel. The operations in both these mines are at present being conducted to the dip of these main adit-levels and in the same seam of coal, which has a general pitch of 25° north. The No. 3 mine is situated at the west end of the mine-yard, the entrance to the mine being on the same elevation as the top terminal of the overhead tramway.

A light railway follows a further distance of 5,400 feet around the side of the mountain to the entrance of the No. 4 mine. These two mines are separated by a large intrusive dyke cutting north-east across the measures, which makes two distinct coal-basins in this section of the Coalmont field.

The seams worked in these mines are very susceptible to spontaneous heating and this constitutes one of the greatest problems encountered in operating the mines at Coalmont. Fortunately they are very free from methane. These mines are operated on a modification of the "panel system" and any disused portions are immediately sealed off by heavy beam stoppings well set back into the sides, roof, and the floor, and treated with a cement grout. These mines are required to be well supervised and every accessible place in the mines is examined not less than once every twenty-four hours for the purpose of detecting any signs of spontaneous heating. Several instances of heating occurred in these mines during the present year and were successfully dealt with in each case.

Power Plant.—Owing to the different operations being so widely scattered, all the mine operations being to the dip of the main adit-levels and the high inclination of the seam, a large amount of power is required. The main power plant, situated at Coalmont, near the Tulameen river, consists of three 250-horse-power Crossrum water-tube boilers fitted with forced draught, duplicate feed-pumps, and feed-water heaters, which provides power for operating a 1,000-kw. Allis-Chalmers turbine generator set provided with large condensers. The voltage at the generator is 500 volts, but the larger portion of this current is stepped up to 10,000 volts by transformers situated near the power-house and carried over high-tension lines to transformers situated near the mines, where the current is distributed at 550 volts for power purposes and 110 for lighting.

This plant is supplemented by an auxiliary steam plant, situated near the mine-yard, at the entrance to the No. 3 mine, consisting of two return-tubular boilers which provide heat for the offices, rooming-house, kitchen, dining-hall, and several other buildings. This plant also operates a steam-driven air-compressor for the use of the mine-hoist and the pumps of the No. 3 mine.

New Mine.—Preparations have been made during the year with a view of opening the No. 5 mine of this property. The coal here is found to be exposed at the side of the crock 2,700 feet north and at an elevation of 275 feet above the entrance to the No. 4 mine. This is the same seam of coal as operated at the present mines. It will be developed by slopes driven from the surface and run by gravity over a surface tramway to the light railway near the entrance to the No. 4 mine.

Overhead Tramway.—For description see previous reports.

NO. 3 MINE.

Harry Hopkins, John Davis, and Robert Barrass, Firebosses.

The entrance to this mine is situated at the same elevation and 1,500 feet north of the top terminal of the aerial tram. The mine has been developed by a well-maintained 8- by 12-foot level from the surface croppings and follows the strike of the seam. A long pillar of coal has been left intact to separate this mine from the No. 2 mine, which has been abandoned.

All the work done in this mine consists of extracting pillars lying above the No. 5 level, off the No. 2 slope, which is used as the main haulage-slope and situated about 1,600 feet from the entrance to the mine. This is a 20° slope and at present is about 700 feet in length. The seam is from 10 to 12 feet in thickness and is of a friable nature. The drawing of pillars produces a great deal of "crushing" on the roads behind, which involves heavy timbering and high maintenance cost. The coal is mined by hand and very little blasting is required.

Ventilation is produced by a 5-foot "booster" fan situated near the entrance to the counter-level and belt-driven by a 30-horse-power induction-motor. During my last visit to this mine ventilation measurements showed 12,000 cubic feet of air a minute passing into this mine for the use of twenty men. The air was well conducted around the working-faces and the mine was free from any trace of explosive gas; the brattice and stoppings being in fairly good order.

The working-places were well timbered and a satisfactory supply of timber was provided for the use of the miners. The roads were well timbered, in fairly good condition, and, being naturally damp, were free from dangerous coal-dust.

No. 4 MINE.

James Webster, Overman; Robert Murray, Shiftboss; A. W. McDonald, Frank Bond, James Simm, John Ovington, William Ross, Thomas C. Vincent, and George Walker, Firebosses.

This is the largest and most important mining operation of the Coalmont Collieries. It is situated 5,400 feet north of the entrance to the No. 3 mine and connected to the top terminal of the aerial tramway by a light railway, built around the side of the mountain, upon which an electric trolley-motor system of haulage is in use. This mine is entered by a 7- by 10-foot rock tunnel 1,600 feet in length, driven into the side of the mountain below the croppings of the seam, which is found to be exposed at a much higher elevation. This mine has been developed to the dip by an 18° slope to the No. 17 East level and the No. 15 West level, and is operated on a modification of the panel system for the purpose of keeping the different sections of the mine isolated.

The operations on the east side, in the lower section of the mine, are very limited owing to a large intrusive dyke heading towards the slope, and as a result all the operations below the No. 17 level are on the west side of the Main slope. With the exception of a small amount of work on the No. 12 West level, all the operations are at present being conducted from the No. 15 West level.

On this No. 15 West level, 500 feet from the Main slope, a pair of 20° slopes have been driven to the dip, a distance of 1,000 feet, while 1,500 feet from the slope on this level slopes have been driven to the dip a distance of 500 feet. While the coal at this depth maintains its usual good quality, and further appears to improve with depth, the overburden greatly increases and causes the lower section of this mine to be subject to heavy crushing, which makes it difficult to maintain roads. As a result this mine is considered to have reached an economical limit at 3,400 feet from the surface croppings. The work in this mine has reached a stage where it is a matter of drawing the pillars and retreating to the surface.

This is the same seam of coal as operated at the other mines of this colliery. It is about 10 to 12 feet in thickness, with a general pitch of 20° to 25° north-west. It is overlaid by a short-grained lime rock and as a result requires very heavy timbering at the faces and on the roads.

During the year a level was driven off the No. 12 West level, cutting the coal-seam series to the dip. A limited amount of work was done in a lower seam which was considered the most promising; however, the coal was found to be of an inferior quality and as a result this work was abandoned.

This mine has been found to be remarkably free from explosive gas and it is only on rare occasions that a trace of methane has been found at the face of the raise places. Spontaneous combustion has been one of the greatest sources of trouble encountered with a large mine of this description and as a result constant supervision is maintained for the purpose of detecting any heating. There are, up to the present time, thirty-three heavy well-constructed beam stoppings treated with cement grout used for sealing off the old disused portions of this mine.

Ventilation is produced by an 84-inch double-inlet belt-driven Sirocco reversible fan, driven by a 75-horse-power constant-speed motor, situated at the side of the mountain near the entrance to the counter-slope. During my last visit of inspection ventilation measurements showed there was 35,000 cubic feet of air a minute passing into the mine for the use of sixty-five men. The brattice, stoppings, and doors were in fairly good condition and the air well conducted around the working-faces.

The working-places were well timbered and a sufficient supply of timber was provided for the use of the miners. The roads were well timbered and in fairly good condition. A spraying system is installed in the Main slope which keeps the slope well moistened. The levels of the mine are naturally wet and as a result the mine is very free from dangerous coal-dust.

A well-appointed first-aid room is maintained at these mines under the supervision of a first-aid man, who is at all times in attendance to render any services that may be required by the employees. The doctor resides at the mine and pays a daily visit to the office. A mine-rescue station is run in conjunction with the first-aid room and contains five sets of Gibbs two-hour oxygen machines; four sets of the Burrell all-service gas-masks; one pulmotor and oxygen-pump, with the necessary supply of materials, which are at all times ready for any emergency.

All blasting is done by permitted explosives and all shots fired by electric detonators under the supervision of certificated officials. Edison electric head-lamps are in use by all the employees underground, while safety-lamps of the Wolf type are used by the officials for inspection purposes. Copies of the "Coal-mines Regulation Act" and special rules are posted near the entrance to these mines.

Middlesboro Collieries, Ltd.

E. W. Hamber, President, Vancouver, B.C.; Thos. Sanderson, Secretary, Vancouver, B.C.;
C. M. O'Brian, Treasurer, Vancouver, B.C.; Robert Fairfoull, Superintendent, Merritt, B.C.

MIDDLESBORO COLLIERY.

Robert Fairfoull, Manager.

This is the largest and most important coal operation situated in the Nicola district and is about 1 mile west of the city of Merritt. The power-house, tippie, and mine-yard are located on the Coldwater River flats and the mining operations are conducted approximately 3,000 feet south and at an elevation of some 300 feet above the mine-yard. These operations are reached by a gravity-plane about 2,000 feet in length near the entrance of the No. 3 North mine.

Some of the coal-seams are found exposed at the side of the hill and others come within close proximity to the surface. The seams are lying at a high angle of inclination, making it possible to follow the crop-line of the seams for some considerable distance. During the year there have been six different coal operations on this property in the same number of seams of coal, which are generally followed by adit-drifts driven into the side of the hill along the strike of the seams, which gain cover quickly owing to the raise of the hill.

Power Plant.—There has been no change made at the power plant during the year. This consists of four return-tubular boilers which have an aggregate capacity of 600 horse-power and provide power for a 2,300-volt alternator coupled direct to a high-speed steam-engine which is used for lighting and power for pumping the water from the Coldwater river to the mine plant; a large steam-driven Canadian Rand 2-stage cross-compound air-compressor, which has a capacity of 2,000 feet of free air a minute, is the only power used at the mines for operating the mine-hoists, mining-machines, and the pumps. This power is transmitted from the power-house to the mines by a 4-inch pipe-line 3,000 feet in length, passing along the side of the hill to the different mining developments.

The coal at these mines is practically all undercut by machines of the post-puncher type and the use of explosives is curtailed as much as possible for the purpose of improving the grade of coal. Edison electric lamps are in use by the employees underground, while flame safety-lamps of the Wolf type are in use by the officials for inspection purposes. I am pleased to state that there has been no serious accident reported at these mines during the present year.

The working-places and roadways throughout the colliery were found to be well timbered and an adequate supply of timber on hand for all requirements. Samples of dust taken throughout the year show that the regulations *re* coal-dust are observed. The ventilation was kept well up to the working-faces and no explosive gas was found.

The miners have availed themselves of the opportunity provided by the "Coal-mines Regulation Act," section 101, Rule 37, and have appointed their representatives to inspect these mines during each month. Reports of the same have been mailed to this office and in each case the report was found to be favourable. Copies of the "Coal-mines Regulation Act" and special rules are well posted at these mines.

No. 2 NORTH MINE.

James Fairfoull, Overman; Richard Dunnigan, Fireboss.

This mine is situated 300 feet west of the top of the surface incline and is developed by an adit-level following the strike of the seam from the croppings into the side of the hill, while a slope has been driven to the dip to recover the coal lying below this adit-drift. The seam has an average thickness of 6 feet and is generally considered the No. 2 seam of this property. The area of the mine is very small and all the work consists of the extraction of pillars in close proximity to the entrance to the mine.

Ventilation measurements showed 12,000 cubic feet of air a minute passing into this mine for the use of eleven men and was well conducted around the faces.

No. 2 SOUTH MINE.

James Fairfoull, Overman; Matthew McKibben, Fireboss.

This mine is situated a short distance west of the No. 2 North mine and has been developed from the surface croppings by an adit-level driven into the side of the hill on the same elevation as the surface haulage-road, and has reached a distance of 1,200 feet from the portal. The seam varies from 7 to 10 feet in thickness and is found to be lying "on end."

An 18° slope, 100 feet west of the entrance to this mine, has been driven to the dip. About 600 feet from the portal a fault was encountered which involved a fairly large amount of rock-work. When the coal was reached a connection was made to the level above by means of a raise, which provided good ventilation in the lower section of this mine. During my last visit to this mine I found the coal at the face of the South drift 18 feet in thickness, practically all clean and following very much the same contour as the seam above, and lying "on end."

Ventilation measurements showed 12,000 cubic feet of air a minute passing into this mine for the use of twenty-one men. The brattice and stoppings were in good order and the mine entirely free from any trace of explosive gas.

No. 2 EAST MINE.

William Ewart, Fireboss.

This is a small mine operated from the surface croppings on the north side of the surface incline, where the measures were found to be subject to a great deal of faulting. Work has been generally of an exploratory nature, developed by an adit-level following the strike of the seam for a distance of 600 feet, with raises driven on the coal to the surface croppings above for ventilation purposes. However, the face of the level came into contact with a major fault and as a result all the development-work has ceased. Operations have been commenced to recover the limited amount of pillar coal available.

During my last visit to the mine, ventilation measurements showed 3,000 cubic feet of air a minute passing into this mine for the use of seven men.

No. 3 NORTH MINE.

Alex. Allen, Overman; Garnet S. Corbett, Fireboss.

This is the largest and, at present, the most important operation of the Middlesboro Collieries, situated a short distance west and on the same elevation as the upper terminal of the surface incline. It has been developed from the surface croppings by a level driven into the side of the hill following the strike of the seam, which is about 6 feet in thickness, and lying at a fairly high angle of inclination for a distance of 2,000 feet. Headings have been driven from the Main level to the surface croppings above and are used for ventilation purposes.

The coal to the dip of this Main level has been developed by a slope commenced near the entrance to the mine across the pitch of the seam, a distance of 600 feet, and levels started off at convenient distances following the strike of the seam.

The work above the Main level of the mine consists of extracting pillars, which have at the present time been drawn back about 500 feet from the face of the Main level while the work is being developed to the dip.

The coal is mined by machines of the post-puncher type and requires very careful spragging; the use of explosives is kept as low as possible.

During my last visit ventilation measurements showed 16,000 cubic feet of air a minute passing into this mine for the use of thirty-two men; the air was well conducted around the working-faces, the brattice and stoppings being in fairly good order, and the mine free from any trace of explosive gas.

No. 3 SOUTH MINE.

James Fairfoull, Overman; Leslie Dickie, Fireboss.

This is a new mine commenced during the latter part of the year and situated 60 feet south of the No. 2 South mine. It has been developed by an adit-level situated on the same elevation as the surface haulage-road and has reached a distance of about 300 feet from the portal.

This seam follows the same contour as the No. 2 South mine, is found to be "lying on end," and, previous to encountering a fault 200 feet from the portal, was 18 feet in thickness; on cutting the fault the seam was found to be 6 feet thick and all good clean coal. This is cut by machines of the post-puncher type.

NEW PROSPECT.

James Fairfoull, Overman.

This is a new mine commenced during the latter part of the year and is situated about 600 feet south of the entrance to the No. 2 North mine; also 75 feet above and connected to the surface haulage by a single-track road up the side of the hill 300 feet in length. This has been developed by an adit-level driven into the side of the hill and has reached a distance of 200 feet from the portal. During my last visit of inspection I found this seam of coal at the face of the level to be 27 feet thick, the upper 16 feet being very good clean coal and following the same contour and pitch of the seams below.

Tulameen Coal Mines, Ltd.

M. Y. Alvazoff, Managing Director, Vancouver, B.C.; Harry Smart, Vancouver, B.C.;
John C. Bennett, Mine Superintendent, Merritt, B.C.

No. 1 MINE.

William Strang, Overman; Thos. Dobie and Robert Gourley, Firebosses.

This mine is situated about 2 miles from Princeton and has been the scene of active developments during 1929. This mine was formerly operated by the Tulameen Valley Coal Company, but was taken over during the year by the Tulameen Coal Mines, Limited. The new company built a new tippie, increased the power plant, and made connections with the Kettle Valley Railway; this involved about 1 mile of standard track.

A considerable addition has been added to the power plant during the year. The 60-horsepower locomotive-type steam-boiler and the 14 by 20 single-cylinder steam-engine, used for driving a single-stage 12 by 14 Ingersoll-Rand air-compressor, has been supplemented by a large return-tubular boiler. A 600-foot R-2 Ingersoll-Rand 2-stage straight-line steam-driven air-compressor and the mine-fan, formerly driven by a gasoline-engine, is now driven by a steam-engine.

The seam averages from 7 to 8 feet of good clean domestic coal overlaid by a fairly good shale roof. This seam at the Tulameen mine has a general pitch east of 15° and has been developed by four adit-levels driven into the side of the hill from the surface croppings. The No. 1 or lower level is the longest and follows the strike of the seam for a distance of some 1,500 feet from the portal of the level, where faulting was encountered; the No. 3 level, situated about 100 feet above, is used as the main haulage-level, and the upper or No. 4 level is the return airway.

Seven hundred feet from the portal of the No. 3 level a slope has been driven to the dip, a distance of some 700 feet, and is used as the present haulage-slope. During the early part of the year some of the old caved and disused roads commenced to heat in the south side, or the faulted area, and as a result some of the old roads were cleaned out and others sealed off. Unfortunately, in the previous operations of this mine little thought was given to arrange the workings to deal with this most important feature, which often determines the difference between success and failure in operating coal-mines in this district, and it was for this reason that it was decided to stop all further developments in this slope, recover all pillar coal possible, and make the future developments by new openings from the surface.

All the coal is mined at the present time by hand and the use of explosives is avoided as much as possible for the purpose of producing a large percentage of lump coal for the domestic market. Edison electric safety-lamps are used by all the employees underground, while safety-lamps of the Wolf type are used by the officials for inspection purposes. All shots are fired by electric batteries and by the officials.

Ventilation is produced by a 5-foot, enclosed-type, belt-driven fan situated near the entrance to the No. 4 level. During my last visit of inspection ventilation measurements showed 12,000

cubic feet of air a minute passing into this mine for the use of nineteen men. The mine was free from any trace of gas and the air well conducted around the working-faces. The stoppings and brattice were in fairly good order, the working-places well timbered, and a sufficient supply of suitable timber was provided for the use of the miners. The roads were in fairly good condition, well timbered, and, being naturally wet, were free from dangerous coal-dust.

During the year there have been no serious accidents reported at this mine. Copies of the "Coal-mines Regulation Act" and special rules are posted near the entrance to the mine.

Pleasant Valley Mining Co., Ltd.

W. R. Wilson, President, Vancouver, B.C.; R. R. Wilson, Vice-President, Victoria, B.C.; Miss M. Duncan, Secretary, Vancouver, B.C.; W. R. Wilson, Superintendent, Vancouver, B.C.

This is a new coal operation situated about 1½ miles west of the town of Princeton and on the south bank of the Tulameen river, and may be considered to be one of the most important developments in the Princeton field for several years.

The surface plant is located on a large flat on the south side of the river, which provides ample room for the mine-yard, tippie, power-house, and other surface equipment necessary for the operation of a large colliery. Connections with the Kettle Valley Railway by means of a bridge across the Tulameen river was completed early in the year. Mining operations are being conducted on the south side of the valley, where the ground raises steeply to a height of approximately 700 feet. The measures are found to have a general pitch south of about 15° and are fairly well exposed.

The mine-tippie is equipped with modern dumping and screening arrangements on a convenient elevation with the portals of the mine tunnels, where the grade has been made in favour of the loaded cars from the entrance of the mines to the tippie. The tippie is provided with mine-car scales, a Phillips cross-over dump, shaking screen, and a picking-belt 90 feet in length. The mine-cars after passing over the dump run down a suitable incline and return by a back switch; from there they are taken to the mines in trips by means of horses. There are five railway loading-tracks under the tippie.

During the year a power plant was installed and consists of four return-tubular boilers situated near the tippie building, two air-compressors having an aggregate capacity of 2,000 cubic feet of air a minute, and an electric generating plant. A 4-inch compressed-air line has been laid from the power house along the side of the hill to the No. 2 mine, and a 3-inch air-line has been laid from the power-house along the side of the hill to the No. 1 mine, as compressed air will be used for operating coal-cutting machines, hoists, and pumps in the mines.

No. 1 MINE.

Thos. Cunliffe, Overman; John Gillham and William Harmison, Firebosses.

This mine is situated on the same elevation, about 1,500 feet east of the tippie and connected to same by a double-track haulage-road. This mine has been developed by a pair of 8- by 10-foot adit-drifts cutting across the measures and reaching the seam of coal about 700 feet from the portal. Two levels have been driven some 800 feet to the west from this point, the work being generally of an exploratory nature. No work has been done to the dip or the raise of these levels.

This seam is intersected by several bands of shale and bone in the lower part, and at present all the work is confined to the upper section of the seam, where there is about 4 feet of clean coal. The coal at present is mined by hand, but recourse will be made to coal-cutting machines as soon as the power plant is in full operation.

Ventilation is produced by a Keith enclosed-type ventilating-fan, driven by a gas-engine. Measurements showed 10,000 cubic feet of air a minute passing into this mine for the use of eleven men. This air is well conducted around the working-faces and the mine free from any trace of explosive gas. The working-places were well timbered and a sufficient supply of suitable timber provided for the use of the miners. The roads were well timbered, in good condition, and, being naturally wet, were free from dangerous coal-dust.

No. 2 MINE.

During the latter part of the year work has been concentrated on the opening of the No. 2 mine, situated about 2,000 feet west of the tippie, where a 6-foot seam of clean coal was exposed at the side of the hill, overlaid by a good hard-shale roof. A tunnel 800 feet long was driven through a bluff which intervenes between this mine and the tippie and reduces the surface haulage to a minimum.

The coal is at present mined by hand, but, being of a very hard nature, no doubt will be mined by cutting-machines as soon as the power plant is placed into operation. The mine at present is very small and the conditions generally good. Edison electric lamps are in use by the employees underground, while safety-lamps of the Wolf type are used by officials for inspection purposes. Permitted explosives are in use, shots being fired by electric batteries and by officials appointed for that purpose.

Blue Flame Coal Co., Ltd.

Lester Ecker, President, Bellingham, Wash.; George Blondin, Vice-President, Bellingham, Wash.; E. W. Hanson, Secretary-Treasurer, Bellingham, Wash.; S. K. Mottishaw, Superintendent, Princeton, B.C.

No. 1 MINE.

Sam Mottishaw, Manager; Charles Webber, Fireboss.

This is the former Lynden coal-mine, which was opened by the Lynden Coal Company, Limited, during the year 1927. Operations were continuous until the month of January, 1929, when the mine was shut down temporarily. It was then taken over and operated for a short time during the month of March by the Lynden Coal Mine Lessees, chiefly consisting of a number of the former employees. During the month of October it was reorganized as the Blue Flame Coal Company, Limited, and continued to operate during the balance of the year.

The mine is situated on Lamont creek, 1 mile south of the Hope-Princeton highway. The seam is about 24 feet in thickness and lies at an angle of 15°; the lower section of the seam is intersected by several small bands of shale and bone, and as a result the operations are confined to the upper section, which is 8 to 9 feet in thickness. The mine has been developed by a Main slope N. 45° E. This follows the pitch of the seam a distance of about 600 feet, when the dip to the measures change, and as a result this main haulage takes a level course for a further distance of 750 feet, making a total distance from the portal of 1,350 feet; headings have been driven to the raise from this main haulage-road for a distance of about 450 feet and places have been driven to the dip for a distance of about 250 feet. The mine is blocked out into fairly large pillars, with roads about 12 feet in width. The coal is mined by machines of the post-puncher type for the purpose of reducing the use of explosives as much as possible and the production of a large percentage of lump coal. Compressed-air hoists are used for haulage underground.

The power plant consists of a 5½- by 16-foot return-tubular boiler situated at the mine. This is used for providing power for a single-stage steam-driven air-compressor, having a capacity of 516 cubic feet of free air a minute, while a 7- by 12-inch steam-driven hoist is located near the entrance to the mine for the main haulage. The coal is shipped by motor-trucks to coal-chutes situated on the Kettle Valley Railway near the town of Princeton.

