ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1930

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

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1931.

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 Mineral Industry of the Province for the year 1930 is herewith respectfully submitted.

W. A. McKENZIE,
Minister of Mines.

Minister of Mines' Office,
February 13th, 1931.

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

SIR,—I have the honour to submit herewith my Annual Report on the Mineral Industry of the Province for the year ended December 31st, 1930.

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 1930, 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,

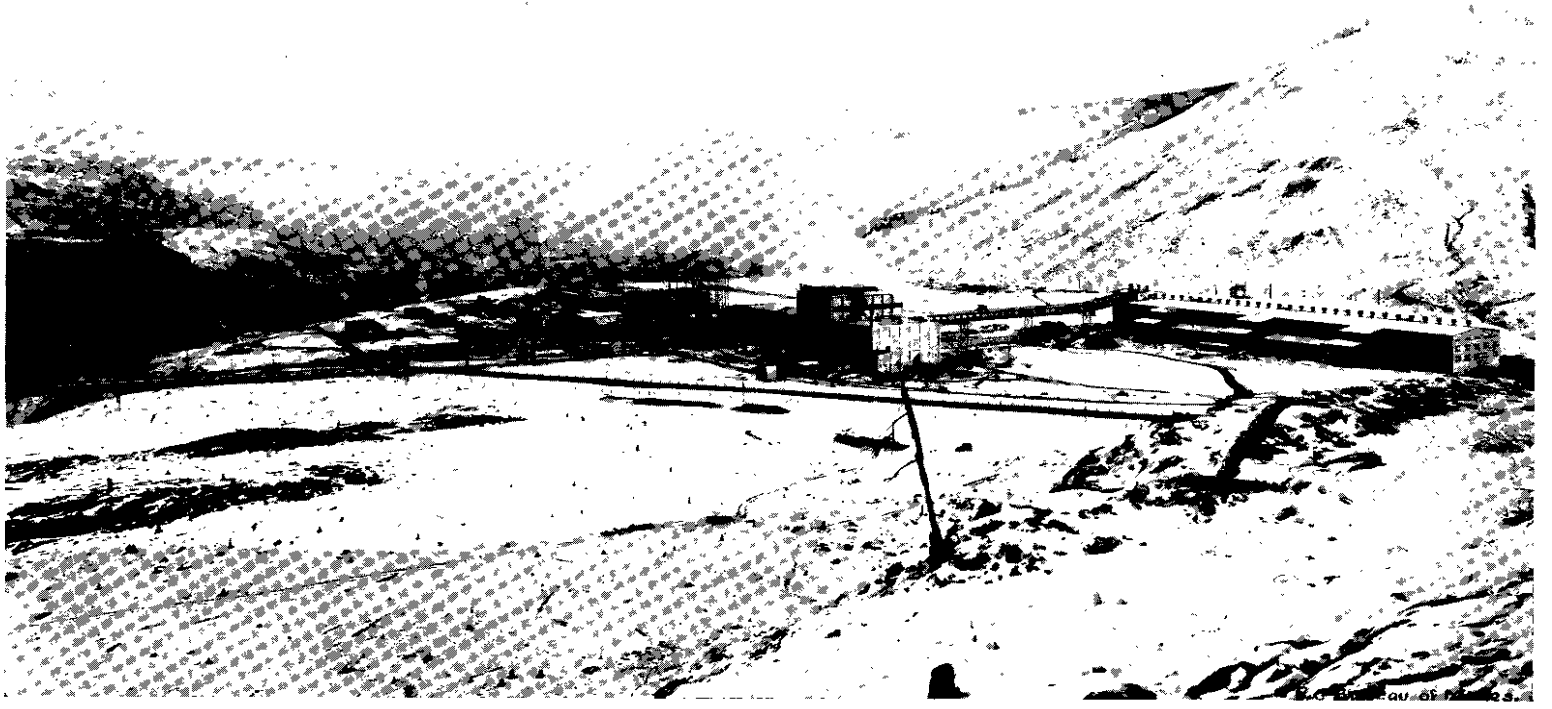
Sir,

Your obedient servant,

JOHN D. GALLOWAY,

Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,
February 13th, 1931.



Consolidated Mining and Smelting Co. of Canada, Ltd.—Fertilizer Plant at Trail.

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STATISTICAL REVIEW OF THE MINERAL INDUSTRY OF BRITISH COLUMBIA IN 1930.

By John D. Galloway, Provincial Mineralogist.

GENERAL SUMMARY.

The gross value of the mineral production of British Columbia in 1930 was $55,391,993, a decrease of $12,853,450, or 18.8 per cent., as compared with the figure of $68,245,443 in 1929. This heavy decline in dollar value was mainly caused by lowered metal prices, together with a substantial drop in the outputs of coal and miscellaneous metals and minerals.

It is remarkable, however, that, notwithstanding very much lower metal prices, the quantities of silver, lead, and zinc produced made new high records in the history of the industry in the Province. The continued expansion of the metallurgical plants at Trail and increased efficiency in treating the *Sullivan* ore largely account for the increased amounts of these metals. In addition, two new mines contributed more than sufficient of these metals to compensate for the closing-down of many small properties throughout the Province.

The tonnage of metalliferous ore mined in the Province during 1930 was 6,803,846 tons, as compared with 6,977,681 tons in 1929, a decrease of 2.5 per cent. This decrease was caused by a lower tonnage from the *Copper Mountain* mine, which closed down in October, and the closing of many small mines throughout the Province. The average gross value of the ore mined in the Province was $6.04 a ton, as compared with $7.35 a ton in 1929. This shows strikingly the effect of lower metal prices during the year.

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 1930 valued at $41,067,630 (including placer gold). This is followed by coal, with an output valued at $9,435,650, and structural materials and miscellaneous metals and minerals, totalling together $4,888,713.

As compared with 1929, the figures show increased quantities of gold, silver, lead, and zinc and a decreased quantity of copper. Coal-output was considerably lower than in the preceding year. The valuation of structural materials shows an increase over the 1929 figure, while that of miscellaneous metals and minerals is considerably less than in the preceding year.

By value, the various products of the mineral industry produced in 1930 are ranked in the following order: Lead, copper, coal, zinc, silver, structural materials, gold, miscellaneous metals and minerals.

The output of lead in 1930 was 319,199,752 lb., valued at $12,535,931. This is the largest quantity of lead ever produced in any year in the Province, comparing with the previous record of 305,140,792 lb. made in 1928. It is interesting to note that for the past seven years the value of the lead-output of the Province has averaged slightly over $15,000,000 a year, being well ahead of copper at somewhat over $12,000,000 and coal at a little more than $11,000,000 for the seven-year average.

Copper-output at 90,421,545 lb. shows a decline of 11,062,312 lb., as compared with the record production of 101,483,857 lb. in 1929. The valuation at $11,738,525 is down 36 per cent. as compared with the preceding year, showing the effect of the big drop in the market price of copper.

The coal production for the year is valued at $9,435,650, as compared with $11,256,260 in 1929, a decrease of $1,820,610, or 19.3 per cent. The decrease was general in all districts in the Province.

The output of zinc in 1930 was 250,287,306 lb., valued at $9,010,093, which compares with 172,096,841 lb., valued at $9,268,792, in 1929. This is a surprising increase in zinc-output and is due in part to a larger production from the *Sullivan*, but in addition a portion of *Sullivan* output made in 1929 is credited to 1930 production. The explanation is that a considerable tonnage of zinc concentrates in storage at Trail at the close of 1929 was not counted as production. These concentrates were treated in 1930 and the zinc metal produced is credited in the 1930

figures for the *Sullivan*. In addition the slag-fuming plant at Trail recovered zinc metal formerly wasted in slags and residues. This output is not credited in Table VII. to the ultimate source in various Mining Divisions (owing to the practical impossibility of so doing), but is given as production in Trail Creek Mining Division, where the Consolidated Company's smelter and refinery is situated.

A substantial output of zinc from the *Monarch* mine more than offset the almost total stoppage of production from small mines in the Slocan and Ainsworth Divisions.

The output of silver was 11,289,171 oz., a new high record, valued at $4,307,270, which compares with 9,918,800 oz., worth $5,256,270, in 1929. Notwithstanding a record production, this is the lowest valuation of silver for any year since 1923, reflecting the material drop in the market price of silver during 1930.

The value of lode gold produced in 1930 was $3,323,576, as compared with $3,004,419 in 1929, or an increase of 10.6 per cent. This is encouraging, more particularly as it was the result of intensive efforts at several small mines which more than compensated for a decline in the output of the main producer—the *Premier*.

Placer-gold output also increased, the value being recorded at $152,235, as compared with $118,711 in 1929, an increase of 28 per cent.

Structural materials produced in 1930 were valued at $4,092,568, as compared with $3,921,768 in 1929, an increase of $170,800. While it may seem surprising that in a year of general depression an increased output of structural materials was made, it is explained by the fact that certain large construction-works were under way; notably the new Canadian National hotel at Vancouver and hydro-electric plants. General construction undoubtedly was in smaller volume in 1930, but the special works caused increased consumption of cement, building-stone, and sand and gravel in sufficient amount to more than offset the declines in brick and other structural materials.

Miscellaneous metals and minerals to the value of $796,145 were produced in 1930, a very severe decline as compared with the figure of $1,773,845 for the 1929 output. A much smaller output of cadmium and no production of bismuth and fluorite were the main reasons for the decline. The mineral products listed in this class are subjected to considerable fluctuations of demand, so that wide variations in the value of the yearly output are to be expected.

While there has been a marked decline in the money value of the mineral industry of the Province in 1930, it should be noted that, if valued at 1929 prices, the 1930 output would be worth approximately $70,000,000; the quantity production of metals and minerals, in the aggregate, has therefore been at the greatest rate in the history of mining in the Province.

For 1931 it seems probable that mineral production will show a decline both in quantity and value. The effect of low metal prices was not fully felt until towards the close of 1930; and it is evident that the 1931 averages will be well below those of 1930.

The rate of metal production in the last quarter of 1930 declined considerably as compared with the previous quarters, owing to the general curtailment programme being practised by most producers. It is evident, therefore, that until there is a radical change in the present condition of the metal markets of the world, with less excess stocks and improved prices, no expansion in base-metal mining in British Columbia can be expected. Similarly, a decided improvement in the price of silver will be necessary to stimulate the mining of that metal. Gold-mining showed some improvement in 1930 and it is expected that prospecting for and development of gold properties will be actively carried on in 1931.

METAL PRICES.

The tremendous declines in metal prices in 1930 have played havoc with the mining industry all over the world. It is unnecessary to discuss this matter at length, except to say that the prices of silver, copper, lead, and zinc have, in the aggregate, declined more this year, as compared with prices in 1929, than in any previous year in history. This condition has resulted in the closing-down of a number of mines in the Province where it was impossible to continue production without making an operating loss. The first mines to feel the effect were small silver-lead-zinc producers, particularly in the Slocan district. Towards the end of the year the *Copper Mountain* mine of the Granby Company—an important copper-producer—was forced to close. Operations were also suspended by the Base Metals Mining Company at the *Monarch* in November.

The following table shows the average yearly prices for silver, copper, lead, and zinc in 1928, 1929, and 1930:—

AVERAGE METAL-MARKET PRICES FOR 1928, 1929, AND 1930.

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.
1928	* 58.1760	* 14.570	* 4.5754	6.305	* 5.4932	6.027
1929	* 52.993	* 18.107	* 5.0504	6.833	* 5.3858	6.512
1930	* 38.154	* 12.982	* 3.9273	5.517	* 3.5999	4.556

* Prices used in compiling total metal valuations in 1928, 1929, and 1930 Annual Reports.

At the end of the year metal prices were still lower than the averages for 1930 shown above, and the early part of 1931 has witnessed practically record low prices for these metals in the markets of the world.

The important question now is, when will metal prices return to a level whereby various mines may be able to profitably resume production? In order to appraise the situation it is necessary to inquire into the causes of the decline.

In a word, it is evident that consumption of metals has failed to keep pace with the tremendous world increase in output in recent years. There seems little doubt that the present world capacity to produce silver, copper, lead, and zinc is greater than the probable world consumption for some time to come. Lacking intelligent and co-operative curtailment of production, the result has been a huge increase in metal stocks, with inevitable price-cutting.

So far as British Columbia is concerned, there is practically no local market for the output of silver, copper, lead, and zinc, and the Canadian market will not absorb at the most more than 25 per cent. of the production of these metals; world market prices therefore rule for British Columbia. It is evident that any improvement in metal prices must come by the concerted action of all important world producers. Such definite action has been taken by producers of lead, zinc, and copper, but so far no important results have been obtained. It is evident that the selling-prices of these metals are below the cost of production for many mines and sooner or later this fact will regulate world output with demand. The law of supply and demand may in the long run prove more effective than policies of artificial control and attempts at price-fixing. It is quite evident, however, that the average prices of these metals will be somewhat lower in 1931 than in 1930. While it is true that in general costs have declined slightly, it is not to be expected, therefore, that real improvement for the productive end of the industry is in sight before 1932. It is hoped, however, that an upturn in general conditions, and consequently in metal prices, will be sufficiently well in sight in the summer of 1931 to again stimulate intensive searching for and development of mineral properties in British Columbia.

METALLURGICAL FEATURES OF THE YEAR.

The era of mill-construction which prevailed in British Columbia during 1927, 1928, and 1929 has passed and much less construction of new concentrators was carried on in 1930. Undoubtedly, some of these plants were prematurely constructed as an adjunct to misguided stock promotions, which were a feature of the recent mining boom. A number of mills, the construction of which was justified at the time, are now idle, as it is impossible to operate profitably the properties at present metal prices. In the future some of these will return to the active shipping-list.

The Consolidated Mining and Smelting Company, however, continued its steady expansion and in 1930 a larger programme of construction was under way than in recent years. During the year the new slag-fuming plant, constructed at a cost of $1,676,000, was completed and operations commenced in August. The interesting feature of this plant is that it recovers zinc formerly wasted in the lead blast-furnace slags. Eventually this plant is expected to produce 100 tons of zinc a day in the form of oxide, which is turned into the metal in a special unit of the zinc-refinery.

In the treatment process in this plant the volatilized zinc oxide and associated gases are evolved at very high temperatures and this heat is used to generate steam in two 1,750-horse-power waste-heat boilers; this central heating plant will supply heat and process steam for the whole metallurgical works at Trail, including the new chemical-fertilizer plant.

The major construction-work of the year by the Consolidated Company was the new fertilizer plant at Warfield Flat, 2 miles from Trail. This plant will cost approximately $10,000,000 and it is expected that the production of phosphate fertilizer will commence in the spring of 1931. Later, other units of the plant will be completed and other synthetic fertilizers produced. This construction has done much to alleviate unemployment, which was severe this year in the Kootenay district owing to the closing-down of many small mines.

Construction of another hydro-electric plant on the Kootenay river was commenced by the West Kootenay Power and Light Company—a Consolidated subsidiary. This is at Corra Linn falls and involves the construction of a large dam. Much employment was provided by this operation. The Corra Linn plant is expected to develop 40,000 horse-power and, upon completion of this unit, power-development will be in excess of 200,000 horse-power.

Another Consolidated operation that may mean much to the Stewart camp is the construction of a 100-ton pilot-mill at the *Big Missouri*. This plant is expected to be in operation early in 1931 and a thorough appraisal of the possibilities of the extensive but irregular mineralization on this property will be made.

New mills constructed at the *Monarch* mine at Field and at the *Union* mine near Grand Forks were completed and tuning-up commenced about the end of 1929, but the adjustment of these to regular working conditions was made in 1930.

At the *Reno* mine, in the Nelson Division, a 30-ton gold-cyanide plant was constructed in 1929 and brought into steady production in 1930. Although a small-tonnage operation, this has been quite successful, with an output of gold for the year of approximately $150,000.

The *Pioneer* mine completed further construction of power plant and incidental equipment to permit of larger tonnages being handled. A very successful year was experienced with a production of gold of over $280,000.

The mine and mill of the Britannia Mining and Smelting Company were speeded up to a considerable extent during 1930. This resulted in the largest output of copper ever made from this mine, with the tonnage treated exceeding 2,000,000 tons. Towards the end of the year, however, the operations were curtailed in accordance with the policy of the leading copper-producers of the world to cease excessive production.

In a time of depressed conditions and low metal prices, when operating profits are necessarily reduced, it is always noticeable that extraordinary efforts are put forth not only to lower mining and milling costs, but also to improve metallurgical efficiencies. Results obtained this year along these lines by several of the larger companies have been impressive; and one benefit to the industry is that when metal prices improve in the future, lower-grade ore reserves may be profitably treated.

DEVELOPMENT AND PROSPECTING.

Development of mineral properties in British Columbia during 1930 was at a somewhat decreased rate as compared with the last three years. In general, it may be said that the big falling-off in development has been in those properties financed by public subscription to small local stock companies. Except under special conditions, there is no great incentive at the present time to develop properties carrying values in silver, lead, and zinc; in fact, many such properties with developed ore reserves and equipped with modern-type concentrators are closed down, as it is impossible to mine and sell lead and zinc concentrates at a profit at present metal prices.

The larger mining companies have maintained development on the usual scale, not only at producing properties, but at many which are in the semi-developed stage. In particular, the Consolidated has continued its widespread development programme throughout the Province with but little curtailment. This company normally each year takes up, and drops after examination or a small amount of work, many properties, but at the present time has an average number under development.

A Consolidated operation that is of particular interest is the erection of a 100-ton pilot-mill at the *Big Missouri* mine at Stewart. The values are mainly in gold, and owing to the erratic nature of the mineralization ordinary sampling apparently was unsatisfactory; hence the

decision to put in a pilot-mill which will conclusively determine average values in different sections of the property. The mill is expected to be in operation early in 1931.

One disappointment of the year occasioned by the abnormally low silver price and uncertain outlook for the future is the indefinite suspension of work by the Britannia Mining and Smelting Company at the *Toric* and adjoining properties in the Alice Arm section.

The year witnessed the completion of the development plans of the Premier Gold Mining Company on the *Prosperity* and *Porter-Idaho* mines on the Marmot river, near Stewart. Towards the end of 1929 the aerial tramway was completed and shipments were commenced from the *Prosperity*, which were continued steadily throughout 1930. The *Porter-Idaho* was also brought into production. The main value in the ore from these properties is silver and it is interesting that both were profitably operated, notwithstanding the low price of silver.

Useful development was done on the property of the B.C. Nickel Company during the year. This consisted of electrical prospecting, surface-stripping, and diamond-drilling. An important success was registered by electrical prospecting on this operation, whereby a new ore-body was found and the general nature of the ore occurrences was more accurately diagnosed than heretofore.

The *Pioneer* mine, in the Lillooet Division, is an old one, but is now entering the best part of its career. Deep development and mill-construction in the last two years have placed this mine now in the position of one of the important gold-mines of the Province. The production this year was greater than ever, with the prospect of a still larger output in 1931.

During the year prospecting, scouting, and exploration for mineral properties proceeded steadily, and more was carried out than would have been expected considering the depressed state of the metal markets. It is apparent from the Resident Engineers' reports that in certain sections more prospectors were in the hills than in recent years.

An intensified search for gold properties was apparent, but it is believed that much keener interest will be shown in potential gold-mines in 1931. There are many gold areas in British Columbia that will justify more prospecting and more development of known properties than has yet taken place. Undoubtedly, in the next few years gold-mining is going to be decidedly popular and British Columbia should share in this reawakened interest.

Some new discoveries were made during the year which promise to be of importance. One of these is a silver-lead-zinc property on the northern end of Vancouver island, optioned by the American Smelting and Refining Company, and the other a gold property north of Kamloops, optioned by the Premier Company. Descriptions of these will be found in the Resident Engineers' reports.

It cannot be too strongly emphasized that there are many promising mineralized areas in British Columbia awaiting adequate prospecting. Many areas relatively close to transportation still remain that justify intensive prospecting. In each of the Resident Engineers' reports in this Annual Report and in previous ones there are descriptions of suitable areas for the prospector.

PROFITS OF MINING COMPANIES.

The following table shows the dividends declared by companies engaged in the mineral industry in the Province during 1929 and 1930:—

Company.	1929.	1930.
The Consolidated Mining and Smelting Co. of Canada, Ltd.	$6,373,750	$6,519,219
Premier Gold Mining Co., Ltd.	1,208,250	1,203,281
Howe Sound Co.*	2,480,190	1,984,152
Granby Consolidated M.S. & P. Co., Ltd.	3,150,005	2,362,341
Bell	46,539	1,000
Crow's Nest Pass Coal Co., Ltd.	372,699	.....
Others	111,875	457,659
Totals	$13,743,308	$12,527,652

* 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.

The dividend total for 1930 is greater than would have been expected, and it is probable that the actual profits for the year were less than the dividends paid. In some instances surpluses from other years were used to maintain dividends.

While the dividend record this year is satisfactory, the outlook is for lower dividends in the next few years than in recent years. However, dividends are not so important to the life of the Province as steady pay-rolls and the money circulated for supplies, transportation, etc.

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

	Dividend.		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	1930	12,527,652

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 concentrates 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 $20.671834 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.

(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 1930.

Gold, placer	$78,588,949
Gold, lode	140,868,011
Silver	102,435,047
Copper	265,871,528
Lead	163,617,773
Zinc	87,772,190
Coal and coke	330,293,688
Structural materials	62,538,833
Miscellaneous minerals, etc.	5,861,828
Total	$1,237,847,847

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1930 (INCLUSIVE).

1852 to 1895 (inclusive)	$94,547,241	1914	$26,388,825
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	1930	55,391,993
1912	32,440,800		
1913	30,296,398	Total	$1,237,847,847

TABLE III.—QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1928, 1929, AND 1930.

Description.	1928.		1929.		1930.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer ..... oz.	8,424	$143,208	6,983	$118,711	8,955	$152,235
Gold, lode ..... oz.	188,087	3,888,097	145,339	3,004,419	160,778	3,323,576
Silver ..... oz.	10,627,167	6,182,461	9,918,800	5,256,270	11,289,171	4,307,270
Copper ..... lb.	97,908,316	14,265,242	101,483,857	18,375,682	90,421,545	11,738,525
Lead ..... lb.	305,140,792	13,961,412	302,346,268	15,269,696	319,199,752	12,535,931
Zinc ..... lb.	181,763,147	9,984,613	172,096,841	9,268,792	250,287,306	9,010,093
Coal ..... tons, 2,240 lb.	2,526,702	12,633,510	2,251,252	11,256,260	1,887,130	9,435,650
Structural materials		3,408,686		3,921,768		4,092,568
Miscellaneous metals and minerals		905,354		1,773,845		796,145
Totals		$65,372,583		$68,245,443		$55,391,993

TABLE IV.—Output of Mineral Products by Districts and Divisions.

Names.	Divisions.			Districts.		
	1928.	1929.	1930.	1928.	1929.	1930.
North-western District (No. 1)				$9,684,465	$10,399,015	$7,752,006
Atlin, Stikine, and Liard	$64,197	$53,612	$58,871			
Nass River	5,307,358	6,901,925	4,130,233			
Portland Canal	4,255,393	3,391,066	3,502,678			
Skeena, Queen Charlotte, and Bella Coola	57,517	52,412	60,224			
North-eastern District (No. 2)				391,783	315,013	185,540
Cariboo and Quesnel	80,914	88,659	125,563			
Omineca and Peace River	310,869	226,354	59,977			
Central District (No. 3)				697,101	727,089	1,105,913
Nicola and Vernon	254,056	298,689	341,966			
Yale, Ashcroft, and Kamloops	275,365	292,046	328,142			
Lillooet and Clinton	167,680	136,354	435,805			
Southern District (No. 4)				4,866,414	6,166,711	3,900,183
Grand Forks, Greenwood, and Osoyoos	540,573	872,978	889,300			
Similkameen	4,325,841	5,293,733	3,010,883			
Eastern District (No. 5)				33,416,442	33,119,358	27,627,947
Fort Steele	31,269,770	31,596,722	25,582,617			
Windermere and Golden	62,995	27,056	904,041			
Ainsworth	357,169	337,318	26,931			
Slocan and Slocan City	1,408,053	1,029,734	128,371			
Nelson and Arrow Lake	99,661	102,392	256,387			
Trail Creek	202,460	5,475	699,253			
Revelstoke, Trout Lake, and Lardeau	16,334	20,661	30,347			
Western District (No. 6)				16,316,378	17,518,257	14,820,404
Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria (Vancouver Island)	8,570,425	7,867,462	7,127,594			
Vancouver and New Westminster (Mainland)	7,745,953	9,650,795	7,692,810			
Totals	$65,372,583	$68,245,443	$55,391,993	$65,372,583	$68,245,443	$55,391,993

TABLE V.—Yield of Placer Gold to Date.

1858	$705,000	1877	$1,608,182	1896	$544,026	1914	$565,000
1859	1,615,070	1878	1,275,204	1897	513,520	1915	770,000
1860	2,228,543	1879	1,290,058	1898	643,346	1916	580,500
1861	2,666,118	1880	1,013,827	1899	1,344,900	1917	496,000
1862	2,656,903	1881	1,046,737	1900	1,278,724	1918	320,000
1863	3,913,563	1882	954,085	1901	970,100	1919	286,500
1864	3,735,850	1883	794,252	1902	1,073,140	1920	221,600
1865	3,491,205	1884	736,165	1903	1,060,420	1921	233,200
1866	2,662,106	1885	713,738	1904	1,115,300	1922	364,800
1867	2,480,868	1886	903,651	1905	969,300	1923	420,000
1868	3,372,972	1887	693,709	1906	948,400	1924	420,750
1869	1,774,978	1888	616,731	1907	828,000	1925	280,092
1870	1,336,956	1889	588,923	1908	647,000	1926	353,503
1871	1,799,440	1890	490,435	1909	477,000	1927	156,247
1872	1,610,972	1891	429,811	1910	540,000	1928	143,208
1873	1,305,749	1892	399,526	1911	426,000	1929	118,711
1874	1,844,618	1893	356,131	1912	555,500	1930	152,235
1875	2,474,004	1894	405,516	1913	510,000		
1876	1,786,648	1895	481,683			Total	$78,588,949

TABLE VI.—Production of Lode 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	195,000			2,135,023	78,996			297,400
1894	6,252	125,014	746,379	470,219	324,680	16,234	5,662,523	169,875			781,342
1895	39,264	785,271	1,496,522	977,229	952,840	47,642	16,475,464	532,255			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	2,122,820	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	63,358,621	2,691,887			10,069,757
1901	210,384	4,348,603	5,151,333	2,884,745	27,603,746	4,446,963	51,582,906	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	4,933,102	3,439,417	1,971,818	37,692,251	5,876,222	56,580,703	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	2,175,632	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	17,784,494	48,727,516	3,007,462	37,168,980	4,043,985	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	41,772,916	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	1,526,855	56,737,051	3,540,429	19,750,498
1920	120,048	2,481,392	3,377,849	3,285,980	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	6,321,776	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	7,654,844	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	145,339	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
1930	160,778	3,323,576	11,289,171	4,307,270	90,421,545	11,738,525	319,199,752	12,535,931	250,287,306	9,010,093	40,915,395
Totals	6,825,728	140,868,011	171,475,857	102,435,047	1,659,968,370	265,871,528	3,123,412,091	163,617,773	1,509,568,154	87,772,190	760,564,549

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	1929		2,408	40,936				
	1930		**3,141**	**53,397**				
Stikine	1929		38	646				
	1930							
Liard	1929		340	5,780				
	1930		**322**	**5,474**				
Nass River	1929	1,722,555			4,671	96,558	285,394	151,239
	1930	**1,512,182**			**3,207**	**66,295**	**256,205**	**97,752**
Portland Canal	1929	268,591			96,676	1,998,467	2,373,972	1,258,039
	1930	**278,651**			**87,492**	**1,808,620**	**4,185,851**	**1,597,070**
Skeena	1929	72	18	306	69	1,426	328	174
	1930		**33**	**561**				
Queen Charlotte	1929		9	153				
	1930		**19**	**323**				
Bella Coola	1929							
	1930							
North-eastern District (No. 2)								
Cariboo	1929		2,495	42,415				
	1930		**2,499**	**42,483**				
Quesnel	1929		1,201	20,417				
	1930		**2,187**	**37,179**				
Omineca	1929	16,758	120	2,040	899	18,584	273,691	145,037
	1930	**3,098**	**147**	**2,499**	**95**	**1,964**	**71,342**	**27,220**
Peace River	1929		120	2,040				
	1930		**147**	**2,499**				
Central District (No. 3)								
Nicola	1929	7,005			794	16,413	41,945	22,228
	1930	**17,001**			**3,295**	**68,114**	**73,743**	**28,136**
Vernon	1929							
	1930		**16**	**272**				
Yale	1929	21	20	340	1	21	1,038	550
	1930	**75**	**1**	**17**	**398**	**8,227**	**116**	**44**
Ashcroft	1929							
	1930							
Kamloops	1929	367			128	2,646	356	189
	1930	**21**	**50**	**850**			**5**	**2**
Lillooet	*1929*	*13,260*			*5,061*	*104,620*	*670*	*355*
	1930	**36,540**			**‡18,067**	**373,478**		
Clinton	1929		109	1,853				
	1930		**83**	**1,411**				
Southern District No. 4)								
Grand Forks	1929							
	1930	**36,916**			**9,488**	**196,134**	**356,291**	**135,939**
Greenwood	1929	2,494			141	2,915	444,429	235,516
	1930	**3,338**			**79**	**1,633**	**650,261**	**248,101**
Osoyoos	1929	71,565			14,217	293,891	226	120
	1930	**39,714**			**11,136**	**230,202**	**203**	**77**
Similkameen	1929	927,992	75	1,275	5,924	122,460	167,040	88,520
	1930	**703,652**	**76**	**1,292**	**4,276**	**88,393**	**115,941**	**44,236**
Eastern District (No. 5)								
Fort Steele	1929	1,913,075	27	459	227	4,692	5,055,996	2,679,324
	***1930**	**1,923,767**	**7**	**119**			**5,154,685**	**1,986,719**
Windermere	1929	909			2	41	2,663	1,411
	1930							
Golden	1929	1,731	3	51			1,466	777
	1930	**75,117**			**4**	**83**	**64,657**	**24,669**
Ainsworth	1929	31,959			96	1,984	92,323	48,925
	1930	**103**			**2**	**41**	**3,310**	**1,263**
Slocan	1929	61,471			156	3,225	958,294	507,829
	1930	**7,900**			**30**	**620**	**137,686**	**52,533**
Slocan City	1929	55					3,252	1,723
	1930	**2**					**237**	**90**
Nelson	1929	16,283			2,465	50,956	26,868	14,238
	1930	**12,253**	**2**	**34**	**9,995**	**206,615**	**10,418**	**3,975**
Arrow Lake	1929							
	1930							
Trail Creek	1929	110			164	3,391	393	208
	†1930	**88**			**134**	**2,770**	**96**	**37**
Revelstoke	1929	30					466	247
	1930	**24**	**211**	**3,587**			**1,153**	**440**
Trout Lake	1929							
	1930		**11**	**187**				
Lardeau	1929	13			2	41	529	280
	1930	**13**			**1**	**21**	**609**	**232**
Western District (No. 6)								
Nanaimo	1929	274			25	517	216	114
	1930							
Alberni	1929	186			4	83	41	22
	1930							
Clayoquot	1929							
	1930	**1**			**17**	**351**	**17**	**6**
Quatsino	1929							
	1930							
Victoria	1929							
	1930		**3**	**51**				
New Westminster	1929							
	1930							
Vancouver	1929	1,920,905			14,290	295,400	199,544	105,744
	1930	**2,153,392**			**13,062**	**270,015**	**208,345**	**78,729**
Totals	1929	6,977,681	6,983	118,711	145,339	3,004,419	9,918,800	5,256,270
	1930	**6,803,846**	**8,955**	**152,235**	**160,778**	**3,323,576**	**11,289,171**	**4,307,270**

* Includes some production from Sullivan mine in 1929; zinc concentrates not treated until 1930.
† Production from slags and residues at Trail plant, which cannot be credited to individual mines.
‡ Includes 4,226 oz. produced in 1929 but not credited in that year.

METALLIFEROUS MINES FOR 1929 AND 1930.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS.		TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1929.	1930.	1930.
	$		$		$	$	$	$
								7,892,666
						40,936		
							53,397	
						646		
						5,780		
							5,474	
36,746,057	6,653,609	10,280	519			6,901,925		
30,551,423	3,966,186						4,130,233	
130,167	23,569	2,197,686	110,991			3,391,066		
50,649	6,575	2,302,170	90,413				3,502,678	
17,548	3,177					5,083		
							561	
						153		
							323	
								128,408
						42,415		
							42,483	
						20,417		
							37,179	
5,760	1,043	807,925	40,803	482,731	25,999	233,506		
		237,354	9,322	173,388	6,242		47,247	
						2,040		
							2,499	
		448,400	22,646			61,287		507,253
30,035	3,899	576,667	22,647				122,796	
							272	
		2,243	113			1,024		
							8,288	
31,574	5,717					8,552		
1,200	156						1,008	
						104,975		
							373,478	
						1,853		
							1,411	
								2,973,050
		42,701	1,677				333,750	
		187,390	9,464	112,681	6,069	253,964		
		276,193	10,847				260,581	
		100	5			294,016		
3,773	490	664	26				230,795	
22,539,798	4,081,281	52,640	2,659	16,229	874	4,297,069		
15,489,798	2,010,885	79,400	3,118				2,147,824	
								23,653,656
		290,544,455	14,673,657	162,904,853	8,773,730	26,131,862		
		301,844,470	11,854,338	218,984,983	7,883,240		21,704,416	
		56,184	2,838			4,290		
		397,876	20,094			20,922		
		12,115,425	475,809	11,186,792	402,713		903,274	
		1,172,475	59,215	4,050,901	218,173	328,297		
		72,257	2,838	15,859	571		4,713	
		5,407,036	273,077	4,510,802	242,943	1,027,074		
		1,200,584	47,150	774,818	27,893		128,196	
		7,359	372	10,492	565	2,660		
		127	5				95	
		63,416	3,203			68,397		
		111,294	4,371				214,995	
		1,914	97	2,387	129	3,825		
				19,151,466	689,434		692,241	
683	124	4,159	210	3,926	211	792		
		25,866	1,016				5,043	
							187	
		4,143	209	1,839	99	629		
		6,193	243				496	
								6,111,597
11,475	2,078					2,709		
12,680	2,296					2,401		
21	3						360	
							51	
41,988,115	7,602,788	967,594	48,867			8,052,799		
44,294,646	5,750,331	308,357	12,111				6,111,788	
101,483,857	18,375,682	302,946,268	15,269,696	172,096,841	9,268,792	51,293,570		
90,421,545	11,738,525	319,198,752	12,535,931	250,287,306	9,010,093		41,067,630	41,067,630

TABLE VIII.—Coal Production per Year to Date.*

	Tons (2,240 lb.)	Value.		Tons (2,240 lb.)	Value.
1836–1885	3,029,011	$9,468,557	1909	2,006,476	$7,022,666
1886	326,636	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	6,338,385
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	7,524,913
1894	1,012,953	3,038,859	1918	2,302,245	11,511,225
1895	939,654	2,818,962	1919	2,267,341	11,337,705
1896	896,222	2,688,666	1920	2,595,125	12,975,625
1897	882,854	2,648,562	1921	2,483,995	12,419,975
1898	1,135,865	3,407,595	1922	2,511,843	12,559,215
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	1,384,312	4,152,936	1929	2,251,252	11,256,260
1906	1,517,303	4,551,909	1930	1,887,130	9,435,650
1907	1,800,067	6,300,235			
1908	1,677,849	5,872,472	Totals	77,375,551	$304,620,088

* 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.