Ventilation is produced by a 4-foot high-speed enclosed-type fan driven direct by a Sturtevant steam-engine situated near the entrance to the fan-drift. During my last visit of inspection ventilation measurements showed 13,500 feet of air a minute passing into this mine for the use of ten men. The brattice and stoppings were in good condition, the air well conducted around the working-faces, and the mine free from any trace of explosive gas.

The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were in good condition, well timbered, and, being naturally damp, were free from dangerous coal-dust.

Edison electric head-lamps are used by the employees underground, facilities for charging the same being installed at the mine, while safety-lamps of the Wolf type are in use by the officials for inspection purposes. All shots are fired by electric batteries by officials appointed for this purpose.

Canadian Coal and Briquetting Co., Ltd.

Joseph Mayers, President, New Westminster, B.C.; W. H. Elson, Vice-President, New Westminster, B.C.; David Whiteside, Secretary, New Westminster, B.C.; Harry N. Freeman, Superintendent, Merritt, B.C.

No. 1 MINE.

Harry N. Freeman, Superintendent; Robert Alstead, Overman.

During the early part of this year the above company took over, under option, the property of the Old Pacific Coast Colliery, Limited, of British Columbia. This is comprised of a large portion of the Coldwater River flats, situated to the west of the city of Merritt.

The present company during the year has concentrated most of the work on the old shaft operations situated near the Middlesboro Collieries' tippie. The old 5- by 5-foot shaft was dewatered and widened out to a 6- by 10-foot 2-compartment operating shaft which has been well timbered.

The old slope, which has been found to be steeply inclined, was dewatered, cleaned out, and retimbered to within what is expected to be a short distance from the face. A raise has been driven from a level situated near the foot of the shaft to within a short distance from the surface and will be used as a return airway for the mine.

A well-equipped surface and steam-power plant has been installed at this mine during the year and consists of an 18-foot by 72-inch return-tubular boiler which supplies power for the shaft-hoist, compressor, and small lighting plant.

Ventilation is produced by a small enclosed-type steam-driven fan situated near the top of the shaft. During my inspections I found the ventilation of the mine fairly good and free from any trace of explosive gas. The working-places were well timbered and a sufficient supply of suitable timber provided for the use of the miners. The roads were also well timbered, in good condition, and, being naturally wet, are free from dangerous coal-dust. Four men are employed underground. Electric lamps of the Wolf type are in use by the employees underground and a Wolf safety-lamp is used by the officials for inspection purposes.

Work in this mine has been entirely of an exploratory nature, its purpose being to prove the commercial value of this property.

BLACK COAL MINE.

Robert Spruston, Overman.

This mine is situated about 6 miles west of the town of Princeton and is accessible by a road into the Findlay Creek coal-basin. This is an unusually thick seam of coal and is exposed at the surface at a high angle of inclination. A small amount of work, mostly of an exploratory nature, has been done over a long period of years on this coal-showing.

The property is at present owned by Mr. Black, of Princeton, and Mr. Glover, of Vancouver. During the present year it was leased for a short period by Messrs. Haigh and Winter, of Princeton, who, with the assistance of the Department of Mines, located and graded a new road from the main highway to the mine. They also built a small tippie and bunker a short distance from the entrance to the main tunnel for the purpose of shipping coal by motor-trucks to the loading-station on the railway at Princeton.

The mine consists of a pair of levels, driven from the outcrop for a distance of 250 feet, with the necessary crosscuts, and a raise driven from the counter-level to the surface above, which is reached at a distance of about 50 feet.

The seam of coal is lying at an angle of about 65° and may be better described as a number of seams intersected by a number of bands of shale, the larger sections of which are good seams of coal about 7 to 8 feet in width, in which the levels are at present being driven.

The present workings are in the upper section of the seams, with the hanging-wall above consisting of a fairly firm shale. The aggregate thickness of the seam has not at the present time been determined, although a section taken across the present workings, which include a crosscut driven a short distance into the foot-wall of the counter-level and the face of which is at present in coal, is not less than 65 feet. As stated above, the work is to a great extent of an exploratory nature, chiefly for the purpose of proving the extent of this portion of the coal-basin.

I found the general conditions of this mine to be fairly good regarding timbering and ventilation and there was no trace of gas. A small force-fan driven by a gas-engine situated near the entrance of the adit-level supplied air to the mine by means of galvanized pipes. There is no machinery underground.

Ashington Coal Co., Ltd.

Joseph W. Irwin, President, Coquitlam, B.C.; Fred Norman, Vice-President, Fort Langley, B.C.; Kilburn King Reid, Secretary-Treasurer, New Westminster, B.C.; Edward Floyd, Superintendent, Princeton, B.C.

No. 1 MINE.

Pete Carr, Shiftboss; William Westenedge and Peter Hunter, Firebosses.

This mine is situated in the town of Princeton, within a few feet of the north bank of the Tulameen river. The work being done so far is entirely of an exploratory nature, consisting of a well-timbered 7- by 10-foot adit-drift driven into the side of the hill immediately below the road, cutting across the measures, which are found to be lying at an angle of about 15°. A seam of coal about 6 feet in thickness was reached about 120 feet from the portal of the tunnel, but owing to being intersected with small bands of shale and bone was found to be of little commercial value; this drift is being continued across the measures for the purpose of intersecting any further seams of coal that may be in this area. At the time of my last inspection in December the tunnel had been driven 280 feet from the portal.

Ventilation is produced by a small enclosed force-fan situated near the entrance to the tunnel and belt-driven by an electric motor; the air being conducted to the face of the drift by 12-inch ventube.

A 6- by 18-foot return-tubular boiler and a vertical-type tandem steam-driven Sentinel air-compressor, having a capacity of 600 feet of free air a minute, is in the course of installation and will be used for providing power for compressed-air drills. This should be in operation during the early part of the year.

Electric head-lamps are in use by the employees underground and Wolf safety-lamps are used by the officials for inspection purposes. During my inspections I found the mine to be in good condition and free from gas.

Gem Domestic Coal Co., Ltd.

W. R. Foster, Manager.

This mine is situated about 1 mile west of the railway-station at Princeton. This seam of coal is approximately 42 inches in thickness and has a pitch to the west of 15°. Operations were commenced under lease in a very small way during the fall of the year. Ventilation is produced naturally; the mine is fairly well timbered and free from any trace of explosive gas. Edison electric lamps are used by the employees underground and safety-lamps of the Wolf type are used for inspection purposes.

NORTHERN INSPECTION DISTRICT.

REPORT BY THOS. J. SHENTON, INSPECTOR.

Telkwa Collieries Co., Ltd.

John J. McNeil, President, Telkwa, B.C.; George Woodland, Vice-President, Prince Rupert, B.C.; Thomas McClymont, Secretary-Treasurer, Prince Rupert, B.C.; Asa Robinson, Superintendent, Telkwa, B.C.

GOAT CREEK.

J. McNeil, General Manager; A. Robinson, Mine Foreman.

This mine did not operate from the end of March to the end of August. The mine is in fair condition, with the production being obtained from development-work. During my inspections I found the mine being operated in accordance with the "Coal-mines Regulation Act."

EAST KOOTENAY INSPECTION DISTRICT.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit the annual report for the year 1929, covering the inspection of coal-mines in the East Kootenay District. The attached report by John MacDonald, Inspector of Mines, covers the work of inspection in more detail and shows conditions to have been fairly good throughout the year.

Of the five collieries in the district, only three were in operation during the year—namely, Coal Creek and Michel, operated by the Crow's Nest Pass Coal Company, Limited, with head office in Fernie; and Corbin, operated by the Corbin Coals, Limited, with head office in Vancouver.

No attempt was made during the year to operate the Morrissey Colliery, owned by the Crow's Nest Pass Coal Company, Limited, or the Hosmer Colliery, owned by the Hosmer Mines, Limited, subsidiary of the Canadian Pacific Railway, Department of Natural Resources.

The Corbin Coals, Limited, went into liquidation towards the end of the year, and has been reorganized under the name of the Corbin Collieries, Limited, and it is gratifying to know that this was accomplished without any stoppage at the colliery.

Coke is made at two of the collieries—namely, Fernie and Michel—but only about 35 per cent. of the ovens are working at either colliery. At both these places the bee-hive oven is used and no attempt is made to recover any by-products.

The reduction in the amount of coal produced during the year has been due to lack of demand, caused to great extent by the partial failure of the crops on the Prairie and also to the failure in moving the crops.

There has been no labour trouble during the year and relations between the workmen and their employers have been very good.

ACCIDENTS.

Fourteen accidents were reported under section 71 of the "Coal-mines Regulation Act," involving death or injury to twenty-four workmen.

Eight of these accidents, involving eighteen workmen, occurred at Coal Creek Colliery; five at Michel Colliery, involving five workmen; and one at Corbin Colliery, involving one workman. One of the above accidents occurred on the surface.

Three accidents involved the death of three workmen, all of which occurred at Coal Creek Colliery.

Falls of roof or coal was responsible for two deaths and six of the injured workmen; haulage for four injured; explosion for ten injured; fall of timber, one injured; and miscellaneous, one death.

One of the fatal accidents, included under miscellaneous, was a bratticeman, who received a small scratch on the cheek on February 18th, and later blood-poisoning set in and he died on July 3rd. This man did not seem to treat the accident as serious and failed to report the same to any of the mine officials, but the doctor's report showed the cause of death as "cerebral meningitis, the direct result of the infection on his cheek."

Another fatal accident, also to a bratticeman who was erecting a set of timbers, was due to the place caving and burying him. The third was the case of a timberman who was repairing, when the roof caved, killing him instantly.

Ten men were injured through being burned, due to an explosion of gas or gas and dust while clearing up an old roadway where a fire had occurred. In this case there is no doubt that the ample supply and distribution of rock-dust prevented a spread of the explosion and what might have been a very serious disaster.

In one case the use of temporary posts might have saved the life of one man and injury to another. The use of sprags to the undermined coal might have saved several from being injured, and in this connection I feel that greater care in taking out these sprags might be used.

All of the accidents were investigated, and where inquests were held these were attended, and we are very much indebted to the Coroner for his courtesy in allowing us to ask questions of the witnesses in order to assist in solving the accident.

DANGEROUS OCCURRENCES.

Fourteen notices were received under the above section and included nine under subsection (b), two under subsection (c), and three under subsection (d).

Under subsection (h) is included five outbursts of methane, three of which occurred in No. 1 East, Coal Creek Colliery; two outbursts of methane in No. 2 mine, Coal Creek; three "bumps" also in No. 1 East mine; and one cave in No. 3 mine, Michel.

No extensive damage was done by the outbursts or the bumps, nor were there any of the workmen injured. In one case in No. 2 mine a horse was killed, the result of the outburst. In this case the horse was attached to a loaded car when the outburst occurred, and the driver did not have time to unfasten it, with the result that it was asphyxiated before the methane could be cleared out.

Where the two outbursts occurred in No. 2 mine a new district was being opened up to reach a lower portion of the No. 2 seam. About 10 feet of shale and dirty coal separated the upper and lower portions and it was in the lower portion that the outbursts occurred. No attempt had been made to drill these faces previous to the outbursts, but since then the suspected places have been drilled similar to those in No. 1 East mine.

The other occurrence under this head was a cave in No. 3 mine, Michel Colliery, where a large cave occurred and a workman was injured while making an examination of the roof.

Under subsection (c) two ignitions of gas or dust were reported—one in No. 1 East mine, Coal Creek Colliery, and one in No. 3 mine, Michel Colliery. That in No. 3 mine, Michel Colliery, was due to a poorly judged shot; the hole was started in rock and ended in a small seam of coal and was fired as a rock shot. Some gas, which apparently had not been detected on examination before the shot was fired, was ignited. No one was injured and no damage was done.

In the case of No. 1 East mine, Coal Creek Colliery, the ignition took place where men were at work to locate and load out a fire in a heavily caved roadway. Some live fire had been uncovered and before this could be dealt with a cave or slide of loose material, accompanied by a cloud of dust, came down on the fire; the dust immediately ignited and fired and seriously burned ten men.

Three mine fires were reported—the one referred to above in No. 1 East mine and one in No. 1 South mine. In both these cases all men were withdrawn from the mines, excepting the fire crews, until the fires were under control. The other fire occurred in the abandoned No. 5 mine old workings near the outcrop which caught fire from a bush fire.

The general conditions with respect to ventilation have been maintained fairly well during the year and are dealt with in detail by Inspector John MacDonald in his report.

The percentage of methane in the air-currents varied very much during the year, due, in my opinion, to the irregular working of the mines. At Coal Creek, No. 1 East mine as usual provided the highest percentages, varying from 0.8 per cent. in the No. 1 split to 2.4 per cent. in the No. 3 split. No. 3 mine, also at Coal Creek, varied from 0.6 in the No. 1 split to 1.95 per cent. in the No. 2 split. In the other mines the percentage remained low, not exceeding 0.8 per cent. and on an average not over 0.4 per cent. At Michel the No. 3 mine showed only a very few cases over 1 per cent. At Corbin the percentage did not exceed 0.4 per cent. In the No. 1 East mine, and also in No. 3 mine, efforts should be made to reduce this percentage by introducing more air.

REGULATIONS FOR PRECAUTION AGAINST COAL-DUST DANGER.

The conditions with respect to this danger have been very well carried out during the year and it is very important that this should be continued. The principal means of dealing with the dangers arising from coal-dust is to use non-combustible rock-dust, principally crushed lime-rock, which is secured from the Summit Limestone Works, situated east of Crownsnest in Alberta. This firm supplies a great many of the coal-mines in Alberta and makes a specialty of providing rock-dust for coal-mines.

The number of tests made as required by section 4 of the "Regulations for Precaution against Coal-dust" were as follows: Coal Creek, 1,262; Michel, 306; Corbin, 13; total, 1,581. Where the analysis showed these tests did not come up to the standard of requirements, the place was again treated and further tests made until the regulations were fully complied with.

INSPECTION ON BEHALF OF THE WORKMEN.

This inspection on behalf of the workmen has been carried out at all the mines in the district, practically every month, and is of great advantage in maintaining safer and healthier conditions in and around the mines. We are very much indebted to the workmen's committee

for this inspection, and so far conditions have been found fairly good and no reports have been made to this office complaining of either dangerous or unhealthy conditions.

I am very glad to be able to state that the inspection committees received every assistance from the mine officials to make their inspections, and during the very trying time of the fires in No. 1 East and No. 1 South, also the explosion in No. 1 East, their assistance and advice was very much appreciated.

At Coal Creek ninety-two inspections were made for the four mines, at Michel thirty-six for three mines, and at Corbin twenty-four for two mines. In the larger mines it takes as much as three days to cover the ground and this accounts for the greater number of inspections at Coal Creek.

Searches for articles contrary to section 101, Rule 9. Under this rule searches were made every month at Coal Creek and Michel, and eight times during the year at Corbin; the list attached shows the name, offence, and penalty inflicted in each case.

HAULAGE.

Underground haulage is either by horse, compressed-air hoists, locomotives, or rope-haulage. No electricity is used underground, but in some cases haulage-ropes underground are operated by electric motors situated outside the mine. At present electric power is secured for the mines from the East Kootenay Power Company, with hydro plants situated at Elko and Bull river, with an auxiliary steam plant situated on Crownsnest lake. A new steam-plant is being installed at Michel Colliery and next year will probably see Michel producing sufficient electric power to supply at least its own requirements along this line.

LIGHTING.

Lighting underground is principally by the Edison electric mine safety-lamp, while the officials also carry a Wolf safety-lamp for the purpose of being able to make a rapid determination of the ventilating-currents with regard to methane. There are three different models of the Edison electric lamp, each succeeding one being a great improvement, so far as lighting or illumination goes, over the preceding one. Therefore the older type is gradually being replaced with the new type, the model "F." The model "H" head-piece, which can be used with the model "F" battery, certainly gives great illumination, giving between 20 and 30 candle-power.

EXPLOSIVES.

At Michel and Corbin Collieries explosives are used to bring down the undermined coal; at Coal Creek no explosives are used for this purpose. At all the collieries explosives are used for rock-work.

The use of explosives in coal-mines is subject to Rules 11 and 12, section 101, of the "Coal-mines Regulation Act," and these have been fairly well complied with during the year. During the year two kinds of explosives were in use—CXL-ite for rock-work and Monobel No. 4 for bringing down coal.

RESCUE APPARATUS.

The rescue apparatus maintained at the collieries is the same as last year, there being six sets at Coal Creek, six sets at Michel, and five sets at Corbin, all of the Gibbs type.

There are sixty men in the mines of this district who have taken the mine-rescue training (twenty-two during 1929) and a number of teams carry out regular practice training throughout the year. Most of the trained men prefer the new Gibbs apparatus provided at the Government station, but as the mining companies are equipped with the Gibbs machine, training is carried on with both types.

Two hundred and twenty-eight men in the mines hold the St. John first-aid certificates and training in this work is well maintained during the year.

Copies of all notices required under the "Coal-mines Regulation Act" have been kept posted and in good condition at the mines during the year.

We again wish to thank the workmen, the officials, and the companies for their co-operation and assistance during the year and look forward to a continuance of this in the year we are now entering. We realize that it is only through this co-operation that the industry of coal-mining can be made safer and healthier.

REPORT BY JOHN MACDONALD, INSPECTOR.

Crow's Nest Pass Coal Co., Ltd.

Head Office—Ferne, B.C.

W. R. Wilson, President, Ferne, B.C.; A. H. McNeill, Vice-President, Vancouver, B.C.; J. S. Irvine, Secretary, Ferne, B.C.; A. A. Klauer, Treasurer, Ferne, B.C.; H. P. Wilson, General Manager, Ferne, B.C.

The above company operated, during 1929, Coal Creek and Michel Collieries on the western slope of the Rocky mountains in East Kootenay Inspection District.

Coal Creek Colliery is situated at Coal Creek, about 5 miles from Ferne. Railway connection from the colliery is made with the Canadian Pacific Railway and the Great Northern Railway at Ferne, over the Morrissey, Ferne & Michel Railway.

Michel Colliery is situated on both sides of Michel creek, on the Crowsnest branch of the Canadian Pacific Railway, about 24 miles in a north-easterly direction from Ferne.

COAL CREEK COLLIERY.

B. Caufield, Manager; J. Taylor, Assistant Manager; E. Morrison, Safety Inspector.

This colliery is situated on both sides of Coal Creek and has railway connection with the Canadian Pacific and Great Northern Railways at Ferne by means of a branch line, 5 miles in length, called the Morrissey, Ferne & Michel Railway. The mines operated during 1929 were No. 1 East, No. 1 South, No. 2, and No. 3 on the south side of the valley; No. 9 was the only mine operated on the north side, where a small force of men was steadily employed keeping the mine roadways repaired.

A general description of the method of working, system of haulage in and around the mines, and surface plant has appeared in previous Annual Reports. An important addition to the surface plant was the erection of a modern barn for housing the mine horses. This is 250 feet long by 80 feet wide, having accommodation for 126 horses, together with five box stalls, office, harness and feed rooms, on the ground-floor. Water-troughs are fitted in front of all stalls, while Beatty feed and manure conveyors are installed throughout. On the second floor there is an oat-bin with a capacity of 3,000 bushels, while storage-rooms are also provided for bran and hay; this floor is equipped with a hay-track to facilitate the handling of feed. All electric wiring for lighting and power purposes is installed in conduit. This building was erected in the latter part of the year to replace three smaller barns which were destroyed by fire on June 29th. A large crib, 140 feet long, 25 feet high, and 18 feet wide, was built on the mountain-side on the north side of the valley at a distance of approximately 1,000 feet above the tippie as a safety measure against snowslides. This was rendered necessary to replace the old cribbing which was demolished by the bush fire of August 16th. As the No. 9 mine-fan and engine-house were burnt down at the same time, a small blower-fan has been built adjacent to the main intake airway of this mine for the purpose of assisting the natural circulation when required.

The haulage arrangement on the surface for No. 3 mine was changed from the electric hoist on the old trestle-work to a more permanent and much safer location and a new 75-horse-power compressed-air hoist installed. The old trestle-work, which was showing signs of weakness, was abandoned, and a solid cribbing, 110 feet long, 22 feet high, and 20 feet wide, was built; this alteration has made the mine approaches safer and simplified the haulage at the top of the Main slope.

The lamp used exclusively by the workmen is the Edison electric cap safety-lamp, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes, all lamps being cleaned and repaired in a well-equipped lamp-room located in a central position at the colliery. Burrell gas-detectors are provided at all the mines for the purpose of detecting lower percentages of methane than that usually found by the ordinary safety-lamp.

A large number of dwellings are provided at Coal Creek for the convenience of those who prefer living near the mines, while a good train service is maintained to Ferne, where the majority of the workmen reside. Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines.

Following is a brief report of the conditions prevailing in the various mines throughout the year:—

NO. 1 EAST MINE.

J. Caulfield, Overman; J. Maltman, T. Reid, E. Rutledge, J. Whyte, and W. Chapman, Firebosses.

This mine operates the eastern portion of No. 1 seam and is ventilated by an electrically driven 11- by 7½-foot Sirocco fan, which, running at a speed of 171 r.p.m., produced an average quantity of 169,000 cubic feet of air a minute, under a water-gauge of 3.6 inches. The ventilation is divided into four splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—38,000 cubic feet of air a minute for the use of sixty-four men and thirteen horses. Safety-lamp indicated 1.3 per cent. methane.

No. 2 Split.—10,500 cubic feet of air a minute for the use of twenty men and three horses. Safety-lamp indicated a slight trace of methane.

No. 3 Split.—28,000 cubic feet of air a minute for the use of twenty-five men and five horses. Safety-lamp, 1.8 per cent. methane.

No. 4 Split.—22,400 cubic feet of air a minute for the use of twenty men and three horses. Safety-lamp, 1.3 per cent. methane.

North Return.—108,000 cubic feet of air a minute for the use of sixty-five men and twelve horses. Safety-lamp, 0.8 per cent. methane.

East side of fan-shaft, 61,600 cubic feet of air a minute; west side of fan-shaft, 108,990 cubic feet of air a minute; total return air, 170,590 cubic feet of air a minute.

Explosive gas has been found several times in the course of inspection, mostly in cavities caused by blowouts and in cavities in the roof above the timbers at the working-faces. Burrell readings taken in the return air-currents have varied from 0.7 per cent. methane in No. 1 split to 2.4 per cent. in No. 3 split.

Roadways and timbering have been kept in fairly good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces. All roadways and working-faces where required are treated regularly with crushed limestone-dust and water to alleviate the coal-dust hazard. Three hundred and thirty-nine samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but five of these being well above the standard set by the above regulation.

NO. 1 SOUTH MINE.

F. Landers, Overman; W. Hynds, M. Hilton, and J. Sweeney, Firebosses.

This mine operates the upper and western portion of No. 1 seam and is ventilated by an electrically driven 11- by 7½-foot Sirocco fan, which, running at a speed of 210 r.p.m., produced an average quantity of 124,000 cubic feet of air a minute, under a water-gauge of 4.5 inches.

NOTE.—This fan ventilates Nos. 2 and 1 South mines and is still operating as a single-inlet unit.

The average quantity of air produced in the main return airway of No. 1 South mine was 47,100 cubic feet a minute. This mine is still on one split; the quantity passing at the last inspection measured as follows:—

Main Return.—44,400 cubic feet of air a minute for the use of fifty-six men and twelve horses. Safety-lamp indicated a slight trace of methane.

No explosive gas was found in the course of our inspections, while Burrell readings taken regularly in the return air-current varied from 0.3 per cent. methane to 0.8 per cent. Roadways and timbering have been kept in fairly good condition, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

All roadways and working-faces, where required, are treated regularly with limestone-dust. Two hundred and seventy-five samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but ten being in keeping with the requirements of the above regulation.

Good progress has been made during the year with the repairing and enlarging of Nos. 1 and 2 South levels for the purpose of making these roadways the permanent return airways for No. 2 mine.

No. 2 MINE.

C. McNay, Overman; J. Bushell, W. Green, J. Haile, and E. Jones, Firebosses.

This mine is situated on the level of the tibble and operates the upper and western portion of No. 2 seam. It is ventilated jointly with No. 1 South mine by an electrically driven 11- by 7½-foot Sirocco fan, particulars of which have already been given in the report on No. 1 South mine. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—31,500 cubic feet of air a minute for the use of forty-five men and seven horses. Safety-lamp indicated a slight trace of methane.

No. 2 Split.—42,000 cubic feet of air a minute for the use of fifty men and nine horses. Burrell gas-detector, 0.4 per cent. methane.

Main Return.—79,700 cubic feet of air a minute.

Explosive gas has been found a few times in the course of inspection, while Burrell readings taken in the return air-currents have varied from 0.1 per cent. methane in No. 1 split to 0.4 per cent. in No. 2 split.

Roadways and timbering have been kept in fairly good condition, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces. Crushed limestone-dust is the principal medium used to reduce the danger to be apprehended from coal-dust, although spraying systems are maintained on many roadways and are available for use if necessary. Three hundred and fourteen samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations; all but six of these were well above the standard set by the above regulation.

No. 3 MINE.

J. Worthington, Overman; R. Phillips, W. Brown, E. Caulfield, and J. Chester, Firebosses.

This mine operates the lower and eastern portion of No. 2 seam and is ventilated by an electrically driven 16- by 8-foot Wilson fan, which, running at a speed of 166 r.p.m., produced an average quantity of 61,300 cubic feet of air a minute, under a water-gauge of 4.8 inches. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—10,500 cubic feet of air a minute for the use of fourteen men and four horses. Burrell gas-detector, 0.7 per cent. methane.

No. 2 Split.—39,000 cubic feet of air a minute for the use of forty men and twelve horses. Burrell gas-detector, 1.4 per cent. methane.

Main Return.—57,000 cubic feet of air a minute for the use of fifty-four men and sixteen horses. Safety-lamp indicated 1.2 per cent. methane.

Explosive gas was only found on two occasions in the course of our inspections, while Burrell readings taken regularly in the return air-currents have varied from 1 per cent. methane in No. 1 split to 1.9 per cent. in No. 2 split.

Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules well attended to at the working-faces. All roadways and working-places are treated regularly with crushed limestone-dust, while spraying systems are still operated on many of the main roadways. Three hundred and thirty-four samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but six being in keeping with the requirements of the above regulation.

A great many improvements have been put into effect on the main haulage-roads of this mine during the year; the most important of these being the brushing of the Main slope, extending the parting at the bottom of the Main slope, straightening a number of bad bends on the main motor-haulage, and improving the track so that a uniform grade exists practically throughout the entire distance of the motor-road.

No. 9 MINE.

R. Fowler, Fireboss.

A small crew of timbermen has been steadily engaged in this mine during the year, cleaning up and enlarging main roads and airways. This operation is all on one split and up to and

including the month of August was ventilated by a fan of the Guibal type, which, running at a speed of 50 r.p.m., produced an average quantity of 6,000 cubic feet of air a minute, under a water-gauge of 1 inch.

As a result of the bush fire which swept the north side of the valley on August 16th the fan-house and engine-house were completely demolished, the mine being ventilated by natural means since the above date. A small blower-fan has been installed close to the main portal of the mine and is ready to operate when required.

No explosive gas has been found on any of our inspections and the percentage of methane in the return air-current has always been below 0.5 per cent. Roadways and timbering have been kept in good shape, a good supply of timber being provided for the purpose.

MICHEL COLLIERY.

R. Bonar, Manager; M. McLean, Assistant Manager; J. Henney, Safety Inspector.

This colliery is situated on Michel creek, 24 miles north-east of Fernie, and has railway connection with the Canadian Pacific Railway. A general description of the method of working, system of haulage in and around the mines, and surface plant has appeared in previous Annual Reports.

An important addition to the surface plant during the year is a new slack-bin measuring 40 by 60 feet, with an elevation of 100 feet above the ground-level, having a capacity of 2,400 tons. It is built on a substantial concrete base, the first or ground floor being used as a storage-room for heavy material. The bin proper is a steel-frame structure, double-lined with heavy timbers inside. The slack is hoisted to the top of the building by a bucket elevator and thence distributed to any part of the bin by a 36-inch belt.

The Edison electric cap safety-lamp is used exclusively by the workmen, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes, all lamps being cleaned and repaired in a well-equipped lamp-room located in a central position at the colliery. Burrell gas-detectors are provided at all the mines for the purpose of detecting lower percentages of methane than that usually found by the ordinary safety-lamp.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines. Following is a brief description of the conditions prevailing in the various mines during the year:—

No. 3 MINE.

M. Littler, Overman; J. Strachan, T. Owen, O. Winstanley, R. Beard, and J. Jenkinson, Firebosses; W. Weaver, Shotfirer.

This mine operates the No. 3 and lower No. 3 seams and is ventilated by an electrically driven 12- by 6-foot Sullivan fan, which, running at a speed of 240 r.p.m., produced an average quantity of 113,000 cubic feet of air a minute, under a water-gauge of 2.9 inches. The ventilation of this mine was originally divided into five splits, but at the present time only two of these are in active operation, Nos. 1, 3, and 4 being sealed off for the time being.

Explosive gas has been found a few times in the course of inspection, while the percentage of methane in the return air-currents as determined by the Burrell gas-detector varied from 0.4 per cent. in No. 2 split to 0.7 per cent. in No. 4 split.

Roadways and timbering have been kept in fairly good condition, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

While spraying systems are still operated in certain districts, crushed limestone-dust is the principal medium used to alleviate the coal-dust hazard. One hundred and fifty-nine samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were above the standard set by the above regulation.

A considerable amount of prospecting has been done in this mine during the year in an effort to prove the faults in the Main Slope and West Level districts. In the former section two parallel tunnels, each approximately 200 feet in length, were driven and a 7-foot seam of coal found. The seam is of good quality with a low ash content, has a hard roof and floor, and rises on a pitch of 30° in the direction of the Sparwood side of the mountain range, where a great many seams outcrop. To handle the output from this district a new main haulage-road is at present under construction which should permit of the rapid development of this area. In the main West level a downthrow fault was encountered which necessitated the driving of

two tunnels 250 feet in length; at this point the No. 3 seam was found, having the very unusual pitch of 45°. Present conditions would indicate that these levels are not yet clear of the faulted ground.

No. B MINE.

C. Stubbs, Overman; W. Cartwright, R. McFegan, D. James, A. Ball, and S. Lazaruk, Firebosses;
J. Robson, Shotfirer.

This mine is reached by a crosscut tunnel from the upper No. 3 seam of No. 3 mine and operates Nos. 1, 2, A, and B seams, of which only Nos. 1 and B are being actively developed at the present time.

Ventilation is provided by No. 3 East fan, particulars of which are given in the report on the latter mine. At the last inspection the quantity passing in Nos. 1 and B return airway measured as follows:—

Main Return.—17,670 cubic feet of air a minute for the use of twenty-four men and five horses. (Mine was idle when this inspection was made.)

No explosive gas was found on any of our inspections and the methane content in the return air-current has not exceeded 0.5 per cent. Roadways and timbering have been kept in good shape, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules well attended to at the working-faces.

Spraying systems are in operation on certain roadways, but crushed limestone-dust is most generally used to reduce the danger of coal-dust. Eighty-three samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were above the standard set by the above regulation.

The main East level of No. 1 seam has been all repaired and the tracks graded for the purpose of making this roadway a main haulage-road, the haulage being done by compressed-air locomotives instead of horses as formerly.

Two main parallel return airways are being driven from a selected point on No. 1 incline in B seam, a distance of 2,000 feet to the outcrop. Work commenced on these places about the middle of July, rapid progress being made, as the faces had advanced a distance of 1,500 feet by December 31st; at the present rate of drivage it is estimated that they will be connected with the surface about the end of February, making it possible for the management to install a separate ventilating unit for this mine.

No. 3 EAST MINE.

C. Stubbs, Overman; W. Cartwright, R. McFegan, D. James, A. Ball, and S. Lazaruk,
Firebosses; J. Robson, Shotfirer.

Operations in this mine during the year have been confined to repairing main roads, attending to drainage, and erecting stoppings in several abandoned roadways where heating was suspected. In all, six stoppings were built between No. 3 East main return airway and the workings adjacent to No. 3 mine, effectually sealing off this section of old workings.

Ventilation is provided by an electrically driven 8- by 3½-foot Jeffrey fan, which, running at a speed of 240 r.p.m., produced an average quantity of 81,400 cubic feet of air a minute, under a water-gauge of 2.3 inches. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—7,000 cubic feet of air a minute. No men were employed in this district at the time this inspection was made. Safety-lamp indicated a slight trace of methane.

No. 2 Split.—28,000 cubic feet of air a minute for the use of five men and one horse. Safety-lamp, slight trace of methane.

Main Return.—80,400 cubic feet of air a minute for the use of thirty men and four horses.

No explosive gas was found during any of our inspections, while roadways and timbering have been kept in a good state of repair, a good supply of timber being provided for the purpose.

No. 8 MINE.

R. Taylor, Overman; A. Almond, E. Ainsworth, W. McKay, J. Scales, and W. Gregory,
Firebosses.

This mine operates the upper portion of No. 8 seam and is ventilated by an electrically driven 8- by 3½-foot Jeffrey fan, which, running at a speed of 240 r.p.m., produced an average quantity of 62,400 cubic feet of air a minute, under a water-gauge of 2.9 inches. The ventilation

is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—25,200 cubic feet of air a minute for the use of forty-five men and fourteen horses.

No. 2 Split.—22,200 cubic feet of air a minute for the use of forty-two men and twelve horses.

Main Return.—65,000 cubic feet of air a minute for the use of eighty-seven men and twenty-six horses.

No explosive gas was found on any of our visits of inspection, while the percentage of methane in the return air-currents has always been kept around 0.5 per cent. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules well attended to at the working-faces. All working-faces and roadways, where required, are treated with the spraying systems and frequent applications of crushed limestone-dust. Sixty-four samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were in keeping with the standard set by the above regulation.

An improvement which has done a great deal toward enhancing safety conditions on the main haulage-road in the winter season has been the diversion of all drainage-water into old No. 8 mine. This was made possible by drilling bore-holes at judicious points, tapping the old workings to the low side of the main haulage. These holes are properly equipped with the necessary pipes and water-traps to prevent any noxious gases from leaking through. This has removed the necessity of having a crew of men engaged in cutting ice and has effectually removed the danger attendant upon such an operation on a main haulage-road where all hauling is done by compressed-air locomotives.

Corbin Collieries, Ltd.

E. L. Warburton, Manager.

This colliery is situated 14 miles from McGillivray Junction on the Crowsnest branch of the Canadian Pacific Railway, to which it is connected by a branch line called the Eastern British Columbia Railway. As in 1928, the whole of the output was produced at Nos. 4 and 6 mines, no work of any kind being done in No. 5 mine during the year. A general description of the method of working, system of haulage in and around the mines, and surface plant has appeared in previous Annual Reports.

The lamp generally used by the workmen is the Edison electric cap safety-lamp, while Wolf safety-lamps are used by the officials and bratticemen for testing purposes, all lamps being cleaned and repaired in a fairly well-equipped lamp-room located convenient to the mines. Copies of the "Coal-mines Regulation Act" and special rules are posted up at the colliery. Following is a brief description of the conditions prevailing in the various mines throughout the year:—

No. 4 MINE.

W. Almond, Under-Manager; W. Commons, Overman; G. Elmes, H. Ferryman, and D. Waddington, Firebosses.

This mine operates the No. 4 seam and is ventilated by an electrically driven single-inlet fan of the Guibal type, which, running at a speed of 94 r.p.m., produced an average quantity of 15,200 cubic feet of air a minute, under a water-gauge of 0.6 inch. The ventilation is all on one split, the quantity passing at the last inspection measuring as follows:—

A Level.—10,000 cubic feet of air a minute for the use of eighteen men and two horses. Safety-lamp indicated a very slight trace of methane.

Explosive gas was found once in the course of our inspections, while the percentage of methane in the return air-current has always been kept below 0.5 per cent. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

This mine being naturally wet throughout, only one sample of dust was taken in accordance with Regulation No. 4 of the Coal-dust Regulations, the resultant analysis showing it to be well above the standard set by the above regulation.

No. 6 MINE.

W. Almond, Under-Manager; W. Commons, Overman; H. Parsons, B. Cheetham, A. Rear, and J. McKelvie, Firebosses; G. Hetherington, Shotfrer.

This mine operates the No. 6 seam and is ventilated by an electrically driven 4½- by 3-foot Sirocco fan, which, running at a speed of 280 r.p.m., produced an average quantity of 25,000 cubic feet of air a minute, under a water-gauge of 0.5 inch. The ventilation is divided into three splits, the quantities passing in each at the last inspection measuring as follows:—

A Level.—12,600 cubic feet of air a minute for the use of fifteen men and two horses.

No. 2 Level.—8,000 cubic feet of air a minute for the use of eight men and one horse.

No. 17 Raise Split.—9,000 cubic feet of air a minute for the use of ten men.

No explosive gas was found during the course of inspection, while the methane content in the return air-currents has always been kept below 0.5 per cent. Roadways and timbering have been kept in fairly good condition, a good supply of timber being provided for the purpose, and the requirements of the "special timbering" rules fairly well attended to at the working-faces.

Twelve samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but one of these being well above the standard set by the above regulation. This mine is generally wet throughout.

GOVERNMENT MINE-RESCUE STATIONS.

Mine-rescue stations are established under authority of section 117, "Coal-mines Regulation Act," for the purpose of supplementing in case of need the colliery installations of mine-rescue apparatus, and also for the purpose of training holders of certificates of competency in the use of mine-rescue apparatus. In cases of emergency these stations are available for the use of any trained corps of mine-rescuers, duly qualified medical practitioners, or corps trained in the work of first aid to the injured, subject always to the order of an Inspector.

In several instances the rescue apparatus owned or supervised by the Government in the different districts were called for by teams dealing with underground fires. All these emergencies were dealt with by experienced teams and the work carried out in an efficient manner.

It is pleasing to note that the larger coal-mining companies are availing themselves of the service provided for the different mine-rescue stations at Fernie, Cumberland, and Nanaimo, and are maintaining and paying teams of qualified men to carry out regular weekly or monthly practice training.

A number of calls were received during 1929 for the use of oxygen resuscitation apparatus from different hospitals and medical men. Four stations are established, as follows:—

Nanaimo.—J. D. Stewart, Instructor; serves the coal-mines in the Nanaimo area of the Vancouver Island Inspection District.

Cumberland.—John Thomson, Instructor; serves the coal-mines in the Comox area of the Vancouver Island Inspection District.

Middlesboro.—W. C. Stone, Instructor; serves the coal-mines in the Nicola-Princeton District.

Fernie.—John T. Puckey, Instructor; serves the coal-mines in the East Kootenay Inspection District.

MINE-RESCUE STATION, NANAIMO.

REPORT BY JOHN D. STEWART, INSTRUCTOR.

I have the honour to submit herewith my annual report as Instructor of Government Mine-rescue Station, Nanaimo, for the year ended December 31st, 1929.

There were several emergency calls in the early part of the year for oxygen by the local doctors and the Nanaimo General Hospital.

On September 22nd, 1929, a call was received at this station for oxygen breathing apparatus, to be sent to No. 1 mine of the Western Fuel Corporation of Canada, by John Hunt, general manager, who requested that apparatus be got ready and shipped to the mine, as it was the intention of the mine officials to attempt to explore in a "sealed-off area" in No. 1 East district

of No. 1 mine, South side. This area had been sealed off since August 15th, 1929, due to fire. The object in entering this sealed area was to ascertain whether or not the fire still existed. The exploratory work was very successfully carried out and all concerned seemed satisfied that the fire had been extinguished. Only one team of explorers took part on this occasion, the personnel of the team being Arthur Newbury, mine manager; John Sutherland, overman; Matthew Broderick and William Frew, firebosses; and John D. Stewart, mine-rescue instructor. T. R. Jackson, District Mine Inspector, John Hunt, and Robert Good were in attendance at the base of operations.

The work accomplished by the team consisted in exploring about 2,000 feet of the sealed area; this took about thirty-five minutes to complete, and as some further work was necessary the team again entered the fire "zone," and after twenty minutes had elapsed returned to the base. The men and apparatus performed the work in a very satisfactory manner. On the following day, September 23rd, 1929, another call for the use of the breathing apparatus was made by the management of the Western Fuel Corporation of Canada to again enter the same fire area. It being found that the ventilating-current was not satisfactory and was possibly obstructed, it was imperative that such an obstruction should be located and, if possible, removed; therefore the equipment was shipped to the base of operations.

With the addition of two extra men and apparatus, the previous mentioned members of the rescue party proceeded into the fire area as far as the auxiliary fan, and after doing some repairs, also finding that one of the party was not comfortable, retreated to the base. This took about twenty minutes. It was decided to make another journey into the fire zone, which was satisfactorily completed in about thirty-five minutes. This completed the work attempted, and the apparatus was shipped to the surface, thence to the rescue-station.

Training the men in the use of the apparatus has been fairly active during the latter part of the year, and at the present time twenty-five men are taking one practice a month, these being employees of the Western Fuel Corporation of Canada from the South side of No. 1 mine and the Reserve mine. There are also sixteen employees of the Western Fuel Corporation of Canada taking their initial course in mine-rescue training, and five from No. 5 mine, South Wellington, of the Canadian Collieries (Dunsmuir), Limited. This is a very satisfactory condition and shows that the larger coal operators are determined to be prepared for any emergency. During the year the following men were awarded certificates for efficiency in the use of mine-rescue apparatus, after a course of training at the Nanaimo Mine-rescue Station: John Christie, William Pashley, Taylor Jenkinson, John E. Anderson, Archibald Courtenay, James Maki, John M. Good, and Ernest D. Ramsell.

The mine-rescue equipment at this station consists of six sets of the McCaa two-hour oxygen machines; six sets of the Gibbs two-hour oxygen machines; twelve sets of the Burrell all-service gas-masks; and sixty-five M.S.A. self-rescuers. An adequate supply of all necessary materials to maintain above machines in service is kept on hand at all times.

MINE-RESCUE STATION, CUMBERLAND.

REPORT BY JOHN THOMSON, INSTRUCTOR.

I have the honour to submit my annual report for the year ended December 31st, 1929, Mine-rescue Station, Cumberland.

During the year ten men took a course of training in mine-rescue work at this station and were awarded their Government certificate for efficiency.

During the year the Canadian Collieries (Dunsmuir), Limited, has had twelve trained men in constant practice once a week.

The mine-rescue equipment at this station consists of twelve Paul two-hour oxygen machines; six McCaa two-hour oxygen machines; twelve sets of the Burrell all-service gas-masks; and twenty-five M.S.A. self-rescuers. In addition, four sets of the Paul apparatus, owned by the Canadian Collieries (Dunsmuir), Limited, are housed in this station. An adequate stock of supplies for above machines is on hand.

Two teams from this district competed at the mine-rescue competition held at Nanaimo on Labour Day.

No emergency calls for mine-rescue apparatus were made during the year 1929.

MINE-RESCUE STATION, MIDDLESBORO.

REPORT BY WILLIAM C. STONE, INSTRUCTOR.

I have the honour to submit the annual report for the Middlesboro Mine-rescue Station for the year ended December 31st, 1929.

No emergency calls were made during the year, but a number of individual men underwent training. Training in crew-work was limited to men who already held certificates in mine-rescue work.

The equipment at this station consists of six sets of the Paul two-hour oxygen apparatus; four sets of the Gibbs two-hour oxygen apparatus; six sets of the Burrell all-service gas-masks; and twelve M.S.A. self-rescuers. An adequate supply of materials is kept on hand.

MINE-RESCUE STATION, FERNIE.

REPORT BY JOHN T. PUCKEY, INSTRUCTOR.

I have the honour to submit my annual report for the year ended December 31st, 1929.

The first-aid classes were held in February and March, but only thirty-three took the examination, which was very small compared with previous years.

In March I was notified that there were indications of a fire in No. 1 East mine, Coal Creek Colliery, and immediately took up six all-service masks and canisters to the mine. These were not used, but were kept in readiness.

On April 13th I was notified that an explosion had happened in the fire area and that several men were badly burned. I had all my apparatus and first-aid material taken up to the mine by motor, but found that all the men had been recovered very shortly after the occurrence. Part of the rescue equipment was kept at the mine until May 23rd in case of emergency.

Eighteen men have taken a full course in mine-rescue work during the year—fourteen from Michel Colliery, one from Corbin Colliery, and three from Coal Creek Colliery; sixteen of these have received mine-rescue certificates.

During December I was instructed by Inspector Strachan to take five of the McCaa apparatus to Kimberley to see how the workmen up there would take to this work. I spent four days up there and was successful in getting a class of fifteen men started to train; these have been formed into three teams.

The mine-rescue equipment at this station consists of eleven McCaa two-hour oxygen machines; six sets of the Gibbs two-hour oxygen machines; six sets of the Burrell all-service gas-masks; and forty-two M.S.A. self-rescuers.

During the year there was used at this station eighteen tanks of oxygen and 436 lb. of cardoxide.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES AND MINE SURVEYORS' CERTIFICATES.

REPORT BY JAMES STRANG, SECRETARY TO THE BOARD.

I have the honour to submit herewith the annual report of transactions of the above Board for the year ended December 31st, 1929.

The Board of Examiners, which was formed on July 10th, 1919, at present consists of James Dickson, Chief Inspector of Mines, as Chairman; Henry Ernest Miard, member; and James Strang, member and Secretary of the Board. The meetings of the Board are held in the office of the Mines Department, Victoria. The examinations are held in accordance with the rules made by the Provincial Board of Examiners and approved by the Minister of Mines, July 10th, 1919.

As it was necessary to have several amendments made to the rules it was decided to redraft them. The Board of Examiners redrafted the rules and they were approved by the Minister of Mines on September 28th, 1929.

The most significant change in the rules being: "If, although having obtained an average of more than 70 per cent. on the whole examination, a candidate for a first-class certificate failed to gain the minimum number of marks required in not more than two subjects, the Board may, at its discretion, decide that such candidate needs to be re-examined only on the subject or subjects in which he was found deficient. This supplementary test, if allowed, shall be undergone at the regular examination immediately following. If again unsuccessful, the candidate shall be treated in all respects in the same manner as a new applicant at any subsequent examination."

Two examinations were held in 1929. The first was held on May 15th, 16th, and 17th; and the second on November 13th, 14th, and 15th.

The total number of candidates at the examinations were as follows: For First-class Certificates, 5 (3 passed and 2 failed); for Second-class Certificates, 6 (3 passed and 3 failed); for Third-class Certificates, 26 (14 passed and 12 failed); for Mine Surveyors, 6 (4 passed and 2 failed).

The following is a list of the candidates who successfully passed in the various classes:—
First-class Candidates.—Clement Stubbs, James Littler, and James A. Quinn.

Second-class Candidates.—Joseph Heathcote, John Stewart, and William L. Strang.