	Tons (2,240 lb.)	Value.		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, 1929 and 1930.

Description.	1929.		1930.	
	Quantity.	Value.	Quantity.	Value.
Coal used in making coke, long tons	215,501	$1,048,691	200,989	$1,002,684
Coke made in bee-hive ovens, long tons	67,280	574,279	65,810	$558,801
Coke made in by-product ovens, long tons	29,738	308,867	28,458	298,004
Coke made in gas plants, long tons	22,891	117,305	40,811	232,917
Total coke made, long tons	119,909	$1,000,451	135,079	$1,089,722
Gas produced	.....	1,461,445	.....	1,547,092
Tar produced	.....	61,084	.....	65,770
Other by-products	.....	39,202	.....	11,935
Total production value of coke industry	.....	$2,562,182	.....	$2,714,519

TABLE XI.—PRODUCTION IN DETAIL OF STRUCTURAL MATERIALS, 1930.

District and Division.	Cement.	Lime and Limestone.	Building-stone.	Riprap and Crushed Rock.	Sand 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)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,340
Atlin, Liard, and Stikine	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nass River	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portland Canal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Skeena and Queen Charlotte	.....	.....	.....	7,329	17,432	.....	.....	.....	.....	.....	24,761	.....
Bella Coola	.....	31,200	.....	.....	3,379	.....	.....	.....	.....	.....	34,579	.....
North-eastern District (No. 2)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45,840
Cariboo and Quesnel	.....	.....	.....	.....	38,243	.....	1,836	.....	.....	675	40,754	.....
Omineca and Peace River	.....	.....	.....	.....	3,732	.....	.....	.....	.....	1,354	5,086	.....
Central District (No. 3)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	164,042
Nicola and Vernon	.....	.....	3,800	.....	25,675	.....	.....	.....	.....	7,813	37,288	.....
Yale, Ashcroft, and Kamloops	.....	.....	.....	11,197	59,711	.....	.....	.....	.....	.....	70,908	.....
Lillooet and Clinton	.....	.....	.....	104	55,742	.....	.....	.....	.....	.....	55,846	.....
Southern District (No. 4)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30,639
Grand Forks and Greenwood	.....	.....	.....	50	3,258	.....	.....	.....	.....	† 16,862	20,170	.....
Osoyoos	.....	2,679	.....	.....	4,292	.....	.....	.....	.....	.....	6,971	.....
Similkameen	.....	.....	.....	.....	3,498	.....	.....	.....	.....	.....	3,498	.....
Eastern District (No. 5)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	160,106
Fort Steele	.....	.....	600	15,768	47,768	.....	.....	.....	.....	.....	64,136	.....
Windermere and Golden	.....	.....	.....	432	215	.....	.....	.....	.....	.....	647	.....
Ainsworth	.....	.....	9,981	.....	12,237	.....	.....	.....	.....	.....	22,218	.....
Slocan and Slocan City	.....	.....	.....	.....	80	.....	.....	.....	.....	.....	80	.....
Nelson	.....	1,223	10,287	1,225	28,657	.....	.....	.....	.....	.....	41,392	.....
Trail Creek	.....	.....	.....	3,000	4,012	.....	.....	.....	.....	.....	7,012	.....
Revelstoke	.....	.....	.....	1,278	23,343	.....	.....	.....	.....	.....	24,621	.....
Western District (No. 6)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,632,601
Nanaimo and Alberni	.....	273,580	.....	1,276	34,417	.....	.....	.....	.....	25,380	334,653	.....
Victoria and Quatsino	1,594,616	58,143	.....	6,829	110,161	11,757	.....	.....	.....	55,050	1,836,556	.....
Vancouver	.....	.....	336,894	116,402	236,536	.....	.....	.....	.....	.....	689,832	.....
New Westminster	.....	.....	.....	97,400	107,314	234,319	12,313	176,885	75,395	67,934	771,560	.....
Totals	1,594,616	366,825	361,562	262,290	819,702	246,076	14,149	176,885	75,395	*175,068	4,092,568	4,092,568

* Includes $7,184 sand-lime brick. † Estimated.

TABLE XII.—Production in Detail of Miscellaneous Metals and Minerals, 1930.

District and Division.	Arsenic.	Cadmium.	Diatomite.	Flux (Lime and Quartz).	Gypsite.	Gypsum.	Ochre.	Palladium.	Platinum.	Shale.	Soda.	Sulphur Content of Pyrite 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	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
North-eastern District (No. 2)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,147
Cariboo and Quesnel	.....	.....	5,147	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,147	.....
Omineca and Peace River	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Central District (No. 3)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	253,008
Nicola and Vernon	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Yale, Ashcroft, and Kamloops	.....	.....	.....	.....	.....	247,938	.....	.....	.....	.....	.....	.....	.....	247,938	.....
Lillooet and Clinton	.....	.....	.....	.....	520	.....	.....	.....	.....	.....	4,550	.....	.....	5,070	.....
Southern District (No. 4)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37,804
Grand Forks and Greenwood	.....	.....	.....	15,933	.....	.....	.....	.....	.....	.....	.....	.....	.....	15,933	.....
Osoyoos	19,595	.....	.....	1,505	.....	.....	.....	.....	.....	.....	.....	.....	.....	21,100	.....
Similkameen	.....	.....	.....	.....	.....	.....	.....	.....	771	.....	.....	.....	.....	771	.....
Eastern District (No. 5)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	368,005
Fort Steele	.....	337,871	.....	.....	.....	.....	.....	1,356	318	.....	.....	28,340	.....	367,885	.....
Windermere and Golden	.....	.....	.....	.....	.....	.....	120	.....	.....	.....	.....	.....	.....	120	.....
Ainsworth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Slocan and Slocan City	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nelson	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Trail Creek	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Revelstoke	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western District (No. 6)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	132,181
Nanaimo	.....	.....	.....	6,349	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,349	.....
Victoria and Quatsino	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,000	.....	.....	2,600	5,600	.....
Vancouver	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	120,232	.....	120,232	.....
New Westminster	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	19,595	337,871	5,147	23,787	520	247,938	120	1,356	1,089	3,000	4,550	148,572	2,600	796,145	796,145

TABLE XIII.

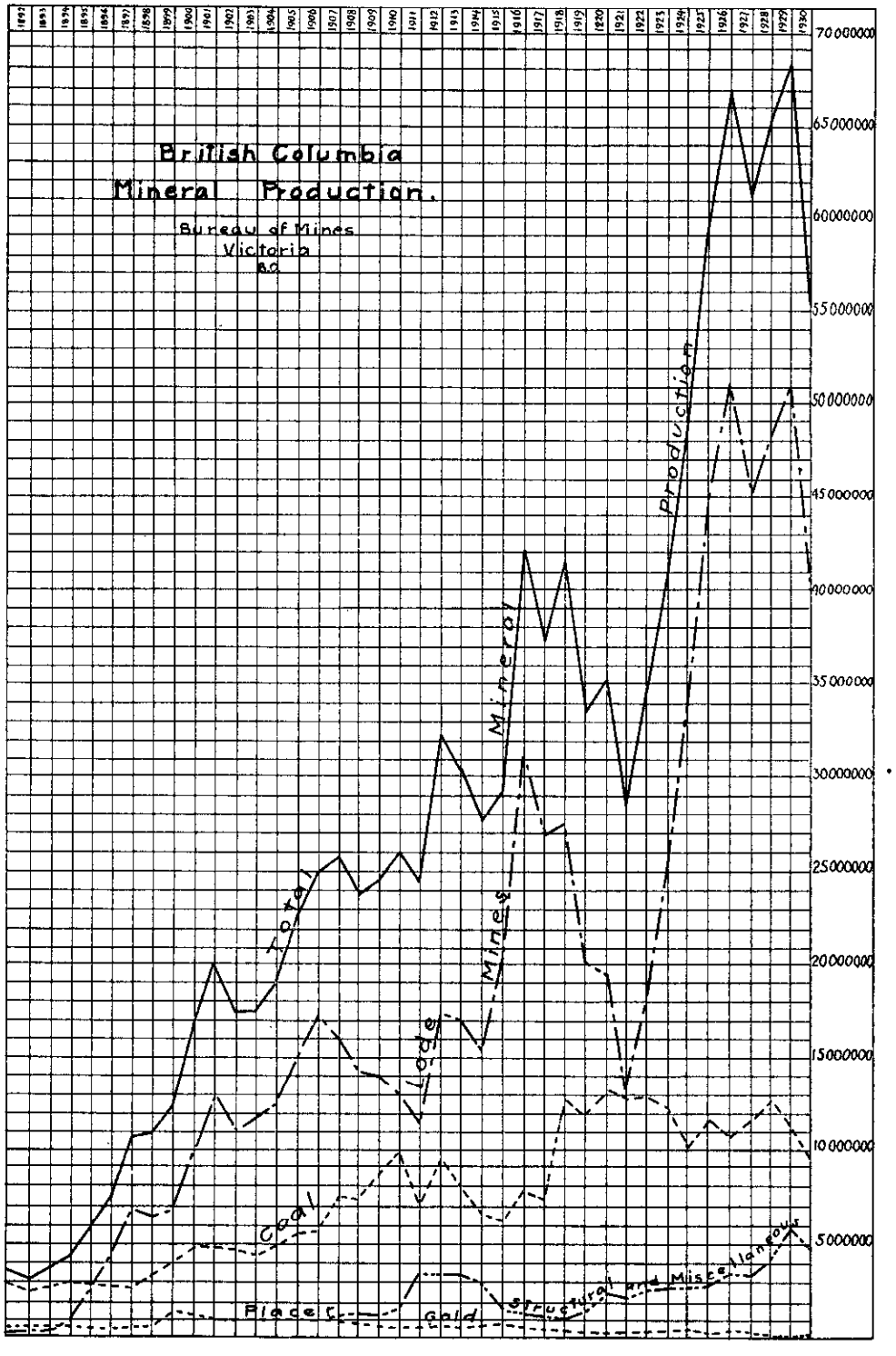

British Columbia
Mineral Production.
Bureau of Mines
Victoria
B.C.
Total Mineral Production
Lode Mines
Coal
Placer Gold
Structural and Miscellaneous
70000000
65000000
60000000
55000000
50000000
45000000
40000000
35000000
30000000
25000000
20000000
15000000
10000000
5000000

TABLE XIV.

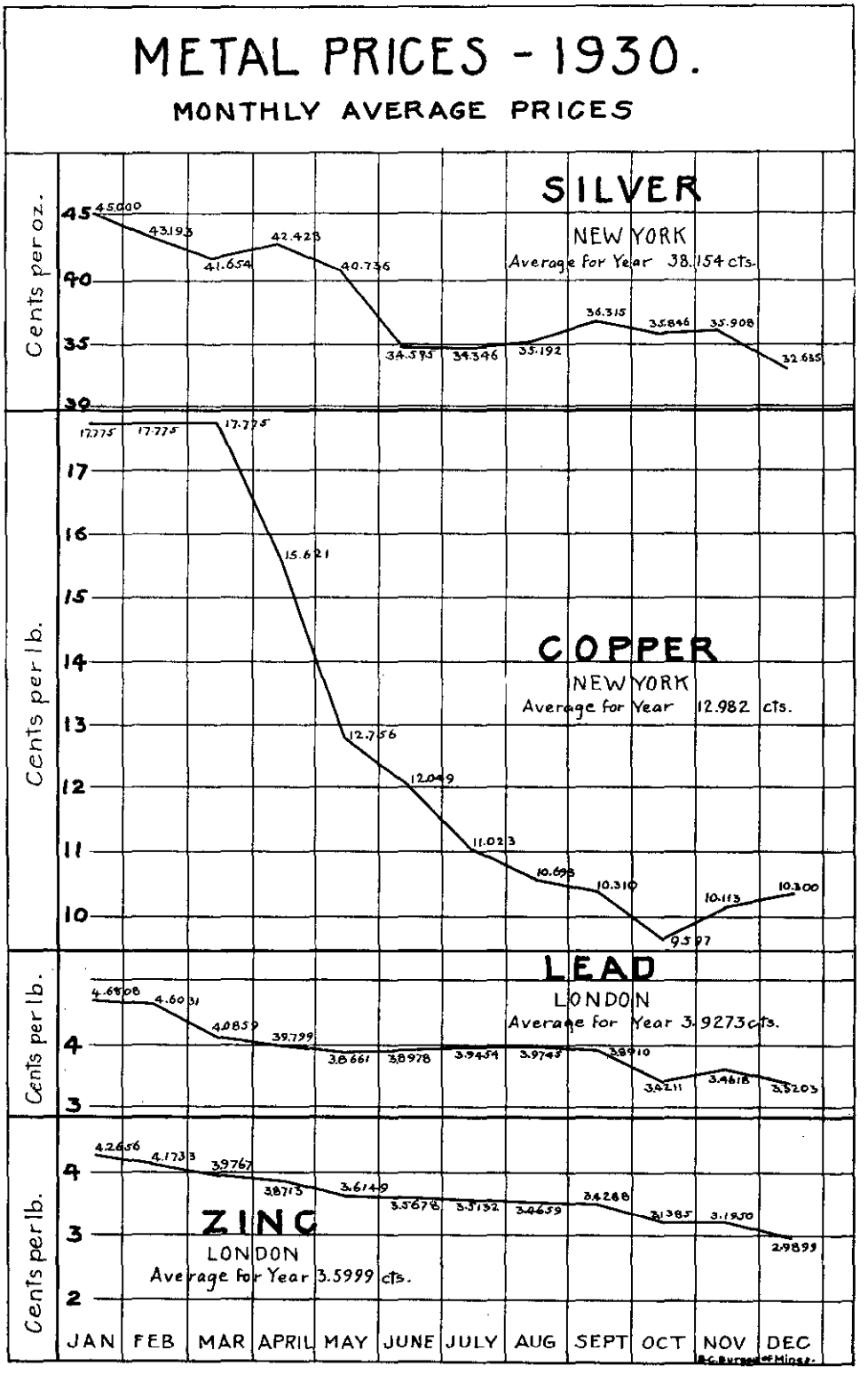

METAL PRICES - 1930.
MONTHLY AVERAGE PRICES
SILVER
NEW YORK
Average for Year 38.154 cts.
Cents per oz.
45.000
43.193
41.654
42.428
40.736
34.595
34.346
35.192
36.315
35.846
35.908
32.685
COPPER
NEW YORK
Average for Year 12.982 cts.
Cents per lb.
17.775
17.775
17.775
15.621
12.756
12.049
11.023
10.698
10.310
9.597
10.113
10.300
LEAD
LONDON
Average for Year 3.9273 cts.
Cents per lb.
4.6908
4.6031
4.0859
3.9799
3.8661
3.8978
3.9454
3.9743
3.8910
3.8211
3.4818
3.5203
ZINC
LONDON
Average for Year 3.5999 cts.
Cents per lb.
4.2656
4.1733
3.9767
3.8713
3.6149
3.5678
3.5152
3.4659
3.4268
3.1385
3.1950
2.9899
JAN
FEB
MAR
APRIL
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
B.C. Bureau of Mines.

TABLE XV.

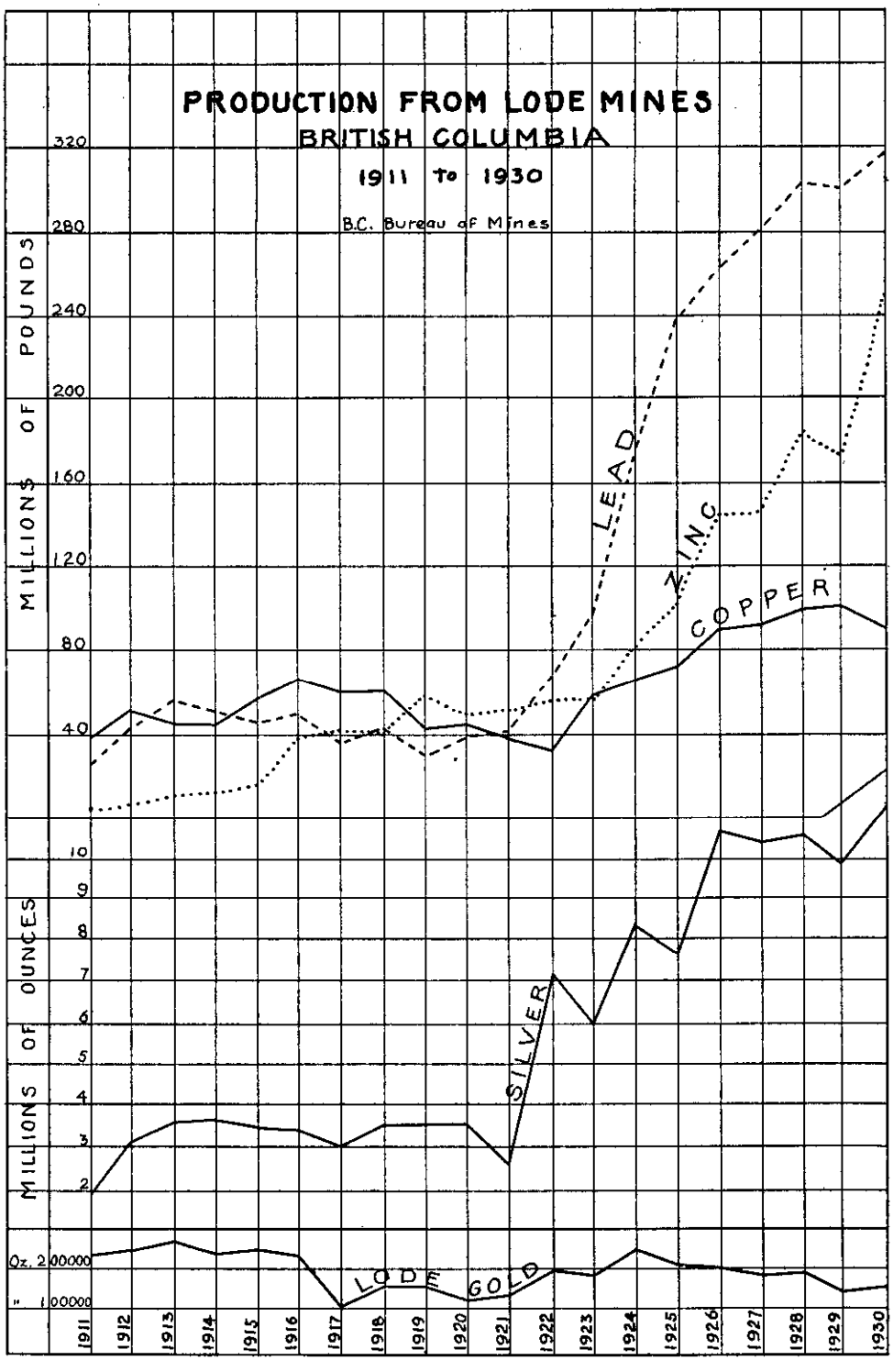

PRODUCTION FROM LODE MINES
BRITISH COLUMBIA
1911 to 1930
B.C. Bureau of Mines
MILLIONS OF POUNDS
320
280
240
200
160
120
80
40
LEAD
ZINC
COPPER
MILLIONS OF OUNCES
10
9
8
7
6
5
4
3
2
SILVER
Oz. 200000
" 100000
LODE GOLD
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930

TABLE XVI.—Men employed in the Mineral Industry of British Columbia, 1930.

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	135	630	285	915	98	404	.....	.....	.....	19	.....	2	1,573
No. 2	125	35	50	85	1	.....	15	3	18	4	10	5	248
No. 3	73	76	51	127	13	.....	80	32	112	28	5	26	384
No. 4	42	306	231	537	146	.....	340	152	492	6	15	8	1,246
No. 5	36	693	385	1,078	378	2,793	931	321	1,252	42	4	71	5,654
No. 6	14	576	258	834	196	.....	2,023	748	2,771	744	310	58	4,927
Totals	425	2,316	1,260	3,576	832	3,197	3,389	1,256	4,645	843	344	170	14,032

TABLE XVII.—Tonnage, Number of Mines, and Net Value of Lode Minerals, 1930.

District.	Tonnage.	No. of Shipping Mines, 1930.	No. of Mines shipping over 100 Tons.	Net Value of Lode Minerals produced.
No. 1	1,790,833	11	6	$5,210,111
No. 2	3,096	2	2	34,231
No. 3	53,637	7	3	448,891
No. 4	783,620	16	8	2,120,472
No. 5	2,019,267	30	12	9,675,172
No. 6	2,153,393	2	1	4,488,811
Totals	6,803,846	68	32	$21,977,688

SUMMARY OF STATISTICAL TABLES.

In compiling the Statistical Tables for the 1930 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 1929 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 1930, aggregating $1,237,847,847. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of $330,293,688; followed next in importance by copper at $265,871,528, and next in order is lead at $163,617,773, with lode gold in fourth place at $140,868,011.

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 1930. The value of the total mineral production of the Province up to the end of 1930 was $1,237,847,847.

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 1930, 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 outputs 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 $3,632,601, as shown in Table XI.

Table V. shows the statistical record of the placer mines of the Province from 1858 to 1930, and shows a total production of $78,588,949. The value of the output for 1930 was $152,235, an increase, as compared with the previous year, of $33,524.

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 $760,564,549; 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 1929 and 1930 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 1930 was 6,803,846 tons, having a gross value of $40,915,395, and, with the placer gold, a total value of $41,067,630.

Table VIII. contains the statistics of production of the coal-mines of the Province. The total amount of coal produced to the end of 1930 was 77,375,551 tons (2,240 lb.), worth $304,620,088. Of this, 1,887,130 tons was produced in 1930, valued at $9,435,650. 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 as 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 1930 was valued at $4,092,568, as compared with $3,921,768 in 1929. 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. In 1930 the production value was $796,145, as compared with $1,773,845 in 1929.

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 1930.

Table XV. shows graphically the lode-metal output of the Province for the last twenty years, indicating clearly the growth in production since 1911.

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.

REVIEW BY METALS AND MINERALS.

GOLD.

Placer Gold. The production of placer gold in 1930 was $152,235, as compared with $118,711 in 1929. The principal placer-mining camps are in Atlin, Cariboo, and Quesnel, while less important areas, such as Liard, Omineca, Clinton, Similkameen, and Fort Steele, add to the production in proportion. The production from Atlin during the last two years has been much less than normal, as the three larger companies have confined their attention to development-work. Indications are that the increase shown by this camp this year over 1929 will continue in the future.

Cariboo Division made about the same production as in 1929, but many plans now under way may result in a larger output in future years.

Quesnel Division made a substantially larger output in 1930 than in the previous year and future prospects are encouraging.

The interest now being taken in gold-mining is stimulating an increased interest in placer-mining, and this branch of the industry may be expected to return gradually to something approaching its former importance.

Lode Gold. The value of lode gold produced in 1930 was $3,323,576, as compared with $3,004,419 in 1929, an increase of 10.6 per cent. The largest part of the gold-output is made by the *Premier* mine, which contributed 54 per cent. of the total. The *Premier* output declined in 1930, but this loss was more than offset by increased production from other properties.

The *Pioneer* mine is now assuming greater importance as a productive gold-mine, from which larger returns may be received in the future. The *Reno* and *Union* mines are virtually new producers in 1930 (the mills were tuned up late in 1929), the former being a straight gold-mine and the latter a gold-silver property.

The *Nickel Plate* mine is still producing gold, but not as much as in former years. A few small gold properties and by-product production from copper-mining account for the remainder of the gold-output of the Province.

It is quite apparent that there is an active interest in searching for gold properties in British Columbia. A number of small properties in the Nelson Division are being developed and many old properties are being carefully examined.

It is probable that the gold-output of the *Premier* mine will decline in future years and expansion in other sections will be necessary to maintain the yearly figure between three and four million dollars.

The following table shows the gold production by Mining Divisions for the years 1929 and 1930:—

Mining Divisions.	1929. Oz.	1930. Oz.
Portland Canal	96,676	87,492
Lillooet	5,061	18,067
Vancouver	14,290	13,062
Osoyoos	14,217	11,136
Nelson	2,465	9,995
Grand Forks	.....	9,488
Similkameen	5,924	4,276
Nicola	794	3,295
Nass River	4,671	3,207
All others	1,241	760
Totals	145,339	160,778

SILVER.

The production of silver was 11,289,171 oz., as compared with 9,018,800 oz. in 1929, an increase of 1,370,371 oz., or 13.7 per cent. This is a new high record for silver-output in the Province. The increase is mainly due to an output of approximately 1,500,000 oz. from the *Prosperity* mine at Stewart, a new producer this year. In addition, the *Premier* made a larger production than in 1929. A heavy decline was registered from the Slocan district, where several former shippers were closed down on account of low metal prices.

The value of the silver-output was $4,307,270, a decline of $949,000 or 18 per cent. from the 1929 value. Thus, notwithstanding a record output, the value, owing to the big drop in silver prices, is less than any of the last seven years.

The largest producer in the Province is the *Sullivan* mine, followed by the *Premier*, with the *Prosperity* in third place.

The following table shows the silver production by Mining Divisions for the years 1929 and 1930:—

Mining Divisions.	1929. Oz.	1930. Oz.
Fort Steele	5,055,996	5,154,685
Portland Canal	2,373,972	4,185,851
Greenwood	444,429	650,261
Grand Forks	.....	356,291
Nass River	285,394	256,205
Vancouver	199,544	206,345
Slocan	958,294	137,686
Similkameen	167,040	115,941
Nicola	41,945	73,743
Omineca	261,351	71,342
Golden	1,466	64,657
All others	129,369	16,164
Totals	9,918,800	11,289,171

Copper.

The output of copper in 1930 was 90,421,545 lb., valued at $11,738,525. This is a decline in output of 11,062,312 lb. and in value of $6,911,685.

The decline in production is accounted for by the closing-down in November of the *Copper Mountain* mine and curtailment by the *Hidden Creek* mine, both owned by the Granby Consolidated Mining and Smelting Company. This decrease was in part offset by increased production from the *Britannia* mine, which in 1930 made a record output.

The tremendous drop in copper price during the year from an average of 18.107 cents a pound in 1929 to 12.982 cents in 1930 is largely responsible for the big decline in the value of the copper-output, and has resulted in greatly decreased profits for the two main copper companies of the Province.

The following table shows the production of copper by Mining Divisions for the years 1929 and 1930:—

Mining Divisions.	1929. Lb.	1930. Lb.
Vancouver	41,988,115	44,294,646
Nass River	36,746,057	30,551,423
Similkameen	22,539,798	15,489,798
Portland Canal	130,167	50,649
Nicola	.....	30,035
All others	79,720	41,994
Totals	101,483,857	90,421,545

Lead.

The production of lead in 1930 was 319,199,752 lb., which is a new high record output, being 16,853,484 lb. greater than the 1929 figure. The main producer is the *Sullivan* mine of the Consolidated Mining and Smelting Company, which made a slightly higher output this year, thereby offsetting a decline from the Slocan district. A substantial output was also made by the *Monarch* mine of the Base Metals Mining Corporation.

The lead produced in 1930 had a value of $12,535,931, a decrease of $2,733,765 as compared with the 1929 figure. The average London price of lead in 1930 was 3.9273 cents a pound, as compared with 5.0504 cents in 1929, a decline of 22.3 per cent. The outlook for the future is that the present rate of output of lead will be maintained.

The following table shows the production of lead by Mining Divisions for the years 1929 and 1930:—

Mining Divisions.	1929. Lb.	1930. Lb.
Fort Steele	290,544,455	301,844,470
Golden	297,876	12,115,425
Portland Canal	2,197,666	2,302,170
Slocan	5,407,036	1,200,584
Nicola	448,400	576,667
Vancouver	967,594	308,387
Greenwood	187,390	276,193
Omineca	820,938	237,354
Nelson	63,416	111,294
All others	1,311,497	227,208
Totals	302,346,268	319,199,752

Zinc.

The output of zinc for the year was 250,287,306 lb., a most substantial increase over that of 1929 and also 1928, the previous record year. The increase amounts to 78,190,465 lb. over the 1929 production. Notwithstanding the largely increased output, the value is slightly lower than the figure for 1929, being $9,010,093 as compared with $9,268,792.

The principal producer of zinc is the *Sullivan* mine of the Consolidated Mining and Smelting Company, which this year made a greater output than in 1929, and in addition a considerable contribution was made by the *Monarch* mine. Part of the *Sullivan* 1930 production was produced as concentrates in 1929, but not treated until 1930; the metal produced is therefore credited to 1930 output.

A large part of the increased production this year was, however, due to the commencement of operations by the new slag-fuming plant of the Consolidated Company at Trail. This plant recovers zinc formerly lost in the slag from the lead-furnaces. In addition to the current slag production, there is a large quantity of slag from former operations stored at the Trail plant awaiting re-treatment. This plant is now turning out zinc oxide, equivalent to 50 tons of metallic zinc a day.

The average London price of zinc for the year was 3.5999 cents a pound, as compared with 5.3858 cents in 1929, a decline of 33.2 per cent.

The following table shows the production of zinc by Mining Divisions for the years 1929 and 1930:—

Mining Divisions.	1929. Lb.	1930. Lb.
Fort Steele	162,904,853	218,984,983
Trail Creek	2,387	19,151,466
Golden	.....	11,186,792
Slocan	4,510,802	774,818
All others	4,678,799	189,247
Totals	172,096,841	250,287,306

Coal.

The production of coal in 1930 was 1,887,130 long tons, which shows a decrease, as compared with 1929, of 364,122 tons.

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

		1927.	1928.	1929.	1930.
Vancouver Island mines	tons, 2,240 lb.	1,331,325	1,277,533	1,120,805	988,805
Nicola-Princeton mines	,,	213,292	245,978	242,236	208,060
Crowsnest mines	,,	907,519	1,001,523	886,706	689,236
Northern District	,,	1,691	1,668	1,505	1,029
Total quantity of coal mined	,,	2,453,827	2,526,702	2,251,252	1,887,130

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, 68 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 148,675 tons; the Fiddick mine, 1,559 tons; the Little Ash mine, 5,596 tons; the Richardson mine, 386 tons; the Lantzville Colliery, 4,024 tons; the Biggs' mine, 1,108 tons; the Morden Colliery, 3,001 tons; and the Little Jingle Pot mine, 421 tons. In the Nicola Valley section of the district the Middlesboro Colliery Company mined 36,322 tons; the Coalmont Collieries, Limited, 104,004 tons; the Tulameen Coal Mines, Limited, produced 36,581 tons; the Blue Flame Collieries, Limited, 10,596 tons; and the Pleasant Valley Coal Company, 20,557 tons.

In the Northern District the Telkwa Collieries, Limited, shipped 559 tons; and the Bulkley Valley Mining Company, 470 tons. These properties, for convenience, are included in the Coast *District figures.*

In the East Kootenay District, in addition to the Crow's Nest Pass Coal Company, which produced 475,824 tons, the Corbin Coals, Limited, produced 213,412 tons.

The collieries of the Coast District, including the Nicola-Princeton and Telkwa fields, are to be credited for 1930 with about 63 per cent. of the total coal-output.

The output of the collieries of the Province for 1930 was, as already stated, 1,887,130 tons, which includes 10,467 tons of coal taken from stock.

Of this amount, there was sold for consumption in Canada, 1,394,363 tons; sold for consumption in the United States, 123,873 tons; sold in other countries, 19,338 tons; making the total coal sales for the year 1,537,574 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, 98,174 tons; used under companies' boilers, etc., 145,049 tons; while 116,800 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.	937,430	456,933	1,394,363
Sold for export to United States..... ,,	47,121	76,752	123,873
Sold for export to other countries..... ,,	19,338	.....	19,338
Total coal sales..... ,,	1,003,889	533,685	1,537,574

Collieries of Coast District.

The collieries of the Coast District, which includes those on Vancouver island and in the Nicola-Princeton fields and two small collieries in the Northern District, mined 1,197,894 tons of coal in 1930, which, together with 7,711 tons taken from stock, made 1,205,605 tons distributed from these collieries in 1930. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	937,430	
Sold as coal in United States	47,121	
Sold as coal in other countries	19,338	
Total sold as coal		1,003,889
Used under companies' boilers, etc.		115,042
Lost in washing, etc.		86,674
		1,205,605
Less taken from stock		7,711
Gross output		1,197,894

The total coal sales of the Coast collieries for 1930 show, as compared with the sales of the previous year, a decrease of 162,013 tons, equivalent to about 13.8 per cent.

The coal sold in Canada by the collieries of the Coast District in 1930 shows a decrease of 138,208 tons, or about 12.8 per cent. less than the preceding year; the amount exported to the United States was 43,143 tons less than the preceding year, a decrease of about 47.7 per cent.; and to other countries 19,338 tons was exported.

On Vancouver island ten companies produced coal in 1930, the combined output being 998,805 tons.

In the Nicola and Princeton coalfields of the Coast District five companies made a combined output of 208,060 tons.

The Telkwa Collieries produced 559 tons, and the Bulkley Valley Coal Mining Company, 470 tons.

East Kootenay Coalfield.

There were only two companies operating in this district in 1930—the Crow's Nest Pass Coal Company, operating two separate collieries, which together mined 475,824 tons; and the Corbin Coals, Limited, which mined 213,412 tons; making an output for the district for 1930 of 689,236 tons of coal.

The amount of coal actually distributed was 691,992 tons, of which 2,756 tons was taken from stock, making the actual production 689,236 tons.

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

	Tons.	Tons.
Sold as coal in Canada	456,933	
Sold as coal in United States	76,752	
Sold as coal in other countries	.....	
Total sold as coal		533,685
Used by Crow's Nest Pass Coal Co. in making coke		98,174
Used by the companies under boilers, etc.		30,007
Lost in washing		30,126
		691,992
Less coal taken from stock		2,756
Gross output		689,236

STRUCTURAL MATERIALS.

The output of structural materials in 1930 was valued at $4,092,568, an increase of $170,800, or 4.2 per cent., as compared with 1929.

The increase is mainly accounted for by larger outputs of cement, building-stone, and sand and gravel. It is probable that general constructional work was at a somewhat lower rate than in 1929, but some large contracts caused a larger output of certain materials. The new Canadian National hotel and work in connection with hydro-electric plants provided a substantial demand for some products. The decreases shown in limestone and brick products indicate that general construction declined slightly as compared with the preceding year.

Approximately 90 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.

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.

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 1930 was $796,145, as compared with $1,773,845 in 1929. A total of thirteen different products are listed in Table XII., which shows in some detail the output by Divisions and districts.

The large decrease of $977,700 is accounted for by fluctuations in demand for some of the principal products. No fluorspar or bismuth was produced in 1930 and only about half as much cadmium. The *Rock Candy* mine of the Consolidated Company produces the fluorspar, and it is only operated a short time every two or three years to supply the acid-making requirements of the Consolidated plant. The world market for bismuth and cadmium is limited, and apparently the Consolidated Company, producing these metals, did not force production in 1930.

Increased outputs of gypsum, arsenic, and talc were made, but other products showed decreases.

The arsenic production is made by the *Nickel Plate* mine at Hedley, in the form of arsenical-iron concentrates carrying gold values which are shipped to the Tacoma smelter for treatment. 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.

Pyrite in the form of a concentrate is produced by the *Britannia* mill as a by-product and sold to chemical plants; the sulphur content is valued and credited as production. The sulphur content of the sulphuric acid made at Trail from smelter fumes is calculated and valued for this production table.