Third-class Candidates.—James Dunn, John C. Smith, Frederick O. Miller, Alexander Cullen, George E. Hetherington, Wilfred Valentine, Roy Wicks, Joseph Frater, James Baguley, Ernest Heyes, Arthur Hilton, George W. Cuthell, John Yard, and Archibald Hannah.

Mine Surveyors.—A. C. D'Altroy, Vilhelm Schjelderup, John A. Rutherford, and Paul E. R. Williams.

On the whole the work of the candidates in the last two examinations was of a higher standard than in some of the previous examinations.

The attention of mining students, who have not the opportunity of attending schools where the subject of mining is taught, is directed to the correspondence course in mining provided by the Department of Education.

EXAMINATIONS FOR CERTIFICATES OF COMPETENCY AS COAL-MINERS.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act further provides that every coal-miner shall be the holder of a certificate of competency as such. By "miner" is meant any person employed underground in any coal-mine to cut, shear, break, or loosen coal from the solid, whether by hand or machinery.

The work of the Board of Examiners in examining candidates has been carried out in all the mining districts and at intervals of not less than sixty days, as required by the amendment to the Act.

No certificate has been granted in any case where the candidate failed to satisfy the Board as to his general fitness, experience in a coal-mine, and a working knowledge of the English language. During 1929 examinations have been held for candidates for certificates of competency as coal-miners in the various coal-mining districts of the Province.

Three hundred and twenty candidates presented themselves for examination; 272 passed and fifty-eight failed to qualify.

In addition to the above, a number of duplicate certificates were issued to coal-miners who had lost their original certificates.

The Board of Examiners desire to thank the different coal-mining companies for the use of their premises for holding these examinations.

The Inspector of Mines in each district has authority, under the amendment (1919) to "Coal-mines Regulation Act," to grant, after a satisfactory examination, a provisional certificate of competency as a coal-miner to applicants which entitles the holder to follow the occupation of a coal-miner for a period not exceeding sixty days, or until the date of the next regular examination before the Board.

**REGISTERED LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY
AS COAL-MINE OFFICIALS.**

FIRST-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT, 1897."

Name.	Date.	Name.	Date.
Shepherd, Francis H.	Mar. 5, 1881	Stockett, Thomas, Jr.	Aug. 3, 1901
Honobin, William	May 1, 1882	Cunliffe, John	Aug. 3, 1901
Little, Francis D.	May 1, 1882	Evans, Daniel	Aug. 3, 1901
Chandler, William	Dec. 21, 1883	Browitt, Benjamin	Aug. 3, 1901
Priest, Elijah	Dec. 21, 1883	McEvoy, James	Oct. 17, 1902
Randle, Joseph	Jan. 18, 1888	Wilson, A. R.	Oct. 17, 1902
Matthews, John	Jan. 8, 1889	Simister, Charles	Oct. 17, 1902
Norton, Richard Henry	Aug. 26, 1889	Budge, Thomas	Oct. 17, 1902
Kesley, John	Mar. 4, 1892	Richards, James A.	Oct. 17, 1902
Wall, William H.	May 30, 1896	McLean, Donald	Jan. 21, 1904
Wilson, David	May 30, 1896	Wright, H. B.	Jan. 21, 1904
Smith, Frank B.	May 30, 1896	Coulthard, R. W.	Jan. 21, 1904
Bradshaw, George B.	June 12, 1899	Roaf, J. Richardson	Jan. 21, 1904
Simpson, William G.	June 12, 1899	John, John	Jan. 21, 1904
Hargreaves, James	Feb. 5, 1901	Manley, H. L.	Jan. 21, 1904
Drinnan, Robert G.	Feb. 5, 1901		

**FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT
Act," 1904-1911-1919.**

Name.	Date.	Name.	Date.
Batthey, Richard	May 27, 1913	Graham, Thomas	Nov. 9, 1907
Baxter, Andrew	June 10, 1911	Gray, James	Nov. 27, 1909
Bennett, John	Dec. 30, 1926	Henderson, Robert	Nov. 27, 1909
Biggs, J. G.	July 22, 1908	Hewlett, Howe	May 27, 1913
Bonar, Robert	Oct. 28, 1911	Higgins, Alexander	Dec. 19, 1918
Brace, Tom	May 13, 1915	Hodge, William K.	June 16, 1925
Bridge, Edward	July 22, 1908	Holden, James	May 1, 1909
Brown, David	May 21, 1914	Howden, Archibald	May 27, 1913
Brown, Robert Joyce	May 13, 1915	Howells, Nathaniel	Oct. 28, 1911
Caufield, Bernard	May 1, 1909	Hughes, John C.	May 17, 1917
Church, James A. II.	June 10, 1911	Humphries, Clifford	June 10, 1911
Cox, Richard	May 13, 1915	Hunter, Alex. B.	July 8, 1916
Crowder, James	June 10, 1911	Huntrods, Eustace S. F.	May 19, 1922
Cunningham, John Howard	May 9, 1912	Jackson, Thos. R.	Nov. 9, 1907
D'Altroy, A. C.	Dec. 20, 1928	Jaynes, Frank	May 13, 1915
Davidson, W. A.	May 1, 1909	Johnston, John	June 30, 1928
Davies, David	June 10, 1911	Kellock, George	June 10, 1911
Davies, Stephen	Nov. 15, 1917	Knox, T. K.	July 27, 1909
Davies, Thos. Owen	May 21, 1914	Laird, Robert	Nov. 15, 1917
de Hart, J. B.	May 17, 1917	Leighton, Henry	May 9, 1912
Derbyshire, James	Nov. 9, 1907	Littler, James	Dec. 2, 1929
Devlin, E. H.	Dec. 30, 1926	Mackinnon, Hugh G.	May 19, 1922
Dickson, James	Oct. 31, 1912	Maccauley, D. A.	June 10, 1911
Elliott, Daniel	Nov. 9, 1907	McCulloch, James	Sept. 10, 1910
Elliott, John B.	June 30, 1928	McDonald, John	Oct. 3, 1919
Emmerson, Joseph	Nov. 9, 1907	McGuckie, Thomas	July 22, 1908
Ewart, William	May 19, 1922	McKendrick, Andrew	May 27, 1913
Fairfoull, Robert	June 10, 1911	McLean, Michael D.	June 16, 1925
Foster, William R.	Dec. 31, 1925	McMillan, J. H.	Sept. 10, 1910
France, Thos.	Nov. 22, 1906	McVicar, Samuel	May 1, 1909
Fraser, Norman	Mar. 4, 1905	Mazey, William John	Oct. 31, 1912
Freeman, H. N.	May 1, 1909	Miard, Henry Ernest	May 9, 1912
Galloway, C. F. J.	July 22, 1908	Millar, John K.	Nov. 22, 1906
Garman, Morris W.	Nov. 15, 1917	Miller, Andrew Anderson	Oct. 31, 1912
Gascoyne, Rowland B.	May 21, 1914	Montgomery, John W.	May 1, 1909
Gillham, John	Jan. 5, 1925	Moore, Wm. H.	May 17, 1917
Glover, Francis	Oct. 31, 1912	Mordy, Thomas	Sept. 10, 1910
Graham, Charles	Nov. 14, 1905	Morrison, Edward	June 24, 1924

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT," 1904-1911-1919—Continued.

Name.	Date.	Name.	Date.
Mottishaw, Sam. K.	Nov. 15, 1917	Stewart, R. T.	Sept. 10, 1910
Murray, George	June 21, 1921	Strachan, Robert	Mar. 4, 1905
Newbury, Arthur	June 21, 1920	Strang, James	June 10, 1911
O'Brien, George	May 21, 1914	Stubbs, Clement	July 21, 1929
Ovington, John	May 27, 1913	Taylor, James	May 16, 1918
Peacock, Frank David	Oct. 28, 1911	Thomas, J. D.	Sept. 10, 1910
Penman, Hugh	May 21, 1914	Thorne, B. L.	Sept. 10, 1910
Phelan, Arthur	May 27, 1913	Touhey, James	May 21, 1914
Powell, J. W.	June 10, 1911	Vincent, Thomas C.	June 24, 1924
Quinn, James A.	Dec. 2, 1929	Walker, William	May 16, 1918
Quinn, John Graham.....	July 8, 1916	Wallbank, J.	Sept. 10, 1910
Ramsay, Peter Millar.....	May 16, 1918	Warburton, Ernest Leonard	July 8, 1916
Roper, William	May 13, 1915	Wark, Samuel David	Oct. 3, 1919
Russell, John	May 21, 1914	Wesledge, William	Dec. 19, 1918
Scott, Thomas Wright	Dec. 22, 1921	Whittaker, John	Dec. 19, 1918
Shanks, John	May 1, 1909	Williams, John Samuel	Dec. 19, 1918
Shenton, T. J.	Sept. 10, 1910	Williams, Thos. B.	May 17, 1917
Shone, Samuel	May 1, 1909	Williams, Thos. H.	Nov. 22, 1906
Smith, A. E.	Oct. 28, 1911	Wilson, Ridgeway R.	Nov. 15, 1917
Smith, Joseph	July 22, 1908	Wilson, Thos. M.	Dec. 23, 1927
Smith, Thos. Edwin.....	Dec. 19, 1918	Wilson, William	May 16, 1918
Spicer, J. E.	Oct. 28, 1911	Wylie, John	July 22, 1908
Spruston, T. A.	Nov. 27, 1908	Yates, Frank	Dec. 31, 1925
Stevens, L. C.	Nov. 27, 1909		

SECOND-CLASS CERTIFICATES OF SERVICE.

Name.	Date.	No.	Name.	Date.	No.
Lee, John S.	Mar. 4, 1905	B 9	Walker, David.....	Mar. 4, 1905	B 14
Millar, J. K.....	Mar. 4, 1905	B 10	Powell, William Baden.....	Mar. 4, 1905	B 16
McCliment, John.....	Mar. 4, 1905	B 11	Bryden, Alexander.....	Mar. 4, 1905	B 18
Hunt, John.....	Mar. 4, 1905	B 13			

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

Name.	Date.	No.	Name.	Date.	No.
Adamson, Robert.....	Sept. 10, 1910	B 120	Brown, James L.....	Oct. 28, 1911	B 136
Allan, Alex. McDiarmid.....	May 27, 1913	B 167	Brown, John C.....	Oct. 23, 1906	B 39
Almond, Walter.....	Nov. 15, 1917	B 213	Brown, John Todd.....	May 9, 1912	B 150
Alstead, Robert.....	June 24, 1924	B 257	Brown, R. J.....	Oct. 28, 1911	B 134
Archibald, William.....	Nov. 22, 1922	B 250	Brown, Robert.....	May 21, 1914	B 183
Ball, Benjamin.....	June 21, 1920	B 235	Brown, Robert Sneddon.....	May 13, 1915	B 196
Barclay, Andrew.....	July 29, 1905	B 25	Brown, William Gold.....	Dec. 19, 1918	B 228
Barlow, Benjamin Robt.....	Dec. 19, 1918	B 229	Brownrigg, John H.....	May 17, 1917	B 124
Bastian, Albert.....	Nov. 21, 1923	B 256	Bushell, J. P.....	May 1, 1909	B 81
Baybutt, Thomas.....	July 8, 1916	B 206	Carroll, Henry.....	July 22, 1908	B 62
Bell, John.....	May 17, 1917	B 212	Caufield, Bernard.....	Oct. 23, 1906	B 30
Beveridge, William.....	June 21, 1920	B 233	Caufield, John.....	July 8, 1916	B 199
Bevis, Nathaniel.....	Sept. 10, 1910	B 123	Cawthorne, L.....	May 1, 1909	B 93
Biggs, John.....	May 1, 1909	B 94	Challinor, Jno. Thomas.....	May 27, 1913	B 169
Biggs, John G.....	Nov. 2, 1907	B 40	Challoner, Jno. Arthur.....	May 21, 1914	B 178
Blair, James.....	May 13, 1915	B 197	Chapman, Wm.....	June 10, 1927	B 268
Bonar, Robt. B.....	June 30, 1928	B 270	Churchill, James.....	July 22, 1908	B 65
Brace, Tom.....	Nov. 27, 1909	B 96	Clark, Robt.....	June 21, 1921	B 242
Bridge, Edward.....	Oct. 23, 1906	B 33	Clarkstone, Wm. W.....	May 21, 1914	B 180
Brown, David.....	Sept. 10, 1910	B 108	Commons, Wm.....	Sept. 10, 1910	B 115
Brown, George.....	Dec. 19, 1918	B 225	Corbett, Garner S.....	June 30, 1928	B 272

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—Continued.

Name.	Date.	No.	Name.	Date.	No.
Coupland, George	May 16, 1918	B 217	Jones, Samuel	May 16, 1918	B 221
Courtney, A. W.	Oct. 28, 1911	B 138	Jones, William T.	July 22, 1908	B 66
Cox, Richard	May 9, 1912	B 148	Jordon, Thos.	Nov. 27, 1909	B 104
Crawford, David	May 1, 1909	B 88	Kirkwood, John R.	Oct. 31, 1912	B 160
Cunliffe, Thomas	May 1, 1909	B 78	Knowles, James E.	Oct. 28, 1911	B 137
Dando, John	May 27, 1913	B 164	Laird, Robert	May 17, 1917	B 210
Daniels, David	Nov. 2, 1907	B 53	Lander, Frank	May 13, 1915	B 195
Derbyshire, James	Oct. 23, 1906	B 32	Lane, Joseph	May 9, 1912	B 142
Davidson, Hugh	May 27, 1913	B 165	Lee, Robert John	Sept. 10, 1910	B 110
Davies, Stephen	Sept. 10, 1910	B 113	Littler, Jas.	June 10, 1927	B 266
Dennis, Fred. W.	May 21, 1914	B 174	Littler, Matthew	Oct. 31, 1912	B 157
Devlin, Ernest H.	May 21, 1914	B 179	Luck, George	June 10, 1911	B 128
Dewar, Alexander	Oct. 31, 1912	B 162	Manifold, Albert	May 9, 1912	B 145
Dickenson, Clifford	May 13, 1915	B 189	Marsh, John	Nov. 15, 1917	B 216
Dunsmuir, John	Nov. 14, 1905	B 26	Mason, Joseph	May 13, 1915	B 193
Duncan, James	Nov. 21, 1923	B 255	Massey, H.	Nov. 27, 1909	B 99
Dykes, J. W.	May 1, 1909	B 77	Mather, Thomas	June 10, 1911	B 127
Eccleston, Wm.	May 1, 1909	B 87	Matusky, A.	May 1, 1909	B 91
Fairfoull, James	May 21, 1914	B 186	Mayer, Ralph Waldo	May 9, 1912	B 144
Fairfoull, R.	May 1, 1909	B 83	Mazay, W. J.	Nov. 27, 1909	B 101
Finlayson, James	July 29, 1905	B 21	Menzies, Fred	Dec. 22, 1921	B 244
Ford, Allan	May 27, 1913	B 171	Merryfield, William	July 22, 1908	B 61
Foster, W. R.	Nov. 27, 1909	B 102	Miard, Hy. E.	Sept. 10, 1910	B 107
France, Thos.	May 14, 1905	B 27	Michek, John	May 17, 1917	B 188
Francis, David M.	May 21, 1914	B 182	Middleton, Robert	July 22, 1908	B 72
Francis, Enoch	May 1, 1909	B 86	Mitchell, Henry	July 8, 1916	B 201
Francis, James	July 22, 1908	B 63	Monks, James	Nov. 2, 1907	B 55
Frater, George	July 8, 1916	B 204	Moore, Wm. H.	May 21, 1914	B 173
Freeman, Henry N.	Nov. 2, 1907	B 45	Morgan, John	Nov. 2, 1907	B 43
Frew, Wm. M.	June 10, 1927	B 269	Morgan, William	Dec. 19, 1918	B 224
Garbett, Richard	Oct. 31, 1912	B 161	Morgan, Daniel	Nov. 21, 1923	B 254
Garman, Morris Wilbur	Oct. 31, 1912	B 155	Morris, John	July 22, 1908	B 67
Gilham, John	June 21, 1920	B 237	Morrison, Edward	Nov. 21, 1923	B 253
Gillespie, Hugh	July 29, 1905	B 24	Morton, Robert W.	July 22, 1908	B 59
Gillespie, John	Oct. 23, 1906	B 36	Mottishaw, S. K.	Oct. 28, 1911	B 135
Gould, Alfred	May 13, 1915	B 190	Murray, George	Oct. 3, 1919	B 232
Gourlay, Robert	Dec. 19, 1918	B 227	Musgrave, J.	May 1, 1909	B 90
Graham, Chas.	Mar. 4, 1905	B 1	Myers, Peter	May 9, 1912	B 140
Gray, David	May 1, 1909	B 76	MacKinnon, Hugh G.	Dec. 22, 1921	B 243
Gray, George	July 8, 1916	B 207	McKay, Walter	June 30, 1926	B 262
Greenwell, Archibald	May 16, 1918	B 220	McLaughlin, Alex.	May 13, 1915	B 191
Hamilton, Robert N.	May 21, 1914	B 175	McDonald, J. A.	Oct. 28, 1911	B 133
Hastings, Andrew P.	Dec. 19, 1918	B 223	McDonald, John	May 27, 1913	B 172
Heathcote, Joseph	July 21, 1929	B 273	McFegan, W.	Nov. 31, 1909	B 106
Henderson, Robert	July 22, 1908	B 60	McFegan, Robert	May 18, 1922	B 246
Hodge, William K.	Jan. 5, 1925	B 259	McGarry, Martin	Oct. 31, 1912	B 156
Holliday, William	Dec. 19, 1918	B 230	McGuckie, Thomas M.	Oct. 23, 1906	B 35
Horrocks, Abner G.	June 10, 1911	B 130	McKelvie, J.	May 1, 1909	B 92
Houston, Robert	June 16, 1925	B 260	McKendrick, And.	Sept. 10, 1910	B 112
Howells, Nathaniel	Nov. 27, 1909	B 97	McLean, Michael D.	June 21, 1920	B 234
Hudson, George	Sept. 10, 1910	B 121	McMillan, D.	June 10, 1911	B 125
Hughes, John C.	Sept. 10, 1910	B 109	McNay, Carmichael	May 9, 1912	B 151
Hutton, Isaac	May 21, 1914	B 185	McPherson, James E.	July 22, 1908	B 73
Hutton, John	May 9, 1912	B 154	Neen, Joseph	June 10, 1911	B 129
Hynds, William	Dec. 14, 1920	B 240	Newbury, Arthur	May 21, 1914	B 184
Hynds, John	May 18, 1922	B 247	Newton, Wm.	Sept. 10, 1910	B 116
Jackson, Thos. R.	Mar. 4, 1905	B 5	Nicholl, Joseph O.	Dec. 31, 1925	B 261
James, David	Nov. 2, 1907	B 58	O'Brien, Charles	May 9, 1912	B 148
Jarrett, Fred	May 1, 1909	B 84	O'Brien, George	May 1, 1909	B 82
Jaynes, Frank	Sept. 10, 1910	B 111	Osborne, Hugh	Dec. 14, 1920	B 239
John, Francis	July 8, 1916	B 200	Ovington, John	Nov. 2, 1907	B 52
John, Howell	Sept. 10, 1910	B 122	Park, William	June 21, 1920	B 238
Johnson, Moses	May 1, 1909	B 75	Parkinson, T.	May 1, 1909	B 80
Johnston, John	June 10, 1927	B 267	Parnham, Charles	Nov. 2, 1907	B 49

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—Continued.

Name.	Date.	No.	Name.	Date.	No.
Quinn, James	May 21, 1914	B 181	Stubbs, Clement	May 18, 1922	B 245
Quinn, John	May 9, 1912	B 146	Sutherland, John	May 16, 1918	B 218
Ramsay, Peter Millar	May 17, 1917	B 209	Taylor, James	May 13, 1915	B 194
Rankin, Geo.	Nov. 27, 1909	B 103	Taylor, Robt.	Dec. 30, 1926	B 265
Raynes, M. T.	Oct. 28, 1911	B 139	Taylor, Thomas	July 8, 1916	B 203
Reid, Wm.	Oct. 28, 1911	B 132	Thomas, J. B.	Nov. 27, 1909	B 105
Renny, James	Oct. 28, 1911	B 140	Thomas, Joseph D.	Oct. 23, 1906	B 38
Richards, Thomas	Nov. 2, 1907	B 57	Thomas, Daniel W.	Nov. 22, 1922	B 249
Richards, Samuel	May 9, 1912	B 152	Thompson, Joseph	Sept. 10, 1910	B 114
Rigby, John	July 29, 1905	B 29	Touhey, James	May 9, 1912	B 147
Roberts, Ebenezer	Sept. 10, 1910	B 117	Touhey, William	July 8, 1916	B 205
Robinson, William	July 22, 1908	B 69	Tonge, Thomas	July 22, 1908	B 71
Rogers, George	May 1, 1909	B 79	Tully, Thomas	Nov. 15, 1917	B 214
Roper, William	May 9, 1912	B 141	Vanhulle, Peter	Nov. 2, 1907	B 54
Rowbottom, Thomas	May 16, 1918	B 222	Virgo, John	May 1, 1909	B 89
Russell, John	Nov. 2, 1907	B 47	Walker, William	May 13, 1915	B 192
Rutherford, Jasper	May 16, 1918	B 219	Warburton, Ernest L.	May 27, 1918	B 170
Scarpino, Francis	Dec. 19, 1918	B 226	Watson, Adam G.	Nov. 14, 1905	B 28
Scott, Thomas Wright	June 21, 1921	B 241	Watson, Arthur W.	May 17, 1917	B 211
Shanks, David	Oct. 31, 1912	B 159	Webster, James S.	June 24, 1924	B 258
Shaw, Thomas John	May 27, 1913	B 166	Wesledge, William	Nov. 27, 1909	B 98
Smith, John	Oct. 3, 1919	B 231	White, John	Nov. 2, 1907	B 48
Smart, Robert K.	Nov. 22, 1922	B 248	Whitehouse, William	Oct. 31, 1912	B 163
Somerville, Alex.	Mar. 4, 1905	B 4	Williams, John Samuel	Nov. 15, 1917	B 215
Spruston, Robert Lecce	July 8, 1916	B 202	Williams, Watkin	Sept. 10, 1910	B 118
Spruston, Thos. A.	Nov. 2, 1907	B 46	Wilson, Joseph	June 30, 1928	B 271
Stafford, Matthew	June 10, 1911	B 131	Wilson, Robinson	May 21, 1914	B 177
Stewart, John	July 21, 1929	B 274	Wilson, Thomas	July 22, 1908	B 74
Stewart, J. M.	May 1, 1909	B 95	Wilson, William	July 22, 1908	B 70
Stobbs, Jacob	May 9, 1912	B 153	Wood, Thos. James	May 21, 1914	B 176
Stockwell, William	Nov. 2, 1907	B 56	Worthington, Joseph	May 1, 1909	B 85
Strang, Thomas	Oct. 31, 1912	B 158	Yates, Frank	Nov. 22, 1922	B 251
Strang, Wm. L.	Dec. 2, 1929	B 275			