There are numerous deposits of non-metallic minerals in the Province, some of which are being investigated and developed, so that this branch of the industry may be expected to expand when normal business follows the present depression.

DEPARTMENT OF MINES.

VICTORIA, B.C.

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

GEO. O'BRIEN, *District Inspector*, Nanaimo.
T. R. JACKSON, *District Inspector*, Nanaimo.
ROBERT STRACHAN, *District Inspector*, Fernie.
JOHN MCDONALD, *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, Nelson.
GEO. A. CLOTHIER, No. 6 District, Vancouver.

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-one 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 112, 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 diver-

gent 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 $1,388,000 was expended in the construction and 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 476 miles of road and 1,784 miles of trail and the maintenance of 2,579 miles of road and 8,418 miles of trail. This means that a grand total of 13,257 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.	Deputy 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	Squaw Creek			Mrs. F. Muncaster.
Sub-office	Tulsequah			
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			A. J. Marion.
Sub-office	McDame Creek			L. F. Murphy.
Sub-office	Fort St. John			F. W. Beatton.
Skeena	Prince Rupert	N. A. Watt	N. A. Watt	
Sub-office	Kitimat			Chas. E. Moore.
Sub-office	Copper City			
Sub-office	Terrace			O. T. Sundal.
Sub-office	Rosswood			
Sub-office	Stewart (Portland Canal)			J. P. Scarlett.
Sub-office	Kimsquit			Percy Gadsden.
Nass River	Anyox	N. A. Watt	E. Ross Oatman	
Sub-office	Alice Arm			Mrs. L. Cummings.
Portland Canal	Stewart	N. A. Watt (at Prince Rupert)	J. P. Scarlett	
Bella Coola	Prince Rupert	N. A. Watt	N. A. Watt	
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	N. A. Watt	G. A. Charter, M.D.	
Sub-office	Jedway			
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.	Deputy Recorder.
Omineca	Smithers	Stephen H. Hoskins	Jas. E. Kirby	
Sub-office	Fort Grahame			H. Ravenal, Act'g.
Sub-office	Bella Coola			C. A. Brynildsen.
Sub-office	Finlay Forks			
Sub-office	Fort St. James			Alec. Kynoch.
Sub-office	Manson Creek			W. B. Steele.
Sub-office	Telkwa			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. Beatton.
Sub-office	Whitewater (Finlay River)			John Melnyk.
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 Aiken.
Peace River	Fort St. John	S. H. Hoskins (at Smithers)	F. W. Beatton	
Sub-office	Prince George			G. Milburn.
Sub-office	Finlay Forks			
Sub-office	Hudson Hope			F. F. Monteith.
Sub-office	Pouce Coupe			M. S. Morrell.
Cariboo	Barkerville	R. F. Ure	R. F. Ure	Mrs. R. F. Ure.
Sub-office	Quesnel			E. C. Lunn.
Sub-office	Prince George			Geo. Milburn.
Sub-office	McBride			H. McGlinchy.
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. Haylmore.
Lillooet	Lillooet	L. J. Price	L. J. Price	R. W. Melton.
Sub-office	S. Fork, Bridge River			W. Haylmore.
Kamloops	Kamloops	E. Fisher	E. Fisher	
Sub-office	Chu Chua			George Fennell.
Sub-office	Vavenby			H. Finley.
Sub-office	Salmon Arm			A. P. Suckling.
Ashcroft	Ashcroft	E. Fisher (at Kam.)	R. G. Cowper	
Sub-office	Lytton			A. Dryden.
Nicola	Merritt	E. Fisher (at Kam.)	A. G. Freeze	
Yale	Hope	E. Fisher (at Kam.)	C. A. W. Lethbridge	J. W. Chadwick.
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.
Sub-office	Kelowna			H. B. Campbell.
Greenwood	Greenwood	Chas. Nichols	Chas. Nichols	
Sub-office	Rock Creek			S. A. H. Brew.
Sub-office	Beaverdell			T. W. Clarke.
Grand Forks	Grand Forks	E. Harrison	E. Harrison	
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	H. 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			S. B. Hamilton.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
Ainsworth	Kaslo	Ronald Hewat	A. McQueen	A. W. Anderson.
Sub-office	Howser			J. F. Thompson.
Sub-office	Trout Lake			H. Macpherson.
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	
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.
Sub-office	Trout Lake			H. Macpherson.
Trail Creek	Rossland	W. H. Reid	W. H. Reid	
Nanaimo	Nanaimo	C. L. Munroe	C. L. Munroe	
Sub-office	Ladysmith			J. A. Knight.
Sub-office	Alert Bay			Ernest H. Robinson.
Sub-office	Vananda			Leonard Raper.
Sub-office	Granite Bay			Henry Twidle.
Sub-office	Powell River			A. C. Sutton.
Alberni	Alberni	W. H. Boothroyd	W. H. Boothroyd	
Clayoquot	Clayoquot	W. H. Boothroyd (at Alberni)	W. T. Dawley	
Quatsino	Quatsino	W. H. Boothroyd (at Alberni)	Ed. Evenson	
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, 1930.

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-verted Crown-granted Mineral Claims.	Placer Claims recorded.	Placer Leases granted (Bench, Creek and Dredging).	Certificates of Work, Placer Claims and Leases.	Bills of Sale, etc.	Free Miners' Certificates.	General.	Mining Divisions.	Districts.
North-western District (No. 1)																**$32,435.15**
Atlin	455	5	1	715	494	29			2	3	122	25	$2,524.25	$11,198.25	$13,722.50	
Stikine and Liard	210	2		86	51	16			12	4	39	6	1,120.50	2,630.00	3,750.50	
Nass River	143	2		50	332	16	24						897.00	1,476.90	2,373.90	
Portland Canal	293	13	1	280	1,043	78	113						2,698.50	5,054.90	7,753.40	
Skeena	538	2	2	112	194	64	5	11	1	1	2		2,656.25	1,424.35	4,080.60	
Queen Charlotte	31	1		11	33	3			1	1	5	10	235.75	437.25	673.00	
Bella Coola	12			22	15								50.50	30.75	81.25	
North-eastern District (No. 2)																**39,267.20**
Cariboo	478	8	11	181	157	27			17	84	80	97	3,044.50	11,291.75	14,336.25	
Quesnel	250	2		25	55	10			11	63	124	89	1,246.25	8,723.00	9,969.25	
Omineca	727	8	1	630	2,160	262	3		10	12	39	12	2,665.80	12,099.65	14,765.45	
Peace River	35			2					2		1		158.75	37.50	196.25	
Central District (No. 3)																**23,141.70**
Nicola	103	1		107	210	7	10		1				577.75	847.05	1,424.80	
Vernon	152	3	2	77	88	11	1				5	7	884.50	893.45	1,777.95	
Yale	232	5	1	268	483	50	3		8	1	17	2	1,569.25	3,044.70	4,613.95	
Ashcroft	69	1	1	86	67	2			1	6	9	24	403.50	941.90	1,345.40	
Kamloops	362	3		211	358	24		7	2	9	11	6	1,854.25	3,407.85	5,262.10	
Lillooet	180	6	2	189	315	41	18	7	3	13	56	20	1,422.75	5,792.50	7,215.25	
Clinton	52	1	1	55	99	22	1		2	6	14	5	253.25	1,249.00	1,502.25	
Southern District (No. 4)																**11,087.55**
Grand Forks	75	1		34	68	5		8			1		452.00	520.00	972.00	
Greenwood	115		3	63	154	34	5	11	1		2		573.50	1,043.50	1,617.00	
Osoyoos	151	1		62	44	1		11					722.00	589.00	1,311.00	
Similkameen	311	7	1	131	318	45		5	9	17	188	15	1,752.75	5,434.80	7,187.55	
Eastern District (No. 5)																**27,809.30**
Fort Steele	220	5	2	92	187	126	93	1	6	9	7	9	1,465.25	3,524.10	4,989.35	
Windermere	73	4		22	102	10			5				619.25	576.25	1,195.50	
Golden	92	2	1	37	110	24	6		1		1		602.00	1,460.00	2,062.00	
Ainsworth	198	7	2	59	304	18	2	9	3	8			1,720.50	1,848.50	3,569.00	
Slocan	82	6		17	167	6							986.75	437.50	1,424.25	
Slocan City	37			33	80	8	4						183.50	703.50	887.00	
Nelson	389	12		185	457	44	71	17	4		2	1	2,859.50	2,710.20	5,569.70	
Arrow Lake	60			29	50	4			1				290.50	816.50	1,107.00	
Trail Creek	148	3		10	54	3		4					739.50	267.50	1,007.00	
Revelstoke	144	7		112	172	20	1	1		2	7		1,637.50	2,668.00	4,305.50	
Trout Lake	35			42	63	2	6		8			2	165.25	796.75	962.00	
Lardeau	37	3	1	10	103	1							446.00	285.00	731.00	
Western District (No. 6)																**30,577.40**
Nanaimo	130	2		205	368	61		5	4				1,047.00	2,497.35	3,544.35	
Alberni	76	1		40	21	8							416.25	232.75	649.00	
Clayoquot	27			45	21						2		104.75	594.55	699.30	
Quatsino	65			91	142	8	4						314.50	612.50	927.00	
Victoria	349	18	11	82	20	16		4	8	2	6	1	3,588.75	785.25	4,374.00	
New Westminster	190	2	3	112	194	44							955.75	1,503.70	2,459.45	
Vancouver	1,601	104	11	46	170	37	2						17,013.25	911.05	17,924.30	
Totals	8,927	248	58	4,666	9,523	1,187	372	101	123	241	740	331	$62,919.30	$101,399.00	$164,318.30	**$164,318.30**

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 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 1930 the Provincial Mineralogist made a number of special examinations involving field-trips in the southern interior and northern sections of the Province.

During 1930 three bulletins were issued. No. 1 bulletin, "Report on the Taku River Area, Atlin Mining Division," by J. T. Mandy, Resident Mining Engineer, North-western District, was issued in January in order to give publicity regarding the nature of the mineral occurrences in this newly discovered camp. This bulletin was reprinted in the Annual Report for 1929. No. 2 bulletin, "Placer-mining in British Columbia," is a compilation giving much useful information regarding placer-mining in the Province. The Honourable the Minister of Mines had arranged in the field season of 1929 for special investigations of certain placer areas in the Province by Herbert Carmichael and C. W. Moore. Bulletin No. 2 was issued early in 1930, so that this information should be given to the public as soon as possible. The bulletin contains, in addition to the special reports, a general summary regarding placer-mining in British Columbia, and condensed historical, geological, and statistical information regarding all the important placer areas of the Province. A bibliography of reports on British Columbia placers is also included, which it is believed will be useful to those interested in this branch of the mineral industry.

Bulletin No. 3, "Preliminary Review and Summary of Mining Operations for 1930 in the Province of British Columbia," was issued on December 23rd. This is the usual year-end report giving a close approximation of the mineral production and a summary regarding important activities and developments of the mineral industry.

In July a mimeographed "Press Statement" was issued summarizing results in mining for the half-yearly period ended June 30th, 1930.

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 output 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.

LECTURES TO PROSPECTORS.

On instructions from the Honourable the Minister of Mines, arrangements were made for the delivery of special lectures to prospectors at different points throughout the Province in the spring of 1930. Two special lecturers were engaged—W. V. Smitheringale and George Winkler. By training and experience, both these gentlemen are particularly well qualified to give lectures on the principal points in regard to geology, mineralogy, ore occurrences, petrography, and the other fundamental ideas requisite for intelligent and efficient prospecting.

Lectures were given at each of the different centres for approximately a week, including five evening lectures and five afternoon classes spent in demonstrating rocks and mineral specimens and discussing special problems. On the average, an excellent attendance was obtained and much interest was shown in the courses. While it is difficult to determine the direct effect of these lectures, it is believed that the information imparted and distributed to many will result in more efficient prospecting. Lecture courses such as these, if carried on steadily for years, will undoubtedly educate many prospectors to a more exact knowledge of how to discover and develop mineral occurrences.

CANADIAN NATIONAL EXHIBITION, TORONTO.

Arrangements having been made for a Provincial exhibit at the Canadian National Exhibition at Toronto, August 22nd to September 7th, the Honourable the Minister of Mines directed the Bureau of Mines to prepare and ship a comprehensive collection of minerals and mineral products to the exhibition. H. T. Nation was in charge of assembling and equipping the exhibit at Toronto.

The exhibit sent comprised specimens of ore from various parts of the Province, together with specimens of miscellaneous mineral products. The specimens were set out on a sloping shelf conveniently arranged and in glass cases along the front. The background was formed of a complete wall panel of British Columbia woods carrying two large paintings representing the Britannia mill and the Trail smelter, with the Provincial Coat of Arms in the centre. A balopticon machine presented a series of photographic slides continuously, the slides having

been prepared at the Bureau of Mines. Other photographs and literature were available to the public.

A very favourable impression was created by this excellent representation of the minerals of the Province and the attendants were engaged from 10 in the morning to 10 at night giving information on the mining industry of the Province. At least one million persons examined the exhibit, those most interested being manufacturers using mineral products, mining men asking details as to individual mines, and students. Gold possibilities in the Province were eagerly inquired for and it is expected the interest aroused will result in much scouting and prospecting for gold properties in 1931.

Although the principal production of British Columbia is from base metals, which were accordingly strongly featured, still it was noteworthy that non-metallic minerals created many inquiries.

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.

BRITISH COLUMBIA COAL COMMITTEE.

In August, 1930, a Coal Conference was called by Hon. W. A. McKenzie, Minister of Mines, which was attended by representatives of the producers, consumers, and the Government. As an outgrowth of this Conference the British Columbia Coal Committee was formed, representing in brief all those interested in improving the coal industry of the Province.

Coal-mining is not in a satisfactory condition at the present time. The figures show that from a production of 2,526,702 tons in 1928, the output has declined to 1,887,130 tons in 1930, with the probability that a further decrease will occur in 1931. In terms of employment, 5,334 men were engaged in coal-mining in 1928, as compared with about 4,000 at the present time. This decline in coal-mining is a serious matter industrially for the Province as it means much less money distributed for wages and supplies.

In a broad way the proposed work of the Coal Committee is to explore the avenues along which increased sales of British Columbia coal can be effected. It is distinctly understood that the committee will not act as a sales agency for British Columbia coal operators, but that it will, by investigation, experimentation, and other suitable methods, show where coal might be sold; and then the coal companies will naturally apply intensive salesmanship efforts.

There is much useful work for the committee to do on the question of British Columbia coal *versus* imported fuel-oil. In recent years coal has been displaced by oil in existing fields and new business has in many instances gone to oil. The essential problem is to show that coal handled efficiently (in various ways) can compete with oil in cost, desirability, and freedom from disagreeable features. It will not be possible to show this everywhere, but it is believed that data can be assembled to show that certain business now going to oil could be obtained for coal. It may be difficult to recapture lost ground, but if a start is made now, new business which will steadily develop in British Columbia may be obtained for the coal industry.

It has also been pointed out that, for British Columbia as a whole, the use of more coal and less imported fuel-oil will result in an advantage more than offsetting slightly lowered costs obtained by using oil. It is, however, difficult to convince the individual consumer that he should relinquish the direct advantage of lower costs. The main problem, therefore, is to show that coal can compete with oil. Similarly, the invasion of the domestic market in the Coast cities by Alberta coal is a matter of concern for the Coal Committee.

COAL ANALYSES.

The following table of analyses was issued in the 1926 Annual Report and is reprinted in order that the information may be available for coal consumers.

The samples were taken by the Inspectors of Mines from the operating collieries of the Province and the analyses show the different grades of coal as mined and prepared for sale at the various collieries of the Province. All analyses were made by the Bureau of Mines Laboratory.

TABLE OF ANALYSES OF BRITISH COLUMBIA COAL.

Sample No.	Date received.	Colliery.	Size of Coal.	Proximate Analysis.							Coking Quality.
				Moisture.	Volatile Combustible Matter.	Fixed Carbon.	Ash.	Sulphur.	British Thermal Units.	Moisture Loss after 4 Days.	
	1926.	Canadian Collieries (D.), Ltd.—		%	%	%	%	%		%	
9301	Feb. 5	No. 5 South Wellington mine, Douglas seam	Washed pea	1.50	31.50	50.50	16.50	0.55	11,656	3.00	Good.
9302	,, 5	No. 5 South Wellington mine, Douglas seam	Washed nut	1.10	34.30	55.20	9.40	0.35	13,020	1.50	Good.
9303	,, 5	No. 5 South Wellington mine, Douglas seam	Washery fines	1.40	34.50	53.60	10.50	0.55	13,020	4.50	Good.
9304	,, 5	No. 5 South Wellington mine, Douglas seam	Lump	1.40	34.20	55.40	9.00	0.26	13,175	1.50	Good.
9305	,, 5	Extension mine, Wellington seam	Washery fines	1.30	34.60	57.10	7.00	0.46	13,485	1.50	Good.
9306	,, 5	Extension mine, Wellington seam	Washed pea	1.20	33.00	52.30	13.50	0.46	12,555	7.50	Good.
9307	,, 5	Extension mine, Wellington seam	Washed nut	1.40	33.80	54.90	9.90	0.40	12,710	3.50	Good.
9308	,, 5	Extension mine, Wellington seam	Lump	1.40	35.30	56.70	6.60	0.40	13,640	1.50	Good.
		East Wellington Coal Co.—									
9309	,, 5	Wellington seam	Washery fines	2.00	34.90	54.40	8.70	0.40	12,710	1.50	Good.
9310	,, 5	Wellington seam	Lump	2.00	34.80	54.70	8.50	0.50	12,865	1.00	Good.
9311	,, 5	Wellington seam	Washed pea	1.90	34.50	52.90	10.70	0.50	12,555	0.50	Good.
9312	,, 5	Wellington seam	Washed nut	2.00	35.10	52.70	10.20	0.50	12,710	0.50	Good.
		Canadian Collieries (D.), Ltd.—									
9313	,, 5	No. 4 mine, Comox district	Crushed lump	0.30	24.90	63.40	11.40	0.88	12,555	4.00	Good.
9314	,, 5	No. 5 mine	Crushed lump	0.40	30.60	56.50	12.50	0.54	12,555	1.00	Good.
9315	,, 5	No. 5 mine	Comox crushed nut	0.40	25.70	64.30	9.60	0.92	12,710	1.00	Good.
9316	,, 5	No. 5 mine	Comox pea	0.30	25.40	62.20	12.10	0.82	12,710	1.00	Good.
		Western Fuel Corporation, Ltd.—									
9317	,, 5	Wakesiah mine, Wellington seam	Lump, domestic	0.80	33.60	53.60	12.00	1.22	11,625	1.00	Good.
9318	,, 5	No. 1 mine, Newcastle seam	Lump, domestic	0.20	33.50	54.00	10.50	1.12	11,780	1.00	Good.
9319	,, 5	No. 1 mine, Douglas seam	Lump, steam	1.30	34.40	56.30	8.00	1.04	12,555	1.00	Good.
9320	,, 5	Reserve mine, Douglas seam	Lump, steam	0.80	32.40	58.80	8.00	3.62	12,245	3.00	Good.
9321	,, 5	Reserve mine, Douglas seam	Washed slack	1.10	32.10	53.30	13.50	1.10	11,780	.....	Poor.
9322	,, 5	Reserve mine, Douglas seam	No. 1 nut	1.20	33.30	56.00	9.50	0.90	12,245	1.00	Good.

TABLE OF ANALYSES OF BRITISH COLUMBIA COAL—*Continued.*

Sample No.	Date received.	Colliery.	Size of Coal.	Proximate Analysis.							Coking Quality.
				Moisture.	Volatile Combustible Matter.	Fixed Carbon.	Ash.	Sulphur.	British Thermal Units.	Moisture Loss after 4 Days.	
				%	%	%	%	%		%	
9323	Feb. 5	Reserve mine, Douglas seam	No. 2 nut	1.10	31.00	54.50	13.40	3.92	11,625	1.00	Good.
9324	„ 5	Reserve mine, Douglas seam	Pea	0.70	32.50	53.40	13.40	1.00	11,780	1.00	Good.
		Crow's Nest Pass Coal Co.—									
9325	„ 5	Michel, No. 1 seam		0.90	21.50	72.50	5.10	0.40	13,640	3.00	Good.
9326	„ 5	Michel, No. 1 seam	Slack	0.70	20.80	68.40	10.10	0.40	12,865	4.00	Good.
9327	„ 5	Michel, No. 3 seam	Slack	0.60	19.30	70.40	9.70	0.70	12,710	3.00	Good.
9328	„ 5	Michel, No. 3 seam	Coal	0.70	19.70	74.10	5.50	0.90	13,795	3.00	Good.
9329	„ 5	Michel, No. 8 seam	Slack	0.60	22.00	73.00	4.40	0.60	13,640	.....	Good.
9330	„ 5	Michel, No. 8 seam	Coal	0.90	23.30	73.20	2.60	0.60	14,105	4.00	Good.
		Granby Consolidated M.S. & P. Co.—									
9331	„ 5	Cassidy	Washed pea and slack	1.10	31.10	52.80	15.00	0.50	11,780	9.00	Good.
9332	„ 5	Cassidy	Washed nut	1.10	33.10	56.80	9.00	0.50	12,865	3.00	Good.
9333	„ 5	Cassidy	Lump	1.50	30.70	57.30	10.50	0.50	12,555	2.00	Good.
9334	„ 5	Cassidy	Washed middlings	1.20	25.60	41.90	31.30	0.70	8,990	15.00	Poor.
		Telkwa Collieries, Ltd.—									
9335	„ 5	Goat Creek mine, No. 1 East level	Coking	0.80	28.20	62.60	8.40	1.80	13,020	3.50	Good.
9336	„ 5	Goat Creek mine, No. 2 East level	Coking	0.50	28.90	61.60	8.80	1.80	13,020	3.00	Good.
		Crow's Nest Pass Coal Co.—									
9337	„ 5	Coal Creek, from tipple	Market, screened	1.00	17.50	74.00	7.50	0.46	13,950	3.00	Good.
9338	„ 5	Coal Creek, from tipple	Market, run of mine	0.80	19.20	69.60	10.40	0.60	13,640	2.00	Good.
9339	„ 5	Coal Creek, from tipple	Market, slack	0.70	17.50	71.80	10.00	0.60	13,330	2.00	Good.
9340A	„ 5	Coal Creek, No. 1 East, No. 1 seam; full height of seam, Main level		0.70	19.40	74.90	5.00	0.80	14,260	0.50	Good.
9341	„ 5	No. 3 mine, No. 2 seam, No. 9 Right room, No. 3 slope; full height of seam, Main level		0.60	18.00	74.40	7.00	0.40	13,640	0.50	Good.
		Middlesboro Collieries, Ltd.—									
9342	„ 5	No. 1 seam		3.30	30.00	56.10	10.60	0.70	12,090	2.00	Fair.
9343	„ 5	No. 2 North seam (new prospect)		5.30	29.40	56.60	8.70	0.60	12,090	6.00	Poor.
9344	„ 5	No. 4 East seam		3.40	32.00	58.10	6.50	0.60	12,710	3.00	Fair.
9345	„ 5	No. 5 seam		4.90	31.30	56.80	7.00	0.70	12,555	4.00	Fair.
9346	„ 5	No. 6 seam		6.60	29.40	54.80	9.20	0.75	11,780	3.00	Poor.
9347	„ 5	No. 6 seam		4.10	30.10	51.50	14.30	0.40	11,160	2.50	Non-coking.

		Coalmont Collieries, Ltd.—									
9348	Feb. 5	No. 3 mine, Bottom bench, counter-level		6.00	26.60	54.20	13.20	0.40	11,470	6.00	Non-coking.
9349	„ 5	No. 3 mine, Upper bench, counter-level		5.20	29.70	58.50	6.60	0.30	11,780	1.00	Non-coking.
9350	„ 5	No. 4 mine, Upper bench, face of slope		5.30	30.10	57.00	7.60	0.28	11,780	.....	Non-coking.
9351	„ 5	No. 4 mine, Bottom bench, face of slope		5.60	29.60	57.20	7.60	0.30	11,780	1.00	Non-coking.
9352	„ 5	Keystone Coal Co., No. 6 mine		4.70	31.90	54.10	9.30	0.40	11,780	.....	Non-coking.
9353	„ 5	Sunshine Coal Co., Merritt		2.80	37.50	55.10	4.60	0.40	13,175	.....	Good.
		Tulameen Valley Coal Co., Princeton—									
9354	„ 5	Lower bench, face of main coal		15.50	30.60	49.20	4.70	0.30	10,540	2.00	Non-coking.
9355	„ 5	Top bench, face of Main level		15.90	29.90	49.70	4.50	0.33	10,540	3.00	Non-coking.
		Princeton-B.C. Colliery Co., Ltd.—									
9356	„ 5	Lower bench		16.40	28.50	49.70	5.40	0.40	10,540	3.00	Non-coking.
9357	„ 5	Top bench		15.20	28.50	47.10	9.20	0.70	10,075	3.00	Non-coking.
	1927.	Corbin Coal & Coke Co., Ltd.—									
9358	Jan. 25	No. 4, run of mine		1.20	18.30	66.10	14.40	0.06	11,880	.....	Poor.
9359	„ 25	No. 6, run of mine		0.80	17.10	67.70	14.40	0.30	12,245	1.00	Good.
9360A	„ 25	Washed coal, 4- by 1-inch		0.60	16.90	67.90	14.60	0.08	12,090	.....	Good.
9361	„ 25	¾-inch slack, unwashed		0.70	19.30	66.50	13.50	0.22	12,245	1.00	Fair.
9362	„ 25	Washed steam		0.30	17.40	68.00	14.30	0.12	12,400	1.00	Good.
		Corbin Coals, Ltd.—									
9363	„ 25	Washed steam, 1½-inch		0.50	20.10	64.40	15.00	0.13	12,090	5.50	Good.
9364	„ 25	Washed furnace, 4- by 1½-inch		0.60	19.00	67.00	13.40	0.12	12,245	2.00	Good.
9365	Feb.	Tulameen coal, J.D.G		17.70	30.40	41.90	10.00	0.23	9,470	.....	Non-coking.
9366	„	Coke from Victoria Gas Works		3.00	3.40	70.20	23.40	0.75	10,307	.....	

ASSAY OFFICE.

REPORT BY D. E. WHITTAKER, PROVINCIAL ASSAYER.

During the year 1930 there were made by the staff in the Government Assay Office 4,322 assays or quantitative determinations and 475 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	$293.65
Fees for assaying	50.00
Fees for assayers' examinations	120.00
Total cash receipts	$463.65

Determinations and examinations made for other Government departments for which no fees were collected:—

Attorney-General's Department	422.00
Agricultural Department	4,530.00
Board of Health	620.00
Treasury Department	12.00
Forest Branch	575.00
Other departments	280.00
	$6,439.00
Value of work done outside of Mines Department work	$6,902.65

The value of gold melted during the year 1930 was $810 in eight lots, as compared with $642 in ten lots in 1929.

FREE DETERMINATIONS.

In addition to the above quantitative work, about 2,100 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 1930 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 May 10th and December 13th, 1930. Three candidates applied for examination on May 10th and passed the examination on that date. Two candidates applied for examination on December 13th and one passed the examination on that date. One candidate applied for exemption under section 2, subsection (2), of the Act on December 13th. The Board recommended that certificates be issued to the above-mentioned five candidates.

In accordance with the recommendation of the Board, certificates have been duly issued by the Honourable the Minister of Mines to the five 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.
Archer, E. G.....Anyox.
Armstrong, N.....Vancouver.
Ayres, D. A.....
Austin, John W.....Vancouver.
Backus, Geo. S.....Britannia Beach.
Baker, C. S. H.....
Bajus, N. J.....Vancouver.
Barke, A. C.....
Beilby, E. B.....Vancouver.
Bernard, Pierre.....Monte Christo, Wash.
Bishop, Walter.....
Boulding, J. D.....Vancouver.
Brachat, Victor A.....Victoria.
Broughton, F. W.....Vancouver.
Buchanan, James.....Trail.
Buehman, A. S.....Trail.
Campbell, Colin.....New Denver.
Carmichael, Norman.....New York.
Church, George B.....
Clarke, E. R.....Vancouver.
Cobeldick, W. M.....Scotland.
Collison, H.....Cobham, England.
Comrie, George H.....Vancouver.
Cotton, G. W.....Trail.
Craufurd, A. J. F.....Rossland.
Crerar, George.....
Crompton, S. V.....Vancouver.
Crossley, C. E.....Nelson.
Cruickshank, G.....
Davidson, J. R.....Sacramento.
Day, Athelstan.....Duncan.
Dedolph, Ed.....
Dockrill, Walter R.....Chemainus.
Dunn, G. W.....Rossland.
Edwards, A. H.....Trail.
Farquhar, J. B.....Vancouver.
Fingland, John J.....Kaslo.
Gardner, C. S.....Victoria.
Goedbloed, L. A.....Vancouver.
Grimwood, G. H.....Rosebery.
Grosvenor, F. E.....Vancouver.
Hamilton, Wm. J.....Anyox.
Hannay, W. H.....Trail.
Harsant, R. C. C.....
Hart, P. E.....
Hawkins, Francis.....Lake Hill.
Hawes, F. B.....Vancouver.
Hodgson, A. R.....Anyox
Hurter, C. S.....Prince Rupert.
Irwin, George E.....Vancouver.
John, D.....Haileybury, Ont.
Kiddie, Geo. R.....California.
King, R.....
Kitto, Geoffrey B.....Victoria.
Lang, T. F.....Vancouver.
Langley, A. G.....Revelstoke.
Laucks, I. F.....Seattle.
Lee, Fred E.....Trail.
Lee, Geo. M.....
Ley, Richard H.....Victoria.
Levy, Frank.....
Lindsay, W. W.....Kimberley.
Locke, V. F.....Vancouver.
Longworth, F. J.....Boyds, Wash.
Mailleue, G.....Vancouver.
Manning, S. M.....Trail.
Marston, R. W.....Allenby.
Martin, S. J.....
Marsh, Richard.....Spokane, Wash.
Marshall, H. Jukes.....Vancouver.
Marshall, William S.....Ladysmith.
Meale, Eric A.....East Helena, Mont.
Merrifield, T. T.....Trail.
Miles, Arthur D.....
Milne, A. S.....Vancouver.
Mitchell, Charles T.....Copper Cliff, Ont.
McBride, D.....Trail.
McCormick, Alan F.....Ruth, Nevada.
MacDonald, Alec C.....Vancouver.
MacDonald, J. S.....Vancouver.
McIntosh, J. H.....Bamberton.
McIntosh, R. H.....Vancouver.
McLellan, R. D.....Vancouver.
Morgan, Richard.....Trail.
Nicholls, Frank.....Norway.
Okell, S. E.....Vancouver.
Parker, Robt. H.....
Parsonow, W. L.....
Perkins, Walter G.....
Pickard, T. D.....Vancouver.
Pirrie, Noble W.....Victoria.
Poole, H. W.....Vancouver.
Prior, C. E.....Hedley.
Puder, H. F. H.....Vancouver.
Raht, K.....Trail.
Richmond, Leigh.....Duncan.
Ringwood, J. G. T.....Vancouver.
Robertson, T. R.....Vancouver.
Rodgers, Ch. B.....
Rogers, G. J.....Knutsford.
Rombauer, A. B.....Butte, Mont.
Schroeder, Curt A.....
Segsworth, Walter.....Toronto, Ont.
Shepherd, G. H.....North Vancouver.
Sharp, Bert N.....Spokane.
Sharples, H.....Vancouver.
Shore, J. T.....Vancouver.
Sim, Chas. John.....Monte Carlo.
Sloan, Wm.....Vancouver.
Snyder, Blanchard M.....
Stephen, Wm. Gordon.....Vancouver.
Stimmel, B. A.....Trail.
Stockly, Galt.....Princeton.
Sundberg, Gustave.....Mexico City.
Tally, Robert E.....Spokane, Wash.
Taylor, E. S.....Vancouver.
Taylor, H. I.....Vancouver.
Teed, A. J.....Vancouver.
Thirkell, V. R.....Vancouver.
Thomas, Percival W.....Vancouver.
Tretheway, John H.....
Turner, H. A.....Vancouver.
Vance, John F. C. B.....Vancouver.
Van Agnew, Frank.....Siberia.
Vaughan-Williams, V. L.....California.
Wales, Roland T.....
Watson, Wm. J.....Ladysmith.
Watson, Thomas.....Vancouver.
Welsh, J. Cuthbert.....Butte, Mont.
Wells, Ben T.....
West, Geo. G.....Vancouver.

Under section 2, subsection (1)—Continued.

Wenerstrom, L. H.....Anyox.
Whittaker, Delbert E.....Victoria.
Widdowson, E. Walter.....Nelson.
Willemar, Douglas R.....Masset.
Williams, W. A.....Vancouver.
Williams, Eliot H.....
Williams, J. R.....Vancouver.
Wilson, Thomas S.....Windermere.
Wimberley, S. H.....Nevada, U.S.A.
Youngs, T. N.....Victoria.

Under section 2, subsection (2).

Archer, Allan.....
Blaylock, Selwyn G.....Trail.
Bisset, D. G.....Trail.
Bolton, George E.....Silverton.
Brennan, Charles Victor.....Britannia Beach.
Browne, R. J.....Rossland.
Browne, P. J.....Nelson.
Bryant, Cecil M.....Victoria.
Bryden, James.....Trail.
Burwash, N. A.....
Cavers, Thomas W.....
Clothier, George A.....Nanaimo.
Cole, Arthur A.....Cobalt, Ont.
Cole, G. E.....Rossland.
Cole, L. Heber.....Ottawa, Ont.
Collins, H. E.....Stewart.
Conway, E. J.....Vancouver.
Coo, Cecil William.....Toronto, Ont.
Coulthard, R. W.....
Cowans, Frederick.....
Dawson, V. E.....Trail.
Dempster, R. C.....Rossland.
Dempster, A. S.....Rossland.
Dixon, Howard A.....Toronto, Ont.
Eardley-Wilmot, V. L.....Ottawa.
Ethredge, F. M.....Anyox.
Fotheringham, D. F.....Trail.
Galbraith, M. T.....
Gilman, Ellis P.....Vancouver.
Gray, Stanley.....
Green, J. T. Raoul.....Blairmore, Alta.
Guess, George A.....Toronto, Ont.
Harding, Wilson M.....
Heal, John H.....
Hearn, Roy D.....Trail.
Hilliary, G. M.....Idaho, U.S.A.
Howells, J. O.....Calgary, Alta.
Johnston, William Steele.....Lachine, Que.
Kaye, Alexander.....Vancouver.
Kendall, George.....Vancouver.
Kidd, G. L.....Edmonton, Alta.
Kilburn, Geo. H.....Victoria.
Lathe, Frank E.....Montreal.
Lay, Douglas.....Hazelton.
Lewis, Francis B.....South Africa.
Mellish, Albert Henry.....Premier.
Merrit, Charles P.....
Millen, J.....Trail.
Murphy, C. J.....St. Catharines, Ont.
Musgrave, W. N.....England.
McArthur, Reginald E.....
McBean, K. D.....Trail.
McLeod, Norman A.....Britannia Beach.
McDiarmid, S. S.....
McGinnis, Wm. C.....Queen Charlotte Isls.
McKay, Robt. B.....Vancouver.
McLellan, John.....Skidegate.
McMurtry, Gordon O.....
McNab, J. A.....Thompson, Nevada.
McPhee, W. B.....
McVicar, John.....Edmonton, Alta.
Maclennan, F. W.....
Moran, P. J.....Sandon.
Newton, W. E.....Nelson.
Nicolle, C. C.....Kirkland Lake, Ont.
Norrie, James P.....Vancouver.
Oliver, Chas. E.....Vancouver.
Oughtred, S. W.....Ainsworth.
Outhett, Christopher.....Kamloops.
Owen, Francis J.....Trail.
Pellew-Harvey, Wm.....London, England.
Pemberton, W. P. D.....Victoria.
Reid, J. A.....Cobalt, Ont.
Ritchie, A. B.....Nelson.
Roaf, J. R.....
Roscoe, Harold M.....Anyox.
Rose, J. H.....Thompson, Nevada.
Rutherford, R. C.....Trail.
Sampson, E. H. S.....Riondel.
Scott, John Mitchell.....Stewart.
Scott, Oswald Norman.....
Shannon, S.....
Sharpe, G. P.....Midland, Ont.
Shorey, P. M.....Trail.
Sloan, David.....Three Forks.
Stevens, F. G.....Mexico.
Stewart, A. G.....Vancouver.
Stroud, J. E. C.....Anyox.
Sullivan, Michael H.....Kellogg, Idaho.
Sutherland, T. Fraser.....
Sutherland, Wm.....Glasgow, Scotland.
Swinney, Leslie A. E.....
Thompson, W. K.....Trail.
Thompson, H. Nellis.....Anaconda, Mont.
Watson, A. A.....
Watson, Henry.....
Weir, William.....Anyox.
White, E. Grove.....Stewart.
Willis, F. S.....Trail.
Winslow, R. H.....Vancouver.
Wilson, Ridgeway R.....Victoria.
Workman, Ch. W.....
Wright, Richard.....Rossland.
Wynne, Llewellyn C.....
Yuill, H. H.....

Under section 2, subsection (3).

Carmichael, Herbert.....Victoria.
Galloway, J. D.....Victoria.
(Provincial Mineralogist.)
Harris, Henry.....Tasmania.
Hedley, Robt. R.....Vancouver.
Kiddie, Thos.....California.
Marshall, Dr. T. R.....London, England.
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 Joseph T. Mandy, Resident Mining Engineer (Headquarters, Prince Rupert).

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. It embraces the Pacific drainage area of the Province from Seymour inlet to the Yukon boundary and all of the Arctic drainage area of the Province north of the Peace river and its tributaries.

Three main topographical features characterize the district. On the west is the comparatively low-lying coastal area of intensely indented and irregular shore-line and numerous islands varying in size from mere reefs to the two large islands of the Queen Charlotte group of about 2,000 to 2,500 square miles in extent. To the east the coastal area gradually rises through rugged, mountainous terrain to the crest of the Coast range, from 7,500 to 9,000 feet altitude. This forms the central spine of the district, which in turn descends to the comparatively rolling, though in places still rugged, Interior plateau of from 2,000 to 2,500 feet general altitude.

These three topographically distinctive sections of the district are further characterized by distinctive geological and climatic features, with corresponding flora and fauna. Decided, in places excessive, moisture precipitation, with mild and comparatively equable temperature, marks the coastal area. Diminution in rainfall, a heavy winter snowfall, and less equable seasonal temperature characterizes the Coast Range section. The Interior Plateau region is featured by moderate rainfall and snowfall and a marked difference in seasonal temperature.

The dominant factor in the geology of the three distinctive sections, particularly from an economic standpoint, is the Coast Range granodiorite batholith. This has been intruded into or underlies the various formations in the district. Most of the ore occurrences in the district are related to or affected by the batholith. The importance to the mining industry of No. 1 District of the detailed study of the geology relative to the Coast Range batholith was very definitely stressed in the 1929 Annual Report. It is pleasing to note that during 1930 a greater interest in and study of batholithic geology has been displayed by the prospectors and operators of the district. A greater clarity is consequently emerging from the complexity of factors that govern the genesis and conditions of mineral-deposition in various areas of the district. This is a practical and constructive outcome that will aid in accelerating the bringing-in of future producers and in directing the expenditure of exploration and development funds along the most productive channels. In view of this, and for the purpose of indicating important lines of study, a short discussion of some of the outstanding features relative to the mineralization characteristics of the district may be of interest.

Geologic Discussion.

The immense Coast Range granodiorite batholith strikes through the district, with its long axis trending in a north-westerly direction. Its intrusion corresponds to about the Lower Jurassic period and probably extended into Tertiary time. The batholith reaches its apex in the high-altitude, central, or Coast Range area. Its eastern flank plunges steeply under the sedimentary and igneous rocks of the eastern contact margin bordering the Interior plateau. Westward of the apex it undulates gradually through the low-lying coastal area and plunges steeply beneath the sedimentary and igneous rocks of the Queen Charlotte islands, the most westerly land-mass of the Dominion.

Erosion, particularly that of the glacial epoch, has played an important part in carving the present surface contour and exposing the present rock types. The degree of erosion is of prime importance in computing ore potentialities of various mineral occurrences in the district. In places great areas of the original ancient surface have been denuded down to the underlying batholithic rocks, exposing extensive outcroppings of the granitic complex. In other sections only a thin shell, or small isolated patches of the older rocks, with numerous granitic apophyses and satellitic dykes cutting through them in all directions, are left superimposed on or included in the underlying batholith. Other sections of the central batholithic zone comprise numerous extensive pendant and inclusion areas of the older formations.

This central section of batholithic rocks, with its areas of roof segments or remnants, pendants and inclusions, has a width of about 160 miles from its western contact margin at the Queen Charlotte islands to the eastern contact margin at the westerly fringe of the Interior plateau. Along these marginal zones of the easterly and westerly plunge of the batholith flanks, especially that of the eastern flank, numerous spurs and bosses, satellitic to the main batholith mass, intrude the appreciable thickness of overlying older formations that spread easterly through the Interior plateau to the Height of Land between the Pacific and Arctic drainage. An ideal sectional diagram illustrating these batholithic and relative features of the district is published in the 1929 Annual Report, to which readers are referred.

In the north-eastern section of the district, and occupying approximately the Height of Land area, the so-called Cassiar batholith of uncertain Lower Cretaceous age crosses into Yukon territory, trending north-west and approximately parallel with the Coast Range batholith. It is highly probable that this generally conceded individual batholith is actually relative and satellitic to the main Coast Range batholith, and represents merely a remote effusion from the main batholithic magma.

Certain features of ore-genesis, mineralization, and mode of mineral occurrence characterize the three distinctive sections of the district. In the western contact margin copper-bearing and magnetite contact-metamorphic and replacement ore-bodies predominate in the Triassic sedimentary and igneous rocks overlying the batholith. Less widespread are gold-bearing quartz veins, probably younger in origin than the copper ore-bodies. Silver-lead-zinc mineralization occurs as a minor accessory. In the sedimentary rocks of Cretaceous and Tertiary age coal occurs. Deposits of hydrocarbon compounds are also known. Superficial clay-deposits are widespread.

In the central or pendant and inclusion area replacement cupriferous ore-bodies predominate. Contact-metamorphic copper and magnetite ore-bodies also occur, but are less frequent than in the western contact margin. Galena and zinc-blende mineralization, however, becomes more intensified than in the western contact margin. In the granitic rocks of the batholith in this section, particularly those tending to a hornblende content, such as quartz diorite, high-grade gold-bearing pyrite in quartz veins frequently occurs. Deposits of molybdenite are also known. Limestone, marble, possible building and ornamental stone, and superficial clay-deposits are widely distributed in this section.

In the eastern contact margin zinc-blende and galena mineralization with a variable low to high silver content predominates in vein occurrences, or forms an important accessory accompanying mineralization in siliceous replacement ore-bodies carrying appreciable silver and gold values. Vein and replacement copper ore-bodies occur in minor degree. Placer-gold deposits occur in pre-, inter-, and post-glacial gravels. The diversified silver-zinc-lead mineralization and the tendency to an intensification or suppression of either the zinc or lead element, with a corresponding increase or decrease in silver content, appears to be related to distinctive lithological conditions. This feature is also indicative of definite period and horizon conditions governing deposition. A similar and possibly associated relationship of gradation of zinc-lead mineralization appears to accompany both the siliceous replacement silver-gold and copper ore-bodies of this section. To single out one element, the predominating deposition motive or indicator in the complex mineralizing solutions of the eastern contact margin seems to be zinc. This characteristic seems to indicate a definite genetic condition that may help in determining details of genesis and potential prospects of various occurrences in this section.

Throughout the three sections from the western contact margin to the eastern contact margin the genetic feature indicated by type-mineralization is the existence of a general chemico-temperature horizon affecting the mineralization occurring in the district from east to west. High-temperature mineralization predominates in the western contact margin and gradually diminishes to a preponderance of medium- to low-temperature mineralization in the eastern contact margin. As mineralization has been practically established as being derived from aqueous and gaseous emanations related to the batholith, the natural inference, then, is that the batholith was gradually intruded from west to east, with a resultant general pressure from the west. In this there is a general foundation of a genetic and structural influence from which to work.

Subsidiary to this general principle, but of foremost practical importance to the mining industry, is the application of its local phases to individual ore-deposits, each with its own

definite characteristics. There is such a wide variation in possible subsidiary genetic and structural influences throughout the district, and especially along the important eastern contact margin, influences of local intrusive masses or spurs, conformities and unconformities of formations, lithological variations and irregularities, wide local differences in depth of the basal batholith (mineralizing influence) below the ancient surface, extreme local differences in the intensity of erosion, that practically each individual deposit contains its own problems.

In certain instances in the district these local problems are comparatively simple and clarity can be readily established. In others they resolve themselves into a combination of complicated and obscured factors needing lengthy, detailed, and expert study. In the 1929 Annual Report, what is considered by the Resident Engineer to be the most important and perhaps the most interesting and complicated problem of this category in the district, the problem of the Salmon River-Cascade Creek replacement deposits, was stressed. Some time was again devoted by the Resident Engineer during the 1930 season to the study of this section. As a result of this work the inference made in the 1929 Annual Report, that a chemico-temperature horizon of commercial ore-deposition and the localization of commercial ore-shoots and variations of mineralization to definite rock-types of certain chemical composition does exist in the Salmon River-Cascade Creek area, is strengthened. Important indicators in this respect are:—

(1.) A decided difference in gangue and metallic mineral texture between the lower and upper horizons of the *Premier-B.C. Silver* ore-zone.

(2.) A tendency to erratic silicification and distribution of values in the lower levels of this zone.

(3.) An apparent general southerly plunge or rake to the commercial ore-deposition horizon.

(4.) The indicated extension of characteristics (2) and (3) from south to north from the *Premier* to the *Big Missouri* and beyond, along silicified zones parallel to the *Premier-B.C. Silver* zone.

(5.) The important influence of erosion on the eradication of substantial but varying thicknesses of formation above the lower limits of the commercial ore-deposition horizon.

(6.) The absence of substantial secondary enrichment in parallel silicified zones westerly and northerly of the *Premier* zone.

(7.) The intensification of zinc-lead mineralization, and diminution of silicification and gold content, in the tuff as compared with the porphyry.

It is again stressed that the detailed elucidation of this problem will be of the utmost immediate benefit to the operators and prospectors of this area and to the future of the mining industry in the district. It is again urged that this work be undertaken by the Geological Survey of Canada.

It is of interest to note that in this important matter of ore-genesis and horizon-deposition greater clarity is emerging in connection with type-deposits in other areas of the district. In the Marmot River section of the Portland Canal Division the localization of commercial ore-shoots to definite tuff-beds and the important influence of erosion on the ore-deposition horizon is indicated. The detailed elucidation of this problem in that locality will be of decided interest to operations such as the *Prosperity* and *Porter-Idaho*.

In the Skeena Division some clarity is also evolving regarding the genetic relationship of gold-bearing pyrite in quartz veins occurring in the granitic rocks of the batholith. A study of these deposits indicates that they are mainly confined to a segregated roof phase of the more basic rock-types of the batholith, such as hornblende granite and quartz diorite. The invariable proximity to, and sometimes intimate association with, granitic pegmatite indicates that the veins were formed under conditions of comparatively high temperature. The roof or cooling cupola phase of the batholith is indicated by associated pegmatite, aplite, and crenulated segregation zones of the basic minerals, and absorption areas and patches of the pre-existing older overlying formation. The indications are that these deposits are the result of aqueo-gaseous emanations into cooling-contraction fissures and were formed at appreciable depth below the ancient surface. The present exposure of these deposits must have resulted from intense erosion of the appreciable thickness of overlying roof-rocks. In computing the commercial potentialities of this kind of deposit, typical of the exposed batholithic areas of the central pendant and inclusion section of the district, an estimate of these factors, particularly that pertaining to the intensity of erosion, should prove helpful. (These factors are further discussed under the headings of individual properties.)

Increased interest by prospectors and operators in important geological factors relative to the ore-deposits of the district has been evident during 1930. The knowledge thus gained will be of much benefit to the industry and should be decidedly encouraged. Through the elucidation of these problems funds available for development and exploration will be directed along the most likely channels. This must undoubtedly result in the more rapid materialization of producing mines than would otherwise be the case.

Production.

As a natural outcome of the average low metal prices prevailing during 1930, the production value from lode mines of the district is considerably less than for 1929.

Lode-gold output in 1930 shows a decrease as compared with that of 1929, due mainly to the lower-grade ore being mined at the *Premier* and a curtailment in *Hidden Creek* operations from which some of this metal is derived. Due to an increased interest in gold-mining, possible potential production from the *B.C. Silver*, and a hopeful possible production from large low-grade ore-bodies such as the *Big Missouri*, the outlook for sustained gold production from the district is encouraging.

Silver shows a substantial increase in quantity, but, due to the depressed price for this metal, a decided decrease in value, compared with the 1929 figures. Production from the *Prosperity* and *Porter-Idaho* and an increased output from the *Premier* are responsible for the increased quantity production of this metal. Future increased production of silver from the North-western District will depend largely on a substantial improvement in the market price of silver.

Copper production from the district shows a decided decrease in both quantity and value during 1930 as compared with 1929, due to the low prices resultant from general industrial depression. The lowering of costs at the *Hidden Creek* mine of the Granby Consolidated Mining, Smelting, and Power Company, and encouraging results obtained from further exploration of this property, promise continued appreciable copper production from this property for several years to come.

The resources of the district in magnetite, coal, clays, and structural material hold promise of future potential production from these sources that will accompany the industrial expansion of the North-western District.

During 1930 the two steadily producing mines of the district, *Hidden Creek* at Anyox and *Premier* in the Portland Canal section, have continued with uninterrupted, though curtailed, output, despite the handicap of depressed metal-market conditions.

Two new producing mines, the *Prosperity* and *Porter-Idaho*, in the Portland Canal section, were brought to continuous production by the Premier Gold Mining Company. When it is considered that the value in the ores of these properties is primarily in silver, that the silver market was acutely depressed and uncertain, and that extremely difficult construction and mining conditions confronted these operations, this achievement and its profitable result reflects great credit on the staff and organization of the Premier Gold Mining Company.

The low prevailing price of copper, the stagnation in the market for this metal, and the consequent piling-up of surplus stocks, necessitated a curtailment in production from the *Hidden Creek* mine of the Granby Consolidated Mining, Smelting, and Power Company. This situation was met by a proportionate curtailment of the mine, concentrator, and smelter operations. To offset these conditions a creditable reduction in per pound copper-production cost was effected at this property. Profits, however, showed a considerable decrease.

A curtailment in production by the Premier Company was necessitated late in December by the fact that surplus ore-supply and a depressed metal market prevented the smelter from taking the normal output of this operation. This situation was met by a curtailment of one day's operation a week at *Premier*, *Porter-Idaho*, and *Prosperity*. Improvements in mill operation resulting in increased efficiency and lower costs have, however, been worked out and applied at the *Premier* mine. At the *Prosperity* and *Porter-Idaho* production costs have been persistently lowered throughout the year. With exceptionally loose ground, short and erratically mineralized and aligned ore-shoots to contend with, this is a noteworthy achievement.

Late in the season a shipment of 5 tons of high-grade silver ore was made by the Argentine Syndicate from the *Kenneth* group, Portland Canal Division. Late in December trial shipments

of about 82 and 75 tons of gold-bearing pyrite ore were made from the *Surf Point* property, Skeena Division, to the Granby Company's smelter at Anyox.

As an outcome of the general depression prevailing during 1930, the acceleration of future increased production from the bringing-in of new producing mines in the district has been retarded. The curtailment and in some instances temporary cessation of development and exploration on several properties will have its proportionate time effect on potential future production that may eventually materialize from such properties. Low metal prices and metal-market uncertainties will also proportionately affect future production value from the stable producers. Future increase in tonnage and value output from mines of the district—excepting gold—is entirely dependent on a return to normal world economics. In this respect it must be noted that low metal prices directly and adversely affect ore-reserve tonnage. Grade that could be calculated as ore reserve with the high metal prices prevailing in 1929 cannot be calculated as ore reserve on the basis of the 1930 low metal prices. Stand-over ore reserves from 1929 to 1930 would consequently call for a complete revision to conform to the low 1930 metal prices. In District No. 1 copper and silver reserve in Granby and Premier operations will be adversely affected in this respect. This will also be reflected in by-product gold reserve associated with this class of ore. Offsetting this to some extent is the achievement of lower production cost.

The fact that the depressed conditions prevailing during 1930 have been met by uninterrupted production from the stable producers, by increased efficiency and lowering of costs, the bringing-in of two new producers, and the advancing of several promising properties to stages appreciably closer to that possibility is, however, a sound tribute to the stamina, stability, and future potentialities of the lode-mining industry in the North-western District. Economies and increased efficiency that have materialized will be lasting. When conditions return to normal the lode-mining industry of the district will be on a sounder footing than ever before and better fitted to reap the utmost harvest.

Production in 1930 from placer-gold operations shows a significant increase over that of 1929. This has come largely from the Atlin Division. Increased interest in this branch of the industry by individuals and company organizations, coupled with more conservative preliminary exploration of placer-ground, has been evident during the past year in the Stikine, Liard, and Atlin Divisions. This condition, coupled with the fact that several large operations are approaching the production stage, and that extensive areas of promising placer-ground still remain to be attacked, augurs a gradually increasing gold production from this source during future years.

The following list gives the production from lode mines in No. 1 District during 1930:—

Name.	Ore.	Gold.	Silver.	Copper.	Lead.
Portland Canal Mining Division—	Tons.	Oz.	Oz.	Lb.	Lb.
Argentine Syndicate	5	1	1,562	.....	467
Black Hill	1	.....	112	10	168
Dunwell	5	18	319	.....	4,238
Marmot Metals	4	.....	793	.....	338
Northern Metals	20	.....	2,871	.....	6,651
Porter-Idaho	3,731	58	272,797	.....	143,901
Premier	256,836	87,031	2,542,668	50,639	1,230,272
Prosperity	18,049	384	1,364,729	.....	916,135
Nass River Mining Division—					
Bonanza	88,317	347	27,515	2,837,448	.....
Granby Point	665	72	2,344	.....	.....
Hidden Creek	1,423,200	2,788	226,346	27,713,975	.....
Totals	1,790,833	90,699	4,442,056	30,602,072	2,302,170

The placer-gold output from No. 1 District for 1930 was 3,515 oz., valued at $59,755, as compared with $47,821 in 1929. This shows an increase of 25 per cent.

Development.

Development in both lode and placer mining has been steadily pushed on many properties during 1930. Depressed financial conditions have, however, to some extent, temporarily retarded development in the district, especially in connection with base-metal and silver properties.

The harnessing of Falls river by the Northern B.C. Power Company and the completion of the first unit plant of 6,000 horse-power for utilization primarily in the city of Prince Rupert is of eventual importance to the mining industry. This source of power has a potential capacity of 32,000 horse-power. From four different sources a total of about 82,000 horse-power has been ascertained. This company has also investigated the power possibilities of the Meziadin Lake area in the Nass River basin. United States interests have been considering the construction of a power plant on Davis river, on the Alaskan side of Portland canal.

Development and exploration has continued uninterruptedly on the major lode-mining operations of the district: *Hidden Creek* (Granby Consolidated), *Premier*, *B.C. Silver*, *Prosperity*, *Porter-Idaho*, and *Big Missouri*. Continuous development has also been carried out on the *Surf Point* (Porcher island) and on the *Tidewater Molybdenum* at Alice Arm. Although depressed financial conditions that prevailed generally caused a curtailment of development on several of the smaller properties, work has been fairly actively prosecuted.

Of outstanding interest is the success attending development of the *Prosperity* and *Porter-Idaho* by the Premier Gold Mining Company in the face of severe technical and metal-market difficulties. The decision of the Consolidated Mining and Smelting Company of Canada to erect a pilot concentrating-sampling mill on the *Big Missouri* to determine the commercial possibilities of this deposit is of prime importance. The outcome of this development and exploration operation will have a far-reaching effect on the future of the mining industry in the Stewart area.

At the *Hidden Creek* and *Bonanza* operations of the Granby Consolidated Mining, Smelting, and Power Company active exploration for continuity of the known ore-bodies has met with encouraging results. Depth development below zero-level on the *Hidden Creek* deposits indicates promising possibilities for additional ore reserves from the lower horizons. Development on *Bonanza* also indicates appreciable further ore-reserve possibilities in the westerly continuity of this zone.

Premier development has been actively pushed on the No. 6 level, but indicates mineralization and values on this horizon to be erratic. On the other hand, work on the upper horizons has resulted in the development of smaller good-grade ore-shoots, lateral and probably satellitic to the main ore-zone. These lateral ore-shoots are an important factor in the augmentation of *Premier* ore reserve and additional possibilities of this category still remain to be explored and developed.

Development on the *B.C. Silver* has been concentrated on the No. 6 level horizon, conforming to *Premier* No. 4 level. Raising from this level on the *B.C. Silver* has been started and should result in the definite development of additional indicated ore reserves which should strengthen the position of this property in the matter of future contemplated production.

On several of the smaller properties encouraging development results promise additional producers in the not-distant future. Worthy of mention is the progress made on the *Surf Point*, Skeena Division, from which some gold-output can be expected, and on the *Tidewater Molybdenum*, Nass River Division.

Noteworthy progress with encouraging results has been made in the development of the *Kenneth* (Argentine Syndicate) and *Unicorn* properties in the Portland Canal Division. In this Division active development and exploration was also carried out on the properties of the Georgia River Gold Mines, Limited; Bi-Metallic Syndicate; Silverado Consolidated Mines, Limited; Mayou Gold Copper Company, Limited; George Enterprise Mining Company, Limited; Mountain Boy Mining Company, Limited; and several other properties and many groups of claims.

In the Queen Charlotte Division development of the *Skidegate-Southeaster* groups has been undertaken by the Kitsault Eagle Silver Mines, Limited. Progress in the reopening and further exploration of this interesting gold prospect has been made. Active development of the old *Drum Lummon*, Skeena Division, was continued by the Los Angeles-Vancouver Mines, Limited, to the end of September, but with discouraging results. In the Atlin Division extensive development was carried out on the *Engineer* and *Atlin-Ruffner* properties.

There have been some disappointments in lode-mining development during the year and a combination of factors has in some cases resulted in the relinquishment of options on properties by operating companies. Outstanding in this respect is the discouraging development result of the *Manville* group, Taku river, which, in the face of severe option terms, compelled the abandon-

ment of the option on this property by the Alaska Juneau Gold Mining Company. Owing to generally depressed financial conditions, the extensive development of the *Tulsequah Chief*, Taku river, planned by United Eastern Mining Company for the 1930 season, was not carried out. As this work would have shed much light on the commercial possibilities of this property, its failure to materialize is regrettable. The temporary cessation of operations by the Torbrit Mining Company on the *Toric* in April, on account of the uncertain condition of the silver market, was a keen disappointment in the Alice Arm area. Several minor exploratory and development operations were temporarily suspended during the year. On others only sufficient work was carried out to hold the properties in good standing.

Placer-gold development operations have been quite active in the Stikine, Liard, and Atlin Divisions. A greater interest is being displayed generally in this phase of the mining industry. There is also a gratifying tendency to more conservative and calculated preliminary exploration of placer-ground before commencing operations. This is gradually placing this branch of the mining industry in No. 1 District on a sound foundation, which will greatly assist in restoring it to the position of importance occupied by it in former years.

In the Liard Division good progress has been made on Mosquito creek by the Gibson Hydraulic Association and on Dease creek by the Cassiar Hydraulic Mines, Limited. These developments promise an appreciable increase in placer-gold production from this Division during 1931.

In the Atlin Division, Consolidated Mining and Smelting Company is progressing slowly towards production from Boulder creek. On Otter creek, Compagnie Française des Mines d'Or du Canada has made noteworthy progress with the assistance of a substantial water-supply. Discovery Mining and Power Company has also carried out active stripping development on Pine creek. On the several other known gold-bearing creeks of the Atlin section, individuals and small syndicates have been very active with development-work that promises increased production.

Summarizing development-work carried out in No. 1 District during 1930, it can be said that, despite the prevailing general depression, the work accomplished has decidedly reinforced the stability of every phase of the mining industry in the district. This is apparent in:—

(1.) Prospects for additional ore reserves in the producing mines that promise continuous production for an appreciable time.

(2.) Prospects for new producers in the not-distant future.

(3.) Encouraging development results on several prospects.

(4.) Greater conservatism and calculation in development operations.

(5.) Increased efficiency and lowering of costs.

(6.) Greater tendency to conservative and calculated development in placer-gold operations.

(7.) Encouraging production results from placer-gold developments.

The outlook resultant from the 1930 development operations is definitely bright and decidedly outweighs the sum-total of disappointments.

New Discoveries.

Although there have been no new discoveries of outstanding importance in No. 1 District during 1930, several discoveries of interest have been made.

On the *Nifty* group, Bella Coola Division, a lead-zinc-silver discovery by Consolidated Mining and Smelting Company prospectors was extensively explored.

In the Skeena Division discoveries of gold-bearing pyrite in quartz veins in batholithic rocks have been made on the *Hunter* group, Khutze River area, and on the *Eddy Pass* group on Porcher island. On Porcher island also a well-defined vein carrying promising chalcopyrite mineralization was uncovered on the *Copper Coin* group in the pendant schists overlying the batholith.

In the Nass River Division recent discoveries are directing attention to the gold possibilities of the west side of the upper Kitsault River area. Recent discoveries also indicate the probability of base-metal replacement ore-bodies in some of the porous tuff-beds of the upper Kitsault River valley.

In the Portland Canal Division several new discoveries have been made on old properties. Noteworthy in this respect are promising discoveries of silver-lead-zinc ore on the *Kenneth* group, a new copper-bearing zone carrying interesting gold values on the *A. and T.* group, and a large

siliceous replacement zone carrying galena and zinc-blende mineralization on the *Palmey* group. On the *Salmon Gold* group in the upper Salmon River valley an exceptionally interesting discovery of appreciable pyrrhotite ore-bodies carrying persistently good gold values has been made by Ted Morris, of Stewart.

Of interest to the future of the Unuk River area, Portland Canal Division, is the discovery of a new route into the mineral-belt of that area by Arthur Skelhorne, prospecting for the Mining Corporation of Canada. This may prove of great utility in the matter of future access to this section.

In the Stikine River area a discovery of chalcopyrite ore was made early in the season on the *Drapich* group near Jackson's Landing. Additional discoveries of promise have also been made by Pete Hamel on the *Central* group on Devils Elbow mountain. Several discoveries have also been made in the Iskut River area.

In the Atlin Division several new discoveries, but of generally low-grade tenor, have been made in the Taku River area. Notable amongst these is the discovery made by Neil Forbes, an Alice Arm prospector, of an extensive silicified zone carrying consistently interesting, though low grade, gold values. On the *Whitewater* group another zone of antimoniferous ore carrying good gold values has been discovered. In the Rainy Hollow section of the Atlin Division fifteen new veins carrying low gold values have been uncovered on the *Gold Cord* (old *Stampede*).

Prospecting.

In comparison with former years, prospecting in No. 1 District has been quite active. There has, however, been a reduced inclination on the part of prospectors to venture too far from available arteries of transportation. This is doubtless wise and constructive. It would seem that a little more discretion in this respect is timely. It is, of course, essential to the progress of a new country that the hinterland should be explored. It would seem, however, that this would be definitely assisted and perhaps accelerated by first deriving the utmost from the foreground, the industrial development of which must necessarily lead to the harvesting of the hinterland. A concentration of prospecting effort in the extensive promising and more accessible areas still available to the prospector will not only bring quick reward to the discoverer of valuable mineral and be of immediate benefit to the industry, but will surely and rapidly lead to the development of the hinterland.

In No. 1 District many very promising sections in areas known to be mineralized are still very slightly or not at all prospected. There is also a tendency with many prospectors to camp at the first discovery of mineral, without prospecting the vicinity for showings perhaps better and more worthy of development than the original discovery. In this way it is frequently the good fortune of some subsequent prospector to come in, prospect in the neighbourhood of the original discoverer, and through a better discovery reap the reward that should rightfully belong to the original discoverer. In this respect it can be said that the bulk of the mineral claims already staked in the known accessible mineral areas of No. 1 District are as yet only very sparingly prospected. Many of them, at present lying dormant, may contain mineral-showings of much greater promise than those on which work has been done.

Although every Division, with the exception of Atlin, shows a decided decrease in the number of claims recorded during 1930 as compared with 1929, it must be remembered that 1929 was a boom year. In 1930 greater conservatism and judgment was exercised by prospectors in the staking and recording of their discoveries.

Due to the deflation of base-metal prices a more intensive search for gold has naturally materialized. Increased attention to the study of economic geological factors relative to the ore-deposits of the district is proving of much benefit to the prospector. The inauguration by the Department of Mines of classes for prospectors during 1930 proved of much constructive benefit and greatly assisted in stimulating interest in the prospecting phase of the industry. These classes, ably conducted by Geo. E. Winkler, were held at central points in the district during the late winter months. They were very well attended by not only the confirmed prospector, but a marked and increasing interest was displayed by the general public of both sexes.

The attention of prospectors is especially directed to the recent publication of "Prospecting in Canada," compiled by members of the Geological Survey of Canada. This is an admirable work, excellently illustrated, and contains a fund of clearly and simply stated information. In it are many detailed references to factors relative to prospecting in British Columbia, includ-

ing District No. 1. Prospectors are urged to acquire this work and study it intensively. The literature cited in the 1929 Annual Report under the heading of "Geologic Discussion" is also recommended. Some information that may be useful to prospectors is also contained under the same heading accompanying this report.

It is gratifying to note that prospecting activity in the coastal area of the Skeena Division has shown a marked increase during 1930. The importance and promise of this area has been stressed in former reports. The types of the batholithic rocks conducive to gold-deposition referred to under the heading of "Geologic Discussion" in this report are especially recommended to the coastal-area prospector at this time. The exposed rocks of the batholith have hitherto been shunned by the majority of prospectors. It is becoming increasingly apparent, however, that the segregated roof-phase rich in ferro-magnesian minerals, especially hornblende, are favourable for deposition of gold-bearing pyrite veins. These segregated cupola areas are easily recognized and should be intensively prospected.

Another easily accessible area as yet very little prospected is the interior of Moresby island of the Queen Charlotte group. This area is favourable for replacement chalcopyrite ore-bodies, with a tendency in some sections to gold-deposits. It is also recommended for intensive prospecting. On Graham island, Queen Charlotte group, the attention of prospectors is directed to the investigation of the Cretaceous and Tertiary sedimentary beds for phosphate contents.

In the Nass River Division intensive prospecting is recommended in a pendant area that occurs between the Kitsault glacier and the head of Hastings arm. On the west side of the upper Kitsault valley contiguous to a dioritic intrusive exposed along the higher altitudes many heavily oxidized pyritized zones occur. It is recommended that these be intensively prospected for gold possibilities. In this area it is also recommended that the porous tuff-beds of the Dolly Varden series on both sides of the upper Kitsault valley be closely examined for disseminated or replacement base-metal ore-bodies. An indicator for this type of mineralization will be found in a rather obscurely coloured zinc-blende accompanied by a yellowish bloom of possibly the sulphide of cadmium, greenockite.

In the Stewart section of the Portland Canal Division prospecting has been very active in the upper American Creek area. This area is worthy of intensive prospecting and increased interest will probably be displayed in it during the 1931 season. Many of the older known sections of the Portland Canal area are still only partially prospected, and on many of the already staked properties more intensive prospecting will undoubtedly be rewarded by additional showings. Concentration on this phase of prospecting is recommended in the Portland Canal area.

In the Stikine, Liard, and Atlin Divisions, although increased interest is being shown in prospecting for placer-ground, this phase is not yet receiving the attention it warrants. In these sections placer-gold operations have practically been confined to the creeks originally worked by the old-timers. Since the active placer-days of the old-timers practically no new gold-bearing creeks have been discovered or seriously prospected for. A tendency to assume that if other creeks were gold-bearing the old-timer would have discovered them seems to have prevailed. This is a false assumption. An overland traverse of the Stikine River and Dease Lake areas indicates much virgin territory still worth prospecting for placer-gold deposits, amenable to operation by modern methods. An aerial reconnaissance of the section from Atlin lake north along the British Columbia boundary to Teslin lake in Yukon territory indicates a similar condition. These areas are recommended to men interested in placer-gold prospecting.

Besides local prospectors, several prospecting-parties representing outside and Eastern interests penetrated the northern sections of the district. Amongst these were parties prospecting for Coniagas Mining Company, of Cobalt, Ontario; Mining Corporation of Canada; and Cyril Knight Prospecting Company, Limited, of Toronto.

Examining engineers representing every large local operation and engineers of several Eastern and United States companies have been very active in the district during 1930. Despite the slump in metal prices, the search for promising prospects in the district by operating companies is as keen as ever.

Non-metallics.

A slight increase in interest in the non-metallic possibilities of the district was evident in 1930. This, however, is not as yet commensurate with the potentialities of the district in this phase of the industry. The resources of No. 1 District in clay products, limestone, coal, build-

ing-stone, marble, mineral springs, and possible phosphate rock were stressed in the 1929 Annual Report. An important aid to this phase of the industry is the immediate seaboard transportation to markets which is available.

Some sand and gravel for road-construction has been excavated in Prince Rupert area. At Terrace, on the Canadian National Railway, T. Turner has been turning out bricks in a small way from a large and good-grade clay-deposit. In Gunboat passage, in the Bella Coola Division, limestone is being quarried at Beale's quarry, chiefly for use in the Ocean Falls paper plant. Of interest is the discovery close to seaboard of a deposit of bentonite. The extent and degree of purity of this deposit has not yet been ascertained, but will be investigated during the 1931 season. Further possibilities for the sillimanite occurrence in the Kumealon Inlet area will also be investigated. An occurrence of a muscovite granodiorite of excellent white colour and fine, even grain, occurring on Labouchere channel, Bella Coola Division, is worthy of investigation for a probably excellent building-stone.

Transportation.

During 1930 substantial assistance has been rendered by the Department of Mines in the construction and reconditioning of mining roads and trails. Every section of every Division has received careful consideration where the expenditure has seemed warranted. The co-operation of the Department of Public Works in this respect has also been of great value.

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

Bella Coola Mining Division.—Trail to the *Nifty* and *Thunder* groups, Thunder mountain, Bella Coola valley; Bella Coola Valley road.

Queen Charlotte Mining Division.—Jedway–Ikeda trail; Port Clements–Queen Charlotte City road; Port Clements–Masset road.