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Name.	Date.	No.	Name.	Date.	No.
Adamson, Robert	May 1, 1909	C 323	Barr, Samuel	June 10, 1927	C 809
Adamson, Wm.	Dec. 22, 1921	C 721	Barrass, Robt.	June 30, 1926	C 795
Ainsworth, Edward	May 16, 1918	C 674	Bastian, Albert	May 30, 1923	C 750
Allan, Alexander	Oct. 28, 1911	C 430	Bate, Horace	Dec. 30, 1926	C 802
Almond, Alex.	Oct. 1, 1907	C 252	Bateman, Joseph William	Oct. 28, 1913	C 551
Almond, Walter	July 22, 1908	C 286	Bauld, Wm.	June 10, 1911	C 422
Alstead, Robt.	June 21, 1921	C 719	Baxter, Robert	Oct. 28, 1911	C 450
Anderson, John	Oct. 28, 1911	C 437	Baybutt, Thomas	May 27, 1913	C 548
Anderson, Peter Blane	Nov. 15, 1917	C 660	Beard, Henry C.	May 30, 1923	C 751
Anderson, Robt.	Oct. 14, 1914	C 599	Beeton, D. H.	May 1, 1909	C 838
Angell, William	May 21, 1914	C 591	Bell, Fred	May 27, 1913	C 514
Arbuckle, John	May 13, 1915	C 622	Bell, John	May 9, 1912	C 477
Archibald, Geo.	May 21, 1914	C 569	Bennett, Andrew M.	Nov. 15, 1917	C 661
Archibald, Thomas	Oct. 28, 1911	C 454	Bennett, John	Oct. 14, 1914	C 597
Ball, Alfred	May 17, 1917	C 635	Bennie, John	June 10, 1911	C 411
Bann, Thomas	Oct. 31, 1912	C 494	Beveridge, Wm.	June 10, 1911	C 396
Baggaley, J.	July 22, 1908	C 300	Biggs, John	March 4, 1905	C 210
Baguley, James	Dec. 2, 1929	C 829	Biggs, Thomas	Oct. 28, 1911	C 449
Bain, James	May 27, 1913	C 546	Birchell, Richard	Oct. 1, 1907	C 266
Bainbridge, James	Nov. 21, 1922	C 744	Blair, James	Oct. 31, 1912	C 502
Ball, Benjamin	May 21, 1914	C 583	Blas, Emil	June 24, 1924	C 774
Barker, Robert	June 10, 1911	C 415	Blewett, Ernest	July 22, 1908	C 298
Barlow, B. R.	May 1, 1909	C 337	Blinkhorn, Thomas	Dec. 19, 1918	C 681

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Name.	Date.	No.	Name.	Date.	No.
Bond, Frank	June 30, 1926	C 797	Cope, Frank	Oct. 28, 1913	C 549
Bradley, William	July 22, 1908	C 291	Corbett, Garnet S.	Dec. 23, 1927	C 812
Bradley, Wilfred	May 17, 1922	C 733	Coulthard, James	June 10, 1911	C 407
Bridge, Edward	July 29, 1905	C 223	Crawford, David	Mar. 4, 1905	C 208
Briscoe, F.	July 22, 1908	C 309	Cullen, Alex.	July 21, 1929	C 824
Broderick, Matthew	Jan. 21, 1913	C 525	Cunningham, G. F.	Nov. 11, 1905	C 229
Brown, Arthur A.	Oct. 14, 1914	C 596	Cunliffe, Thos.	Oct. 1, 1907	C 265
Brown, David	Nov. 1, 1909	C 348	Cuthell, George W.	Dec. 2, 1929	C 832
Brown, George	July 8, 1916	C 626	Dabb, Owen	May 21, 1914	C 578
Brown, George A.	Dec. 14, 1920	C 706	Dando, John	May 9, 1912	C 465
Brown, James	Sept. 10, 1910	C 364	Davey, George	June 21, 1921	C 718
Brown, James	June 10, 1911	C 412	Davidson, Hugh	May 9, 1919	C 464
Brown, James	July 8, 1916	C 625	Davies, Alfred	Oct. 3, 1912	C 691
Brown, Jas. Millie	May 13, 1915	C 615	Davies, Evan Thomas	May 9, 1912	C 463
Brown, John	Sept. 10, 1910	C 392	Davies, John H. C.	May 17, 1922	C 729
Brown, Robert	Oct. 28, 1911	C 451	Davis, John David	May 16, 1918	C 660
Brown, Robert D.	June 10, 1911	C 423	Davis, William	May 1, 1909	C 339
Brown, Robert S.	June 10, 1911	C 408	Dean, Andrew	Dec. 19, 1918	C 688
Brown, Wm. A.	May 21, 1914	C 576	Dean, Joseph	May 13, 1915	C 611
Brown, William Gold	July 8, 1916	C 629	Derbyshire, A.	June 10, 1911	C 401
Bruce, Preston	Dec. 14, 1920	C 712	Déwar, Alex.	Sept. 10, 1910	C 369
Bullen, Thomas	Sept. 10, 1910	C 379	Devlin, Edward	Oct. 23, 1906	C 241
Bushell, Jas. P.	Oct. 1, 1907	C 264	Devlin, Ernest Henry	May 27, 1913	C 538
Bysouth, Thomas	May 16, 1918	C 673	Devlin, John	Oct. 3, 1919	C 693
Cairns, Andrew	June 10, 1911	C 420	Devoy, William	May 17, 1917	C 638
Cairns, Robert	May 27, 1913	C 539	Dickenson, Clifford	May 27, 1917	C 532
Caldwell, Daniel	May 17, 1917	C 639	Dickie, Leslie	Nov. 20, 1923	C 762
Caldwell, Peter	June 21, 1921	C 715	Dingsdale, Geo.	Oct. 28, 1911	C 459
Calverly, Joseph	Sept. 10, 1910	C 375	Dobie, Thomas	Dec. 22, 1921	C 726
Camamile, Hollis	Oct. 28, 1911	C 443	Doherty, J. J.	May 1, 1909	C 340
Campbell, Samuel	Nov. 15, 1917	C 662	Doney, John	Mar. 4, 1905	C 211
Campbell, Andrew	Nov. 27, 1917	C 651	Donnachie, John	June 10, 1911	C 425
Carroll, George	Nov. 21, 1922	C 746	Doodson, Robert	Oct. 28, 1911	C 455
Carr, Peter	Oct. 31, 1912	C 497	Dorrance, Orlin William	Jan. 21, 1913	C 517
Carson, George	Mar. 17, 1917	C 663	Douglas, D. B.	Oct. 23, 1906	C 235
Cartwright, Wm. H.	June 24, 1924	C 768	Dow, And. Y.	May 21, 1914	C 587
Cass, Wm.	Dec. 30, 1926	C 800	Drybrough, Robert	June 21, 1920	C 701
Catchpole, Charles	July 29, 1905	C 227	Dunn, James	July 21, 1929	C 821
Cavfield, Edward	May 16, 1918	C 670	Dunn, Wm.	Oct. 14, 1914	C 606
Caufield, John	May 1, 1909	C 321	Dunnigan, Richard	June 21, 1921	C 716
Challoner, Arthur	Oct. 28, 1911	C 433	Dykes, Isaac	June 10, 1911	C 409
Chambers, Ralph H.	Dec. 14, 1920	C 709	Dykes, Joseph W.	Oct. 1, 1907	C 248
Chapman, Wm.	Dec. 22, 1921	C 720	Eccleston, Thomas	May 17, 1917	C 482
Chapman, John	May 30, 1923	C 753	Eccleston, John I.	May 30, 1923	C 757
Chapman, Thomas H.	Jan. 5, 1925	C 779	Edwards, John	May 27, 1913	C 542
Charnock, John	Nov. 15, 1917	C 653	Elliott, John	May 27, 1913	C 541
Cheetham, Ben	July 22, 1908	C 311	Elliott, John B.	Dec. 23, 1927	C 811
Chester, John	Oct. 28, 1911	C 440	Elmes, George	Oct. 31, 1912	C 511
Christie, John	Dec. 20, 1928	C 820	Evans, D.	July 22, 1908	C 284
Clare, Albert	Dec. 20, 1928	C 819	Ewing, Robert	May 13, 1915	C 608
Clark, Lewis	June 10, 1911	C 405	Fairfoull, James	Oct. 28, 1911	C 453
Clark, Walter Pattison	May 9, 1912	C 480	Farrow, John William	Dec. 19, 1918	C 683
Clarkson, Robert	June 21, 1920	C 696	Ferryman, Henry	June 21, 1920	C 697
Clarkstone, Wm. W.	Oct. 28, 1911	C 431	Fitzpatrick, T. J.	Oct. 2, 1911	C 452
Clarkstone, Hugh	May 17, 1922	C 736	Flockart, David	Jan. 21, 1913	C 531
Cleaves, Walter	May 9, 1912	C 475	Ford, Allen	Oct. 28, 1911	C 445
Clifford, William	July 22, 1908	C 313	Fowler, Robert	Oct. 31, 1912	C 495
Cloke, Chas. E.	June 16, 1925	C 782	Francis, David Morgan	Oct. 28, 1913	C 558
Coates, Frank	June 16, 1925	C 789	Francis, James	Oct. 1, 1907	C 250
Colgrove, Charles Henry	Dec. 19, 1918	C 679	Frater, George	May 13, 1915	C 616
Commons, William	July 22, 1908	C 304	Frater, Joseph	July 21, 1929	C 828
Coupland, David	June 21, 1921	C 713	Freeman, H. N.	Nov. 14, 1905	C 230
Cooke, Joseph	Mar. 4, 1905	C 209	Frew, William M.	May 30, 1923	C 752
Coomb, Alexander	May 27, 1913	C 533	Frew, Andrew	Nov. 27, 1909	C 360
Cooper, John Andrew	Dec. 10, 1918	C 689	Frodsham, Vincent	July 22, 1908	C 282

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Name.	Date.	No.	Name.	Date.	No.
Furbow, John	Jan. 21, 1913	C 528	Irvine, David	June 10, 1911	C 413
Gabriel, Ernest P.	May 17, 1922	C 739	Jack, John	May 21, 1914	C 582
Garbett, Richard	Sept. 10, 1910	C 377	Jackson, Harry	June 24, 1924	C 776
Gascoyne, Rowland B.	Jan. 21, 1913	C 513	James, Thos.	May 21, 1914	C 538
Geater, Jas. Gordon	May 21, 1914	C 573	Jardine, Geo. Edward	Jan. 21, 1913	C 521
Gemmell, James	Oct. 31, 1912	C 505	Jarrett, Fred. J.	Oct. 1, 1907	C 256
Gillham, John	May 13, 1915	C 623	Jaynes, Frank	July 22, 1908	C 277
Gillies, William	May 16, 1918	C 668	Jenkins, John	Sept. 10, 1910	C 390
Glenn, James	Oct. 28, 1911	C 435	Jenkinson, Jonathan	Dec. 23, 1927	C 813
Gordon, Davis John	May 9, 1912	C 474	John, Howel	July 22, 1908	C 305
Gourley, Robert	May 9, 1912	C 470	Johnson, Moses	Oct. 1, 1907	C 258
Gray, George	May 9, 1912	C 467	Johnston, Fred	Dec. 30, 1926	C 803
Gregory, William	May 30, 1923	C 756	Johnston, Robert	May 9, 1912	C 479
Gregson, John B.	Dec. 31, 1925	C 790	Jones, Alf. Geo.	May 21, 1914	C 584
Green, William	Nov. 15, 1917	C 659	Jones, Samuel	May 27, 1913	C 518
Greenhorn, John	May 21, 1914	C 575	Jones, William C.	Jan. 21, 1913	C 556
Groat, Ed. Murray	Nov. 20, 1923	C 764	Jones, William Ernest	Oct. 28, 1913	C 221
Griffiths, Edward	Oct. 31, 1914	C 508	Jones, W. T.	Mar. 4, 1905	C 544
Gunniss, Matthew	May 9, 1912	C 460	Judge, Peter	Sept. 10, 1910	C 391
Haile, Joseph G.	May 17, 1922	C 731	Keenan, Wm. James	June 10, 1911	C 426
Hallinan, William	May 1, 1909	C 343	Kelly, Ernest	May 17, 1917	C 646
Hall, Joseph	May 17, 1922	C 742	Kemp, Wm.	Oct. 14, 1914	C 594
Halsall, J.	July 22, 1908	C 307	Kingham, Alfred	Oct. 28, 1913	C 559
Hamilton, John	Oct. 28, 1911	C 444	Kirkeberg, H. S.	Nov. 27, 1909	C 350
Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550	Klejko, Steve	Dec. 14, 1920	C 703
Hampton, Samuel	Nov. 15, 1917	C 650	Lane, Joseph	Oct. 1, 1907	C 254
Hancock, Arthur	Nov. 15, 1917	C 656	Lavin, Joseph	June 21, 1920	C 700
Hannah, Archibald	Dec. 2, 1929	C 834	Lazaruk, Steve	June 30, 1928	C 815
Hardy, Edward	June 21, 1920	C 694	Leeman, T.	May 1, 1909	C 345
Hartley, Thomas	Oct. 31, 1912	C 510	Lester, Frank	May 17, 1922	C 734
Hart, Daniel M.	May 17, 1922	C 730	Lewis, Benj. J.	Sept. 10, 1910	C 386
Harwood, Fred	Sept. 10, 1910	C 384	Leynard, Paul	May 17, 1917	C 637
Harvey, Thomas	May 9, 1912	C 466	Liddell, John	July 29, 1905	C 228
Harvie, George	Sept. 10, 1910	C 378	Lindsay, William	May 17, 1917	C 642
Hears, Robert	Sept. 10, 1910	C 373	Linn, George Y.	May 17, 1922	C 737
Hemer, Herbert	Oct. 14, 1914	C 595	Litherland, David	June 30, 1923	C 816
Henney, Jonathan	June 10, 1911	C 424	Littler, James	June 30, 1926	C 792
Hendry, James	May 9, 1912	C 471	Littler, John	June 10, 1911	C 410
Herd, William	Dec. 19, 1918	C 682	Littler, Matthew	June 10, 1911	C 417
Hetherington, Geo.	July 21, 1929	C 825	Littler, Robert	June 10, 1911	C 418
Heyes, Edward	May 1, 1909	C 320	Livingstone, Alex	Oct. 28, 1911	C 436
Heyes, Ernest	Dec. 2, 1929	C 830	Loxton, George	June 10, 1911	C 428
Hilton, Arthur	Dec. 2, 1929	C 831	Loxton, John	June 10, 1911	C 416
Hilton, Mathias	Dec. 19, 1918	C 677	Lloyd, Thomas	May 17, 1922	C 740
Hilton, R. G.	Sept. 10, 1910	C 376	Luck, George	May 1, 1909	C 318
Hindmarsh, John G.	June 30, 1926	C 799	Lynch, Stewart	Oct. 28, 1911	C 432
Hindmarsh, Peter	May 30, 1923	C 755	Mackie, John	June 10, 1911	C 421
Hodson, R. H.	Mar. 4, 1905	C 216	Makin, J. Wm.	Sept. 10, 1910	C 385
Hodge, William K.	Nov. 20, 1923	C 761	Malone, John	May 21, 1914	C 585
Holdsworth, William	May 16, 1918	C 671	Maltman, James	Oct. 31, 1912	C 501
Holliday, William	July 8, 1916	C 634	Mansfield, A.	May 1, 1909	C 336
Hopkins, Harry	Dec. 31, 1925	C 791	Marrs, John	May 17, 1917	C 640
Horbury, Joseph W.	June 10, 1911	C 406	Marsh, Daniel Parks	May 27, 1913	C 543
Horrocks, A. G.	May 1, 1909	C 324	Marsh, John	Oct. 1, 1907	C 270
Horwood, S.	July 22, 1908	C 312	Martin, James	June 10, 1911	C 398
Houston, Robert	July 8, 1916	C 631	Mason, Joseph	July 22, 1908	C 297
Howells, Nathaniel	May 1, 1909	C 316	Massey, Henry	May 1, 1909	C 317
Hunter, Peter M.	June 30, 1926	C 798	Mather, Thomas	July 22, 1908	C 293
Hunter, Thomas	June 16, 1925	C 786	Matusky, Andrew	Oct. 1, 1907	C 259
Hutchison, Ben	Nov. 14, 1905	C 232	Mawson, J. T.	Nov. 27, 1909	C 359
Hutchison, Fred	Nov. 27, 1909	C 358	Maxwell, Geo.	May 21, 1914	C 571
Hynd, John	Dec. 14, 1920	C 707	McAlpine, John	Mar. 4, 1905	C 217
Hynds, William	July 8, 1916	C 632	McArthur, John Malcolm	May 17, 1917	C 648
Ireson, John	Oct. 31, 1912	C 507	McArthur, Robert	Dec. 22, 1921	C 723

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Name.	Date.	No.	Name.	Date.	No.
McBroom, Al.	July 2, 1908	C 287	Newman, John	Oct. 14, 1914	C 603
McCourt, John	Oct. 14, 1914	C 605	Nicholson, James	May 9, 1912	C 489
McCourt, Thos.	Dec. 30, 1926	C 805	Nimmo, James	May 9, 1912	C 461
McCulloch, James	May 1, 1909	C 315	Norris, Joshua	Oct. 28, 1913	C 557
McDonald, Allen	June 30, 1928	C 817	Nuttall, Wm.	June 16, 1925	C 780
McDonald, John	Oct. 28, 1911	C 448	Oakes, Robert	Oct. 31, 1912	C 498
McFagen, Alexander	May 9, 1912	C 490	O'Brien, Charles	Nov. 27, 1909	C 349
McFegan, Robert	June 21, 1920	C 698	Odgers, Eli	Jan. 21, 1913	C 523
McFegan, W.	May 1, 1909	C 319	Orr, Alexander	Oct. 28, 1911	C 434
McGarry, Martin	May 1, 1909	C 326	Osborne, Hugh	Oct. 28, 1913	C 555
McGrath, James	July 8, 1916	C 630	Oswald, Geo. L.	Sept. 10, 1910	C 370
McGuckie, Jno. M.	May 21, 1914	C 562	Owen, Thomas	May 1, 1909	C 347
McGuckie, Thomas	July 29, 1905	C 226	Park, William	Dec. 19, 1918	C 684
McGuire, Thomas	Oct. 28, 1913	C 553	Parks, Alexander	Jan. 21, 1913	C 519
McIntyre, Neil	May 21, 1914	C 574	Parker, L.	May 1, 1909	C 341
McKay, Walter	Nov. 20, 1923	C 763	Parkinson, James Wm.	Nov. 15, 1917	C 655
McKelvie, J.	July 22, 1908	C 285	Parkinson, T.	July 22, 1908	C 289
McKenzie, Peter	June 10, 1911	C 427	Parkinson, Thomas	June 24, 1924	C 769
McKibben, Matthew	May 21, 1914	C 580	Parrott, Jas. E.	May 21, 1914	C 590
McKinley, John	Oct. 28, 1914	C 442	Parson, Herbert	May 13, 1915	C 621
McLaren, John	May 30, 1923	C 754	Parsons, Albert	June 10, 1927	C 808
McLaughlin, James	May 9, 1912	C 485	Pearson, Jonathan	May 9, 1912	C 473
McLachlan, Alex.	June 10, 1912	C 419	Penman, Hugh	Oct. 28, 1913	C 552
McLean, M. D.	Sept. 10, 1910	C 389	Perry, Geo. Harewood	May 17, 1917	C 643
McLellan, William	Mar. 4, 1905	C 219	Phillips, Richard S.	May 17, 1917	C 620
McLeod, James	July 22, 1908	C 296	Phillips, James	Nov. 21, 1922	C 749
McLeod, John	May 13, 1915	C 609	Pickup, A.	July 22, 1908	C 310
McMeakin, James	May 13, 1915	C 612	Picton, W.	May 1, 1909	C 333
McMillan, D.	Sept. 10, 1910	C 363	Plank, Samuel	Nov. 14, 1905	C 233
McMillan, Edward	Oct. 31, 1912	C 493	Pollock, John	May 30, 1923	C 760
McMillan, Neil	Nov. 15, 1917	C 654	Poole, Samuel	May 27, 1913	C 536
McNay, Carmichael	July 22, 1908	C 306	Price, Walter	Sept. 10, 1910	C 371
McNeill, Adam L.	July 22, 1908	C 281	Puckey, John Thomas	Dec. 19, 1918	C 687
McNeill, Robert	Sept. 10, 1910	C 387	Quayle, Alex. B.	Jan. 5, 1925	C 778
McWhirter, Archibald	June 30, 1926	C 794	Quinn, James	Oct. 28, 1911	C 441
Meek, Matthew	May 9, 1912	C 484	Quinn, John	Oct. 28, 1911	C 429
Meikle, Harry Alexander	July 8, 1916	C 627	Radford, Albert	May 21, 1914	C 579
Menzies, Frederick	Dec. 14, 1920	C 704	Rallison, R.	July 22, 1908	C 279
Merrifield, George	Oct. 23, 1906	C 239	Rallison, James	May 30, 1923	C 759
Merrifield, William	Oct. 23, 1906	C 236	Rankin, George	July 22, 1908	C 275
Michek, John	May 21, 1914	C 563	Rankin, Wm. Shaw	May 9, 1912	C 489
Miles, John	June 10, 1911	C 414	Raynor, Fred	Oct. 1, 1907	C 257
Miller, Frederick	July 21, 1929	C 823	Rear, Albert E.	June 10, 1927	C 807
Mitchell, Charles	May 1, 1909	C 322	Reid, Robert	Sept. 10, 1910	C 383
Mitchell, Henry	Sept. 10, 1910	C 366	Reid, Thos.	May 21, 1914	C 592
Monks, James	Nov. 14, 1905	C 234	Reid, Wm.	June 10, 1911	C 403
Moore, George	Oct. 23, 1906	C 242	Reilly, Thomas	July 22, 1908	C 303
Moore, John	May 1, 1909	C 335	Renney, Jas.	Nov. 27, 1909	C 354
Moreland, Thomas	July 22, 1908	C 299	Richards, James	Nov. 1, 1907	C 249
Morgan, John	July 29, 1905	C 224	Richards, Samuel	Oct. 23, 1906	C 244
Morgan, William	May 17, 1917	C 636	Richardson, J. H.	Oct. 28, 1911	C 458
Morgan, Cornelius	Dec. 22, 1921	C 725	Rigby, John	July 29, 1905	C 225
Morgan, John	June 24, 1924	C 773	Roberts, Arthur	June 24, 1924	C 772
Morris, David	May 9, 1912	C 472	Roberts, Ebenezer	May 1, 1909	C 327
Mottishaw, Samuel K.	Oct. 23, 1906	C 237	Robinson, Michael	May 1, 1909	C 332
Murdock, Jno. Y.	May 21, 1914	C 564	Robinson, Asa	June 16, 1925	C 787
Murray, Robt.	June 30, 1926	C 796	Robson, James	June 16, 1925	C 788
Myers, Peter	Oct. 28, 1911	C 446	Robson, Thomas	May 21, 1914	C 566
Nanson, T. H.	July 22, 1908	C 280	Rogers, Ellis	May 13, 1915	C 624
Nash, George William	May 17, 1917	C 565	Roper, William	July 22, 1908	C 274
Nash, George F.	Dec. 22, 1921	C 727	Ross, William	June 21, 1920	C 702
Nee, Wm. R.	Dec. 22, 1921	C 724	Rowan, John	Oct. 14, 1914	C 602
Neen, Joseph	Nov. 27, 1909	C 352	Rowbottom, Thomas	Oct. 31, 1914	C 492
Nelson, Horatio	Oct. 1, 1907	C 263	Royle, Edward	Oct. 31, 1912	C 506
Neilson, William	May 9, 1912	C 481	Russell, Robert	Nov. 27, 1909	C 351