Skeena Mining Division.—North Fork Khutze River trail; Williams Creek trail, Lakelse valley; Douglas Creek trail, Kitsumgallum valley; Kitsumgallum Valley road; Lakelse Valley road.

Nass River Mining Division.—Saddle Mountain trail, Hastings arm; *Tidewater Molybdenum* trail; Illiance River road; Illiance River trail to Nass River valley; upper Kitsault River trail to Clearwater summit; continuation of trail from Red Point to *Combine* fraction.

Portland Canal Division.—*Big Missouri* road; Tide Lake trail; Bulldog Creek trail; Marmot River South Fork trail; Glacier Creek trail to *Kenneth* group; North Fork Bitter Creek trail; Mayou trail; Bear River road; Hanna River bridge; east side American Creek trail; upper American Creek Valley trail.

Stikine-Liard Mining Division.—Devils Elbow Mountain trail; Chutine River trail; Dease Lake road; Telegraph trail from Echo lake to Telegraph Creek; trail from Tahltan to Klappan river.

Atlin Mining Division.—Tulsequah River trail; Taku River South Fork trail; Otter Creek road; Fourth of July road; Surprise Lake road; Indian River road; Pine Creek road; Birch Creek road; Spruce Creek road; O'Donnel River road; Telegraph trail from Telegraph creek to Nahlin.

Aeroplanes were used to a lesser degree in 1930 than in 1929. A plane stationed at Juneau, Alaska, was frequently called on as an adjunct to transportation into the Taku River area. A plane operated by the Airlands Manufacturing Company, of Vancouver, and piloted by E. J. A. Burke. was stationed at Atlin during the season and made many flights into the interior, chiefly in connection with placer-gold prospecting north of the British Columbia boundary in Yukon territory. It is relevant to this report to chronicle the tragic death of Captain Burke on November 20th from starvation and exposure in the wilderness of the upper Liard river. A sterling flier of outstanding character and a dauntless pioneer has passed.

For transportation to mining properties in the various sections of the district, automobiles, trucks, tractors, and teams are used where roads are available. During the winter horse-drawn "go-devils" are generally used on the wider trails, or sleighs on the roads. During the summer months pack-horses are used on trails of suitable condition and are generally procurable in the various camps. Back-packing is used where horse transportation is not feasible.

As a guide to the cost of packing and general freighting in the district, the following schedule of the Crawford Transfer Company, Stewart, in the Portland Canal area, is quoted: Packing, 2½ cents a pound a day, or horse $4 a day, and man $7 a day; saddle-horses, $5 a day; heavy team,

$15 a day, including man; truck-hauling to points of delivery to pack-horses, ½ cent a pound within a radius of 15 miles (this includes horse-feed); tractor, $25 a day, including driver. These prices are subject to alteration according to conditions. On quantity contracts better prices can be obtained.

A very efficient steamer service by the Canadian National, Canadian Pacific, and Union Companies serves all main camps or feeders to them. During 1930 augmented service by the Canadian National Steamships to the Queen Charlotte islands was inaugurated. The Skeena River Valley area is efficiently served by the Canadian National Railway from the port of Prince Rupert. The Atlin area is reached by the White Pass & Yukon Route Railway and lake-boat system from Skagway, Alaska. To serve the Stikine and Liard Divisions the Barrington Transportation Company operates a very efficient and commodious river-boat system from Wrangell, Alaska, to Telegraph Creek, B.C. For the Taku River area a river-boat service operates from Juneau, Alaska, to Tulsequah, B.C.

During the 1930 season a new route into the Unuk River mineral-belt was discovered and traversed by Arthur Skelhorne, prospecting for the Mining Corporation of Canada. This route starts near the Unuk River mouth and follows Lake Creek valley across the Alaskan panhandle and crosses a comparatively low divide to the headwaters of Gracey creek, on the British Columbia side. Gracey creek is followed to the South fork of the Unuk river and Sulphurets creek. Mineral development in the Unuk River area has been held back by impractical and dangerous navigation of the Unuk River route. This new route into this promising mineral area will be investigated with a view to its possible development in co-operation with the Alaskan Government.

Geological Survey of Canada.

Commendable work by the Geological Survey of Canada has been continued during the 1930 season. This will greatly assist the prosecution of efficient work by prospectors and operators in the district.

George Hanson, with two assistants, carried out the final details of the geological survey and investigation of the ore-deposits of the Alice Arm area. F. A. Kerr, with two assistants, made a preliminary examination of the Taku River area and carried out a reconnaissance of the country east and south of the Taku River quadrangle. R. Bartlett, with two assistants, commenced a topographical survey of a 2-mile quadrangle of the Taku River section as a basis for geological work. V. L. Eardley-Wilmot, of the Dominion Mines Branch, examined the *Tidewater Molybdenum* deposit, Alice Arm. C. S. Parsons, Testing and Research Laboratories of the Dominion Mines Branch, visited the Portland Canal area.

In the section of this report captioned "Geological Discussion" attention is drawn to the genetical problem of the Salmon River-Cascade Creek area ore-deposits. This area includes the properties of the *Premier, B.C. Silver, Sebakwe, High Ore, International, Premier Border, Woodbine, Indian, Big Missouri, Unicorn, Silver Tip, Silver Crest, Forty Nine,* and several others. It is urged that the detailing of this problem relative to localization of ore-deposition horizon and ore-shoots be undertaken by the Geological Survey of Canada. The elucidation of the obscurities of ore-deposition prevailing in this section will be of unlimited practical value to prospectors and operators in that region and will greatly aid a more rapid progress of the mining industry in the Portland Canal area.

Addresses.

During the year addresses covering various phases of the mining industry in No. 1 District were given in different localities before various organizations. The keen interest of audiences indicates an appreciation of the importance of the mining industry to the progress of the country. The dissemination of information and close contact with the public in this way should assist in stimulating this interest.

Outlook.

The remarkable degree of stability displayed by the mining industry of No. 1 District during the 1930 period of deflated metal prices, stock-market decline, and general financial depression augurs well for the future potentialities of the industry in this district.

Taking the 1930 period as a test-run of the mining industry in this district, conducted under the most adverse conditions, it is found that not only has the operation continued uninterrupt-

edly, but a remarkably good extraction has been made in the face of these conditions. A tabulation of this record is illuminating:—

(1.) Stable producing mines have operated uninterruptedly.

(2.) Two new producers have been brought in.

(3.) Development has steadily progressed.

(4.) New sources of ore reserves have been developed.

(5.) Profits from all stable producers, though showing a decline, have been continuous.

(6.) Several properties have been advanced appreciably closer to the stage of production.

(7.) Development and exploration of several properties has indicated the ear-marks of potential producers.

(8.) Placer-gold production has shown a definite increase.

(9.) Production costs have been lowered and efficiency increased.

(10.) Constructive conservatism has shown a marked advance and unscrupulous undertakings have been markedly eliminated.

(11.) Prospecting has been quite active.

(12.) Transportation has been improved.

(13.) Interest in the acquisition of promising properties by sound capital is as keen as ever.

(14.) Geological knowledge of the ore-deposits of the district has shown a definite advance.

With this record achieved during an acute slump year, the outlook for exceptional progress and prosperity when normal conditions prevail is very bright. It must, however, be considered that the year 1931 will be entered with metal prices and markets still in the doldrums and the outlook regarding improvement uncertain, though hopeful. It must also be considered that the stamina of the healthiest of industries in the face of affliction is not perpetual. The 1930 record of No. 1 District, however, indicates that even should the present depressed conditions continue for some considerable time, which is decidedly improbable, the industry is sufficiently healthy to hold its own.

With base metals depressed, District No. 1 is in the happy position to be reinforced with known and increasingly apparent gold resources. Marked progress, increasing profits, and prosperity in District No. 1 is, however, dependent on the re-establishment of the silver and base-metal markets. Ore-reserve value of important producers such as *Premier*, and potential producers such as *B.C. Silver*, is considerably affected by an adverse silver price. It must also be considered that tonnage reserve and potentiality of *Premier*, the important gold-silver source of the district, which has produced continuously since 1919, is being depleted from year to year. On the other hand, other producers are in the offing to offset this. Should silver and zinc become re-established at higher prices, the extensive known resources of the district in these metals will call for a marked expansion of the industry. Favourable in the picture of future expansion are lowering commodity prices, probable lowering of freight rates, and the eventual development of sufficient reserve ore to warrant smelting and refining facilities on the Pacific coast of British Columbia. Through the lowering of costs these items should favourably affect ore reserves. This district is also industrially young, with vast promising mineral-bearing areas still to be explored and developed. Considering all factors, the future outlook for the mining industry in No. 1 District is decidedly bright.

ACKNOWLEDGMENT.

The Resident Engineer desires to express his thanks to the prospectors and operators of the district for the many courtesies and kind assistance extended during the conduct of his work. Much helpful information and discussion has also been extended by members of the Geological Survey of Canada. The hearty co-operation of the staff of the British Columbia Bureau of Mines in the prompt determination of many samples and specimens has been of great constructive assistance.

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 section; Illiance River section; Kitsault River section.

Portland Canal Mining Division—Portland Canal section; Georgia River section; Marmot River section; Bear River section; American Creek section; Salmon River section; Unuk River section.

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

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

BELLA COOLA MINING DIVISION.

This Division embraces a land-mass area of approximately 15,295 square miles. Of this, about a quarter lies within the eastern contact margin of the Coast Range batholith and three-quarters is embraced in the central pendant or inclusion section within the batholith. The eastern margin of the batholith cuts through the interior in a north-westerly direction, about 20 miles inland from the head of North Bentinck arm at Bella Coola. In both portions are areas well worth intensive prospecting for ore-bodies typical to these geological conditions. Sufficient mineralization of these areas is already apparent to warrant very much more than the cursory prospecting the Division has hitherto received. During 1930 fifteen certificates of work were issued, as compared with sixteen during 1929. The advent of the Consolidated Mining and Smelting Company of Canada in the exploration of the *Nifty* and *Thunder* properties during the 1930 season may assist in promoting interest in the mineral possibilities of this Division. Besides opportunities in metallic minerals, the Division also possesses resources in clays, thermal springs, and building-stone. The occurrence on Labouchere channel of a whitish granodiorite of an excellent building-stone quality is referred to under the heading of "Non-metallics" in this report.

Nifty. This property was discovered by Consolidated Mining and Smelting Company of Canada prospectors. It consists of the *Nifty* and *Nifty No. 1* to *No. 5* claims. Incorporated in the exploration-work of the group is also the *Thunder* claim. The *Nifty* claims are situated on the north slope of Thunder mountain and the Tseapseahoolz (Noosgulch) river, a north-side tributary of the Bella Coola river, and about 12 miles from the Bella Coola river. The *Thunder* claim is situated on the north slope of Thunder mountain below the glacier and about 5 miles from Tseapseahoolz river.

At present the claims are reached by a trail 24 miles long from the McKenzie highway at Fairvale, which is about 20 miles from seaboard. Should results from the present preliminary exploration warrant more extensive work, the more direct route up the Tseapseahoolz valley will probably be developed.

The deposit is mainly zinc-blende and galena mineralization carrying fair silver values, occurring in a quartz-barite gangue in a limestone country-rock close to intrusive andesite. Extensive stripping and trenching was carried out by the Consolidated during the 1930 season. It is understood exploration will be continued in the 1931 season. The values so far encountered appear to be low grade.

Beale's Limestone-quarry. This property is situated on Cunningham island, on the north side of Gunboat pass and about 20 miles southerly from Ocean Falls. The occurrence is intercalated limestone in a remnant area of the Prince Rupert formation in the batholith. The property is owned by J. F. Beale, of Bella Bella, and the work is under the supervision of J. Coulter. Limestone has been quarried from the deposit for several years, mainly for use at the Ocean Falls pulp and paper plant of the Pacific Mills, Limited, but other markets are being built up.

During 1930 the operation was carried on from February to November, employing fifteen men. During this period 11,303 tons of limestone was shipped to Ocean Falls. This is used to treat Kraft pulp-mill liquors and the sludge therefrom is utilized in making the requisite acid for sulphite pulp. Beale's quarry supplies the total present need of the Ocean Falls plant for this material. About 6,000 tons was also shipped to the B.C. Pulp and Paper Company plant at Woodfibre. Some 500 tons was shipped to B.C. Refractories, Vancouver, for stucco-work in buildings.

The limestone product from this quarry is priced at $2 a ton at the quarry, or $3 a ton delivered at Vancouver. A mixed-feed lime-kiln burning about 10 tons a day was built in 1930. This and a lime-hydrating plant producing a high-grade chemical lime will be operating in 1931.

This operation is a creditable example of efficient and persistent work in building up a non-metallic producer.

Thermal Springs.

There are several thermal mineral springs of varying saline content situated in the Bella Coola Division, chiefly in the Burke and Dean Channel areas. The Eucott Bay spring was described in the 1929 Annual Report. For details of the different springs and chemical analyses of the waters, readers are referred to a report by V. Dolmage contained in Summary Report, 1921, Part A, Geological Survey of Canada.

QUEEN CHARLOTTE MINING DIVISION.

The Queen Charlotte Mining Division embraces the Queen Charlotte islands, the most westerly land-mass of the Dominion of Canada. Two large and many small islands, with indented shore-lines typical of the coastal area, constitute the group. Graham island and Moresby island, approximately 2,500 and 1,000 square miles in area respectively, are the main islands. The geology of Graham and Moresby islands, and consequently the type-mineralization occurring on them, is characteristically different. Graham island, with the exception of its south-westerly quarter, is composed entirely of Cretaceous and Tertiary sedimentary and eruptive rocks, with a generally low-lying topography. Moresby island, lying to the south of Graham island, is composed almost entirely of Triassic volcanics and sediments and has a comparatively elevated and rugged topography. These differences are probably the result of an extensive main fault running approximately parallel to the trough of Skidegate channel that separates the two islands, with Graham island on the north occupying the low side of the fault.

Although the mineral occurrences of the islands were amongst the first in the district to receive attention, and promising deposits carrying copper and gold are known to occur, the area has not received the exploration, development, or prospecting attention it warrants. During 1930 thirty-seven assessments on claims were recorded, as compared with thirty-nine in 1929. Great advantages to an economical conduct of mining on the islands are accessibility, an efficient seaboard transportation system, contiguity of mineral occurrences to seaboard, and a mild, equable climate suitable to all-year-round operation. Both operators and prospectors are recommended to intensify their exploration activity on these islands, which have everything in their favour conducive to a successful outcome of such operations.

Graham Island Section.

A general description of geological, mineralogical, and topographical features of this area was included in the 1929 Annual Report, to which readers are referred. Lode-mining on Graham island revived during 1930 with the bonding and operating of the *Skidegate-Southeaster* groups by the Kitsault Eagle Silver Mines, Limited, of Vancouver. Experiments in connection with the recovery of gold from the beach-sands on the east coast of the island were also continued during the year by two syndicates using different methods.

Skidegate-Southeaster.

The property embracing these claims is situated at the south-easterly end of Graham island, about 8 miles by road from Queen Charlotte City wharf, via Skidegate (3 miles) and Skidegate Indian village (5 miles). A fair truck-road about 1 mile in length connects the workings with the main highway between Port Clements and Queen Charlotte City. The camp is at about 300 feet elevation above sea-level. The claims are owned by A. J. Gordon, J. McLellan, and associates, of Skidegate. The property is interesting on account of its gold possibilities. Early in the season the *Skidegate* claim was optioned by Kitsault Eagle Silver Mines, Limited, which also acquired by staking the *Sunrise Nos. 1, 2,* and *3, Disraeli,* and *Gladstone* claims. In October the adjoining *Southeaster* and *Beaconsfield* were also optioned.

The mineral occurrence on these claims is described in the 1929 Annual Report. Early in the year a shaft (Indian shaft) was sunk on the shear-zone on the *Skidegate* claim to a depth of 42 feet. At this level a crosscut was driven for 40 feet to the east side of the zone, the east wall of which was then drifted on for about 35 feet in a southerly direction. This work seems to indicate the zone to have an easterly dip of 55° in contradiction to a general westerly dip in the assumed continuation in the old workings on the *Southeaster* to the north. This easterly dip indicated in the Indian shaft-workings is assumed from the attitude of quartz veins or lenses contained in the zone where cut by the shaft. The bottom of the shaft still shows shearing structure. It may be possible that the attitude of the quartz-lenses within the zone is uncon-

formable to that of the zone itself. In view of this the dip of the zone in the Indian shaft-workings cannot be definitely ascertained without further exploration of this area. Some good-grade ore is exposed in a surface-stripping about 50 feet east of the Indian shaft-collar. Samples taken by the company's consulting engineer from this exposure assayed: Across 4 feet, 0.08 oz. gold to the ton; across 3 feet, 0.20 oz. gold to the ton; across 3 feet, 0.02 oz. gold to the ton; across 2.7 feet, 5.78 oz. gold to the ton; across 2.5 feet, 0.94 oz. gold to the ton; across 7 feet, 0.44 oz. gold to the ton. Trenching at this locality exposes the zone for a width of about 16 feet.

It would seem from an examination of the creek-bed area southerly from the Indian shaft that the shear-zone follows approximately the site of the creek trough. Two or three obscure natural exposures of quartz in the banks of the creek and a decided shearing in an old working on the east bank indicate the possibility of discovering ore-bearing lenses and possibly offshoots from the main zone in this direction. Exploration of this area by stripping and open-cutting is recommended. It is also recommended that the zone be crosscut to the west from the Indian shaft-workings to get under the ore exposed on the surface to the east of the shaft-collar.

Late in the season a pump was installed for the purpose of unwatering the old workings on the *Southeaster* claim. To facilitate this the old drainage-tunnel was also reopened. These workings will be examined and sampled by Angus W. Davis, who has been retained as consulting engineer, and a plan for further exploration outlined with a view to ascertaining the attitude and extent of indicated gold-bearing ore-shoots.

Hanssen Positive Separation Mining Co., Ltd.

The Queen Charlotte Syndicate, which had been conducting tests in extraction of gold from the black sands of Graham Island east coast with the Hanssen positive machine, was merged with this company. The tests were continued for a short period during 1930. Several improvements and alterations in mechanism have been worked out and applied. The report of the engineer conducting the experiments indicates an economic extraction of gold values. A recovery of about $325 in gold is reported. The success of the venture on the Graham Island beach-sands is, however, dependent on the quantity of black sand available, which factor is both doubtful and variable. As was pointed out in the 1929 Annual Report, successful application of this machine to the Graham Island deposits is, however, dependent on the introduction of some feasible portable method of preliminary concentration. Difficulties confronting this are: A system yet to be worked out; difficulty of procuring a continuous water-supply; tailings-disposal. For a description of the characteristics and mode of occurrence of these beach-sands, readers are referred to the 1929 Annual Report.

On November 27th a petition for the winding-up of the Hanssen Positive Separation Mining Company was granted. It is understood that interested parties with the experience gained in this venture may undertake further operations.

During the season gold-recovery experiments were also carried out by other interests on beach-sands in Masset inlet. The method employed was some tar compound spread on blankets. No details are available concerning these experiments, but it is understood that the product sent to the Vancouver Assay Office did not return any commercial recovery.

Moresby Island.

This island lies to the south of Graham island and is about 11 miles wide. The island has a peculiar wedge shape and a decidedly indented shore-line. Its greatest width of about 40 miles is at its north end and the narrowest section about 1½ miles wide near its south end.

With the exception of a small area of Cretaceous sediments occurring at the north-east end and a few outcrops of granitic rocks on the east coast, the island is composed entirely of altered Triassic volcanic and sedimentary rocks. These are underlain by the steeply westerly-dipping, western flank of the Coast Range batholith. The area is geologically favourable for the occurrence of contact-metamorphic magnetite and copper deposits and replacement and disseminated copper ore-bodies. In some areas gold-quartz veins occur.

Although the first gold-rush in British Columbia was to the west coast of Moresby island, where gold-quartz veins were discovered in 1852, and promising copper ore-bodies have been known for a number of years, the interior of the island has never been thoroughly prospected, nor have the majority of known deposits contiguous to seaboard received the exploration they warrant.

During 1930 assessment-work was carried out on about thirty properties. This work resulted in improved showings on several properties, including the *Swede* and *Star* (old *Apex*) groups near Lockeport, the *McMillin* near Harriet harbour, and the *Enterprise*, *Houston*, and *Hope* properties in the Huston Inlet area. These properties are all thoroughly described in the 1929 Annual Report.

Late in the year arrangements were made for further exploration of the *Star* group, subject to an examination by the consulting engineer of the company interested. Outside interests have also optioned the *Enterprise*, *Houston*, and *Hope* groups and plan commencing exploration early in 1931. Some interest is also being taken in properties on the west coast of Moresby island which may lead to some activity in this section also during 1931. An increasing interest in the magnetite-deposits is also evident. The prospects for a revival of exploratory development-work on Moresby island during 1931 are bright.

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. It embraces the largest extent of the Central batholith-pendant-inclusion area in No. 1 District. Type-mineralization is that characteristic of these geological conditions and is described under the heading "Geological Discussion," introductory to this report.

Coincident with a clearer understanding of these geological conditions and associated mineralizing factors, interest in prospecting the area is steadily increasing. During 1930, 194 assessments were recorded, as compared with 156 in 1929. In 1930 five certificates of improvement were issued, as compared with none in 1929. This is a gratifying increase in actual working activity. Prospectors in increasing numbers are availing themselves of the advice of the Department of Mines concerning their discoveries of mineral before proceeding with staking. In this way the efforts of prospectors in the Division are being guided along lines productive of the greatest efficiency.

Besides its metallic-mineral possibilities, the Skeena Division possesses appreciable probable resources in non-metallics, as yet not investigated. Clays, limestone, and marble are widely distributed. There are also possibilities for mica and refractory deposits and the occurrence of building-stone. Detail tests for phosphatic limestone are also worthy of consideration. Of interest is the discovery this year of a mineral occurrence, which has been identified by the Bureau of Mines, Victoria, as bentonite. This occurs on an island close to seaboard and will be further investigated during 1931. In the large coastal area of the Skeena Mining Division the availability of immediate seaboard transportation to markets eradicates what is generally the main handicap for the establishment of a profitable non-metallic industry. It is considered that this important phase of the mining industry is worthy of a more intensive investigation in the Skeena Mining Division than it is receiving.

Coast Section.

Detroit Western Mining Corporation.—This company had been exploring the old *Western Copper* group, situated up the Khutze River valley, about 5 miles from the head of Khutze inlet. Operations closed in November, 1929, since when no work of any kind has been done on the property. A watchman has been in charge. The ore occurrence is fully described in the Annual Report for 1928.

Hunter. This group of twelve claims is owned by C. W. Meldrum and associates, of Vancouver. It is situated about 8¼ miles from the Detroit Western Mining Company's railway-camp terminus and about 12 miles from the head of Khutze inlet. The camp is at altitude 950 feet on the east side of a north branch of the North fork of Khutze river. The property is reached by a meandering trappers' trail from the railway through the rugged granitic confines of the narrow North Fork valley. The rainfall of the area is excessive and at times the Khutze river and its branches rapidly swell to raging proportions.

The original claims of the property were staked in 1927 on the east side of the main north branch of the North fork. In 1929 and 1930 further discoveries were made on the west-side slope between elevations 1,200 to 2,750 feet. Late in the season the property was optioned to Vancouver parties, who plan a thorough exploration of the showings.

The mineral-deposit consists of lenses of pyrite carrying high gold values occurring in narrow quartz veins in a segregated phase of what appears to be a hornblende granite or quartz diorite. At the time of examination (October 16th) six veins varying in width from 1 to about 30 inches had been discovered. Practically no work had been done on these. Surface-tracing has been intermittent and mainly by natural outcrops.

A sample of selected pyrite and quartz containing about 75 per cent. pyrite, taken from a pyrite-lens about 2½ feet long and 11 inches wide, occurring in the most southerly vein on the east bank of the river, assayed: Gold, 6.75 oz. to the ton; silver, 2.60 oz. to the ton; copper, 3.2 per cent. A sample of the sericitized wall-rock of this lens, containing impregnated pyrite and fine veinlets of siderite or ankerite, assayed: Gold, *nil;* silver, *nil.* This vein had been traced for about 60 feet, striking N. 25° W. (mag.) and dipping 45° east, and is characterized by lenticular structure. About 100 feet north another quartz vein 12 inches wide has been traced for about 15 feet, striking N. 20° E. (mag.) and dipping 70° east. Continuity to the north is obscured by overburden. To the south the continuation cannot be found in the exposed bed-rock of the creek 20 feet away. A sample of pyrite from a streak 12 inches long and about 1 inch wide on the hanging-wall of this vein assayed: Gold, 1.92 oz. to the ton; silver, 0.40 oz. to the ton; copper, trace. A sample from the same vein consisting of quartz and a little pyrite assayed: Gold, 0.35 oz. to the ton; silver, 0.1 oz. to the ton.

The four showings on the west slopes of the creek were covered by an early snowfall and could not be examined. The main showing at altitude 1,850 to 2,750 feet is reported by the owners to contain three pyrite-lenses of from 20 to 50 feet in length composed of from 10 to 50 per cent. pyrite. These lenses are exposed at intervals of from 400 to 600 feet. Intermittent natural exposures show vein-widths of 3 to 30 inches. Three other showings are reported to occur at altitudes from 1,250 to 1,900 feet. These show quartz veins 2 to 12 inches wide, with some pyrite in places, and had been traced 30, 100, and 300 feet.

An examination of the general geology of this locality shows this occurrence to be a typical deposit of the segregated roof-phase of the batholith, referred to under the heading of "Geological Discussion," introductory to this report. The country-rock is a coarse-grained hornblende granite or quartz diorite in which are dense segregated patches, streaks, and belts of aplite, irregular masses of micro-pegmatite, and dark patches of fine-grained hornblendic segregations and absorption areas of the roof-rocks. Small aplite dykes, crenulated bands of segregated basic material (ferro-magnesian minerals) with blended contacts, course through the rock irregularly. Small discontinuous quartz-filled gash-veins and stringers also occur irregularly. Primary gneissic and flow or cleavage structure, parallel streaking, schlieren, and banding are marked characteristics of the formation. Fracture-cleavage is absent.

The locality represents a segregated cooling phase of probably the upper or roof-zone of the batholith in which a certain amount of compression movement took place whilst the rock was still in a plastic or viscous condition. The structure indicates that the locality occupied a deep horizon below the old surface on the border between the zone of fracture and the zone of flowage. The quartz veins probably occupy cooling or contraction fractures which were filled very shortly after the consolidation of the batholith. The quartz and pyrite were probably the last products of gaseous and aqueous differentiation from the parent magma.

The high gold values in this type of deposit are attractive, and they are consequently always worth a thorough exploration to prove continuity. General characteristics of such deposits are narrow veins of frequent occurrence in a small defined area; restriction of gold values to the pyrite in the veins; absence of gold values in the quartz gangue; restriction of replacement in the wall-rocks; lenticular vein-structure; lenticulation of the pyrite in the veins. An assumption of both horizontal and vertical continuity based on intermittent surface exposures of this type of deposit is hazardous. Preliminary exploration by close stripping, open-cutting, and test-pitting, followed by crosscutting or drifting at carefully selected sites to explore for continuity at depth of the most likely pyrite-lenses, is advised.

As the operators planned to prosecute work during the winter a log cabin was being erected.

Bute. This property consists of the *Bute* and *Bute No. 2* claims and is owned by Albert Lund and Godfrey Knutson, of Butedale. The showings are situated opposite Butedale salmon-cannery on the south side of Butedale bay, off Fraser reach, about 90 miles south of Prince Rupert.

The ore-deposit consists of bunches and veinlets of chalcopyrite with some pyrite and sparse molybdenite, occurring in slightly sheared zones of hornblendic bands in granite, striking N. 20° W. (mag.) and dipping 75° east. Alteration products of epidote and garnet and a slight silicification accompany the mineralization. In an open-cut about 15 feet above high-tide mark a width of about 2 feet well mineralized with chalcopyrite is exposed; 12 inches of this should run about 7 per cent. copper. No tracing back from the shore has been done.

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. The ore occurrence is described in the 1929 Annual Report.

During the 1930 season five claims of the group were surveyed for Crown-granting. The remaining three claims are being prospected and may be Crown-granted later. Work was concentrated on the new discovery in the canyon about 300 feet below the outcrop, where 10 feet of encouraging mineralization was encountered. One shot was put in the lower lead at altitude 600 feet and tools placed there in preparation for further work at that locality next season.

Abruzzi. This group comprises eight claims owned by Cesaro Venanzio and associates, of Terrace. It is situated about 8 miles south of the old *Drum Lummon* on the north-westerly shore of Douglas channel. The mineral occurrence is a replacement in altered schists in a schist inclusion in the batholith. A general description may be found in the 1929 Annual Report.

Extension of the two open-cuts 30 feet apart along the beach has shown some improvement in the tenor of chalcopyrite mineralization. The best mineralization observed is in the most southerly cut, where some bunches and seams of fair-grade chalcopyrite mineralization is irregularly developed in the more basic phases of the schist. The mineralization in this cut does not, however, represent a commercial grade of ore when considered from the standpoint of a working-face. A sample across 7.7 feet of the best material exposed in the floor of this cut assayed: Gold, trace; silver, 0.30 oz. to the ton; copper, 1.4 per cent.

Sixty feet of cross-trench and an open-cut at 15 feet higher elevation and about 40 feet north-westerly strike south of the most southerly cut. This would indicate that what ore is mineralization. It would appear from the structure exposed by this work that the schists are folded and assume a north-easterly strike a few feet north of the northerly cut, in contrast to a north-westerly strike south of the most southerly cut. This would indicae that what ore is exposed is probably confined to the folded crest of a definite schist-band, and that if it has further continuity this will be found in the northerly limb of this band, which bends down to the beach again within about 100 feet north of the most northerly cut. Exploration at depth for further continuity and improvement of the known mineralization would necessitate sinking operations close to the shore of Douglas channel and would probably be burdened with excessive water difficulties. It is possible other bands on the crest of this fold farther inshore may be mineralized (*see* generalized section, page 48, 1929 Annual Report). These should be prospected for by cross-formational stripping and open-cutting.

Decaire. This group is situated about 2 miles south of the *Abruzzi*, on the north side of the North fork of Koskeesh creek, at altitude 550 feet. It is owned by Cesaro Venanzio and associates, of Terrace. The occurrence is an irregular silicification of gneissic granite contiguous to a kersantite dyke. In places several feet of quartz is developed, which grades again into granite or disperses as tightly frozen bull-quartz veinlets. Some zinc-blende, pyrite, and a little galena show in cross-fractures. The mineralization is very sparse. The occurrence is of no commercial importance.

Los Angeles-Vancouver Mines, Ltd. This company is developing the old *Drum Lummon* property, formerly held by the Paisley Point Mining Company. The property is situated on the west shore of Douglas channel, about 22 miles from its head. The ore occurrence consists of a very irregular and bunchy development of chalcocite, covellite, bornite, and chalcopyrite in granitic pegmatite, contained in a quartz-diorite phase of the batholith. The pegmatite, which has generally been referred to on this property as occurring in "dykes," is developed in the quartz diorite in irregular masses of very erratic outline which cannot be classified as dykes in the true sense of the term. It would seem that

these masses represent the last and more richly gaseous upper portion of the batholith magma to crystallize. This was probably injected into the still slightly viscous rock in the form of irregular apophyses which in places verge into what appear to be quartz veins. A description of the ore occurrence is contained in the 1922 and 1929 Annual Reports, and in the Geological Survey of Canada, Summary Report for 1921, Part A.

In the development of this mineral-deposit it seems to have been assumed that the pegmatite in which the ore occurs consists of one more or less regular body with comparatively well-defined walls. This is not the case. It can be taken that defined walls to the pegmatite-bodies do not exist and that this rock occurs in several practically separate and unconformable masses, with irregular branches extending from each mass. Along their borders the pegmatite-masses grade into aplitic and altered quartz diorite. These characteristics have been clearly indicated in the more recent lower-level workings and raise from this level to the upper-tunnel workings at 236 feet higher elevation.

It is interesting to note that native silver and gold, which sometimes occurred in small quantities with the chalcocite, covellite, and bornite in the upper workings, are practically absent from the bunches of ore encountered in the lower-tunnel workings. The lower-tunnel ore also shows a greater proportion of chalcopyrite than is the case in the upper-tunnel ore. This suggests that the chalcocite, covellite, bornite, native gold, and silver are secondary from chalcopyrite carrying high gold and silver values. The following assays of type-ores seem to further strengthen this hypothesis. A sample of the chalcocite-covellite-bornite ore-type from the east drift of the lower tunnel assayed: Gold, 0.14 oz. to the ton; silver, 28 oz. to the ton; copper, 42 per cent. A sample of chalcopyrite from the same locality assayed: Gold, 0.84 oz. to the ton; silver, 3.90 oz. to the ton; copper, 20.5 per cent. A series of systematically taken samples would be necessary to confirm this point.

Work during 1930 was chiefly confined to the continuation of the lower crosscut tunnel at elevation 239 feet, to intersect the ore occurrence showing in the upper tunnel at elevation 575 feet. Pegmatite was cut at about 1,605 feet in and the crosscut continued for a further 45 feet. At the point of intersection a drift west for about 70 feet showed irregular aplitic bands. A raise off this drift was put up for 85 feet. About 320 feet of drifting and side-swiping was completed to the east of the crosscut tunnel intersection. A raise of 240 feet was put through from the east drift to the upper-tunnel workings. Irregular masses of pegmatite and small bunches of ore were encountered in these workings. A crosscut 30 feet long connecting the upper-tunnel drift with the raise passed through about 15 feet of pegmatite carrying some nice bunches of ore. From this, thirty-nine sacks of good-grade ore was taken.

In all, about 2,370 feet of underground work has been done from the lower-tunnel level. This has exposed the same bunchy and erratic ore conditions that have hitherto characterized this ore occurrence, and also a persistently irregular development of the pegmatite in which the ore occurs. This work should offer a fair criterion of the general character of the deposit and consequently indicates that the general very erratic distribution of ore in small, bunchy shoots will persist. The possible development of any stable shipping or milling tonnage from this type of deposit would be both doubtful and expensive. What ore does occur, however, is high grade, and it is suggested that an individual operator or lessee employing very close selective mining and rigidly following the ore-bunches where encountered, coupled with hand-sorting and cobbing, might possibly earn a profit from the sacking of shipping-grade ore. In this way some further exploration of the deposit would also be accomplished.

Work on the property ceased about the end of September, with the company afflicted with financial stress and the employees left stranded on the property and financially embarrassed. With assistance from the foreman and a local hand-logger, transportation for the crew to Vancouver was eventually arranged.

Mica-deposits on Campania Island.

This is an outlying island of the archipelago, bordering Hecate strait. It is about 17 miles long and 4 miles wide and lies directly south of Pitt island and west of the northerly end of Princess Royal island, between Squally passage and Estevan sound. A trip was made to the island for the purpose of examining mica-deposits reported to occur. The island rocks are composed of granodiorite, quartz, monzonite, and quartz diorite of the Coast Range batholith. On the whole, these rocks grade into one another. The quartz diorite, however, seems to find its greatest distribution in

a narrow strip on the east coast and also in a comparatively wide belt on the south end of the island. Granodiorite is widely distributed on the westerly side and forms about 75 per cent. of the rocks of the island.

The mica area examined lies on the west coast, about 8½ miles from the north end of the island. In this locality the rock-texture is characteristically pegmatitic, ranging from a general micro-pegmatite to bands and belts of fairly coarse pegmatite. The mica is light-coloured and resembles muscovite. It occurs in fairly coarse crystal structure in bands of the coarse pegmatite 6 to 24 inches wide and constitutes about 10 to 25 per cent. of the bands. These bands are irregular and discontinuous, having a horizontal extent of from 25 to 100 feet. They seem, however, to be of frequent occurrence. Belts and streaky zones of fine crystalline mica are widely distributed on the finer-textured pegmatite. Some of these zones can be traced for 200 to 300 feet. Stellate aggregates of mica characterize the structure of these belts. Some of these belts are composed of from 25 to 50 per cent. of fine mica. No work has been done on these deposits. The surface exposures are slightly weathered and the mica in them is consequently friable.

Banks Island.

Banks island is situated on the easterly side of Hecate strait, west of Pitt island. It is about 45 miles long and 10 miles wide. The rocks composing the island are quartz diorite of the Coast Range batholith, with a few inclusions and remnant segments of crystalline schists and limestone of the Prince Rupert formation.

The *Henrietta* and *Margaret* are a group of old claims on which a Crown grant was issued in 1907. The property is owned by E. J. Smith, of Victoria. It is situated on the east side of Banks island, about a quarter of a mile up Donaldson creek from the shore of Patsy cove. No work has been done on the property for several years. The ore occurrence consists of irregular masses of pyrrhotite with chalcopyrite and magnetite in what appears to be detached semi-absorbed segments of the Prince Rupert formation in fine-grained quartz diorite of the batholith. White, glassy quartz is widely distributed through the quartz diorite in the vicinity of the deposit in irregular vertical-standing veins and thin horizontal sheets that might be mistaken for domes. Peculiarities of the gangue accompanying the mineralization are the development of actinolite in the gangue and included in a transparent and very vitreous smoky quartz. The deposit has been explored by several pits, trenches, and open-cuts. These show a very discontinuous and patchy development of mineralization. The mode of occurrence and mineral character of the deposit indicate that it was formed under high temperature and rapid cooling conditions in semi-absorbed segments of a pre-existing thin roof of the Prince Rupert formation.

Limestone Bay.—This is a small bay on the east coast of Banks island, about 20 miles from the south end of the island and 4 miles south of Patsy cove. The formation of the locality consists of an inclusion of limestone and schistose rocks of the Prince Rupert series in quartz diorite of the batholith. The shore-area of the northerly section of Limestone bay is covered by Lot No. 2223 on the 1924 Grenville Channel map of the Department of Lands. This embraces an inclusion area about 1,500 feet wide, consisting of two belts of crystalline limestone, each about 500 feet wide, separated by a belt of pyrrhotized quartzite and banded, silicified schist, about 500 feet wide. The bedding of the formation stands practically vertical and strikes northeast.

The limestone is definitely crystalline in texture and can be characterized as marble. It varies in colour from pure white to dark grey. In places serrated surface weathering indicates that some sections are somewhat siliceous. This, however, is not a general condition, but seems to favour the contact-zones of the limestone with the quartzite. A few thin chert-bands, up to about 12 inches wide, also cut through the limestone irregularly; it is, however, free from pebble and nodule impurities. Comparatively widely-spaced jointing is evident in the surface outcrop along the beach. There are no cuts, however, and consequently no criterion of structure beyond the influence of surface conditions can be formed. It was thought that some sections of the grey limestone might be phosphatic. A general sample of this type, however, assayed: $CaCO_3$, 86 per cent.; P_2O_5, trace. A sample of the general occurrence of limestone assayed: $CaCo_3$, 92 per cent.; SiO_2, 3.5 per cent.; P_2O_5, trace.

Kumealon.

This group of claims, owned by Pete Brozet and situated around the head of Kumealon inlet, about 35 miles south of Prince Rupert, was further prospected during the season. Nothing of additional interest has, however, been

discovered. The owners of this group and of other claims in this area are advised to continue prospecting the Prince Rupert series of altered sediments in the vicinity of the batholith contact, and also the batholith rocks close to the contact. No commercial utility is as yet indicated in the sillimanite and illmenite rock occurring in this locality. Further tests on this mineral combination may, however, be suggested to the Department of Mines at Ottawa.

Royal. This group consists of *Royal No. 1* and *Royal No. 2* claims and was formerly owned by Mathew Kertz, of Prince Rupert, who transferred his holdings to the Canadian and Oriental Mining and Exploration Company, of Vancouver, for a share interest in the company. Eight claims of the original holdings have lapsed. The property is situated in Stuart anchorage, on the east coast of the northerly end of Pitt island, about 35 miles south of Prince Rupert.

The ore occurrence is magnetite in schists of the Prince Rupert formation. At this locality the bedding of the rocks and the planes of schistosity practically coincide and are cut by fine-grained granite dykes. The magnetite occurs impregnated and also as small discontinuous massive bands and streaks and comparatively small, irregularly distributed massive lenses.

The main outcrop occupies a small ridge which rises abruptly from the shore to an elevation of about 100 feet. This strikes north-west and dips 80° east, conformable with the formation. A cross-section of this outcrop along the shore for a distance of 112 feet shows faces of fairly massive magnetite varying from 2.2 to 15 feet wide, separated by belts of schist, or schist impregnated with magnetite, varying from 4.5 to 21 feet wide. The massive magnetite sections, however, do not show any continuous length and grade rapidly into schist or schist impregnated or banded with magnetite. They are very irregular and acutely lenticular. Extensive inshore stripping for a distance of about 200 feet exposes a similar condition.

The occurrence is, however, remarkably free from adulterants, and pyrite only occurs as occasional rare grains. A sample of the best grade of magnetite exposed in a band 3 feet wide assayed: Iron, 68 per cent.; silica, 7 per cent.; sulphur, *nil*. The mode and conditions of occurrence of this deposit suggest that it is a replacement relative in origin to the underlying batholith.

Gibson Girl. This group of four claims is 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 ore occurrence was described in detail in the 1929 Annual Report. During 1930 further extensive stripping and open-cutting was carried out by the owners and additional exposures of good-grade chalcopyrite, zinc-blende, and galena mineralization have been made on both the old and new mineralized belts. In some exposures chalcopyrite mineralization of good grade and widths is developed in the altered schist rocks as well as in the limestone. Continuity of the belts is now proved for a distance of about 1,100 feet, with numerous exposures of milling-grade ore over fair average widths. This is one of the best showings in the coastal area and it is recommended to examining engineers as being decidedly worthy of further exploration for possibilities of a small-tonnage milling proposition.

Rowe. This property of three claims is owned by C. O. Rowe, of Prince Rupert. 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 2 to 5 feet wide that follows an aplitic, in part micro-pegmatitic phase of granodiorite. The vein has been traced about 700 feet with seven cuts and a tunnel 6 feet long at the north end. It strikes N. 57° E. (mag.) and dips from 15° to 30° east. Mineralization is with pyrite and in places some chalcopyrite. Open-cutting was continued by the owner during the 1930 season. In the majority of cuts the mineralization is sparse and bunchy. In the tunnel-face, however, about 25 per cent. of the vein-width of 5 feet is composed of sulphides. A sample across 58 inches on the south side of the tunnel-face, containing about 40 per cent. of sulphides, assayed: Gold, trace; silver, 0.30 oz. to the ton; copper, 0.5 per cent. A sample taken from the face by the owner later in the season assayed: Gold, 0.02 oz. to the ton; silver, 0.30 oz. to the ton; copper, 2.4 per cent. Another sample taken by the owner at the conclusion of the season from the south side near to the tunnel entrance assayed: Gold, 2.04 oz. to the ton; silver, 0.8 oz. to the ton.

Constructive further exploration by the owner would be the continuation of some of the other open-cuts that show pyrite, to determine whether these might open up appreciable lenses of sulphide mineralization that may be gold-bearing.

Surf Point. This property embodies the old *Trixie* group and has been acquired by J. B. Woodworth, of Vancouver, with whom is associated Noah A. Timmins. The claims are situated off Welcome harbour on the westerly slope of Porcher island, about 25 miles south-easterly of Prince Rupert. The mineral occurrence of gold-bearing pyrite in quartz veins in quartz diorite is described in detail in the 1919, 1928, and 1929 Annual Reports, and in the Geological Survey of Canada, Summary Report, 1922, Part A.

During 1930 a crew of from twenty to thirty men has been employed. The No. 1 and No. 3 tunnel-workings have been connected by drifting and a raise of about 20 feet from No. 1 to No. 3 tunnel-level. Raises on ore-shoots have been started on both No. 1 and No. 3 levels. The year's work has resulted in the cutting of additional sulphide-lenses. At the raise connection between the two levels and also at a point about 270 feet north of No. 1 portal good widths and lengths of sulphide ore-shoots are developed. Raise and sub-level work concentrated at these two localities may be productive of a fair tonnage of good-grade gold ore.

Mining-work was suspended in June to concentrate on the construction of a narrow-gauge railway from the beach to the mine, a distance of about 1¼ miles and an elevation variance of about 350 feet, and a wharf at the beach terminal. Mining operations were resumed in November. At the time of examination (November 9th) a crew of thirty men was employed between the mine and railway operations.

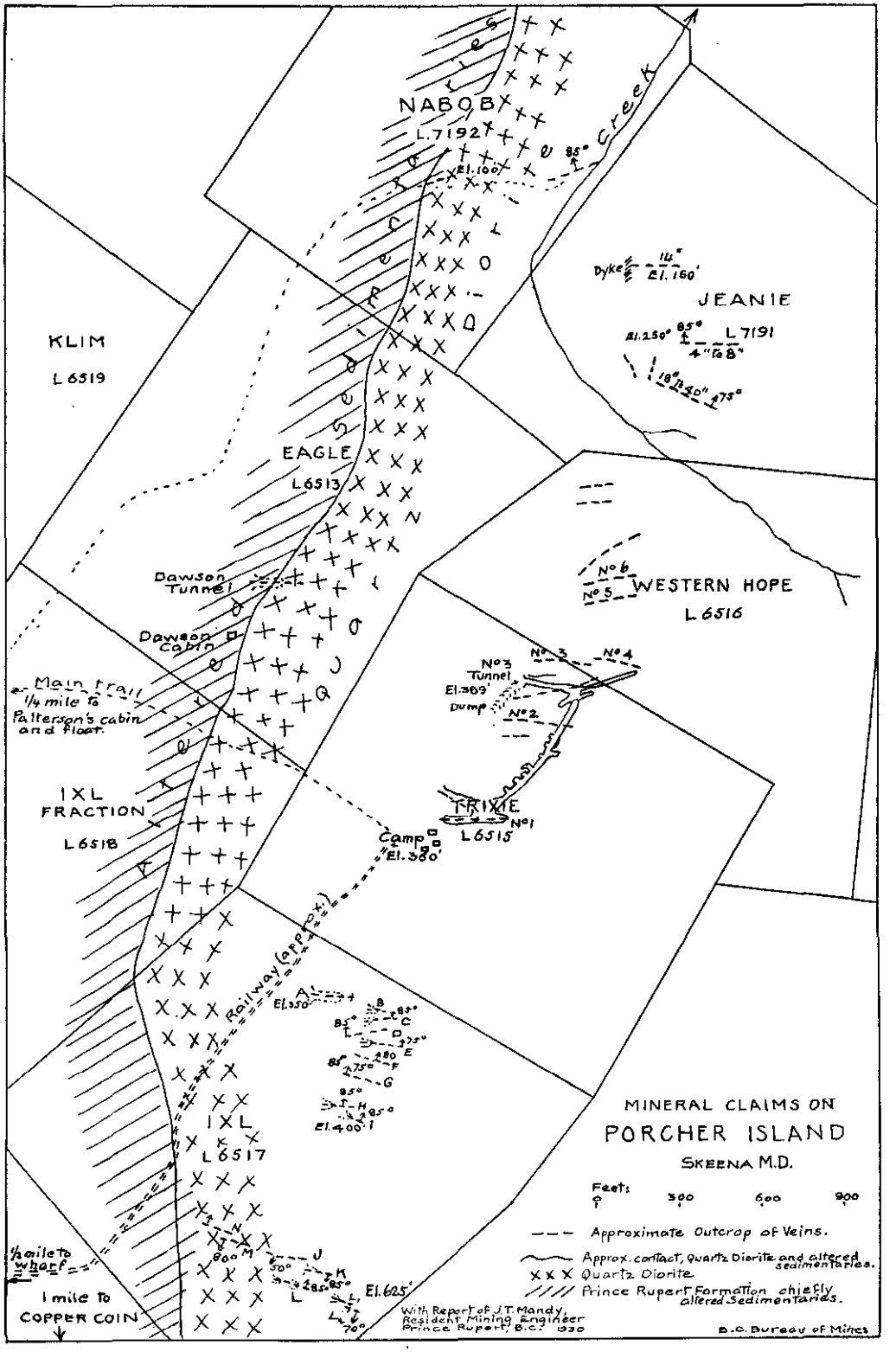
In December two test shipments of about 82 and 74 tons of ore were sent to the Granby Company's smelter at Anyox. These were made up from sorting low-grade material that was on the dump and probably will not be higher than milling grade. Other shipments of ore from the stopes will follow and will be sorted to a possible smelting grade.

Belmont-Surf Inlet. This property is situated on the west side of Princess Royal island, about 7 miles from the head of Surf inlet. From 1916 to June, 1926, it was operated by Belmont-Surf Inlet Mines, Limited, a subsidiary of the Tonopah Belmont Development Company, but has been idle since cessation of operations by that company. A total of 836,500 tons of ore, yielding nearly $8,000,000, of which $1,437,500 was paid in dividends, was produced from the property. During the period of 1926 operations, 26,650 tons of ore was mined and milled, yielding $276,453; most of this latter ore, however, came from the robbing of pillars. Over 50,000 feet of underground workings has been excavated in the mine.

The ore-deposit consists of gold-bearing pyrite with some chalcopyrite, bornite, chalcocite, and covellite, occurring in large quartz veins in an extensive shear-zone. The country-rock is mainly quartz diorite of the batholith, but a section of the shear-zone also cuts through a remnant-inclusion of chlorite-schist in the batholith. Lithological evidence indicates this occurrence to be another instance of a pyritic gold-ore development in the roof or cupola horizon of the batholith referred to under the heading of "Geological Discussion," introductory to this report, with the difference, however, that it is associated with pronounced shearing. A detailed description of the deposit will be found in the 1919 Annual Report and also in the Geological Survey of Canada, Summary Report, 1921, Part A.

The property and plant of the Belmont-Surf Inlet Mines have been purchased by J. B. Woodworth, Vancouver, in association with Noah A. Timmins. These interests carried out a preliminary investigation of the workings during 1930 and found bad conditions of caving on the 550-, 700-, and 800-foot levels. The 900-foot level, originally driven off-grade, now has about 6 feet depth of water in it at the shaft. The new interests plan to start work early in 1931, preparatory to a thorough examination with a view to reopening this property, probably in conjunction with some of the neighbouring properties.

Eddy Pass. *This group of five claims is owned by F. T. Patterson, of Prince Rupert. The* property adjoins the *Surf Point* on the north. Several good showings of gold-bearing pyrite in a system of quartz veins in quartz diorite have been exposed on the property by extensive stripping through deep muskeg overburden. The veins vary from 4 inches to 3 feet in width and occupy a north-east and north-west structure in the quartz diorite, a few hundred feet east of the contact of the diorite with the altered sedimentaries.


NABOB
L.7192
El.100'
Creek
Dyke
14"
El. 150'
JEANIE
El.250'
85°
L 7191
4" to 8"
18"
30"
75°
KLIM
L 6519
EAGLE
L6513
Dawson Tunnel
Dawson Cabin
Main trail
1/4 mile to
Patterson's cabin
and float.
No 6
No 5
WESTERN HOPE
L 6516
No 3
No 4
No 3
Tunnel
El.369'
Dump
No 2
TRIXIE
No 1
L 6515
IXL
FRACTION
L 6518
Camp
El. 380'
Railway (approx.)
El.350'
IXL
L 6517
1/2 mile to
wharf
1 mile to
COPPER COIN
El.625'
MINERAL CLAIMS ON
PORCHER ISLAND
SKEENA M.D.
Feet:
0
300
600
900
Approximate Outcrop of Veins.
Approx. contact, Quartz Diorite and altered sedimentaries.
Quartz Diorite.
Prince Rupert Formation chiefly altered Sedimentaries.
With Report of J.T. Mandy
Resident Mining Engineer
Prince Rupert, B.C. 1930
B.C. Bureau of Mines

In places the pyrite carries high gold values. On the main showing a fair shearing structure and a pyrite ore-shoot length of about 80 feet, with a width of from 1 to 3 feet, is indicated. An average sample across 1.2 feet at this locality assayed: Gold, 1.78 oz. to the ton; silver, 0.6 oz. to the ton; copper, *nil.*

Further prospecting will undoubtedly be rewarded with additional discoveries. The property is conveniently situated at about altitude 150 feet above sea-level and within about a quarter of a mile of the shore. The property is worthy of further extensive exploration.

I.X.L. This group of two claims and two fractions, owned by H. E. Dennison, Box 964, Prince Rupert, adjoins the *Trixie* claim of the *Surf Point* on the south. A system of eleven more or less parallel east-west (mag.) quartz veins in quartz diorite are exposed by open-cuts and a 70-foot tunnel on the *I.X.L.* claim, between altitude 300 and 600 feet. The veins vary in width from 2 inches to 3 feet and have been traced for distances of from 30 to about 80 feet. Mineralization is pyrite in erratic distribution, with encouraging gold values in places. The pyrite occurs with both a light- and deep-yellow colour. A sample of the light-coloured pyrite selected from a dump of about 2 tons of ore from an open-cut, showing quartz stringers 1 to 18 inches wide over a face 5 feet wide, assayed: Gold, 6.06 oz. to the ton; silver, 1.60 oz. to the ton; copper, trace. A sample of deep-yellow pyrite selected from the same dump assayed: Gold, 2.28 oz. to the ton; silver, 0.80 oz. to the ton; copper, trace. The ore on this dump is composed of about 30 per cent. pyrite and 70 per cent. quartz. At the southerly end of the *I.X.L.*, which is contiguous to a remnant of the Prince Rupert series of altered sediments, a tendency to chalcopyrite mineralization is indicated.

Copper Coin. This group of six claims, owned by H. Dodd and associates, of Prince Rupert, is situated about 1½ miles southerly of the *Surf Point* on the westerly side of Porcher island. The showings are at altitude 150 feet and about 1,500 feet from the head of a small bay.

The occurrence is a well-defined banded quartzose shear-zone, 7 to 12 feet wide, in chlorite-schist of the Prince Rupert series. The vein has been traced about 250 feet, striking N. 50° W. (mag.) and dipping 45° north. In the south-westerly cut a width of 7.7 feet is exposed, showing about 2 feet of well-mineralized quartz vein-matter on the foot-wall. Ninety feet north-east of this a deep open-cut 20 feet long exposes a vein-width of 11 feet. A sample of 2.6 feet of gouge and crushed rock on the hanging-wall assayed: Gold, 0.05 oz. to the ton; silver, 0.2 oz. to the ton; copper, trace. The adjacent 3.2 feet of sheared rock and quartz-bands with streaks of chalcopyrite assayed: Gold, trace; silver, trace; copper, 0.8 per cent. The next 3.8 feet of banded quartz and chlorite with some chalcopyrite assayed: Gold, trace; silver, trace; copper, 0.5 per cent. And 2.4 feet on the foot-wall, consisting of quartz well mineralized with disseminated chalcopyrite, assayed: Gold, trace; silver, trace; copper, 2.7 per cent. The shear is contiguous to a granitic dyke.

At the time of examination work was being prosecuted in a tunnel that should cut the foot-wall with a back of about 10 feet at about 11 feet from the portal. The tunnel is only 20 feet from the open-cut described above, and with no back developed is practically superfluous. The operators are advised to prosecute further systematic tracing and surface exploration by open-cutting at reasonable intervals. Should this work indicate a sufficient surface continuity of the promising showings exposed in the present cuts, the occurrence should receive further preliminary exploration by diamond-drilling. This would shed some light on underground mineralization. It would also determine the most important factor of the depth of the underlying batholith and whether the shear continued through the sediments into the granitic basement.

Interesting possibilities worth investigating are suggested by the fact that the deposit is on the border of a quartz-diorite area of the batholith known to be gold-bearing. The characteristic gold-bearing part of the batholith indicated by various deposits on the coast is the quartz-diorite phase of the roof or cupola horizon (*see* "Geological Discussion," introductory to this report). Development of the old *Surf Inlet* property on Princess Royal island showed the shear-zone of that deposit to be continuous from the quartz diorite into a remnant of overlying schist and to contain good gold values in the schist close to the quartz diorite. This suggests the interesting possibility that the *Copper Coin* shear may continue into the underlying batholith, with possible appreciable gold values in the batholith and in the schist in contact

with the batholith. Besides its interesting copper mineralization, it would seem that the *Copper Coin* is a geological speculation worthy of thorough exploration.

Drumharvey. This group is situated on the westerly side of Tuck inlet, about 4 miles northerly from Prince Rupert. The property is owned by W. H. Montgomery, of Prince Rupert. It consists of *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 consists of zinc-blende, galena, pyrite, pyrrhotite, and a little chalcopyrite in a glassy quartz gangue in gneissic schist. At the time of examination a small discontinuous lens of this material about 12 inches wide was exposed on the side of a creek. This showing does not hold much promise. However, this pendant area of the Prince Rupert series is worthy of further prospecting.

Englestone. This group is situated about 1 mile beyond the first narrows on the west side of Tucks inlet, about 7½ miles northerly from Prince Rupert. The property consists of the *Englestone* and *Englestone Fraction* claims and is owned by S. K. Larson, of Prince Rupert.

The formation consists of metamorphosed schists of the Prince Rupert series striking N. 10° W. (mag.) and dipping 45° east. In this locality the schists are decidedly silicified and garnetized in places. The showing between the beach and altitude 150 feet consists of several sheared zones with small lenses of glassy quartz, occurring in a dark-coloured pyritized schist. In places the quartz carries massive patches of pyrrhotite with a few specks of chalcopyrite. These have been prospected by stripping, open-cutting, and a short tunnel. A sample across 6 feet of the face of the tunnel, showing quartz-streaks, some massive pyrrhotite and sparse chalcopyrite in talcose, sheared and pyritized mica-schist, assayed: Gold, trace; silver, 0.2 oz. to the ton. A sample of the foot-wall of the shear in an open-cut, showing silicified mica-schist, pyrite, and some pyrrhotite, assayed: Gold, trace; silver, trace. A sample of silicified pyritized schist, 300 feet east of this cut, assayed: Gold, trace; silver, 0.20 oz. to the ton. These showings do not hold much promise; the area, however, warrants further prospecting.

Canadian National Railway Section.

During the summer season this section was comparatively inactive. Coincident with the usual fall closing of the fishing season, however, fishermen who devote part of their time to prospecting were quite active in exploring the belt of the Prince Rupert formation penetrated by the highway and extending from Prince Rupert to mileage 16 on the Canadian National Railway. This activity resulted in several discoveries and a revival of interest in the mineral possibilities of this area.

In the 1929 Annual Report four inclusion areas of basic schists from 2 to 6 miles wide, occurring at mileages 36, 46, and 68, were recommended for thorough prospecting. The belt, 8 miles wide, of Kitsalas series (Triassic) porphyrites, andesites, tuffs, and breccias which crosses the railway at mileage 82 is also recommended for intensive prospecting. Prospectors are also advised not to neglect the gold-bearing possibilities of the batholithic rocks, especially in the sections of segregated quartz diorite that may occur close to the contacts of these rocks with the inclusion belts (*see* "Geological Discussion").

Some further work was carried out on the *Autumn* and *Teddy Bear* groups, located in the Kitsalas series belt, about 8 miles west of Terrace. The *Autumn* group was described in the 1929 Annual Report. The *Teddy Bear* will be examined in the 1931 season.

Kitsumgallum Lake Section.

This section embraces an area striking north-westerly, contiguous to the eastern contact of the Coast Range batholith, from Terrace in the Skeena River valley to the Nass River divide. The contact follows approximately the Kitsumgallum River drainage-trough. In the neighbourhood of the south end of Kitsumgallum lake Upper Jurassic granodiorite and quartz-diorite rocks of the batholith cross the valley in an easterly direction and continue south-easterly in a spur 10 miles wide that crosses the Skeena River valley at Terrace. The rocks bordering the main batholithic contact from Kitsumgallum lake north to the Nass River divide and beyond are mainly Middle or Lower Jurassic argillites, sandstones, quartzites, and tuffs of the Upper Hazelton group. A small area of Skeena formation argillites, sandstones, and shales of probably Lower Cretaceous age embraces a part of the Cedar River area, immediately north of Kitsumgallum lake. An interesting feature of the area is the tendency to gold-ore deposition in the

section lying to the east of the northerly half of Kitsumgallum lake, embraced by Maroon and Goat mountains. These gold-deposits in quartz veins seem to be localized in a horizon of the sediments lying about 100 feet below a bed of conglomerate 50 feet thick. Several veins of this type have been discovered on the Maroon Mountain slope draining to Wesach (Hall) creek. The same condition has been found across the divide along Fiddler and Lorne creeks, draining into the Skeena river. Placer gold is found in Douglas creek, the next creek north of Wesach creek. As the conglomerate horizon would cross Douglas creek below timber-line, the timbered slopes of this creek should receive intensive prospecting for gold-bearing veins. Transportation into the area is effected by a good motor-road from Terrace to the foot of Kitsumgallum lake, a distance of 22 miles. The 7-mile length of Kitsumgallum lake to the settlement of Rosswood at its north end can be covered by small gas-boats or a trail which extends around the east shore. From Rosswood a wagon-road continues north up the Cedar River valley for a distance of about 9 miles, from where a good horse-trail extends 37 miles over the Nass River divide to Aiyansh on the Nass river.

Kalum Lake Mines, Ltd.

The property of this company consists of two claims and one fraction, not Crown-granted. The claims are situated on the west shore of Kitsumgallum lake, about 1½ miles from the foot of the lake. The company is capitalized at 75,000 shares of $1 par value; most of the outstanding stock is held locally. The mineral occurrence consists of narrow quartz veins in argillite and quartz diorite, mineralized with gold-bearing pyrite in erratic distribution. The veins have been explored by some open-cutting, two inclined shafts, 32 and 81 feet deep respectively, about 205 feet of drifting, and three short crosscuts. There is also an adit-drift 90 feet long. Due to inadequate pumping facilities the underground workings have been flooded. A sample of selected sulphides from a small dump at the shaft-house assayed: Gold, 0.62 oz. to the ton; silver, 2.2 oz. to the ton.

Motherlode.

This property of seven claims, owned by Oscar Olander and associates, of Terrace, is situated at altitude 5,000 to 6,000 feet on the south-west slope of Maroon mountain. The property is reached by a good trail, about 4¾ miles in length, from Rosswood at the north end of Kitsumgallum lake. The formation of the area consists of silicified argillites and schists, striking N. 20° E. and dipping 50° west, intruded by quartz diorite.

Exploration on this property was undertaken for the purpose of trying to locate a mineralized band in the sedimentaries surmised to occur on account of the presence of float on the steep, talus-covered slope of the mountain. Several large blocks of this float are scattered through the coarse talus from the base of the peak to about half-way up. Some very high assays in silver are reported by the owners from these blocks of float. A specimen sample containing pyrite, zinc-blende, a little galena, and some grey copper, taken by the Resident Engineer, assayed: Gold, 0.04 oz. to the ton; silver, 19 oz. to the ton; copper, 0.3 per cent.; lead, trace; zinc, 4.4 per cent.

The property is being explored by two tunnels crosscutting the formation. The lower tunnel at elevation 5,410 feet has been driven 140 feet in argillite; the upper tunnel at elevation 5,590 feet is in 210 feet. Recent work has been prosecuted in the continuation of the upper tunnel. This crosscuts about 100 feet of argillite from the portal, then 65 feet of coarse hornblende porphyry, after which it enters chlorite-schist with brown mica and disseminated pyrite and pyrrhotite. The face is composed of chlorite-schist seamed with small calcite veinlets and mineralized with some pyrite and pyrrhotite. A chip sample of this assayed: Gold, trace; silver, 0.5 oz. to the ton.

The mountain slopes from the tunnel portal to the peak at an angle of 35°. At the mountain-peak, altitude 5,890 feet, the formation dips at an angle of 55° towards the tunnel portal at altitude 5,590 feet. Should this dip persist, this tunnel should crosscut any strata or bed occurring between the portal and the mountain-peak at about 220 feet in. With the tunnel already advanced 210 feet, a further advance of about 30 feet could be safely taken as having crosscut every belt of the formation lying between this portal of the tunnel and the peak of the mountain.

Black Wolf Mining Co.

This company was organized in the State of Washington in 1923 with a structure of 100,000 shares of $1 par value. The property consists of the *Black Wolf* group of five claims, situated on the westerly slope of Maroon mountain towards Wesach creek, at altitude 5,000 feet. A good horse-trail

about 4½ miles in length leads to the property from Rosswood. No work has been done on the property since the 1928 season.

The ore occurrence, which has been partially explored, consists of two narrow flat-dipping quartz veins mineralized with galena, zinc-blende, and pyrite and carrying good gold values in places. These have been opened up by two short tunnels and some stripping. These veins occur either in or below a bed of conglomerate which seems to form the upper horizon on Maroon mountain of several quartz veins carrying attractive gold values. The main tunnel had been driven about 100 feet on a vein occurring in the conglomerate near the top of a bluff south-east of the old camp-site. At the outcrop this vein is from 12 to 24 inches wide and dips 47° east. Towards the face of the tunnel it flattens considerably and is from 4 to 8 inches wide. In places it is well mineralized. A sample across a width of 12 inches, 30 feet in from the tunnel portal, assayed: Gold, 1.06 oz. to the ton; silver, 2 oz. to the ton; lead, 1 per cent.; zinc, 5 per cent.

A continuous vein system that without further work cannot, however, be said definitely to be one and the same vein outcrops across the *Black Wolf*, *Hawk*, *Bear*, *Cub*, and *Gold Cap*, and across Wesach (Hall) creek to the *Alice* group on Goat mountain. In several places in these various outcrops good gold values, and in the weathered portions of the veins some free gold, occurs. The veins are generally narrow, but these properties operated together as one unit would be attractive for exploration as a possible small-tonnage gold proposition. Near the trail westerly of the old *Black Wolf* camp a quartz vein about 6 feet wide outcrops. No work has been done on this. Considering the size of this vein and the occurrence of gold values in the neighbouring smaller veins, it is worthy of exploration by stripping and open-cutting.

Hawk. This group of two claims is owned by Dave Wilson and William Treston, of Terrace. It is situated on the north slope of Maroon mountain to Wesach (Hall) creek, at altitude 4,300 to 5,000 feet. The property adjoins the *Black Wolf* on the south and the *Bear* on the east. The ore occurrence consists of quartz veins mineralized with pyrrhotite and some pyrite, in a country-rock of argillite and argillaceous sandstone, with some aplitic dykes. Cuts have been excavated in several places on veins 12 inches to 4 feet wide, in attempts to prove continuity of the *Bear* vein on this property. The veins exposed strike generally north-east, across the formation bedding, and dip from 45° to 60° both east and west. A sample of massive pyrrhotite occurring in a vein 4 feet wide at altitude 4,750 feet assayed: Gold, trace; silver, trace. At altitude 5,000 feet there is an interesting occurrence of a hydrocarbon mineral resembling anthraxolite in a shear 12 inches wide, in graphitic slate.

The vein most likely to be the continuation of the *Bear* vein is that occurring close to the boundary of the *W.L.* (old *Hall* fraction *Black Wolf* group). This consists of 18 inches of quartz striking N. 30° E. (mag.) and dipping 60° south. This should be traced north by open-cutting and stripping at intervals towards the workings on the *Bear* vein.

On the *Old Timer* claim a newly discovered quartz vein 8 feet wide is being open-cutted and stripped. This vein outcrops on the west bank of a creek, strikes N. 40° W., and dips 70° north. Another wide quartz vein also occurs in the bed of the creek. A pronounced shearing structure accompanies these veins. The only mineralization evident is pyrite, pyrrhotite, and limonite. These claims are in an area known to contain gold-bearing veins and warrant extensive prospecting.

Bear. This group, consisting of the *Bear* and *Cub* claims, is owned by Matt Allard, of Terrace, and is situated on the north slope of Maroon mountain at altitude 4,500 feet. The property is about 7 miles from Rosswood and is reached by a good horse-trail. There is a good camp consisting of a cook-house and a well-constructed bunk-house.

The ore occurrence on the *Bear* consists of a quartz vein 2 inches to 3 feet wide, striking N. 30° E. (mag.) and dipping 55° south, in slate and argillaceous sandstone country-rock. Mineralization consists of galena, zinc-blende, pyrrhotite, and pyrite in banded structure, in places carrying good gold values. Some free gold also occurs in the weathered portions of the outcrop. The vein has been traced across the *Bear* claim from the tunnel in an easterly direction into the adjoining *Gold Cap* claim for a distance of about 1,200 feet. At the *Gold Cap* line the vein is from 2 to 3 inches wide.

Between 1925 and 1927 the property was under option to Idaho parties, who carried out underground exploration by a 142-foot crosscut tunnel to the vein, with drifts on the vein for

39 feet to the north and 27 feet to the south. The back at the point of intersection by this tunnel is about 75 feet. In the face of the north drift the vein is 1.3 feet wide and in the face of the south drift it is about 5 inches wide. Throughout the 66 feet of drift the vein carries a fair mineralization of galena, zinc-blende, pyrrhotite, and pyrite. A sample across 1.3 feet of the vein in the face of the north drift assayed: Gold, 0.50 oz. to the ton; silver, 2 oz. to the ton; lead, 1.2 per cent.; zinc, 6 per cent. A chip sample of a 2-foot width of the slate wall-rock on either side of the vein, showing disseminated pyrrhotite, assayed: Gold, trace; silver, trace.

On the *Cub* claim at altitude 4,350 feet a quartz vein 1 to 2 inches wide outcrops in a slate country-rock on the east side of a steep gulch. It has been traced about 80 feet along the side of the gulch and at the north end is well mineralized with galena. The foot-wall of the vein is a pyrrhotized and silicified aplitic dyke.

During the course of their option on this property the Idaho parties attempted the commercial extraction of gold from the *Bear* vein by means of amalgamation in a Ross mill in conjunction with a small Wilfley table. It would seem that these operations were conducted without the necessary technical supervision and advice. The property is decidedly worthy of further development. It is suggested that a consolidation of this and adjoining properties would be worthy of exploration for the possibility of a small-tonnage gold-producing operation.

Gold Cap. This claim is owned by J. Carruthers, of Terrace, and adjoins the *Bear* on the east. It is situated about 2 miles from the Fiddler Creek divide to the Skeena River valley. The ore occurrence is a quartz vein 2 to 3 inches wide, much oxidized on the surface and in places showing specks of free gold in the cavernous quartz. The vein strikes N. 30° E. and dips 15° south. The country-rock is sandstone and arkose slate. At this locality the formation is folded and the showing is near the top of a gentle anticline, with the north limb dipping north into Goat mountain and the south limb dipping towards the Skeena River valley. The vein has been traced from the *Bear* for an appreciable distance on the *Gold Cap* by surface-trenching.

Alice. This property of one claim and a fraction is owned by Paul Broden and associates, of Terrace, and adjoins the *Gold Cap* on the east. Some work has been carried out on what is possibly the continuation of the *Bear* and *Gold Cap* vein on the south side of Wesach creek. The occurrence here is 3 feet of oxidized quartz stringers in slate. Where the vein crosses the creek the owners report that it assays $7 in gold. Very little work has been done on this property and further tracing is necessary in order to correlate the showings with those on the *Gold Cap* and *Bear*.