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Name.	Date.	No.	Name.	Date.	No.
Rutherford, Jasper	May 17, 1917	C 644	Taylor, Robert	June 21, 1920	C 695
Rutledge, Edwin	July 22, 1908	C 302	Taylor, Thomas	May 21, 1914	C 577
Scales, Joseph	May 17, 1922	C 738	Tennant, Joseph	June 24, 1924	C 770
Scott, Henry	July 22, 1908	C 294	Thacker, Geo.	May 27, 1913	C 537
Saunders, Eustace L.	Jan. 21, 1913	C 520	Thomas, Thomas	Sept 10, 1910	C 365
Scarpino, Francis	May 17, 1917	C 649	Thomas, John B.	Nov. 14, 1905	C 231
Seddon, James	Oct. 3, 1919	C 692	Thomas, Joseph	Mar. 4, 1905	C 220
Shanks, David	Sept. 10, 1910	C 372	Thomas, Warriett	Oct. 1, 1907	C 273
Sharp, James	May 1, 1909	C 325	Thomason, Charles	Nov. 15, 1917	C 657
Sharpe, Henry	June 16, 1925	C 783	Thompson, Charles	June 24, 1924	C 765
Sharples, J. T.	Sept. 10, 1910	C 380	Thompson, Thomas	Oct. 1, 1917	C 267
Shea, Thomas J.	Dec. 22, 1921	C 722	Thompson, John	Oct. 31, 1912	C 509
Shearer, L.	May 1, 1909	C 330	Thompson, Joseph	Oct. 1, 1907	C 269
Shields, Thomas	May 16, 1918	C 667	Thomson, Duncan	Mar. 4, 1905	C 218
Shipley, John W.	Oct. 28, 1911	C 456	Tolley, John	Dec. 19, 1918	C 678
Shooter, Joseph	Oct. 1, 1907	C 261	Touhey, William	May 27, 1913	C 547
Shortman, J.	May 1, 1909	C 331	Travis, Joseph	June 21, 1920	C 699
Simister, J. H.	Nov. 27, 1909	C 353	Tully, Thomas	May 9, 1912	C 468
Simister, W.	May 1, 1909	C 334	Tune, Elijah	May 9, 1912	C 476
Sim, James	Dec. 14, 1920	C 711	Unsworth, John	June 16, 1925	C 784
Simms, Hubert Allan	Jan. 21, 1913	C 526	Valentine, Wilfrid	July 21, 1929	C 826
Sinclair, William	Jan. 21, 1913	C 527	Vardy, Robt.	May 21, 1914	C 570
Skelton, Thos.	May 1, 1909	C 344	Vaughan, John Henry	Oct. 28, 1913	C 560
Slee, Thomas	June 30, 1926	C 793	Vincent, Thomas C.	Nov. 21, 1922	C 745
Smith, A. E.	Sept. 10, 1910	C 367	Waddington, D. M.	June 10, 1927	C 806
Smellie, John	May 29, 1923	C 755	Walker, George	July 8, 1916	C 633
Smith, John C.	July 21, 1929	C 822	Walker, Jas. Alexander	Oct. 31, 1912	C 496
Smith, John Watterson	May 16, 1918	C 665	Walker, Robert C.	May 17, 1922	C 728
Smith, Joseph	Mar. 4, 1905	C 207	Walker, Wm.	May 21, 1914	C 586
Smith, Richard Beveridge	Oct. 28, 1913	C 561	Wallace, Fred	Oct. 1, 1907	C 260
Smith, Thomas	Dec. 30, 1926	C 804	Walls, John	Dec. 14, 1920	C 710
Smith, Thos. J.	Oct. 1, 1907	C 271	Warburton, Ernest L.	June 10, 1911	C 899
Smith, Thomas	May 9, 1912	C 486	Ward, Ernest Hedley	May 17, 1917	C 641
Smith, Thomas	Dec. 14, 1920	C 705	Wardrop, James	Oct. 31, 1912	C 504
Snow, Aubrey	June 15, 1918	C 675	Watson, Adam G.	Mar. 4, 1905	C 212
Sopwith, Reginald Scott	Jan. 21, 1913	C 512	Watson, Arthur W.	May 27, 1913	C 535
* Sparks, Edward	Oct. 1, 1907	C 255	Watson, George	July 22, 1908	C 288
Spencer, G.	May 1, 1909	C 329	Watson, Joseph	Jan. 21, 1913	C 515
Spruston, R. L.	Nov. 27, 1909	C 355	Watson, William	Oct. 22, 1906	C 246
Spruston, Thomas A.	Mar. 4, 1905	C 206	Watson, William	May 17, 1917	C 645
Stafford, M.	Sept. 10, 1910	C 382	Watson, John	May 17, 1922	C 743
Starr, Wallace	May 9, 1912	C 488	Weaver, William	Nov. 17, 1922	C 748
Staton, Edward	May 21, 1914	C 581	Webb, Herbert	Oct. 28, 1911	C 457
Steele, Walter,	Oct. 28, 1911	C 439	Webster, James Stewart	Dec. 19, 1918	C 685
Stewart, George	May 27, 1913	C 534	Weeks, John	Mar. 4, 1905	C 214
Stewart, James M.	Oct. 23, 1906	C 240	West, James Gloag	May 16, 1918	C 676
Stewart, James B.	June 16, 1925	C 785	Whalley, William	Dec. 19, 1918	C 686
Stewart, John	Dec. 30, 1926	C 801	White, James	Oct. 31, 1912	C 499
Stobbert, David	June 16, 1925	C 781	White, John	Oct. 22, 1906	C 245
Stockwell, William	Oct. 23, 1906	C 238	Wicks, Roy	July 21, 1929	C 827
Stone, Wm. C.	June 21, 1921	C 714	Wilkinson, Edward	Oct. 28, 1911	C 438
Strachan, John	Oct. 14, 1914	C 604	Williams, John Sam.	June 10, 1911	C 404
Strang, James	May 13, 1915	C 614	Williams, Watkin	June 22, 1908	C 301
Strang, Thomas	June 10, 1911	C 400	Wilson, Joseph	June 24, 1924	C 767
Strang, Wm.	June 10, 1911	C 395	Wilson, Joseph	June 30, 1928	C 814
Strang, William L.	Jan. 5, 1925	C 777	Wilson, Robinson	June 10, 1911	C 397
Sutherland, John	May 27, 1913	C 545	Wilson, Thomas M.	Oct. 1, 1907	C 272
Sweeney, John	May 17, 1922	C 735	Wilson, William	Oct. 1, 1907	C 262
Taylor, Charles M.	Mar. 4, 1905	C 213	Wilson, William	May 17, 1917	C 674
Taylor, Henry	Dec. 20, 1928	C 818	Winstanley, Robert	Nov. 21, 1922	C 747
Taylor, Hugh	Jan. 21, 1913	C 530	Winstanley, Oliver	May 17, 1922	C 741
Taylor, James	May 21, 1914	C 567	Winstanley, H.	July 22, 1908	C 283
Taylor, Jonathan	Dec. 19, 1918	C 680	Wintle, Thomas A.	July 29, 1905	C 222
Taylor, J. T.	Oct. 28, 1911	C 447	Witherington, George	Oct. 28, 1913	C 554
Taylor, Leroy	Sept. 10, 1910	C 381	Wood, Thos. James	Oct. 31, 1912	C 491

* C 314 issued in lieu of C 253 destroyed by Fernie fire.

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—Continued.

Name.	Date.	No.	Name.	Date.	No.
Worthington, J.	July 22, 1908	C 295	Yates, Frank	May 17, 1922	C 732
Wright, John	May 21, 1914	C 593	Yeowart, Hudson	June 24, 1924	C 771
Wright, Robert	May 21, 1914	C 589	Young, Alexander	May 16, 1918	C 666
Wright, William	Jan. 21, 1913	C 522			

COAL-MINE OFFICIALS.

Third-class Certificates issued under "Coal-mines Regulation Act Further Amendment Act, 1904," sec. 38, subsec. (2), in exchange for Certificates issued under the "Coal-mines Regulation Act Amendment Act, 1901."

Name.	Date.	No.	Name.	Date.	No.
Adam, Robert	Oct. 12, 1904	C 42	Lanfear, Herbert	Jan. 27, 1905	C 63
Addison, Thos.	Dec. 10, 1904	C 52	Lewis, Thos.	Oct. 11, 1904	C 35
Aitken, James	Oct. 24, 1904	C 44	Marsden, John	May 3, 1904	C 21
Allsop, Harry	Oct. 11, 1904	C 34	Miard, Harry E.	Mar. 3, 1905	C 76
Ashman, Jabez	Feb. 5, 1907	C 131	Middleton, Robt.	Feb. 11, 1905	C 71
Auchinvole, Alex	Mar. 29, 1905	C 89	Miller, Thos. K.	Feb. 21, 1905	C 74
Barclay, Andrew	April 27, 1904	C 19	McKenzie, John R.	Oct. 12, 1904	C 40
Barclay, James	April 27, 1904	C 20	McKinnon, Arch'd	April 3, 1905	C 102
Barclay, John	April 17, 1905	C 111	McMillan, Peter	Mar. 29, 1905	C 94
Bickle, Thos.	Oct. 11, 1904	C 37	McMurtrie, John	Mar. 29, 1905	C 96
Bowie, James	May 13, 1905	C 116	Moore, Wm. H.	June 17, 1905	C 119
Briscoe, Edward	Oct. 10, 1906	C 129	Morris, John	Dec. 27, 1904	C 57
Campbell, Dan	Mar. 29, 1905	C 93	Myles, Walter	April 3, 1905	C 100
Carr, Jos. E.	Oct. 11, 1904	C 36	Nash, Isaac	June 1, 1904	C 120
Carroll, Harry	Mar. 29, 1905	C 98	Neave, Wm.	Oct. 12, 1904	C 43
Clarkson, Alexander	April 27, 1904	C 18	Nelson, James	April 27, 1904	C 16
Collishaw, John	Feb. 7, 1905	C 68	Nimmo, Richard E.	April 18, 1911	C 133
Comb, John	Mar. 23, 1904	C 2	O'Brien, Geo.	Feb. 6, 1905	C 66
Courtney, A. W.	Nov. 2, 1904	C 45	Pearse, Thomas W. H.	April 14, 1916	C 138
Crawford, Frank	April 6, 1904	C 7	Power, John	Sept. 8, 1920	C 142
Daniels, David	April 27, 1904	C 12	Price, Jas.	Nov. 8, 1904	C 50
Davidson, David	April 3, 1905	C 106	Rafter, Wm.	Mar. 29, 1905	C 95
Davidson, John	Mar. 29, 1905	C 87	Reid, James	Mar. 23, 1904	C 1
Dobbie, John	Nov. 27, 1905	C 126	Richards, Thos.	April 27, 1904	C 14
Dudley, James	Mar. 22, 1905	C 114	Roughhead, George	Jan. 30, 1907	C 130
Duncan, Thomas	Aug. 29, 1906	C 128	Ryan, John	Dec. 28, 1904	C 59
Dunlap, Henry	Nov. 21, 1904	C 51	Sanders, John W.	April 3, 1905	C 107
Dunn, Geo.	Dec. 19, 1904	C 56	Shenton, Thos. J.	July 25, 1904	C 30
Dunsmuir, John	Mar. 29, 1905	C 90	Shepherd, Henry	June 13, 1904	C 26
Eccleston, Wm.	Mar. 15, 1905	C 80	Smith, Geo.	Mar. 29, 1905	C 84
Fagan, David	April 6, 1905	C 109	Somerville, Alex.	Mar. 24, 1904	C 3
Farquharson, John	April 27, 1904	C 17	Stauss, Chas. F.	Feb. 9, 1905	C 69
Findlayson, James	June 6, 1904	C 25	Steele, Jas.	Mar. 29, 1905	C 92
Fulton, Hugh T.	April 3, 1905	C 105	Steele, John	June 4, 1913	C 4
Gibson, Edward	May 30, 1905	C 118	Stewart, Duncan H.	Mar. 28, 1904	C 137
Gilchrist, Wm.	Mar. 29, 1905	C 85	Stewart, John	April 3, 1904	C 104
Gillespie, Hugh	April 6, 1904	C 8	Stewart, Daniel W.	May 16, 1904	C 23
Gillespie, John	April 6, 1904	C 5	Stoddart, Jacob	Feb. 21, 1905	C 73
Gould, Alfred	April 17, 1906	C 112	Strachan, Robt.	April 27, 1904	C 15
Green, Francis	Oct. 11, 1904	C 38	Strang, James	April 27, 1904	C 10
Handlen, Jas.	June 16, 1904	C 122	Sullivan, John	July 4, 1916	C 139
Harnison, Wm.	Feb. 3, 1905	C 65	Summers, Joseph	May 17, 1920	C 141
Hescott, John	Jan. 16, 1905	C 62	Thomas, John	Mar. 29, 1905	C 97
Hoggan, Wm.	June 6, 1911	C 134	Vass, Robt.	Dec. 12, 1904	C 53
John, David	Nov. 8, 1904	C 49	Vater, Charles.	April 6, 1904	C 66
* John, Evan	July 25, 1916	C 140	Webber, Chas.	Sept. 13, 1904	C 32
Johnson, Geo.	May 9, 1904	C 124	Whiting, Geo.	May 29, 1905	C 117
Johnson, Wm. R.	Mar. 1, 1905	C 75	Wilson, Austin	Feb. 7, 1905	C 67
Jones, Evan	April 30, 1913	C 136	Wilson, Thos.	April 27, 1904	C 11
Lander, Frank	Jan. 9, 1905	C 61	Woodburn, Moses	Mar. 29, 1905	C 83

* Issued in lieu of No. C 132, lost.

MINE SURVEYOR CERTIFICATES ISSUED UNDER THE "COAL-MINES REGULATION ACT AMENDMENT ACT, 1919."

Name.	Date.	No.	Name.	Date.	No.
Anderson, Harry C.	May 19, 1922	59	MacDonald, John	May 19, 1922	46
Baile, Wynne Jeffreys	Oct. 3, 1919	16	McKenzie, Frank	June 10, 1927	66
Bonar, Robert B.	Dec. 30, 1926	64	Miard, Harry Ernest	Oct. 3, 1919	2
Bowerman, Everard S.	Dec. 14, 1920	39	McCulloch, Robert	Oct. 3, 1919	6
Boyce, Joseph Patrick	Oct. 3, 1919	5	Owen, Wm. Arthur	Oct. 3, 1919	10
Caufield, Bernard	May 19, 1922	54	Priest, Elijah	May 19, 1922	53
Corbett, Garnett S.	May 19, 1922	49	Rafter, Wm.	May 19, 1922	51
Cox, Richard	May 19, 1922	57	Reger, Frederick Wm.	Oct. 3, 1919	7
Crosscombe, James S.	May 31, 1923	60	Richards, Chas. Clifton	Oct. 3, 1919	19
D'Altroy, A. C.	July 21, 1929	68	Ridley, James	Oct. 3, 1919	18
Daniell, Geo. W. B.	Oct. 3, 1919	29	Roaf, Jos. R.	Oct. 3, 1919	14
Davis, Gerald D.	Oct. 3, 1919	28	Richards, James A.	Oct. 3, 1919	15
Delaney, James	Oct. 3, 1919	21	Rutherford, John A.	Dec. 2, 1929	70
Dickson, James	Oct. 3, 1919	3	Schjelderup, Vilhelm	July 21, 1929	69
Drewry, Wm. Stewart	May 19, 1922	56	Scott, Thos. Wright	Oct. 3, 1919	4
Edwards, Jas.	June 10, 1927	65	Strachan, Robert	June 21, 1920	36
Freeman, Harry N.	May 19, 1922	47	Spruston, Thos. A.	May 19, 1922	52
Garman, Maurice W.	Oct. 3, 1919	11	Strachan, Robert	May 19, 1922	45
Gregory, P. W.	Nov. 17, 1919	32	Sandland, Joseph	May 31, 1923	61
Graham, Charles	May 19, 1922	50	Stewart, R. T.	Nov. 17, 1923	62
George, Frank J.	May 19, 1922	48	Townsend, Neville F.	Nov. 17, 1919	31
Hargreaves, James	Nov. 29, 1920	33	Vallance, Wm. Dixon	Oct. 3, 1919	8
Hepburn, James T.	Dec. 14, 1920	37	Verkirk, Lucas	June 21, 1921	42
Holdsworth, William	Oct. 3, 1919	9	Waddington, Geo. W.	June 21, 1920	35
Hughes, Edward	Dec. 14, 1920	38	Wark, Samuel David	Oct. 3, 1919	20
Hunter, George	Oct. 3, 1919	30	White, Harold	Oct. 3, 1919	25
Howden, Archibald	May 19, 1922	55	Williams, Paul E. R.	Dec. 2, 1929	71
Jackson, Thos. R.	May 19, 1922	43	Wilson, R. Robinson	Oct. 3, 1919	12
King, Alfred Geo.	Oct. 3, 1919	27	Wilson, Arthur Rupert	Oct. 3, 1919	13
Kneen, Percy	Dec. 20, 1928	67	Wilson, Chas. Jas.	Oct. 3, 1919	22
Lancaster, Peter	Oct. 3, 1919	23	Wilson, Hartley Paul	Oct. 3, 1919	24
Lauderbach, Wilfrid P.	June 16, 1925	63	Wilton, Douglas D.	May 19, 1922	59
Lindoe, Luke	June 21, 1921	41	Wilkie, Octavius B. N.	Oct. 3, 1919	26
Lynn, Albert Crompton	Oct. 3, 1919	17	Wright, Austin	Dec. 14, 1920	40

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Mine and Date.	Occupation of Defendant.	Offence charged.	Judgment.
Crow's Nest Pass Coal Co., Ltd.—			
Michel Colliery, September 3rd.....	Miner.....	Failing to timber place.....	\$5 and costs.
Michel Colliery, September 3rd.....	Miner.....	Failing to timber place.....	\$5 and costs.
Michel Colliery, September 13th.....	Miner.....	Matches in possession.....	\$20 and costs.
Coalmont Collieries, Ltd.—			
No. 4 mine, October 12th.....	Miner.....	Interfering with electric-bell system	\$50 and costs.
Canadian Collieries (D.), Ltd.—			
No. 1 mine, Extension Colliery, December 12th	Fireboss.....	Firing a shot without seeing all persons had taken shelter	\$10 and costs.

METALLIFEROUS MINES SHIPPING IN 1929.

NORTH-WESTERN DISTRICT (No. 1).

PORTLAND CANAL MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Mayou.....	Bitter creek.....	Mayou Gold Copper Co., Ltd., 700 Hall Bldg., Vancouver.....	Silver, lead, gold.
Black Hill.....	Bear river.....	Black Hill Mining Co., Ltd., Stewart.....	Silver, lead.
Melvin.....	Marmot river.....	Melvin Mining Co., Ltd., Stewart.....	Silver.
Mountain Boy.....	American creek.....	Mountain Boy Mining Co., Stewart.....	Silver, copper.
Outland.....	Salmon river.....	Outland Silver Bar Mines, Ltd., Bank of Nova Scotia Bldg., Vancouver.....	Silver, lead.
Prosperity.....	Marmot river.....	Premier Gold Mining Co., Ltd., Vancouver.....	Silver, lead, gold.
Premier.....	Cascade river.....	Premier Gold Mining Co., Ltd., Vancouver.....	Gold, silver, lead.
Woodbine.....	Salmon river.....	Woodbine Gold Mining Co., Ltd., Vancouver.....	Gold, silver, lead.

NASS RIVER MINING DIVISION.

Saddle.....	Hastings arm.....	Silver Crest Mines, Ltd., Vancouver.....	Silver, lead, copper.
Golskeish.....	Anyox.....	Granby Cons. M.S. & P. Co., Vancouver.....	Gold, silver.
Bonanza.....	Anyox.....	Granby Cons. M.S. & P. Co., Vancouver.....	Copper, silver, gold.
Granby Point.....	Anyox.....	Granby Cons. M.S. & P. Co., Vancouver.....	Gold, silver (flux).
Hidden Creek.....	Anyox.....	Granby Cons. M.S. & P. Co., Vancouver.....	Copper, silver, gold.
Toric.....	Alice arm.....	Toric Mines Co., Ltd., Vancouver.....	Silver, lead.

SKEENA MINING DIVISION.

Western Copper.....	Khutze inlet.....	Detroit Western Mining Co., Vancouver.....	Copper, gold, silver.
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NORTH-EASTERN DISTRICT (No. 2).

OMINECA MINING DIVISION.

Rocher Deboule.....	Rocher Déboulé mt.....	Aurimont Mines, Ltd., Vancouver.....	Silver, copper, gold.
Duthie.....	Hudson Bay mt.....	Duthie Mines, Ltd., Smithers.....	Silver, lead, gold.
Mohawk.....	4-Mile mountain.....	Mohawk Mining Co., Ltd., Vancouver.....	Silver, lead, zinc.
Silver Cup.....	9-Mile mountain.....	Silver Cup (Hazelton) Mining Co., Vancouver.....	Silver, lead, zinc.
Babine Bonanza.....	Babine range.....	Babine Bonanza Mining & Milling Co., Ltd., Vancouver.....	Silver, gold.

CENTRAL DISTRICT (No. 3).

LILLOOET MINING DIVISION.

Pioneer.....	Cadwallader creek.....	Pioneer Gold Mines of B.C., Ltd., Vancouver.....	Gold.
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KAMLOOPS MINING DIVISION.

Copper King.....	Kamloops.....	H. R. Graham, Box 275, Kamloops.....	Copper, gold, silver.
Ford.....	Meadow creek.....	A. C. Skaling, Mgr., Box 112, Kamloops.....	Copper, silver.
Bonny Etta.....	Kamloops.....	J. L. Fisher, Kamloops.....	Copper, gold, silver.

NICOLA MINING DIVISION.

Planet.....	Stump lake.....	Planet Mines & Reduction Co. of Nicola, Ltd., Vancouver.....	Lead, gold, silver.
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CENTRAL DISTRICT (No. 3)—*Continued.*

YALE MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Silver Daisy.....	23-Mile camp.....	Silver Daisy Mines, Ltd., Vancouver.....	Silver, lead, go'd.

SOUTHERN DISTRICT (No. 4).

GREENWOOD MINING DIVISION.

Beaver.....	Wallace mountain.....	Beaver Silver Mines, Ltd., Victoria.....	Silver, lead.
Bell.....	Beaverdell.....	McIntosh & Lee, Beaverdell.....	Silver, gold, lead.
Bounty.....	Beaverdell.....	P. B. Spencer-Stanhope, Beaverdell.....	Silver, lead, zinc.
Duncan.....	Wallace mountain.....	T. T. Henderson, Beaverdell.....	Silver, lead.
Elkhorn.....	Greenwood.....	George White, Greenwood.....	Silver, lead, gold.
Highland Lass.....	Beaverdell.....	Highland Lass, Ltd., Kelowna.....	Silver, zinc, lead.
Providence.....	Greenwood.....	Providence Mine Leasing Co., Ltd., Greenwood.....	Silver, gold, lead.
Sally.....	Beaverdell.....	Sally Mines, Ltd., Penticton.....	Silver, gold, lead.
Silver Star.....	Beaverdell.....	E. M. Barrett, Beaverdell.....	Silver, lead, gold.
Wellington.....	Beaverdell.....	Beaverdell Wellington Synd., Ltd., Greenwood.....	Silver, zinc, lead, gold.
Waterloo.....	Lightning peak.....	Waterloo Cons. Mines, Ltd., Penticton.....	Silver, lead, gold.

OSOYOOS MINING DIVISION.

Hedley.....	Hedley.....	Hedley Gold Mining Co., Ltd., Hedley.....	Gold, silver, arsenic.
Oro Fino.....	Oliver.....	B.E. Mining Co., Oliver.....	Gold, silver, lead.

SIMILKAMEEN MINING DIVISION.

Shamrock.....	Summers creek.....	R. J. Armstrong, Copper Mountain.....	Copper, silver.
Silver King.....	Summit camp.....	Silver King Mining Co., Ltd., Vancouver.....	Silver, lead, zinc.
Copper Mountain.....	Allenby.....	Granby Cons. M.S. & P. Co., Vancouver.....	Copper, silver, gold.

EASTERN DISTRICT (No. 5).

WINDERMERE MINING DIVISION.

Lead Queen.....	Brisco.....	G. L. Larabee, Brisco.....	Silver, lead.
Paradise.....	Invermere.....	Paradise Holdings, Ltd., Vancouver.....	Silver, lead.

TRAIL CREEK MINING DIVISION.

I.X.L.....	Rossland.....	Cullhane & Moline, Rossland.....	Gold, silver.
Mayflower.....	Rossland.....	S. J. Hackney, Rossland.....	Silver, gold, zinc, lead.
Midnight.....	Rossland.....	Midnight Synd., C. Dally, Rossland.....	Gold, silver.

FORT STEELE MINING DIVISION.

North Star.....	Kimberley.....	O. C. Thompson, Salmo.....	Silver, lead.
St. Eugene.....	Moyie.....	Cons. M. & S. Co. of Canada, Trail.....	Silver, gold, zinc, lead.
Sullivan.....	Kimberley.....	Cons. M. & S. Co. of Canada, Trail.....	Silver, lead, zinc.

EASTERN DISTRICT (No. 5)—Continued.

AINSWORTH MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Banker.....	Ainsworth.....	H. Giegerich, Kaslo.....	Silver, lead, zinc.
Cork-Province.....	Zwicky.....	Cork-Province Mines, Ltd., Kaslo.....	Silver, lead, zinc.
Davy's Mill.....	Kaslo creek.....	M. S. Davys, Kaslo.....	Silver, gold, zinc.
Kootenay-Florence.....	Ainsworth.....	Kootenay-Florence Mining Co., Ainsworth.....	Silver, lead.
Montezuma.....	Kaslo creek.....	H. Giegerich, Kaslo.....	Silver, zinc, lead.
No. 1.....	Ainsworth.....	McPherson & Grant, Ainsworth.....	Silver, lead.
Revenue.....	Sturgis creek.....	Sturgis Creek Mines, Ltd., Calgary, Alta.....	Silver, gold, lead.
Silver Bear.....	Keen creek.....	F. Helme, Nashton.....	Silver, zinc, lead.
Spokane-Trinket.....	Ainsworth.....	H. Giegerich, Kaslo.....	Silver, lead.
Whitewater.....	Whitewater.....	Whitewater Mines, Ltd., Kaslo.....	Silver, gold, zinc, lead.

SLOCAN MINING DIVISION.

Alamo.....	Alamo.....	Cunningham Mines, Ltd., Alamo.....	Silver, zinc, lead.
Bosun.....	Sandon.....	C. J. Campbell; W. S. Ellis, Supt., New Denver.....	Silver, lead, zinc.
Canadian-Brandon.....	Sandon.....	Joseph Brandon, Sandon.....	Silver, lead, zinc.
Colonial.....	Cody.....	Colonial Slocan Mines, Ltd., Vancouver.....	Silver, lead.
Galena Farm.....	Silverton.....	Galena Farm Cons. Mines, Ltd., Vancouver.....	Silver, gold, zinc, lead.
Helenita.....	McGuigan basin.....	Helenita Mines, Ltd., Calgary, Alta.....	Silver, lead.
Hewitt.....	Silverton.....	The Victoria Synd., Ltd., Vancouver.....	Silver, gold, zinc, lead.
Ivanhoe.....	Sandon.....	Minnesota Silver Co., Ltd., New York.....	Silver, lead, zinc.
Lucky Jim.....	Zintoon.....	Lucky Jim Lead & Zinc Co., Vancouver.....	Silver, zinc, lead.
Lucky Thought.....	Silverton.....	H. Dewis, McDonell, <i>et al.</i> , Silverton.....	Silver, lead, zinc.
Mammoth.....	Silverton.....	Western Exploration Co., Silverton.....	Silver, lead, zinc.
Soho.....	McGuigan basin.....	Baldwin & Zachman, Spokane, Wash.....	Silver, lead.
Molly Hughes.....	New Denver.....	Molly Hughes Mines, Ltd., Spokane, Wash.....	Gold, silver.
Monitor.....	Three Forks.....	G. T. Gormley, Alamo.....	Silver, gold, lead, zinc.
Mountain Chief.....	Alamo.....	John Cecheclero <i>et al.</i> , New Denver.....	Silver, zinc, lead.
McAllister.....	Three Forks.....	Slocan Silver Mines, Ltd., Alamo.....	Silver, gold.
Noble Five.....	Cody.....	Noble Five Mines, Ltd., Nelson.....	Silver, lead, zinc.
Queen Bess.....	Alamo.....	Cons. Queen Bess Mines, Ltd., Alamo.....	Silver, zinc, lead.
Ruth-Hope.....	Sandon.....	Ruth-Hope Mining Co., Ltd., Vancouver.....	Silver, gold, lead, zinc.
Sovereign.....	Sandon.....	American Boy Mining Co., Spokane, Wash.....	Silver, lead, zinc.
Slocan Rambler.....	New Denver.....	Slocan Rambler Mining Co., Vancouver.....	Silver, zinc, lead.
Standard.....	Sandon.....	Western Exploration Co., Silverton.....	Silver, zinc, lead.
Surprise.....	Sandon.....	The Noble Five Mines, Ltd., Nelson.....	Silver, lead, zinc.
Victor.....	Three Forks.....	Geo. A. Petty, Sandon.....	Silver, lead, zinc.
Wakefield.....	4-Mile creek.....	Oscar V. White, Agent, New Denver.....	Silver, lead, zinc.

SLOCAN CITY MINING DIVISION.

Two Friends.....	Slocan City.....	Empee Mining Co., Ltd., Vancouver.....	Silver, zinc, lead.
Westmont.....	10-Mile creek.....	R. F. Ainslie, Silverton.....	Silver, lead.

LARDEAU MINING DIVISION.

Spider.....	Pool creek.....	Multiplex Mining, M. & P. Co., Beaton.....	Silver, lead.
Teddy Glacier.....	Camborne.....	Teddy Glacier Mines, Ltd., Vancouver.....	Silver, zinc, lead.

REVELSTOKE MINING DIVISION.

Snowflake.....	Albert Canyon.....	Snowflake Mining Co., Ltd., Vancouver.....	Silver, lead, zinc, copper.
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EASTERN DISTRICT (No. 5)—*Continued.*

GOLDEN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Crown Point.....	McMurdo creek.....	Witwatersrand Synd., Ltd., Revelstoke.....	Silver, lead.
Monarch.....	Field.....	Base Metals Mining Corp., Ltd., Field.....	Silver, lead.

NELSON MINING DIVISION.

Delaware.....	Nelson.....	G. A. M. Young and J. E. Hayden, Creston..	Silver, lead.
Euphrates.....	Nelson.....	Euphrates Gold Mining Co., Nelson.....	Gold, silver.
Goodenough.....	Ymir.....	Alex. McDonald, Ymir.....	Gold, silver, lead.
Hunter V.....	Ymir.....	Consolidated M. & S. Co., Trail.....	Gold, silver (flux).
Perrier.....	Nelson.....	West Kootenay Equip. Co., Nelson.....	Gold, silver, lead.
Reno.....	Sheep creek.....	Reno Gold Mines, Ltd., Salmo.....	Gold, silver.
Second Relief.....	Erie.....	Relief-Arlington Mines, Ltd., Erie.....	Gold, silver.

WESTERN DISTRICT (No. 6).

VANCOUVER MINING DIVISION.

Britannia.....	Britannia beach.....	Britannia M. & S. Co., Britannia Beach.....	Copper, silver, gold.
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NANAIMO MINING DIVISION.

Hope.....	Thurflow island.....	Thurflow Gold Mines, Ltd., Vancouver.....	Gold, silver.
Marble Bay.....	Vananda.....	Marble Bay Copper Mines, Ltd., Vananda.....	Copper, gold, silver.
Romana.....	Goat island.....	Romana Copper Mines, Ltd., Vancouver.....	Copper, silver.
Caledonia.....	Hardy bay.....	Caledonia Mines, Ltd., Vancouver.....	Copper, silver.

ALBERNI MINING DIVISION.

Island Copper.....	Alberni.....	Island Copper Co., Ltd., Victoria.....	Copper, gold, silver.
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LIST OF CROWN-GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1929.

NORTH-WESTERN DISTRICT (No. 1).

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Atlin—			
Bob Fraction.....	Engineer Gold Mines, Ltd.; June 17.....	4659	2.01
Wann Fraction.....	Engineer Gold Mines, Ltd.; June 17.....	4655	6.64
Llard—			
Burrard.....	Alice Trites; Sept. 18.....	300	51.65
Capilano.....	A. St. Clair Brindle; Sept. 18.....	301	51.65
Meteor Flag.....	Alice Trites; Sept. 18.....	330	51.65
Union Jack.....	Amos Bliss Trites; Sept. 18.....	303	49.81
Vancouver.....	Amos Bliss Trites; Sept. 17.....	299	51.65
Skene—			
L.C. Fraction.....	Columario Gold Mines, Ltd.; Oct. 5.....	6750	49.75
Norman Fraction.....	Columario Gold Mines, Ltd.; Oct. 5.....	6751	18.37
Valhalla No. 2.....	Columario Gold Mines, Ltd.; Oct. 5.....	6748	42.29
Valhalla No. 3.....	Columario Gold Mines, Ltd.; Oct. 5.....	6749	47.03
Portland Canal—			
Ace No. 1 Fraction.....	Alaska Canadian Consolidated Gold Mines, Ltd.; Jan. 17.....	4422	18.80
A.L.....	Mohawk Mining Co., Ltd.; May 2.....	5055	44.81
A.L. Fraction.....	Mohawk Mining Co., Ltd.; May 2.....	5056	7.16
Alpine.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4927	23.82
Amazon.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4945	47.27
Amazon Fraction.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4950	27.15
Amazon No. 1.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4946	40.93
Amazon No. 2.....	John McNeill; Oct. 11.....	4968	51.65
Amazon No. 2 Fraction.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4951	10.74
Amazon No. 3.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4947	35.79
Amazon No. 4.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4948	42.18
Amy A.	Outland Silver Bar Mines, Ltd.; June 12.....	5480	37.40
Anacanda.....	Wm. Rounsefell Tonkin, Sr. and Jr.; Oct. 5.....	4618	46.18
Anacanda No. 1.....	Wm. Rounsefell Tonkin, Sr. and Jr.; Oct. 5.....	4619	48.79
Apex No. 1.....	Marmot River Gold Mines, Ltd.; June 12.....	5074	11.59
Apex No. 2.....	Marmot River Gold Mines, Ltd.; June 12.....	5075	26.10
Argyle No. 1.....	Rufus Argenta Mines, Ltd.; May 3.....	4576	39.51
Argyle No. 2.....	Rufus Argenta Mines, Ltd.; May 3.....	4577	42.21
Argyle No. 3.....	Rufus Argenta Mines, Ltd.; May 3.....	4578	36.95
Argyle No. 4.....	Rufus Argenta Mines, Ltd.; May 3.....	4579	35.77
Argyle No. 5.....	Rufus Argenta Mines, Ltd.; May 3.....	4580	48.83
Argyle No. 6.....	Rufus Argenta Mines, Ltd.; May 3.....	4581	38.81
Bar Cross.....	Outland Silver Bar Mines, Ltd.; June 12.....	5428	34.27
Barite.....	Barite Gold Mines, Ltd.; June 26.....	5341	51.65
Barite No. 1.....	Barite Gold Mines, Ltd.; June 26.....	5342	51.65
Barney.....	United Empire Gold and Silver Mining Co.; July 5.....	4994	40.38
Bess.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4976	41.16
Betsy Fraction.....	Stewart Central Mines, Ltd.; May 2.....	3524	49.80
Betty.....	Stewart Central Mines, Ltd.; May 2.....	3461	33.58
Betty No. 1.....	Stewart Central Mines, Ltd.; May 2.....	3462	34.73
Betty No. 2.....	Stewart Central Mines, Ltd.; May 2.....	3463	43.91
Betty No. 3.....	Stewart Central Mines, Ltd.; May 2.....	3464	18.51
Betty No. 4.....	Stewart Central Mines, Ltd.; May 2.....	3466	50.53
Betty No. 5.....	Stewart Central Mines, Ltd.; May 2.....	3468	50.98
Big Chief No. 1.....	John E. Munro and Alex. N. McDonald; Dec. 7.....	5413	50.67
Big Chief No. 2.....	John E. Munro and Alex. N. McDonald; Dec. 7.....	5414	31.99
Big Chief No. 3.....	John E. Munro and Alex. N. McDonald; Dec. 7.....	5415	31.13
Boundary.....	John E. Munro and Alex. N. McDonald; Dec. 7.....	5421	23.32
Briton No. 1.....	Benjamin O. Erickson; Feb. 21.....	1804	50.43

NORTH-WESTERN DISTRICT (No. 1)—Continued.

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Portland Canal—Cont'd.			
Cliff No. 1.....	Bear Valley Mines, Ltd.; April 12.....	4557	51.65
Cliff No. 2.....	Bear Valley Mines, Ltd.; April 12.....	4558	40.83
Cliff No. 3.....	Bear Valley Mines, Ltd.; April 12.....	4559	48.94
Dalhousie.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4924	51.65
Dalhousie Fraction.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4972	41.80
Dan Fraction.....	William A. Noble; Feb. 21.....	5091	51.65
Deep Fraction.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4930	36.68
Donald.....	John Watkins; Feb. 21.....	4546	28.65
Elf and Fairy.....	Wm. Forrest, Ben. O. Erickson, and Georgina Barbara Clarke; Dec. 5.....	4873	42.36
Elf and Fairy No. 1.....	Ditto.....	4874	28.70
Enterprise.....	George Enterprise Mining Co., Ltd.; Oct. 5.....	5346	51.65
Enterprise Fraction.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5360	48.71
Enterprise No. 1.....	George Enterprise Mining Co., Ltd.; Oct. 5.....	5347	51.65
Enterprise No. 2.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5348	41.85
Enterprise No. 3.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5349	51.65
Enterprise No. 4.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5350	34.63
Enterprise No. 5.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5351	28.12
Enterprise No. 6 Fraction.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5352	19.50
Enterprise No. 7.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5353	37.45
Enterprise No. 8.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5350	50.07
Eureka.....	Porter-Idaho Mining Co., Ltd.; Jan. 17.....	4732	43.51
Florence.....	Stewart Central Mines, Ltd.; May 2.....	3458	44.13
Florence Fraction.....	Stewart Central Mines, Ltd.; May 2.....	3467	23.62
Florence No. 1.....	Stewart Central Mines, Ltd.; May 2.....	3459	44.76
Florence No. 2.....	Stewart Central Mines, Ltd.; May 2.....	3460	48.76
Florence No. 3.....	Stewart Central Mines, Ltd.; May 2.....	3465	33.13
Fountain.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4750	44.92
Galena.....	Ell Watland; Feb. 21.....	4544	28.79
Glacier.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4984	32.51
Gold Cliff No. 1.....	United Empire Gold and Silver Mining Co.; July 5.....	4989	47.38
Gold Cliff No. 1 Fraction.....	United Empire Gold and Silver Mining Co.; July 5.....	4997	34.54
Gold Cliff No. 2.....	United Empire Gold and Silver Mining Co.; July 5.....	4987	44.37
Gold Cliff No. 2 Fraction.....	United Empire Gold and Silver Mining Co.; July 5.....	4990	42.74
Gold Cliff No. 4.....	United Empire Gold and Silver Mining Co.; July 5.....	4988	45.40
Gold Cliff No. 5.....	United Empire Gold and Silver Mining Co.; July 5.....	4992	46.92
Gold Fraction.....	United Empire Gold and Silver Mining Co.; July 5.....	4996	51.65
Grey Rock.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4983	44.19
Heather.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5354	51.65
Heather Fraction.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5366	49.26
Heather No. 1.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5355	51.65
Heather No. 2.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5356	46.91
Heather No. 3.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5357	51.64
Heather No. 4.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5365	50.82
Heather No. 5.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5361	28.31
Heather No. 6.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5362	49.37
Hector No. 1.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4805	51.64
Hibbard C.....	Outland Silver Bar Mines, Ltd.; June 12.....	5429	48.15
High Grade Extension No. 1.....	Marmot River Gold Mines, Ltd.; Nov. 13.....	5072	51.65
High Grade Extension No. 2.....	Marmot River Gold Mines, Ltd.; Nov. 13.....	5073	49.40
High Grade Fraction.....	Marmot River Gold Mines, Ltd.; June 12.....	5071	25.05
High Grade No. 1.....	Marmot River Gold Mines, Ltd.; June 12.....	5068	23.63
High Grade No. 2.....	Marmot River Gold Mines, Ltd.; June 12.....	5069	51.43
High Grade No. 3.....	Marmot River Gold Mines, Ltd.; Nov. 13.....	5071	51.65
Homestake.....	Mohawk Mining Co., Ltd.; May 2.....	5051	47.70
Homestake No. 2.....	Mohawk Mining Co., Ltd.; May 2.....	5052	45.72
Horse Shoe.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4975	51.65
Hub.....	Barite Gold Mines, Ltd.; June 26.....	5343	40.14
Idaho.....	William Arthur Noble; Jan. 17.....	2836	36.84
Idaho Fraction.....	William Arthur Noble; Jan. 17.....	2841	48.63
Jerry Dog.....	United Empire Gold & Silver Mining Co.; July 5.....	4986	44.37

NORTH-WESTERN DISTRICT (No. 1)—Continued.

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Portland Canal—Cont'd.			
Junction.....	Stewart Central Mines, Ltd.; May 2.....	3457	51.65
Lion Fraction.....	Dalby B. Morkill and William Hobill; Feb. 21.....	4169	49.51
Lion No. 1.....	Dalby B. Morkill and William Hobill; Feb. 21.....	4166	51.60
Lion No. 2.....	Dalby B. Morkill and William Hobill; Feb. 21.....	4167	14.05
Lion No. 3.....	Dalby B. Morkill and William Hobill; Feb. 21.....	4168	45.26
Mack Fraction.....	M.C. Mining Co., Ltd.; Nov. 14.....	1807	42.07
Mack No. 1.....	M.C. Mining Co., Ltd.; Nov. 16.....	1808	51.65
Mack No. 2.....	M.C. Mining Co., Ltd.; Nov. 16.....	1809	30.51
Mack No. 3 Fraction.....	M.C. Mining Co., Ltd.; Nov. 16.....	1810	32.33
Mack No. 4 Fraction.....	M.C. Mining Co., Ltd.; Nov. 16.....	1811	37.40
Maude.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4980	15.69
May.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4981	36.40
May Fraction.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4982	40.28
Melvin.....	H. W. M. Rolston; March 23.....	1867	34.98
Melvin No. 1 Fraction.....	H. W. M. Rolston; March 23.....	1868	51.65
Melvin No. 2 Fraction.....	H. W. M. Rolston; March 23.....	1869	33.36
Melvin No. 3.....	H. W. M. Rolston; March 22.....	4727	2.56
Melvin No. 4 Fraction.....	H. W. M. Rolston; March 22.....	1870	48.23
M.G. Fraction.....	Marmot River Gold Mines, Ltd.; June 12.....	5082	13.98
Mohawk.....	Mohawk Mining Co., Ltd.; May 2.....	5048	51.65
Mohawk Fraction.....	Mohawk Mining Co., Ltd.; May 2.....	5053	21.05
Mohawk No. 2.....	Mohawk Mining Co., Ltd.; May 2.....	5050	35.80
Montana.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4974	50.24
Montana.....	Alaska Canadian Consolidated Gold Mines, Ltd.; June 11.....	5092	24.16
Montana No. 1.....	Alaska Canadian Consolidated Gold Mines, Ltd.; June 11.....	5093	48.62
Montana No. 2.....	Alaska Canadian Consolidated Gold Mines, Ltd.; June 11.....	5094	46.64
Montana No. 3.....	Alaska Canadian Consolidated Gold Mines, Ltd.; June 11.....	5095	28.24
Munro.....	John E. Munro and Alexander N. McDonald; Dec. 7.....	5412	51.65
Munro No. 1.....	John E. Munro and Alexander N. McDonald; Dec. 7.....	5411	51.65
Munro No. 2.....	John E. Munro and Alexander N. McDonald; Dec. 7.....	5416	24.11
Munro No. 3.....	John E. Munro and Alexander N. McDonald; Dec. 7.....	5417	19.04
Munro No. 4.....	John E. Munro and Alexander N. McDonald; Dec. 7.....	5419	21.49
Munro No. 5.....	John E. Munro and Alexander N. McDonald; Dec. 7.....	5420	19.27
Nabob.....	John Watkins; Feb. 21.....	4547	5.82
Nabob No. 2.....	John Watkins; Feb. 21.....	4548	38.88
Nabob No. 3.....	Ell Watland; Feb. 21.....	4549	2.96
Nabob No. 4.....	Ell Watland; Feb. 21.....	4550	28.33
Native Silver Fraction.....	Outland Silver Bar Mines, Ltd.; June 12.....	5527	26.48
O.K.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4928	38.49
O.K. Fraction.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4929	39.91
Orient.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4925	23.08
Pat Fraction.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	3358	48.92
Pny Roll No. 3.....	Roland W. Irwin; July 17.....	5524	47.36
Pay Roll No. 4.....	Roland W. Irwin; July 17.....	5525	46.24
Peach Fraction.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4979	38.61
Peach No. 1.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4977	31.02
Peach No. 2.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4978	40.88
Petite Fraction.....	William Arthur Noble; Jan. 17.....	2842	0.22
P.G. No. 1 Fraction.....	Premier Gold Mining Co., Ltd.; June 11.....	5105	29.73
P.G. No. 2 Fraction.....	Premier Gold Mining Co., Ltd.; June 11.....	5106	28.55
Point Fraction.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4985	13.16
Prince.....	John Wardlaw Stewart; June 12.....	1818	43.84
Prince No. 2.....	May S. Stewart; June 12.....	1819	43.78
P.X. Fraction.....	Alaska Canadian Consolidated Gold Mines, Ltd.; Jan. 17.....	4425	2.38
Rawhide Fraction.....	Marmot River Gold Mines, Ltd. June 12.....	5083	40.10
Rawhide No. 1.....	Marmot River Gold Mines, Ltd. June 12.....	5076	43.72
Rawhide No. 2.....	Marmot River Gold Mines, Ltd. June 12.....	5077	43.30
Rawhide No. 3.....	Marmot River Gold Mines, Ltd.; Nov. 13.....	5078	48.07
Rawhide No. 4.....	Marmot River Gold Mines, Ltd.; June 12.....	5079	47.67
Red Top.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4803	51.25
Red Top Fraction.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4806	19.18
Red Top No. 1.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4804	50.89
Red Top No. 2 Fraction.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4949	3.37

NORTH-WESTERN DISTRICT (No. 1)—*Continued.*

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
<i>Portland Canal—Cont'd.</i>			
Rock of Ages Fraction.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4940	38.44
Rock of Ages No. 1.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4939	51.65
Rock of Ages No. 2.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4933	47.93
Rock of Ages No. 3.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4935	18.29
Rock of Ages No. 4.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4934	19.90
Rock of Ages No. 5.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4936	13.09
Rock of Ages No. 6.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4938	33.94
Rock of Ages No. 7.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4937	28.72
Ruby Silver Fraction.....	Outland Silver Bar Mines, Ltd.; July 5.....	5528	24.41
Silver Coin.....	William Arthur Noble; Jan. 17.....	2837	51.06
Silver Coin Fraction.....	William Arthur Noble; Jan. 17.....	2840	1.73
Silver Dollar.....	John E. Munro and Alexander N. McDonald; Dec. 7.....	5418	49.77
Silver Key Fraction.....	J. J. Haahti; June 11.....	5103	45.20
Silver Key No. 1.....	J. J. Haahti; June 11.....	5104	37.88
Silver Key No. 2.....	J. J. Haahti; June 12.....	5122	0.47
Silver Key No. 3.....	J. J. Haahti; June 11.....	5114	30.44
Skyscraper.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4897	51.65
Some Fraction.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5364	36.59
Standard.....	Miles Donald, Nels Olsen, Wm. McLean, and Norman McLeod; May 28.....	5501	32.33
Standard No. 1.....	Ditto.....	5502	31.34
Standard No. 2.....	".....	5503	34.62
Standard No. 3.....	".....	5504	43.70
Storm.....	William Arthur Noble; Jan. 17.....	2838	39.86
Storm Fraction.....	William Arthur Noble; Feb. 21.....	5090	47.58
Sunlight.....	Marmot Metals Mining Co., Ltd.; Sept. 10.....	4749	28.59
Superior.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4801	48.13
Superior No. 1.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4802	38.10
Superior No. 2.....	John McNeill and Jas. Jos. Connors; Oct. 9.....	4806	12.58
Talisman Fraction.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4932	40.37
Talisman No. 1.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4931	51.65
Tillamook.....	Dalhousie Mining Co., Ltd.; Dec. 20.....	4926	51.65
Tom.....	United Empire Gold and Silver Mining Co.; July 5.....	4993	41.71
Tom Fraction.....	United Empire Gold and Silver Mining Co.; July 5.....	5101	35.91
Trail Fraction.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4896	50.71
Trail No. 1.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4889	43.26
Trail No. 2.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4890	51.48
Trail No. 3.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4891	47.23
Trail No. 4.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4892	51.65
Trail No. 5.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4893	51.65
Trail No. 6.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4894	51.65
Trail No. 7.....	George Gold Copper Mines, Ltd.; Oct. 9.....	4895	51.65
Tram.....	Mohawk Mining Co., Ltd.; May 2.....	5054	46.86
Unity Fraction.....	J. Hovland and Louis Watkins; April 30.....	4542	1.54
View.....	M.C. Mining Co., Ltd.; July 22.....	1806	51.65
View Fraction.....	M.C. Mining Co., Ltd.; July 22.....	1805	41.48
Viking.....	John Verdi Clegg; Feb. 21.....	4545	26.70
V. Fraction.....	John Hovland and Louis Watkins; April 30.....	4543	0.72
Wedge Fraction.....	George Enterprise Mining Co., Ltd.; Oct. 7.....	5363	36.31

NORTH-EASTERN DISTRICT (No. 2).