Hunter. This group of four claims is situated on the south side of Egan creek, a tributary of the Cedar river, about 16 miles from Rosswood at the head of Kitsumgallum lake. The claims are reached via the wagon-road from Rosswood (altitude 480 feet) to 9-Mile (altitude 850 feet), whence a good trail leads to the property at altitude 1,530 feet. Along this trail the bridge over Johnson creek (altitude 2,120 feet), 4½ miles from the wagon-road, is in need of repair, and the bridge across Lawrence creek, 1¼ miles north of Johnson creek, has collapsed.

The occurrence is a brecciated quartz vein of undetermined width striking N. 80° E. (mag.) and dipping 65° north, in a formation of bedded sandstone and graphitic slate. The vein has been traced for about 150 feet. Mineralization consists of irregular patches and specks and small seams of galena, zinc-blende, and chalcopyrite. On the foot-wall of the vein exposed in the most westerly cut a 2-foot width of fair chalcopyrite mineralization is exposed. The vein has been explored by two shallow shafts and one open-cut. A sample across 2 feet of the best-mineralized band on the foot-wall of the vein in an open-cut near the edge of the creek assayed: Gold, trace; silver, 2.3 oz. to the ton; copper, 0.8 per cent.; lead, 3.2 per cent.; zinc, 0.5 per cent.

Placer-mining.

Douglas Creek. Placer-mining has been carried on in a small way on Douglas creek by old-timers and remains of these workings are seen in several places. In recent years work has been done spasmodically in a small way and some gold has been recovered. Douglas creek is a small stream flowing into the north end of Kitsumgallum lake, and draining the northerly slopes of Goat mountain and the southerly slopes of Couture mountain.

Half a mile up the creek from its mouth, the stream continues east to the Skeena River divide in a narrow canyon which is particularly confined for the first 3 miles of this distance. The formation is bedded argillaceous sandstone, sandstone, and quartzite. The bedding strikes N. 70° W. (mag.) and dips 10° to 15° east. As the creek consequently flows almost at right angles to the strike and the bedding dips up the stream, there is little chance for bed-rock riffles to be formed. Consequently there is a great tendency for slippage of concentrates along the slightly sloping bedding-shelves of the smooth bed-rock. Much of the gold might in this way be carried a considerable distance down the stream towards its mouth. It would seem that the section of the creek and its old channels in the neighbourhood of the mouth would be worth prospecting.

The source of the gold is probably from quartz veins lying structurally below the conglomerate-bed horizon referred to in connection with the Maroon Mountain gold-deposits. This horizon follows around Goat Mountain slope to Douglas creek from about altitude 3,500 feet at its south-westerly end to about altitude 2,500 feet at its north-easterly end, where it crosses Douglas creek about 6¼ miles from the mouth of the creek, and about 1¾ miles from Lorne Creek North Fork divide. On the north side of Douglas creek the conglomerate-bed horizon probably curves around the southerly slopes of Couture mountain from about 2,500 feet altitude at the creek-crossing to about 3,500 feet altitude on the westerly slopes of this mountain. The area below this horizon is below timber-line, but as there is a good possibility that it contains gold-bearing veins it is worth intensive prospecting.*

Nightwine Lease. About 2 miles up Douglas creek Mr. and Mrs. Nightwine, who hold a creek lease, are shovelling gravel from the creek-bed in a narrow canyon. At the time of examination (August 30th) bed-rock had not been reached. The outfit consists of eleven sluice-boxes and twenty-eight sections of flume. A daily clean-up of about $3 was being made. Better values will probably be encountered if bed-rock, which is about 6 feet below the present shovelling, can be reached.

Stevens-Cavanagh Lease. About 2¼ miles up Douglas creek, W. A. Stevens and W. H. Cavanagh, of Terrace, have two placer claims. At the time of examination they were shovelling ground worked over years ago by old-timers. About 6 feet of this ground remained to be shovelled before entering virgin ground, and about 150 feet to what is probably an old channel on the east bank of the creek. About $3 to $5 was being recovered from every three days' shovelling. The equipment consists of eighteen 10- by 12-inch sluice-boxes 12 feet long and eighteen sections of flume. There is also a very ingeniously constructed sawmill made of old Ford-car parts and odds and ends of home-made accessories.

Egan Lease.—About 1½ miles above the Stevens workings, A. Egan, of Terrace, is sluicing for bed-rock in deep-channel ground.

Lakelse Section.

The Lakelse Valley section in the neighbourhood of Terrace forms the southerly extension of the great depression which pierces the Coast range and is crossed by the Skeena river at this point. On the north side of the Skeena river this depression is occupied by the Kitsumgallum River valley, with Kitsumgallum lake as the central drainage-reservoir. On the south side of the Skeena river the depression is occupied by the valley of the Lakelse river and several smaller streams, with Lakelse lake as the central drainage-reservoir. Thick deposits of sand, gravel, and clays, of post-glacial age and possibly partly marine in origin, form the floor of the valley. As with the Kitsumgallum valley, the lowlands of the Lakelse trough are well suited to agriculture. These areas are occupied by a thriving and growing farming community.

The depression is bounded by the south-easterly continuation of the granitic spur which crosses the Skeena River valley from the east side of the Kitsumgallum valley and gradually bends south-westerly about 17 miles up the valley to again join the main mass of the batholith. The easterly margin of this granitic mass contains many small included and pendant segments of Triassic limestones and argillites. To the north and north-east, over the divide into the Zymoetz river, lies an extensive area of probably Lower Jurassic breccias, red fragmentaries, and andesite.

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* *See* G. Hanson, Geological Survey of Canada, Summary Report, 1923, Part A.

St. Paul. This group consists of five claims owned by J. A. and A. Michaud, of Terrace. The property is situated on the Lakelse Valley slope of Thornhill mountain at 4,275 to about 5,000 feet altitude, and also down the slope to the Zymoetz river. It is reached by a steep trail 3 miles long from about mileage 8 (altitude 900 feet) on the main Terrace–Lakelse Lake highway to the Forest Branch lookout on the summit of Thornhill mountain, altitude 5,050 feet.

The predominating country-rock of the area is granitic. A basic phase of quartz diorite, in places porphyritic in structure, is widespread. Pegmatite and micro-pegmatite, aplitic zones, segregated basic bands, and in places numerous dykes of dark lamprophyre also occur. To the north-west, towards the Skeena River Valley edge of the range, an inclusion of crystalline limestone with seven interbedded ferruginous bands about 8 feet wide can be seen. To the east, along the crest of the range, some small included segments of limestone also occur. The locality presents the characteristics of a typical segregated roof or cupola phase of the granitic intrusive. In this connection it is interesting to note that here again gold values feature the mineral-deposits (*see* "Geological Discussion").

On the *Sadie* claim, at altitude 5,000 feet and about 800 feet east of the lookout cabin, a replacement fracture-zone, 4 feet wide, striking N. 75° W. and dipping 80° north, occurs in basic porphyritic quartz diorite. This has been traced about 150 feet by three open-cuts. Stringers and veinlets of quartz accompanied by epidotization of the wall-rock cut through the zone in various directions and are mineralized with chalcopyrite in places.

On the *Ptarmigan* claim at altitude 4,625 feet on the Zymoetz River slope a 100-foot wide carbonate area characterized by siderite, oxidized in places to limonite, and carrying numerous quartz stringers 1 to 2 inches wide, occurs in quartz diorite. About 75 per cent. of the zone is composed of quartz, which in places is sparsely mineralized with specks and small isolated patches of chalcopyrite. The attitude of this zone is not clear. At altitude 4,700 feet and 300 feet south a similar carbonate area occurs. This is sparsely mineralized with chalcopyrite, zinc-blende, galena, and grey copper. A chip sample across 15 feet of this exposed in an open-cut assayed: Gold, 0.01 oz. to the ton; silver, 1.60 oz. to the ton. At altitude 4,300 feet a sheared carbonate-zone 10 to 12 feet wide outcrops for about 600 feet along the face of a steep bluff, striking north-south and dipping 60° west. In one small section 12 inches on the foot-wall is well mineralized with grey copper and about 4 feet shows scattered grey copper and chalcopyrite mineralization. These carbonate-zones, although large, seem to be lenticular and discontinuous and gradually grade into comparatively unaltered quartz diorite. They have the characteristics of semi-absorbed and replaced small segments of the pre-existing roof-rocks.

The main showing on this group is on the *St. Paul* claim. This is the "St. Paul" vein, a vein 13 feet wide occurring at altitude 4,800 feet, striking N. 75° E. (mag.) and dipping 37° north. The foot-wall of this ledge is composed of an aplite dyke 9 feet wide. Bordering the upper side of this is 4 feet of quartz mineralized with pyrite and some galena. The country-rock is fine-grained diorite. This vein has been traced south-west for several hundred feet by short tunnels and cuts across the *St. Paul* claim into the adjoining *Society Girl* group (D. Mason, Terrace). A chip sample across 4 feet exposed in a short crosscut through the vein assayed: Gold, 0.50 oz. to the ton; silver, 0.1 oz. to the ton. Two or three smaller quartz veins occur on the *St. Paul;* one at altitude 4,275 feet has been traced about 400 feet and in one place carries some scheelite, barite, pyrite, galena, and zinc-blende, with specks of free gold. On the *Annie Laurie* a small 8-inch wide barren quartz vein also occurs. The "St. Paul" ledge, however, is a well-defined vein, carries attractive gold values, and is worth further extensive exploration for possible commercial ore-shoots.

La Libertad. This claim is situated at altitude 4,800 feet on Thornhill mountain and is owned by P. J. Fitzpatrick, of Terrace. The showing consists of a sheared carbonate-quartz vein from 4 to 8 feet wide occurring in quartz diorite cut by many lamprophyre dykes. The vein strikes N. 30° E. (mag.) aand dips 60° north. The vein has been traced about 900 feet by open-cutting and stripping. Quartz and siderite stringers cut through the vein in various directions and are mineralized in places with small seams of chalcopyrite, grey copper, and galena. Good values in gold and silver have been reported from selected samples from this vein, but no criterion of the possible extent of the comparatively sparse mineralization showing in the exposures can be formed from the small amount of work done.

Eureka. This claim is situated at altitude 4,825 feet on Thornhill mountain and about 2 miles south-east of the Forest Branch lookout. It is owned by J. A. Michaud and A. Michaud, of Terrace. The ore-showings consists of molybdenite in aplitic and pegmatitic granite. The ore occurrence does not follow any particular structure and the molybdenite occurs in isolated scattered bunches and small lenses with an occasional slight impregnation into the aplite wall-rock. It does not seem that this deposit could be mined in bulk, but small quantities of a good commercial grade could possibly be taken out by individual operators, mining selectively in a small way and cobbing and sorting the ore.

Copper Queen. This group of claims is owned by J. Bell, of Terrace. It is situated on the high-altitude terrain on the south side of Williams creek, about 10¾ miles from mileage 8½ on the Terrace–Lakelse Lake auto-road. From Johnson's ranch on the auto-road 1¼ miles of fair road leads to Bell's cabin (altitude 550 feet), beyond which there is a truck-road for a further three-quarters of a mile. From this point a good horse-trail up Williams Creek valley leads to Michaud's trap-line cabin at 5-Mile (altitude 1,200 feet), where Williams creek is crossed; 5-Mile creek is crossed about half a mile beyond Williams Creek bridge. From this point for about 2½ miles to timber-line at altitude 3,300 feet the trail is very steep and badly located, no effort having been made to achieve grade. From altitude 3,500 feet the trail follows a series of meadows to the tent camp at altitude 3,375 feet. The showings are situated about 1 mile from the camp on the steep slopes of a glacier-fed creek-draw from altitude 3,800 feet to near the top of the ridge at altitude 4,800 feet.

The geology in the locality of the showings is featured by isolated inclusion-segments of limestone and silicified slate surrounded by intrusive fine-grained granitic to gabbroic rocks of the batholith. In places the limestone is thickly fossiliferous and contains numerous crinoid stalks, brachiopods, molluses, and sponges. In places the limestone is completely altered to epidotite and garnetite, and the slates totally silicified and heavily impregnated with pyrrhotite and pyrite.

The ore-showings consist of isolated lenses of garnetite and epidotite mineralized with chalcopyrite, magnetite, and in places with some galena and zinc-blende. The predominating mineral in these lenses is magnetite in massive streaks and bunches in which is sometimes a generally sparse admixture of chalcopyrite with accompanying oxidation products of malachite and azurite. The showings have been explored by open-cuts which expose widths of from 6 to 15 feet of the mineralization. The lenses, however, are generally small and discontinuous and in some instances totally surrounded by intrusive rock. The ore occurrence is a typical contact-metamorphic mineralization of isolated sedimentary inclusion-segments in intrusive rock.

Surprise. This property is situated south-east of and adjoining the *Copper Queen* group. It consists of the *Blue Bell*, *Hidden Trail*, *New Find*, and *Surprise* claims and is owned by T. Turner and associates, of Terrace. The geology of the locality coincides with that described on the adjoining *Copper Queen* group. The ore-showings are along the crest of the range from 4,800 to 5,075 feet altitude. These have been explored by several open-cuts and expose epidotite and garnetite, mineralized with massive magnetite in bunches and small lenses, with a very sparse admixture of chalcopyrite and its oxidation products of malachite and azurite. These lenses have a width of from 8 to 15 feet, but are discontinuous and isolated. The whole locality is intensely intruded by fine-grained granitic rocks which in some instances totally surround the included limestone and slate segments. The ore occurrences are typical contact-metamorphic small lenticular deposits in comparatively small and isolated segments of sedimentaries in granitic rocks of the batholith.

Non-metallics.

Clay-deposits suitable for the manufacture of brick and tile are known to occur in the neighbourhood of Terrace. On T. Turner's ranch, about 4 miles from Terrace, there is an extensive occurrence of a fine, very plastic chocolate-brown clay. During the summer T. Turner was experimenting with this material and turning out a fair-grade brick from a crude kiln. A sample submitted to the Bureau of Mines is pronounced as a good clay suitable for the manufacture of common brick and tile.

Over the divide from Williams creek to the Chlore (South fork of Zymoetz) river a fine plastic purplish-brown clay of very absorbent quality and with a remarkably low coefficient of expansion occurs. Another remarkable feature of this clay is that it hardens very rapidly on

drying with a normal temperature and takes a brilliant polish without burning or glazing. This material would seem to have possibilities for the manufacture of art pottery.

Several thermal springs are known to occur in the Skeena River area. One in the neighbourhood of Port Essington is much frequented by local residents and in the summer-time by fishermen. On Lakelse lake a thermal spring has been exploited and splendid accommodation is available in a hotel at the springs.

Near Kwinitsa Station on the Canadian National Railway a strongly saline brine-spring has been known for several years. This was at one time operated by the British Columbia Salt Works, Limited, which recovered the salt by evaporation. In 1913 this deposit was bored and 15 tons of salt was produced at an experimental plant. No development-work has been done since then. The dried salt from the deposit analyses: Sodium chloride, 98.15 per cent.; calcium sulphate, 1.82 per cent.; traces of several other constituents. The deposit is described in the Annual Report for 1913, page 85, and in Bulletin No. 716, Canada Department of Mines, 1930.

NASS RIVER MINING DIVISION.

The Nass River Mining Division embraces an area of approximately 4,000 square miles. Although it is the smallest Division in the district, it holds the distinction of being a very important producing area. Within its confines is the *Hidden Creek* copper-deposit, operated by the Granby Consolidated Mining, Smelting, and Power Company, Limited. This is one of the largest copper-producers in the Province.

Geologically this Division embraces a substantial portion of the central pendant-inclusion area of the Coast Range batholith cross-section and an appreciable length of the eastern contact margin. The mineral-deposits of the Division vary in character in conformity to their relationship to these geological conditions. The outstanding general feature in this respect is a lowering genetic temperature gradation from west to east, embracing predominating copper mineralization in the westerly pendant-inclusion area to a predominating zinc-lead-silver mineralization along the eastern contact margin. This feature is elaborated under the heading "Geologic Discussion," introductory to this report.

During 1930 the stagnation, especially in the silver and zinc markets, has retarded progress in the development of the promising eastern contact margin, of which the Alice Arm section is the important centre in this Division. With an adjustment of world economics appearing on the horizon, it can be taken that this set-back is but temporary and that the Alice Arm area must receive the active development attention its important ore-deposits warrant. In this area there are known ore-bodies of potential commercial promise. Further extensive exploration and possible production from these sources should materialize with an adjustment of and stability in the silver, lead, and zinc markets. Accompanying this possible future production is the development in the area tributary to the coast of a sufficient continuous tonnage of this type of ore that would warrant the inauguration of smelting and refining facilities on the British Columbia coast. This metallurgical factor would not only revolutionize production from the whole North-western District, but the Alice Arm area would be reinforced against future set-backs and would play a very important rôle in the picture.

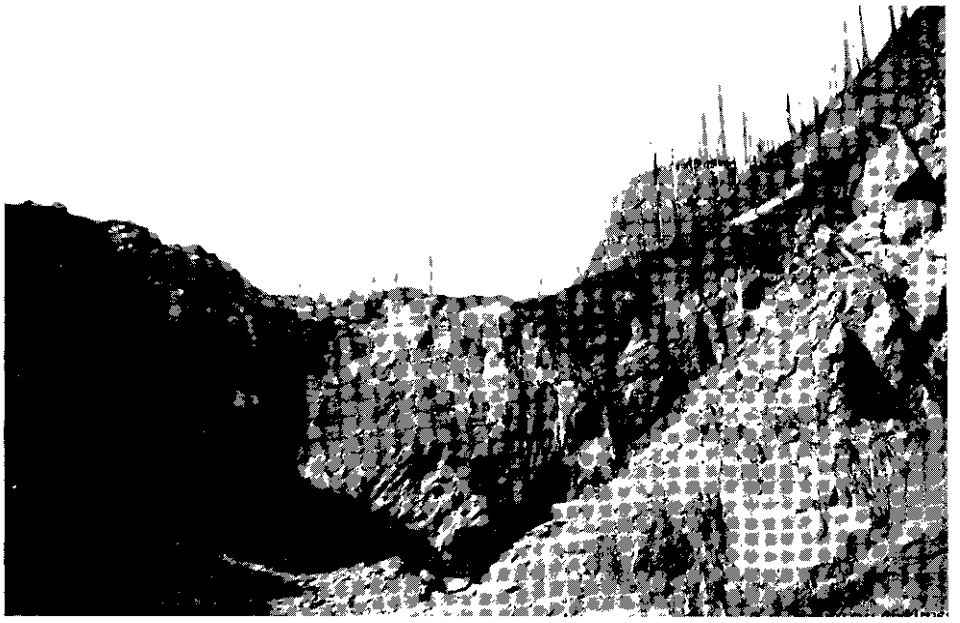
As with all the known mineralized areas of the district, much of the Alice Arm and other sections of the Nass River Mining Division still remains to be thoroughly prospected. With a better understanding of the geology and localization of ore-bodies in the important Alice Arm area gradually emerging, new ore sources and possibilities are gradually being indicated. In this category are possibilities for appreciable zinc-lead-silver replacement and disseminated deposits in the porous tuff-beds of the Kitsault River and Dolly Varden formations contiguous to the upper Kitsault River valley, and the gold-bearing possibilities of siliceous pyritic zones contiguous to intrusive diorite or porphyrite on the high-altitude ground west of the Kitsault glacier. These possibilities are deserving of intensive investigation.

Observatory Inlet Section.

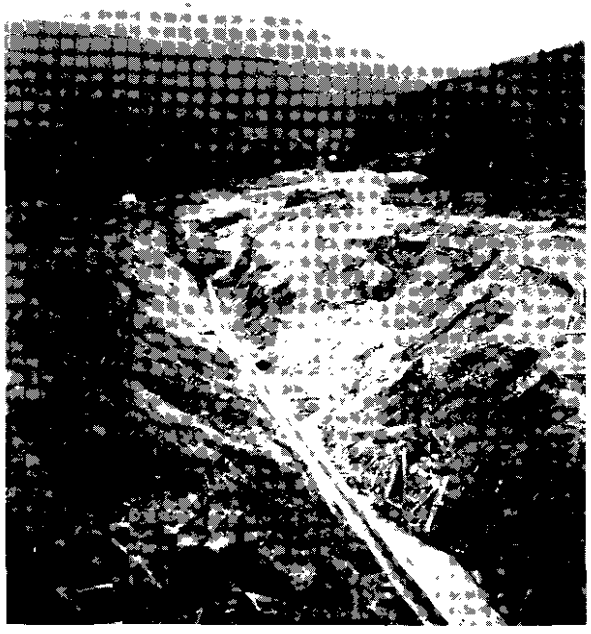
Granby C.M.S. & P. Co., Ltd.

This company acquired the *Hidden Creek* group in 1911 and brought the ore-deposits into production in 1914. This operation is one of the largest copper-producers in the Province. The ore occurrence consists of replacements and sheared zones in an inclusion of argillites and altered andesites about 9 miles wide in granodiorite of the Coast Range batholith. Numerous dykes cut the formation and the ore-bodies. Mineralization consists of pyrite, pyrrhotite, chalcopyrite, some

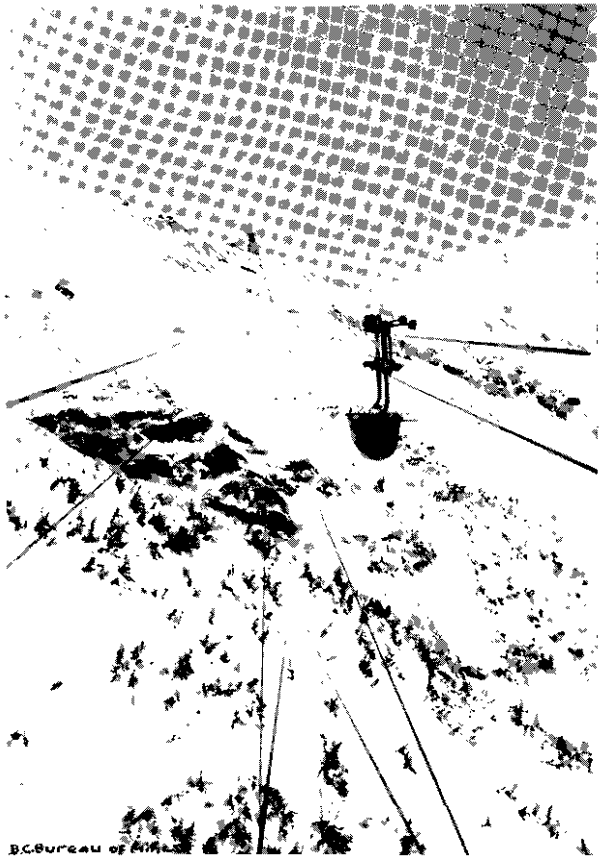
Granby Consolidated M.S. and P. Co.—Looking South from Mine, Anyox.



Granby Consolidated M.S. and P. Co.—Glory-hole at Anyox.

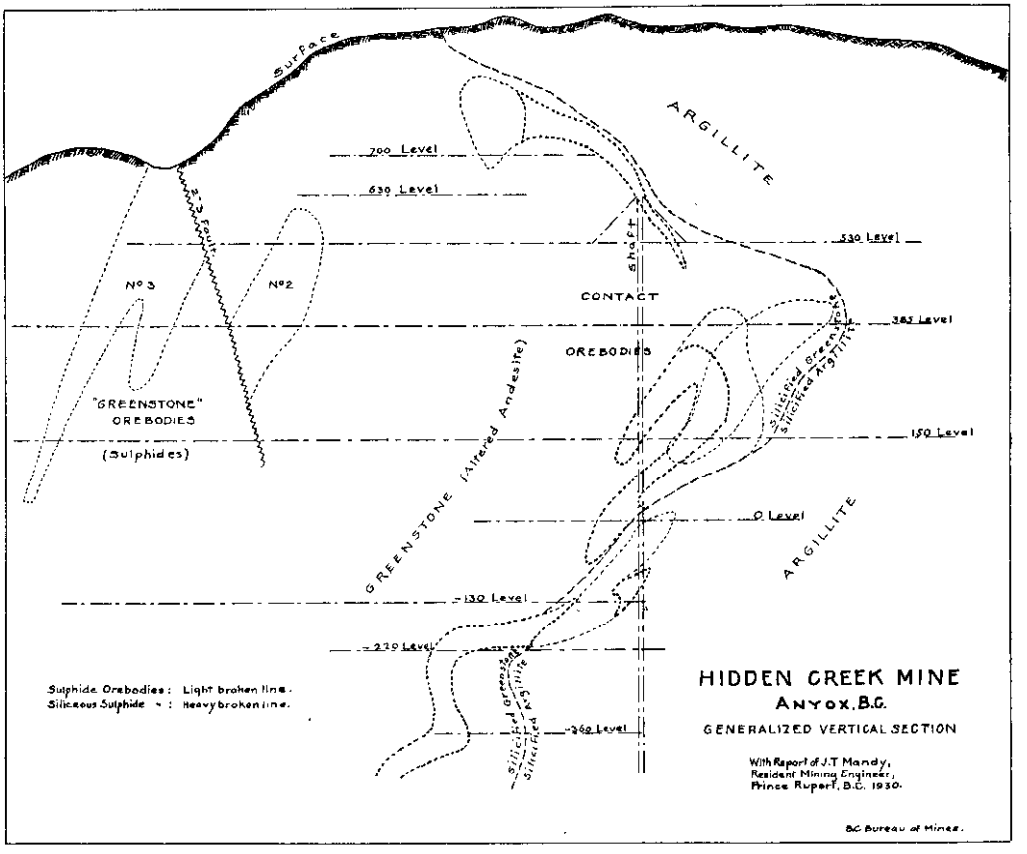


Boulder Creek, Atlin—Placer-workings.



Porter-Idaho Tram, Portland Canal M.D.

zinc-blende, magnetite, arsenopyrite, and galena. The ore-bodies occur at or near the north-south-striking contact between argillite and a younger intrusive of so-called "greenstone" (altered andesite). Acute folding and faulting is a pronounced feature of the formation and the ore seems to be intimately related to these structural conditions, favouring the crests and troughs of the folds. The ore-deposits are replacements along the folded argillite contact or are in sheared zones in the "greenstone" contiguous to the contact. The argillite-contact ore is generally more siliceous and pyritic than that in the greenstone, which is generally an association of chalcopyrite and pyrrhotite. The lithological and structural relationship of these two types of ore-bodies is well illustrated in the accompanying generalized vertical section which has been kindly supplied by the Granby Company management. It will be observed that Nos. 2 and 3 ore-bodies are one ore-body separated by an easterly-dipping fault. This structural relationship



is also shown in the accompanying photograph looking north across the glory-hole on these ore-bodies. The possible relationship of the contact ore-bodies to each other and the possibility for depth continuity in conformity with the vertical continuation or repetition of the related structure is apparent.

The *Bonanza* ore-body is situated on Bonanza creek, about 3½ miles southerly of the *Hidden Creek* deposits. Although the structure of this ore-body is not quite clear, it appears to be a shear-zone in biotite and hornblende-schist near its contact with argillite. Numerous dykes of light and dark lamprophyre and also diorite cut through the formation in a general east-west direction. A large dyke of aplite cuts across the 250-foot level tunnel on the south side of Bonanza creek. In the shaft on the north side of the creek a pronounced fault strikes N. 30° W. (mag.) and dips 70° south. The ore-zone seems to occupy a flat anticlinal fold. The south wing dips from 10° to 15° W. and steepens to a dip of about 30° west about 500 feet southerly of the outcrop, at the same time diminishing in width and increasing in grade. To

the east the structural continuity is not clear. This zone has been developed on the north and south sides of Bonanza creek. On the south side it is from 80 to 90 feet thick. The best development of ore seems to occupy the central portions of the zone where there are ore-widths up to 70 feet, with the best grade developed in 10- to 40-foot widths on the foot-wall side. In the zone bands of solid sulphides (pyrite with chalcopyrite) several feet in width are separated by belts of very sheared chloritic schist, also containing ore. A peculiar feature of these bands is a streak of loose-grained rhombdodecahedral pyrite with a little chalcopyrite and pyrrhotite 12 to 18 inches thick, generally on the foot-wall side. The attitude of these sulphide-bands in the zone is not clear, and it is possible they may, in part, be unconformable to the walls of the zone itself. The shoots of the best ore are irregular in shape and sometimes occupy the locality of "rolls" in the zone, which may also possibly be interzonal and unconformable to the walls of the zone. This deposit was brought into production by the Granby Company early in 1929.

The town of Anyox, from which the operations on these ore-deposits are carried out by the Granby Company, has a population of about 2,000. During 1930 an average of about 1,000 employees was engaged at the Anyox plant and about fifty at the *Bonanza* mine. Ore produced from the various operations and treated amounted to: *Hidden Creek*, 1,424,594 tons; *Bonanza*, 88,317 tons; *Granby Point*, 665 tons. Copper production amounted to 30,551,423 lb. Throughout the year the smelter operated continuously. The mines and concentrator were operated on a somewhat curtailed basis, as a result of which they were shut down occasionally for a day or two at a time. A very creditable reduction in per-pound cost of copper production was achieved during the year.

Hidden Creek operations consisted of the usual mining with the necessary accompanying development. Development consisted chiefly of shaft-sinking to the minus 960-foot level and the starting of the minus 535-foot and minus 885-foot levels. Exploration by crosscutting, drifting, raising, and diamond-drilling was also carried out on the upper levels. Extensive development was also carried out on the minus 220-foot level in the country lying north of the projection of No. 6 ore-body. For the *Hidden Creek* operation the main working-tunnel from the mine camp is the plus 385-foot level; the main haulage-tunnel for the smelter is the plus 150-foot level. Exploration generally has met with some encouraging indications of additional ore on the lower horizons. Geological work in connection with the elucidation of the structural characteristics of the ore occurrence was also carried on. During the year *Hidden Creek* mine was operated 280 days.

At the *Bonanza* mine operations were carried on throughout the year. On the north side of Bonanza creek the shaft was completed to 684 feet and No. 1 and No. 2 levels opened up. This work has resulted in the development of additional ore in this section, but a crosscutting fault in the shaft indicates a possible northerly limitation. On the south side the main 250-foot level was driven ahead and raises driven from it for mining the south end of the ore-body. Structural mapping to clarify the mode of occurrence and attendant dislocations of this ore-body has also been carried out. The possibility for the development of additional ore reserves, particularly from the westerly continuity of the south section of this ore-body, appears encouraging. During 1930 the *Bonanza* mine was operated 316 days.

About the middle of November a slide caused by incessant heavy rains demolished the *Bonanza* bunk-house and unfortunately resulted in seven fatalities and several being injured. Reconstruction of the bunk-house was undertaken immediately.

Granby Point, ore from which is largely used as flux, was closed down on January 19th, 1930, as far as ore-breaking was concerned, although shipments to the smelter were continued until some time in February. Work was carried on for a total of forty-three days at this operation.

Deadwood and Quartz.

These groups adjoin the *Hidden Creek* mine-workings on the north and are owned by W. Hanna, of Anyox. Each group consists of seven claims. The main showing is on the *Deadwood* claim on the west side of Hidden creek. This consists of a silicified mineralized zone about 30 feet wide in altered andesite, striking N. 20° E. (mag.) and dipping west. It outcrops along the ridge at altitude 775 feet on the west side of the creek and has been traced about 300 feet south from the first open-cut opposite the cabin and for an appreciable distance north of this. Mineralization consists of pyrrhotite carrying some chalcopyrite.

At altitude 750 feet near the bed of the creek and east of the first showing an 8-foot length of siliceous replacement material mineralized with pyrrhotite and a fair admixture of chalcopyrite is exposed. Continuity of this exposure is obscured by heavy overburden. The width could not be determined, but the strike seems to be about N. 50° E. (mag.) and the dip about 45° west. The chalcopyrite mineralization evident in this patch is more intense than in the zone on the west side of the creek; the structure and shearing in the vicinity also seems to be better defined. This showing should be extensively explored. Late in the season further work was done by the owner, who reports that an exceptionally promising copper-showing has been uncovered. On the *Quartz* group the showing consists of a quartz vein 6 to 18 feet wide mineralized with pyrite, chalcopyrite, zinc-blende, and galena. This showing occurs about 2,000 feet east of the shear-zones on the *Deadwood* and is more or less parallel to them.

It would seem that there is a possibility for the northerly continuation of the structure with which the *Hidden Creek* ore-bodies to the south are related. The lithological relationship of andesite (greenstone) and argillite continues, as on the *Deadwood* there is chalcopyrite mineralization and evidence of replacement in sheared structure in the greenstone; and although the territory to the north is largely overlain by argillite, the possibility is logically suggested that folded embayments not apparent on the surface may exist in which concentrations of copper mineralization may occur.

Black Bear. This group of one claim and two fractions is owned by S. W. Barclay, of Anyox. It adjoins the *Bonanza* on the south-east at elevation 1,000 feet and occupies the south-east slope of Bonanza ridge to Granby bay. The main mineral occurrence consists of a stockwork about 600 feet wide of irregular lenticular masses, veins, and stringers of quartz in altered hornblende-schist. The general strike of this is about N. 10° E. (mag.). The widest development of quartz is about 70 feet. In one place a few small isolated bunches of chalcopyrite occur.

About 600 feet west of this showing at elevation 1,300 feet a sugar-quartz vein 10 to 12 feet wide has been traced about 500 feet, striking N. 20° W. (mag.) and dipping steeply west, in altered andesite. A felsite dyke lies in close proximity to the east wall. The only mineralization observed is a stringer about 1 inch wide and 2 feet long on the hanging-wall, carrying some molybdenite.