<i>Ominca—</i>			
Blue Bell No. 1.....	Ingenika Mines, Ltd.; Aug. 24.....	3719	50.50
Ingenika No. 15.....	Ingenika Mines, Ltd.; Aug. 24.....	3733	43.57
Ingenika No. 16.....	Ingenika Mines, Ltd.; Aug. 24.....	3731	43.49
Ingenika No. 17.....	Ingenika Mines, Ltd.; Aug. 24.....	3728	42.97
Muir.....	Ingenika Mines, Ltd.; Aug. 24.....	3726	49.14
Sanders.....	Ingenika Mines, Ltd.; Aug. 24.....	3729	49.48
Topsey.....	James Dyer and Martin Cain; April 4.....	4453	35.93
Trout Lake No. 1.....	Ingenika Mines, Ltd.; Aug. 24.....	3717	25.02
Yount.....	Ingenika Mines, Ltd.; Aug. 24.....	3727	48.07

CENTRAL DISTRICT (No. 3).

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Clinton—			
Lela.....	Herbert J. Wicher; Oct. 18.....	5253	37.73
Puzzle.....	British Columbia Chemical Co., Ltd.; Dec. 27.....	4113	51.65
Kamloops—			
Amazon No. 1.....	Nathaniel Nicholson and John Bodine; June 7.....	5454	51.65
Best.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1618	14.54
Blue Diamond.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1875	45.39
Charlotte.....	Angele Sartorio; May 15.....	1448	47.83
Diamond.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1619	35.59
Donovan.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	4854	29.92
Dyke.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1615	22.92
Dyke Fraction.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1607	2.94
Eileen.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	4853	27.15
Eureka.....	Bessie Tibbs, A. Seymour Black, William Meurer, and Alex. Robinson; May 30.....	1210	38.93
Eureka Fraction.....	Bessie Tibbs; May 18.....	1212	11.01
Fifty.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1873	25.34
Fifty One.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1874	39.61
Glenora.....	Guy A. Lafferty and Geo. Jos. Novak; Jan. 28.....	4467	49.69
Highland No. 2.....	Guy A. Lafferty and Geo. Jos. Novak; Jan. 28.....	4468	32.89
Kimberley.....	Angele Sartorio; May 15.....	1447	51.65
Last Chance.....	Angele Sartorio; May 15.....	1449	51.64
Mabel.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	4852	28.51
Occidental.....	Angele Sartorio; May 15.....	1452	49.07
Nugget.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1620	32.14
Ridgeway.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	4851	26.43
Silver Bell.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1876	30.32
Snow Shoe Fraction.....	Windpass Gold Mining Co., Ltd.; Aug. 27.....	1621	30.63
Tamarac.....	Bessie Tibbs; May 18.....	1214	33.30
Tamarac No. 2.....	Bessie Tibbs; May 18.....	1213	51.65
Why Not No. 3.....	Bessie Tibbs; May 18.....	1211	39.30
Lillooet—			
Cascade Fraction.....	Lorne Gold Mines, Ltd.; Nov. 20.....	5480	26.43
Empire Fraction.....	Lorne Gold Mines, Ltd.; Nov. 20.....	5478	20.06
Hope.....	John Henry Anthony; Dec. 5.....	5083	51.65
Lytton Fraction.....	John Henry Anthony; Dec. 5.....	5079	46.90
Mock Fraction.....	Lorne Gold Mines, Ltd.; Nov. 20.....	5485	40.65
Night Hawk.....	Lorne Gold Mines, Ltd.; Nov. 20.....	5486	2.17
Pasadena Fraction.....	Lorne Gold Mines, Ltd.; Nov. 20.....	5488	7.70
Polnud.....	Lorne Gold Mines, Ltd.; Nov. 20.....	5484	47.54
Polnud Fraction.....	Lorne Gold Mines, Ltd.; Nov. 20.....	5487	1.54

SOUTHERN DISTRICT (No. 4).

Greenwood—			
Providence Fraction.....	Joseph H. Duhamel; July 29.....	1093s	1.29

EASTERN DISTRICT (No. 5).

Ainsworth—			
Ida C. Fraction.....	D. F. Strobeck; May 1.....	12718	47.29
Ina E. Fraction.....	D. F. Strobeck; May 1.....	12720	51.65
R.F.G. Fraction.....	D. F. Strobeck; May 1.....	12719	17.85
Richard the First.....	Berengaria Mining Co., Ltd.; May 30.....	1407	51.45
Fort Steele—			
Bath.....	Consolidated Mining and Smelting Co.; Oct. 25.....	13622	51.65
Bear No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13453	51.65
Bear No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13458	51.65
Bear No. 3.....	Western Exploration Co., Ltd.; Jan. 10.....	13461	51.65
Bear No. 4.....	Western Exploration Co., Ltd.; Jan. 3.....	9539	51.65

EASTERN DISTRICT (No. 5)—Continued.

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
<i>Fort Steele—Cont'd.</i>			
Bear No. 5.....	Western Exploration Co., Ltd.; Jan. 3.....	9542	51.65
Bear No. 6.....	Western Exploration Co., Ltd.; Jan. 3.....	9547	51.65
Beat.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 21.....	13605	51.65
Bet No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13454	51.65
Bet No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13457	51.65
Bet No. 3.....	Western Exploration Co., Ltd.; Jan. 3.....	9535	51.65
Bet No. 4.....	Western Exploration Co., Ltd.; Jan. 3.....	9538	51.65
Bet No. 5.....	Western Exploration Co., Ltd.; Jan. 3.....	9543	51.65
Bet No. 6.....	Western Exploration Co., Ltd.; Jan. 3.....	9546	51.65
Blt.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 21.....	13606	51.65
Brace.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13653	51.65
Bread.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13635	51.65
Bur No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13448	51.65
Bur No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13804	51.65
Bur No. 3.....	Western Exploration Co., Ltd.; Jan. 10.....	12878	51.65
Bur No. 4.....	Western Exploration Co., Ltd.; Jan. 4.....	12883	51.65
Bur No. 5.....	Western Exploration Co., Ltd.; Jan. 4.....	12884	51.65
Bur No. 6.....	Western Exploration Co., Ltd.; Jan. 5.....	12889	51.65
Bur No. 7.....	Western Exploration Co., Ltd.; Jan. 5.....	12891	51.65
Caper.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13647	51.65
Capon.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13641	51.65
Car No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13503	51.65
Car No. 2.....	Western Exploration Co., Ltd.; Jan. 7.....	12908	51.65
Carp.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13618	51.65
Cast.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 24.....	13611	51.65
Castle.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 21.....	13592	51.65
Cat.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 21.....	13593	51.65
Catch.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13642	51.65
Cater.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13646	51.65
Celt.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 24.....	13612	51.65
Chafe.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13615	51.65
Chill.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13944	51.65
Cub No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13455	51.65
Cub No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13456	51.65
Cub No. 3.....	Western Exploration Co., Ltd.; Jan. 3.....	9536	51.65
Cub No. 4.....	Western Exploration Co., Ltd.; Jan. 3.....	9537	51.65
Cub No. 5.....	Western Exploration Co., Ltd.; Jan. 3.....	9544	51.65
Cub No. 6.....	Western Exploration Co., Ltd.; Jan. 3.....	9545	51.65
Cue No. 2.....	Western Exploration Co., Ltd.; Jan. 7.....	12909	51.65
Cue No. 3.....	Western Exploration Co., Ltd.; Jan. 10.....	13504	51.65
Cue No. 4.....	Western Exploration Co., Ltd.; Jan. 10.....	13510	51.65
Cue No. 5.....	Western Exploration Co., Ltd.; Jan. 10.....	13511	51.65
Cue No. 6.....	Western Exploration Co., Ltd.; Jan. 10.....	13518	51.65
Cue No. 7.....	Western Exploration Co., Ltd.; Jan. 10.....	13519	51.65
Cue No. 8.....	Western Exploration Co., Ltd.; Jan. 7.....	12924	51.65
Cue No. 9.....	Western Exploration Co., Ltd.; Jan. 7.....	12923	51.65
Cue No. 10.....	Western Exploration Co., Ltd.; Jan. 7.....	12916	51.65
Cue No. 11.....	Western Exploration Co., Ltd.; Jan. 7.....	12915	51.65
Cue No. 12.....	Western Exploration Co., Ltd.; Jan. 10.....	13549	51.65
Dab.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13645	51.65
Dart.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13643	51.65
Dasp.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13614	51.65
Data.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 24.....	13613	51.65
Eke.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13652	51.65
Ell.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13636	51.65
Eua.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13621	51.65
Fir No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13450	51.65
Fir No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13802	51.65
Fir No. 3.....	Western Exploration Co., Ltd.; Jan. 7.....	12999	51.65
Fir No. 4.....	Western Exploration Co., Ltd.; Jan. 7.....	12996	51.65
Fir No. 5.....	Western Exploration Co., Ltd.; Jan. 7.....	12993	51.65
Fir No. 6.....	Western Exploration Co., Ltd.; Jan. 3.....	11989	51.65
Flush.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13946	35.00

EASTERN DISTRICT (No. 5)—Continued.

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Fort Steele—Cont'd.			
Happy.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13651	51.65
Hawk.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13637	51.65
Haze.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13620	51.65
Heaven.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 21.....	13607	51.65
Hope No. 2.....	Western Exploration Co., Ltd.; Jan. 7.....	12910	51.65
Hope No. 3.....	Western Exploration Co., Ltd.; Jan. 10.....	13505	51.65
Hope No. 4.....	Western Exploration Co., Ltd.; Jan. 10.....	13509	51.65
Hope No. 5.....	Western Exploration Co., Ltd.; Jan. 10.....	13512	51.65
Hope No. 6.....	Western Exploration Co., Ltd.; Jan. 10.....	13517	51.65
Hope No. 7.....	Western Exploration Co., Ltd.; Jan. 10.....	13520	51.65
Hope No. 8.....	Western Exploration Co., Ltd.; Jan. 10.....	13523	51.65
Hope No. 9.....	Western Exploration Co., Ltd.; Jan. 7.....	12922	51.65
Hope No. 10.....	Western Exploration Co., Ltd.; Jan. 7.....	12917	51.65
Hope No. 11.....	Western Exploration Co., Ltd.; Jan. 7.....	12914	51.65
Hope No. 12.....	Western Exploration Co., Ltd.; Jan. 10.....	13550	51.65
Imp.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13619	51.65
Impel.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 24.....	13608	51.65
Infer.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13638	51.65
Intent.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13650	51.65
Human.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 21.....	13589	51.65
Kent No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13449	51.65
Kent No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13803	51.65
Kent No. 3.....	Western Exploration Co., Ltd.; Jan. 3.....	12998	51.65
Kent No. 4.....	Western Exploration Co., Ltd.; Jan. 7.....	12997	51.65
Kent No. 5.....	Western Exploration Co., Ltd.; Jan. 4.....	11991	51.65
Kent No. 6.....	Western Exploration Co., Ltd.; Jan. 4.....	11990	51.65
Kent No. 7.....	Western Exploration Co., Ltd.; Jan. 5.....	12890	51.65
Kraft.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13945	51.65
Lex No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13447	51.65
Lex No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13805	51.65
Lex No. 3.....	Western Exploration Co., Ltd.; Jan. 4.....	12879	51.65
Lex No. 4.....	Western Exploration Co., Ltd.; Jan. 4.....	12882	51.65
Lex No. 5.....	Western Exploration Co., Ltd.; Jan. 4.....	12885	51.65
Lex No. 6.....	Western Exploration Co., Ltd.; Jan. 5.....	12888	51.65
Lex No. 7.....	Western Exploration Co., Ltd.; Jan. 5.....	12892	51.65
Magma.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13942	51.65
Nash.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13943	51.65
Oak No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13451	51.65
Oak No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13001	51.65
Oak No. 3.....	Western Exploration Co., Ltd.; Jan. 12.....	13000	51.65
Oak No. 4.....	Western Exploration Co., Ltd.; Jan. 7.....	12995	51.65
Oak No. 5.....	Western Exploration Co., Ltd.; Jan. 7.....	12994	51.65
Oak No. 6.....	Western Exploration Co., Ltd.; Jan. 3.....	11988	51.65
Overt Fraction.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13932	26.66
Owl Fraction.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13931	31.24
Par No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13502	51.65
Par No. 2.....	Western Exploration Co., Ltd.; Jan. 7.....	12907	51.65
Purl.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13933	51.65
Putt.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13930	51.65
Pyre.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13915	51.34
Pyx Fraction.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13914	44.44
Radio.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13941	51.65
Ruff.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13934	51.65
Rung.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13929	51.65
Runt.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13916	51.65
Rush.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13913	51.65
Rut.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 29.....	13900	51.62
Rye.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13899	51.65
Ryot.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13889	51.51
Sun No. 2.....	Western Exploration Co., Ltd.; Jan. 7.....	12911	51.65
Sun No. 3.....	Western Exploration Co., Ltd.; Jan. 10.....	13506	51.65
Sun No. 4.....	Western Exploration Co., Ltd.; Jan. 10.....	13508	51.65
Sun No. 5.....	Western Exploration Co., Ltd.; Jan. 10.....	13513	51.65

EASTERN DISTRICT (No. 5)—Continued.

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
<i>Fort Steele—Cont'd.</i>			
Sun No. 6.....	Western Exploration Co., Ltd.; Jan. 10.....	13516	51.65
Sun No. 7.....	Western Exploration Co., Ltd.; Jan. 10.....	13521	51.65
Sun No. 8.....	Western Exploration Co., Ltd.; Jan. 10.....	13524	51.65
Sun No. 9.....	Western Exploration Co., Ltd.; Jan. 7.....	12921	51.65
Sun No. 10.....	Western Exploration Co., Ltd.; Jan. 7.....	12918	51.65
Sun No. 11.....	Western Exploration Co., Ltd.; Jan. 7.....	12913	51.65
Sun No. 12.....	Western Exploration Co., Ltd.; Jan. 10.....	13551	51.65
Tall No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13806	51.65
Tall No. 3.....	Western Exploration Co., Ltd.; Jan. 3.....	12880	51.65
Tall No. 4.....	Western Exploration Co., Ltd.; Jan. 4.....	12881	51.65
Tall No. 5.....	Western Exploration Co., Ltd.; Jan. 5.....	12886	51.65
Tall No. 6.....	Western Exploration Co., Ltd.; Jan. 5.....	12887	51.65
Tall No. 7.....	Western Exploration Co., Ltd.; Jan. 7.....	12893	51.65
Tallonis.....	Western Exploration Co., Ltd.; Jan. 10.....	13446	51.65
Text.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 26.....	13649	51.65
Tiger No. 1.....	Western Exploration Co., Ltd.; Jan. 10.....	13452	51.65
Tiger No. 2.....	Western Exploration Co., Ltd.; Jan. 10.....	13459	51.65
Tiger No. 3.....	Western Exploration Co., Ltd.; Jan. 10.....	13460	51.65
Tiger No. 4.....	Western Exploration Co., Ltd.; Jan. 3.....	9540	51.65
Tiger No. 5.....	Western Exploration Co., Ltd.; Jan. 3.....	9541	51.65
Tiger No. 6.....	Western Exploration Co., Ltd.; Jan. 3.....	9548	51.65
Timid.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	12618	51.65
Tip No. 4.....	Western Exploration Co., Ltd.; Jan. 10.....	13507	51.65
Tip No. 5.....	Western Exploration Co., Ltd.; Jan. 10.....	13514	51.65
Tip No. 6.....	Western Exploration Co., Ltd.; Jan. 10.....	13515	51.65
Tip No. 7.....	Western Exploration Co., Ltd.; Jan. 10.....	13522	51.65
Tip No. 8.....	Western Exploration Co., Ltd.; Jan. 10.....	13523	51.65
Tip No. 9.....	Western Exploration Co., Ltd.; Jan. 7.....	12920	51.65
Tip No. 10.....	Western Exploration Co., Ltd.; Jan. 7.....	12919	51.65
Tip No. 11.....	Western Exploration Co., Ltd.; Jan. 7.....	12912	51.65
Tip No. 12.....	Western Exploration Co., Ltd.; Jan. 10.....	13583	51.65
Title.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13639	51.65
Tusk.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13935	51.65
Twine.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13928	51.65
Twist.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13917	51.65
Twixt.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13912	51.65
Tyre.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 29.....	13901	51.65
Tyro.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13898	51.65
Tzar.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13890	51.65
Uproof.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13936	51.65
Upset.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13927	51.65
Upshot.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13918	51.65
Urchin.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13911	51.65
Urn.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13897	51.65
Urge.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 29.....	13902	51.65
Usher.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13891	51.65
Vat.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 24.....	13609	51.65
Veal.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 21.....	13590	51.65
Vial.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 21.....	13591	51.65
Vole.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13937	51.65
Volt.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13926	51.65
Voodoo.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13919	51.65
Vortex.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13910	51.65
Vote.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 29.....	13903	51.65
Vouch.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13896	51.65
Vow.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13892	51.65
Watt.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 24.....	13610	51.65
Wax.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13617	51.65
Weak.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 25.....	13640	51.65
Wort.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13938	51.65
Wot.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13925	51.65
Wrap.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13920	51.65
Wren.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13909	51.65
Wrest.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 29.....	13904	51.65

EASTERN DISTRICT (No. 5)—Continued.

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Fort Steele—Cont'd.			
Writ.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13895	51.65
Yale.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13894	51.65
Yam.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13648	51.65
Yawl.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13939	51.65
Yew.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13924	51.65
Yokel.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13921	51.65
Yore.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 29.....	13905	51.60
Yon.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13908	51.65
Zero.....	Consolidated Mining and Smelting Co., Ltd.; Nov. 1.....	13940	51.65
Zircon.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13923	51.65
Zodiac.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13922	51.65
Zone.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 30.....	13907	51.65
Zoon.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 29.....	13906	51.65
Zulu.....	Consolidated Mining and Smelting Co., Ltd.; Oct. 28.....	13893	51.65
Lardeau—			
Donaldo.....	Emma T. Blochberger; Dec. 6.....	3607	50.62
Dudley Fraction.....	Emma T. Blochberger; Dec. 6.....	5722	47.80
Golden Nugget.....	Emma T. Blochberger; Dec. 6.....	9133	38.46
Hunter George Fraction.....	Emma T. Blochberger; Dec. 6.....	9140	37.50
Sandy.....	Emma T. Blochberger; Dec. 6.....	8719	41.83
Nelson—			
Bonanza.....	David E. Grobe and Laurent Rodrigue Archambault; Sept. 11.....	14117	51.65
Commodore.....	David E. Grobe and Laurent Rodrigue Archambault; Sept. 11.....	14118	51.65
Idaho.....	David E. Grobe and Laurent Rodrigue Archambault; Sept. 11.....	14119	38.00
Rhomberg Fraction.....	William Henry Rhomberg; April 4.....	13494	51.65
Sunrise.....	David E. Grobe and Laurent Rodrigue Archambault; Sept. 11.....	14116	51.65

WESTERN DISTRICT (No. 6).

Nanaimo—			
Bear Paw.....	Paramount Mining Co., Ltd.; Jan. 19.....	1344	47.74
Beaver Paw.....	Paramount Mining Co., Ltd.; Jan. 19.....	1345	48.91
Left Paw.....	Paramount Mining Co., Ltd.; Jan. 19.....	1347	34.59
Right Paw.....	Paramount Mining Co., Ltd.; Jan. 19.....	1346	50.30
New Westminster—			
Expremier.....	W. H. Wooley; May 17.....	5578	51.19
Incline.....	W. H. Wooley; May 17.....	5577	45.57
Missouri.....	William Henry Wooley; May 17.....	5574	51.55
Pioneer.....	William Henry Wooley; May 17.....	5579	49.52
Vancouver—			
H. Fraction.....	Basil G. Hawkins; Dec. 5.....	2153	18.60
L. Fraction.....	Basil G. Hawkins; Dec. 5.....	2158	40.00
Victoria—			
Alcila.....	Louis Titus; March 21.....	449	24.59
Bauxite.....	Alexander J. Campbell and Eliza R. Petch; Dec. 6.....	79	51.65
Florence.....	Florence E. Campbell; Dec. 6.....	77	34.26
Lakeside.....	Louis Titus; March 21.....	448	51.05
Mystery.....	Joseph John Baird; Jan. 22.....	898	39.75
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