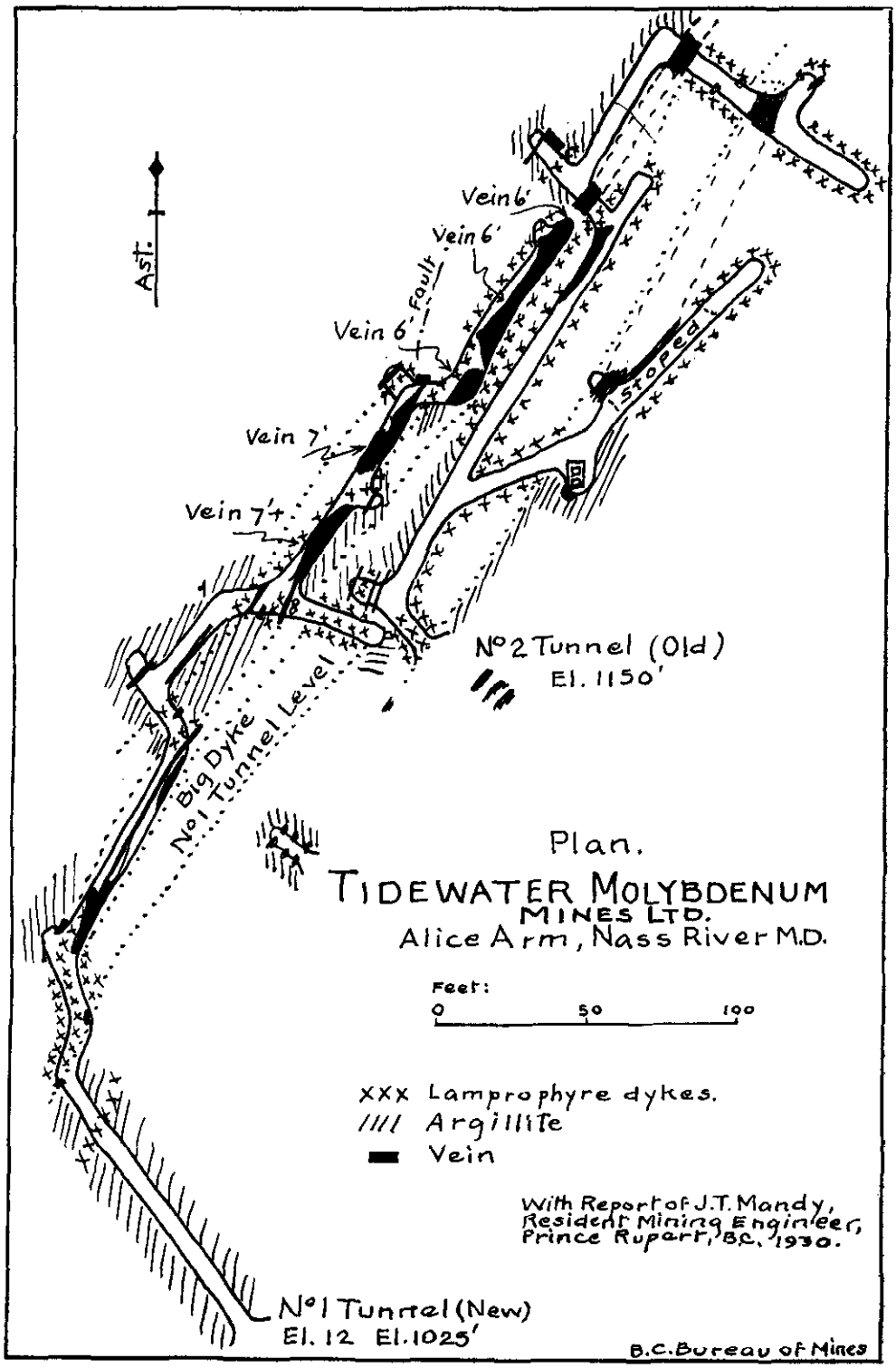
Silver Crest Mines, Ltd. This company has been developing the *Saddle* claim, situated on the crest of Saddle mountain from about altitude 4,200 to 5,000 feet. The property is situated near the head of Hastings arm on the west side. The ore occurrence has been thoroughly described in the 1927, 1928, and 1929 Annual Reports. During 1930 the contract for driving the tunnel at altitude 4,400 feet an additional 400 feet was completed in the early spring. It is estimated that a further 275 feet will have to be driven to reach the objective of the downward extension of the vein showing in the shaft at altitude 4,600 feet.

Elkhorn. This group of four claims is owned by J. Flynn and associates, of Alice Arm. It is situated on the east slope of Saddle mountain, Hastings arm, adjoining the *Silver Crest*. During 1929 an interesting discovery of free gold was made on this property. This showing was described in the 1929 Annual Report. It was hoped some extensive exploration would be carried out on this mineral occurrence during the 1930 season. Very little further exploration was carried out, however, the owners devoting their attention chiefly to trail-construction.

Alice Arm Section.

Tidewater Molybdenum Mines, Ltd. This property is now under option to the Dalhousie Mining Company, Limited. It is situated on the north side of Alice arm, about 4 miles from its head. The holdings consist of the *Molybdenum* and *Success* Crown-granted claims and about eight claims not Crown-granted. The camp is at altitude 1,025 feet, about 1 mile from the beach, and is reached by a good pack-trail. During the 1930 season this trail was considerably improved with the assistance of the Department of Mines, with a view to conditioning it for hauling machinery that may be necessary for more extended exploration.

The property was operated some years ago by the Molybdenum Mining and Reduction Company, which constructed a concentrator on the beach and an aerial tramway from the


Ast.
Vein 6'
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No 2 Tunnel (Old)
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TIDEWATER MOLYBDENUM MINES LTD.
Alice Arm, Nass River M.D.
Feet:
0 50 100
XXX Lamprophyre dykes.
//// Argillite
Vein
With Report of J.T. Mandy, Resident Mining Engineer, Prince Rupert, B.C. 1930.
No 1 Tunnel (New)
El. 12 El. 1025'
B.C. Bureau of Mines

concentrator to the mine. A limited quantity of ore was shipped. At the cessation of these operations in 1916, litigation afflicted the property and it remained idle until the resumption of development by the Dalhousie Mining Company, Limited, in April, 1930.

The geology of the section embraces a contact of sedimentaries with granitic rocks of the Coast Range batholith. The sedimentary rocks consist of interbedded slates, argillites, argillaceous sandstone, sandstone, and quartzite, with possibly some beds of water-lain tuff. In places these rocks are quite silicified and have a dense cherty texture. Due to crushing and shearing the strike and dip of the sedimentary beds is variable. The formation, however, has a general north-south (mag.) trend, with about a 60° west dip. Numerous basic dykes related to the batholith cut through the formation in a general N. 25° E. (mag.) direction. The main eastern contact of the batholith lies about three-quarters of a mile to the west of the property. About 800 feet north of the old tunnel and along the beach south of the showings granitic rocks are exposed. The sedimentary rocks in which the ore-deposit occurs occupy a marginal section of the contact area, into which tongues and spurs of the granite and its segregated cooling phases have been intruded. Due to this contiguity, crushing, shearing, and dislocations have been manifested in the sedimentary rocks and, in conjunction with the intruded dykes, cause irregularity of the ore-bodies.

The ore-bodies are quartz veins of irregular strike and dip occurring in the sedimentary rocks and lying generally conformable to the attitude of their bedding. They are cut by the basic dykes and sometimes dislocated by shearing and crushing in their vicinity. The intense shearing and crushing that has affected the formation also affects the quartz veins and in places has shattered them so acutely as to disturb their continuity entirely and produce a brecciated mixture of vein material and country-rock. Mineralization at the lower exposures at altitude 1,025 feet consists of amorphous molybdenite occurring in very fine distribution in thin layers in the quartz veins. In places a mere dark discoloration of the quartz is the only evidence of mineralization. When freshly broken, finely divided molybdenite is visible in these places under the magnifying-glass. The only adulterant accompanying the molybdenite in the lower exposures is a sparse distribution of iron pyrites. The ore occurs in concentrations of ore-shoots of irregular distribution and size in the quartz veins. The veins vary in width from a few inches to about 15 feet in places. The ore in the shoot concentrations would grade about 1 to 2½ per cent. molybdenum sulphide. A sample representing some of the best average-grade ore exposed in the old workings assayed: Gold, trace; silver, trace; copper, *nil;* arsenic, *nil;* iron, 2 per cent.; silica, 93 per cent.; molybdenum sulphide, 2.2 per cent.

About 50 feet easterly of the old tunnel portal at altitude 1,150 feet two parallel main veins and several stringers outcrop in the bed of a creek gulch. These strike north-south (mag.) and dip 60° west. These veins are cut off sharply by a fault striking N. 20° W. (mag.) and dipping 72° east, which seems to conform to the creek-bed. North of this fault several exposures of quartz carrying fair molybdenite mineralization can be seen outcropping at intervals along the creek-bed to altitude 1,375 feet. These may possibly be correlated with the showings in the east drift of the old tunnel-workings. At this altitude on the west side of the creek a quartz-outcrop 12 feet wide, carrying good molybdenite mineralization, may conform to the quartz-body developed in the west drift of the old workings. The showings on the east bank of the creek can be traced to about altitude 1,400 feet, where they seem to stringer out. As continuity in the argillite is erratic, further prospecting northward may disclose increased continuity.

On the west side of the creek the system of veins differs in texture of the quartz and in type of mineralization, particularly towards the upper workings at altitude 1,490 feet. In this higher area a fine-grained feldspathic granitic spur is approached and the molybdenite mineralization seems to give place to an increase in pyrite and the appearance of galena, zinc-blende, mispickel, and some chalcopyrite in stringers and veinlets of quartz and calcite. In the lower horizon the molybdenite is, however, remarkably free from refractory adulterants. It is hoped that shoots of good-grade clean molybdenite ore may be developed from the lower tunnel (elevation 1,015 feet) along a length of about 1,000 feet and an average backs of about 200 feet. The degree of lenticularity and frequency of these commercial-grade shoots will have to be determined by further development. There is a reasonable possibility that lateral exploration to east and west of the known veins will lead to the discovery of additional veins.

The present operators have confined their attention to the development of the lower showings of molybdenite and the proving of continuity of these veins and the molybdenite mineralization

below the main old tunnel-workings at altitude 1,150 feet. For this purpose a crosscut tunnel-site was selected on the west bank of the creek at altitude 1,025 feet. This offers an opportunity for developing backs rapidly after the veins have been intersected. This tunnel is driven on a bearing of N. 70° W. (mag.) and at about 135 feet intersects the downward extension of the vein exposed on surface, about 125 feet above, on the west side of a lamprophyre dyke 20 feet wide. Where intersected the vein carries fair molybdenite mineralization over a width of about 2½ feet. Drifting on this ore-body in a general north-west direction had advanced about 150 feet (station 8) at the time of the last examination (August 22nd). In this distance the quartz is continuous, though quite erratic in development. Much shearing and crushing is evident which in places has acutely shattered the vein and completely isolated sections of it. Basic dykes cutting the vein are also evident. In places good molybdenite mineralization is exposed in the quartz in this 150 feet of drifting. At the time of examination the face was contiguous to a basic dyke. It was the intention to cut through this to pick up the vein and possibly more stable conditions.

The management reports drifting on this vein on the west side of the big dyke has continued for a further 160 feet, showing widths of from 5 to 7 feet of quartz carrying some sparse molybdenite mineralization. In this work, although some small dykes cut across the vein, the strike of the big dyke is fairly stable. So far all the ore found on the lower tunnel-level lies on the west side of this dyke. It is planned later to crosscut and explore the east side of this dyke. Five hundred and seven feet of tunnel has been driven from April 15th to the end of the year. Work at present is being carried on by hand with a crew of twelve men. It is the conservative plan of the management not to embark on expenditure for machinery until the results of development definitely warrant this. The operation is being efficiently conducted under the direction of Angus McLeod.

Cariboo.—The molybdenite-showings on this property on the east side of Alice Arm have been further prospected by the owner. An option procured on this property by the Dalhousie Mining Company, Limited, was not exercised.

Winnie Mine Development Co., Ltd.

This company, with head office in Vancouver, was formed to take over the *Mohawk* group of claims. The group consists of twelve claims, three of which are Crown-granted, situated on the northerly side of Roundy creek, which flows into the east side of Alice arm, about 2 miles from its head. The property is reached by a good pack-horse trail from Silver City to the main workings on the *Mohawk No. 2* claim at altitude 2,225 feet, a distance of about 2½ miles. The camp cabin at altitude 2,200 and about 150 feet northerly of the main workings has collapsed and is at present not habitable.

The general geological formation of the area is Jurassic argillite, argillaceous sandstone and quartzite, intruded in places by granitic dykes and small spurs, emanating from the main batholith, which crops out about 2 miles westerly of Roundy creek. The mineral occurrence consists of a series of milky quartz veins and stringers occurring in and conformable with the bedding of the argillite. These have been prospected by several strippings, open-cuts, and a shallow shaft.

On the east side of the draw of a small creek a well-defined milky quartz vein 1 to 6 feet wide has been exposed in the face of the draw, striking N. 65° W. (mag.) and dipping 76° north. The wall-rock is silicified argillite impregnated with finely divided pyrrhotite. Several quartz stringers 1 to 2 inches wide cut through the argillite from the main vein. No mineralization of the quartz is evident in this exposure. Two trenches 150 feet south-easterly of this have been dug through overburden. These were caved at the time of examination.

On the west side of the same draw, and about 50 feet westerly of this showing, a similar quartz vein 1.6 to 1.8 feet wide has been exposed in the bank of the creek. This vein strikes N. 80° E. (mag.) and dips 80° north. Some sparse pyrite and a few small patches of a black mineral occur on the hanging-wall in this exposure, with a slight development of sericite on both the hanging and foot walls. The wall-rock is silicified argillite with disseminated pyrrhotite.

Thirty feet westerly of this exposure is a small cut in overburden. About 15 feet westerly of this a shaft 5.7 by 4.6 feet between timbers has been sunk. This was filled with water. Between the timbers of the north-east corner of the collar, however, a portion of a well-defined white quartz vein can be seen. About 15 feet westerly of the shaft a small cut exposes two stringers of milky quartz 4 and 8 inches in width, separated by 2 to 8 inches of silicified

argillite. In one place in this showing a small kidney of mispickel about 2 inches in diameter occurs. As this patch was the most metallic mineral noticed in the veins, a sample was taken to determine any possible values. This assayed: Gold, trace; silver, trace. These showings from the west side of the creek-draw to the last-mentioned cut probably represent the continuity of the one vein, a distance of about 60 feet. The showing on the east side of the draw does not line up with these exposures, and unless some faulting not now evident has occurred it is probably a distinct vein from that on which the shaft has been sunk.

Westerly of the last-mentioned cut and along a distance of about 500 feet six trenches have been dug through overburden. With the exception of the most westerly, these were caved. The most westerly of these showed some quartz in argillite, but no mineralization. About 100 feet westerly of this a milky-quartz vein 14 inches wide striking N. 65° W. (mag.) and dipping 80° north is exposed, carrying a few specks of pyrite. This has been traced for about 70 feet north-west to the main trail at altitude 2,130 feet. At altitude 1,825 feet a few stringers and patches of white quartz have been exposed by stripping the south bank of a small creek. These occur interbedded with the north-striking and vertical-standing silicified argillite and are isolated and discontinuous. Sparse mineralization of pyrrhotite occurs in one or two places in the quartz. A selected sample of this mineralization assayed: Gold, trace; silver, trace. On the south side of this creek 2 feet of barren white quartz outcrops through the overburden.

Nothing of commercial importance was seen in the exposures examined. A vein carrying molybdenite, reported to occur at a lower altitude on the north-westerly claims of the group, may warrant some prospecting.

Keystone Mining Co., Ltd.

This company has its registered office at 624 Birks Building, Vancouver, and the business office at 412 Title and Trust Building, Seattle, Wash. The property is situated on the easterly side of Roundy creek, which flows into the southerly shore of Alice arm. It is understood that the following claims are held in good standing by the company: *45, Storm King, Crackerjack, Mollie Darling, Violet, Sunset No. 1, Sunset No. 3,* and *Brownie Fraction.* The claims are reached by a good horse-trail about 3½ miles in length from Silver City, on the south shore of Alice arm, to the camp-site at altitude 2,375 feet. The camp consists of a well-built log bunk-house capable of accommodating six to eight men, an adjoining log cook-house, and a log office building capable also of sleeping three or four men. These buildings are all in good shape and equipped for immediate occupation.

The general geology of the section consists of interbedded argillite, sandstone, argillaceous sandstone, and quartzite of Jurassic age, intruded by dykes and spurs of granitic rocks. These granitic intrusives represent offshoots from the main Coast Range batholith, the easterly contact of which cuts across Alice arm about 2 miles westerly of Roundy creek.

In the area under discussion the bedded sediments have been definitely though not acutely folded, and in the area under development represent the westerly flank of a gentle anticline with a slightly west-of-north axis and a 45° to 60° westerly dip. Transverse faulting of comparatively minor dimensions has occurred along north-easterly-striking, northerly-dipping planes. Crushing and shearing has developed along lines conformable to the bedding of the sediments. The most intensive of these stress-zones have developed contiguous to the granitic dyke intrusives, and it is along one of these zones of shearing that metallic minerals have been deposited.

The ore occurrence consists of quartz veins which have developed along or near the contact of a granitic spur intrusive into the argillite. The granitic spur is from 100 to 130 feet wide and appears to have a general north-easterly strike. Several minor branches or offshoots project from the main spur, making the contact quite irregular. On the west side of this spur, marked shearing in the argillite, and conformable to the argillite bedding, has occurred and in places extended slightly into the granite itself. Lenticular quartz veins from 2 to 18 inches in width, carrying galena, zinc-blende, pyrite, pyrrhotite, and possibly some grey copper, occur in this sheared area. The shear-zone strikes N. 32° E. and dips about 50° west, with the granite on the foot-wall side. Small, discontinuous quartz veins occur in the argillite of the hanging-wall, but these have a tendency to stringer out and disperse in distances of 20 to 30 feet. In the sheared area itself, and particularly contiguous to the granitic spur, that is on the foot-wall side of the shear, there appears to be a more sustained continuity.

The shear-zone can be traced along the bed of Snow creek above, and westerly of the Bowyer tunnel, from altitude 2,225 feet to altitude 2,460 feet, or to about 10 feet above the old upper

tunnel—a horizontal distance of about 660 feet, with irregular exposures of quartz carrying some sulphides along this distance. It is evident in this tracing that the shear dips about 60° west into the west bank of the creek. At altitude 2,250 feet a well-defined fault striking north-south and dipping 50° west cuts across the creek. It would appear from the drag along this fault, also to be observed in the Bowyer tunnel, that the fault is a normal one, with a westerly throw. This, the only important dislocation observed, would have the effect of displacing the northerly continuation of the shear farther west than its theoretical southerly projection.

Development and exploration has been carried out on the *Crackerjack* claim. At altitude 2,450 feet a tunnel 48 feet long has been driven to a vein striking N. 32° W. (mag.) and dipping 50° west. This tunnel was partially caved and a shallow winze about 25 feet in was filled with water. It was only examined from the portal to the winze, at which point the tunnel crosscuts into the vein. The vein exposed here is 10 to 12 inches wide in a decomposed and sheared granitic rock, impregnated with pyrrhotite. The vein is well mineralized with fine-grained galena, zinc-blende, pyrrhotite, and pyrite. An open-cut about 10 feet above this tunnel exposes 14 inches of quartz well mineralized with galena, zinc-blende, and pyrite in the contact of decomposed granite and argillite. The vein here strikes N. 30° W. (mag.) and dips 55° west. Adjoining these surface exposures on the west is a wide decomposed shear-zone in argillite striking north-westerly and dipping 50° west. Narrow bands of crushed granite cut into this.

From altitude 2,450 to altitude 2,190 feet in a north-west direction are several cuts along the bed of Snow creek, exposing a continuation of the shear-zone with 2 to 18 inches of slightly mineralized quartz in places. At altitude 2,190 feet the Bowyer tunnel has been driven in a very winding though general S. 20° E. (mag.) direction for a distance of about 650 feet, with the face estimated to be about 40 feet easterly of the vertical projection of the showings in the upper tunnel. In the creek-draw on the westerly side of the Bowyer tunnel portal the argillite bedding strikes N. 48° W. (mag.) and dips 55° south. The tunnel is driven in this material and meanders along some erratic quartz-lenses dipping 50° to 60° west, with very sparse mineralization. At about 120 feet from the portal a granitic dyke forms the west wall of the tunnel to about 225 feet from the portal (15 feet southerly of station 6), where a fault striking north-east and dipping 45° north cuts across the tunnel. From this point the tunnel continues its winding course, with two or three sharp turns, for a further distance of about 170 feet to station 12. At station 12, about 400 feet from the portal, a well-defined shear carrying some quartz and brecciated vein-matter is cut, striking N. 25° W. (mag.) and dipping 59° west and lying contiguous to a granitic intrusive. This is probably the downward extension of the shear that has been developed in the old upper workings at altitude 2,450 feet on the westerly side of the granitic spur.

The tunnel crosscuts easterly through this shear, leaving it striking into the west wall, and enters the granitic intrusive, in which rock it continues a winding crosscutting course for about a further 240 feet, where it enters silicified argillite for the last 10 feet to the face, a distance of about 650 feet from the portal. The latter part of the tunnel is very crooked, with two very sharp turns, one due south and the last 30 feet nearly due east. In the stretch of the tunnel that crosscuts the granitic intrusive to the face there is no structure such as slips or shearing of any major importance. Only some minor jointing striking north-south and a few unimportant barren quartz stringers are cut in this section of the tunnel.

At the easterly contact of the granitic intrusive with the argillite, 10 feet from the face, grains of pyrrhotite occur in the granitic rock and also in the silicified argillite of the face. Thirty feet westerly of the face a 15-foot crosscut is driven S. 20° E. (mag.) in the granitic rock. The face of this shows three or four quartz stringers with grains of pyrrhotite in the country-rock. The pyrrhotization of the country-rock in this area is merely a contact phenomenon and is of no commercial significance. It is estimated that the face of the Bowyer tunnel is 40 feet easterly of the vertical projection of the showing in the upper tunnel at altitude 2,450 feet.

Should the vein and shear-zone as exposed at the upper showing retain its dip of 50° west, it would be projected at a horizon 260 feet lower, 218 feet westerly of the vertical projection of the upper showings. In other words, if the face of the Bowyer tunnel is 40 feet east of the vertical projection of the upper showings, the downward extension of these showings on the Bowyer tunnel-level will be about 258 feet west of the present face. The projection and altitude of the shear cut at station 12, 400 feet from the portal of the Bowyer tunnel, as well as its relation to the adjacent granitic intrusive which lies on its foot-wall side, indicates that it is

the downward extension on this level of the structure exposed in the old workings at altitude 2,450 feet. This could be explored by a drift along it, with the granitic rock as the east side of the drift.

It is considered that the ore-showings and their mode of occurrence warrant some further exploration. Further exploration should be carried out by drifting along the shear on the west side of the granitite intrusive contact at station 12, about 400 feet in from the portal of the Bowyer tunnel. Short crosscuts should be run to right and left to explore the zone laterally as the work proceeds. A maximum of 200 feet of drifting south on this zone, with cross-sectional sampling at intervals, would indicate possibilities and determine whether further work is warranted.

Illiance River Section.

The Illiance river rises west of the divide to the Nass River drainage and flows west into the head of Alice arm due east of the town of Alice Arm. The river-valley area is reached by a road from Alice Arm for a distance of about 2½ miles, from where a good trunk horse-trail extends to the head of the valley and on over the divide into the Nass River valley. At 11-Mile, altitude 1,960 feet, there is a good Government log shelter-cabin. Branch trails radiate from this to the various mining properties contiguous to the valley.

The rocks of the area consist of well-bedded water-lain tuffs of the Dolly Varden formation (Jurassic age) overlain by argillites, quartzites, and sandstones of the Kitsault River formation. This group has been correlated by Hanson (Geological Survey of Canada, Summary Report, 1923, Part A) with the Hazelton group. The westerly section of the valley for a distance of about 5 miles from the river-mouth is composed practically entirely of argillaceous rocks. From that point the river follows approximately the contact between the argillites and tuffs for a distance of about 2½ miles, where it takes a sharp bend north into the tuff and fragmental area, which rocks embrace the valley to its head, a further distance of about 5 miles. Predominating zinc-lead mineralization carrying silver values, in shear-zones, are the characteristic ore occurrences of the area. In the upper area near the Nass River divide pyritic siliceous replacement zones also occur. In recent years the area has been comparatively inactive and more recently development has been discouraged by stagnation in the silver and zinc markets. With a return to normal conditions several deposits of particularly the upper section of the valley should receive extensive and warranted development.

Kitsault Eagle Silver Mines, Ltd.—This company had been exploring the *Sunrise* group on McGrath mountain. This property was described in detail in the 1929 Annual Report. Owing chiefly to the uncertain outlook in the zinc market, the option held by this company on the *Sunrise* was relinquished early in the 1930 season.

Three Mile. This property, consisting of the *Three Mile* and *Three Mile Extension* claims, is owned by John Hauber, of Alice Arm. It is situated about 3 miles up the Illiance River. The formation consists of interbedded argillite, sandstone, tuff, and agglomerate. The bedding strikes about north-south and dips 60° east. The rocks are cut by diorite dykes and there is also extensive shearing.

The showing on the *Three Mile* is at elevation 400 feet in the river-canyon on the east bank. This consists of a pyritized silicified shear-zone striking north in water-lain tuffs. Two hundred feet of crosscut tunnelling has been completed towards the zone. The west crosscut from this tunnel is in 140 feet, but would have to be extended about 60 feet to cut the zone.

On the *Three Mile Extension* 20 feet of tunnel has been driven into the steep bank on the west side of the river in sheared and crushed graphitic and calcareous argillite mineralized with a little pyrite. About 80 feet south of this a few shots have been put into a bed of agglomerate in the river-bank. This exposes an interesting mineralogical occurrence of pea-size patches of anthraxolite in quartz and calcite veinlets.

The only apparent possibility on these claims is for the pyrite to be auriferous. Lithological and geological conditions do not appear to hold much hope for this.

Iron. This group consists of the *Iron* and *Iron No. 1* to *No. 5* claims. It is owned by John Hauber, of Alice Arm, and is situated around altitude 2,650 feet, about 1 mile north-east of 11-Mile cabin and about half a mile west of the divide to the Nass River slope. The showings are on the *Iron No. 5*, about 400 feet west of the Bowman Lake trail. The formation in the vicinity is tuffs and breccias. The showing consists of a silicified breccia zone over 50 feet wide heavily mineralized with masses and veinlets of

fine, granular pyrite. The replacement quartz is grey in colour, of very fine texture, and in sections completely replaces the country-rock. In one place a dome 20 feet wide of this material, heavily pyritized, is exposed. Several shots have been put into this showing at different places. The attitude of the zone could not be determined. The only apparent possibility of this mineral occurrence is for the pyrite to be gold-bearing. The owner reports, however, that assays so far have showed only traces of gold and silver. Geological and lithological conditions of the locality do not suggest an inclination to gold values.

Beaver Extension.

This group consists of the *Beaver Extension* and *Beaver Extension No. 1* to *No. 5* and is owned by John Hauber, of Alice Arm. The claims are situated on Iron creek, which flows into the Illiance river on the east side, about half a mile north of 11-Mile cabin.

On the *Beaver Extension No. 5* some open-cutting at altitude 2,300 feet has been done on belts of silicified pyritized breccia similar to that occurring on the *Iron*. The formation in the neighbourhood of the *Beaver Extension No. 5* showings consists of bands of breccia generally pyritized and in places carrying some barite, alternating with bands of tuff. The general trend of the formation is N. 20° E., with a steep easterly dip.

On the *Beaver Extension No. 4* some shots have been put into a similar silicified occurrence at altiude 2,700 feet on the steep east bank of the creek. This showing is heavily pyritized. Of mineralogical interest is the occurrence in the quartz of anthraxolite in patches, filaments, and veinlets, scattered over a face 20 feet wide.

Titrite.

This property consists of eight claims and is owned by John Hauber, of Alice Arm. The property is situated near Crater lake, on the Nass River slope, at from 3,600 to 4,050 feet altitude and about 1 mile from Bowman lake. The formation of the area consists of interbedded tuffs and breccias. Some open-cutting has been done on two north-south-striking shear-zones in a calcareous fragmentary rock. These zones are slightly mineralized with pyrite and seamed with veinlets of siderite and quartz. On the *Titrite No. 7*, several hundred feet north-westerly of the Bowman Lake slope showings, an open-cut 10 by 6 feet exposes a 6-foot width of pyritized silicified breccia carrying a little chalcopyrite. This showing is the same type as that described on the *Iron* and *Beaver Extension* groups.

On the *Silver Cliff*, situated at altitude 4,190 feet on the Illiance River slope, some work has been done on a quartz vein 2 feet wide striking N. 40° W. (mag.) and dipping 70° north, mineralized in places with massive sphalerite and a little galena, occurring in a calcareous tuff. Two hundred feet west of this is a parallel quartzose zone, 6 feet wide, heavily oxidized and showing a little copper-carbonate stain. About 300 feet west of this showing a quartz-calcite vein 12 inches wide, carrying veinlets and bunches in sphalerite with a little galena and chalcopyrite, outcrops in calcareous tuff. This vein strikes N. 70° E. and dips 60° east. About 200 feet southerly, at altitude 4,000 feet, a short tunnel has been driven on some stringers of heavily pyritized quartz striking N. 30° W. and dipping 45° west, occurring parallel to a small dyke in calcareous tuff.

Near the north end of the *Silver Cliff* claim a shear-zone in silicified argillite occupies the bed of a small creek. A few cuts in this have exposed quartz and calcite stringers mineralized with pyrite and a little zinc-blende. South of this an 8-inch quartz vein in calcareous tuff is mineralized with sphalerite, galena, and some arsenopyrite. These showings on the *Silver Cliff* claim are contiguous to a granitic dyke.

John Hauber, the owner of the three last-described groups, deserves credit for having done some really constructive prospecting-work on this ground in a conscientious attempt to find commercial values in the various mineral occurrences.

Monarch.

This property consists of two claims and one fractional claim, owned by W. B. Bower, of Alice Arm. The property is situated about 16 miles from tide-water, at about elevation 4,000 feet on the west slope to the headwaters of the North fork of the Illiance river. The cabin is situated at altitude 3,800 feet. In recent years very little additional work has been done on the showings. The property was examined at the request of the owner to ascertain the possibilty of picking up the horizontal and vertical continuity of the present ore-exposures. The ore occurrence is a strong shear-zone in red andesite breccia well mineralized in one section of the exposure with chalcopyrite, chalcocite, grey copper, zinc-blende, and some galena.

The work done on the property consists of surface cuts and stripping at elevation 4,050 feet, which expose a well-mineralized brecciated silicified shear-zone up to 8 feet in width striking N. 8° E. (mag.) and dipping 50° north. This is traced for a distance of about 250 feet. Continuity at the northerly end of the trench is obscured by overburden and should be picked up by cross-trenching. The south end of the zone is cut off by a decided fault-plane striking N. 80° E. (mag.) and dipping 45° north. The zone shows a decided drag to a N. 20° W. strike for about 60 feet before contacting with this fault, and in the fault-fracture itself are crushed blocks of dragged ore, on which a deep open-cut has been driven. It would seem that the fault is a normal one and the exposed north part of the ore-zone is the low segment. The throw could not be determined, but it would seem that the southerly continuation should be located higher up the hill. This could be accomplished best by trenching east along the strike of the fault.

At elevation 4,000 feet and 140 feet N. 76° W. (mag.) from the open-cut on the fault a crosscut tunnel has been driven 170 feet in a general S. 80° E. (mag.) direction. At 90 feet in, a branch crosscut has been driven 42 feet in a N. 12° E. (mag.) direction. This work failed to pick up the downward extension of the surface showings. This tunnel was apparently started too far south and is most probably on the foot-wall side of and underneath the fault. A crosscut to the north from about 40 feet in this tunnel or a raise from about the junction of the north branch crosscut with the main adit should locate the possible downward extension of the ore-zone. There is a strong well-mineralized ore-showing on this property which warrants further extensive exploration.

Falcon. This property of two claims is owned by W. B. Bower and Gus Pearson, of Alice Arm, and is situated on the east slope to the headwaters of the North fork of Illiance river, about 15 miles from tide-water. The formation consists of interbedded argillaceous sandstone and tuffs. On the higher altitudes to the west, the beds are gently folded, with a general southerly dip. The occurrences are between 3,900 and 4,000 feet altitude. They consist of zinc-blende, galena, and grey-copper mineralization in a brecciated quartz-carbonate gangue in shear-zones and fault-veins in a tuff country-rock. Three parallel zones striking N. 40° E. (mag.) and dipping steeply east have been open-cutted and traced for distances up to 100 feet, showing widths of from 2 to 5 feet and carrying in places encouraging mineralization. In sections the outcrops are heavily oxidized and in some places manganese oxide is strongly developed. These showings warrant more intensive development than they have received.

Homebush. This property of two claims is owned by A. D. York, of Alice Arm, and is situated south of and adjoining the *Falcon*. At altitude 3,625 feet a couple of shots have been put into some irregular veinlets of quartz associated with barite and siderite and mineralized in places with small blebs of grey copper. An open-cut should be extended to the east, where there may possibly be a vein or shear-zone from which these stringers emanate. About 400 feet east of this, at the side of the trail, 5 feet of stripping has exposed a heavily oxidized zone with encouraging galena mineralization. The attitude of this could not be determined. More work should be done on this showing. The showings on this claim, generally, lack work.

United Metals Mining Co. The holdings of this company are situated south of the *Homebush*, on the west bank of the Illiance river and about 14 miles from tide-water. The ore occurrence is thoroughly described in the 1918 and 1919 Annual Reports. In view of a circular soliciting stock subscriptions apparently sponsored by an organization styled Universal Alaskan Corporation, with head office in Seattle, which contained references to this property, and several inquiries addressed to the Department of Mines, the property was examined in August, 1930.

No work has been done on this property for several years and the condition of the ore-showings is practically the same as in 1919, except that some of the buildings have collapsed and the open-cuts are piled with caved-in material. In one ore-dump there is about 10 tons of fair-grade ore and on another about 40 tons of lower-grade material. This ore is mainly zinc-blende, but with it is also associated some galena and grey copper. Under present conditions no profit could possibly accrue from the shipment of this material. No ore was seen in the showings from which continuous profitable shipments could materialize under present conditions. The small amount of exploration-work completed falls very far short of assuring

any continuous production. It is not possible to bring the property to a stage of "satisfactory production within six months" as stated in the Universal Alaskan Corporation circular. It must also be pointed out that the property is in the Alice Arm area of the Nass River Mining Division, and not in the "Portland Canal section" as stated in the circular.

On the property, however, there are promising showings that warrant further development and exploration with the aspect of a possible mill-grade proposition. It has not, however, the potentialities of a high-grade shipping operation.

Silver Star. These claims are situated on the east side of Illiance river and are reached by a trail branching from the main *Monarch* trail at the *United Metals* camp. The trail ascends the east bank of the river, crosses the ridge at elevation 3,900 feet, and drops down to the cabin at elevation 3,700 feet. About 200 feet west of the cabin a small cut at altitude 3,780 feet has exposed a shear-zone 2 feet wide in greenish-red andesite breccia. The shear strikes N. 30° W. (mag.) and dips 50° west and, with the exception of a 1-inch streak of galena and zinc-blende, is heavily oxidized with iron and manganese oxides. Half-way between this and the cabin a similar and parallel shear 18 inches wide occurs at altitude 3,750 feet. At altitude 3,625 feet and about 400 feet south of the cabin a 12-foot crosscut has been driven through a shear-zone 6 feet wide, the hanging-wall of which had then been drifted on. This zone strikes N. 25° W. (mag.) and dips 85° south. At the tunnel portal the zone is well mineralized with galena, zinc-blende, and grey copper, and in the drift shows some streaks of similar mineralization. Towards the northerly end of the tunnel the country-rock is excessively sheared and crushed. This occurrence is in the bluff wall of a small creek and strikes at a very acute angle to the bluff, so that tunnelling from this situation is difficult. There is encouraging mineralization and good structure on this group and further prospecting should result in additional discoveries. The property should be extensively explored.

Belleview Group. This is an old property of two claims and a fraction formerly owned by W. T. Kergin, G. E. Richards, and J. E. Stark. Some fairly extensive surface and underground work was done several years ago, but the claims have now lapsed. The workings are situated up the Illiance River valley, about 13½ miles from tide-water, and are reached by a branch trail from the main *Monarch* trail. The lower cabin is at altitude 2,625 feet and about 2 miles from 11-Mile cabin. The upper cabin is at altitude 3,100 feet on the main *Monarch* trail and about 1,000 feet west of the tunnel-workings. The formation of the locality consists of tuffs and breccias which are generally pyritized and extensively sheared along zones striking N. 50° W. (mag.).

Some of the sheared belts have been replaced in part by reticulated quartz stringers mineralized in places with some galena, zinc-blende, and pyrite. No work has been done on this property for several years. At altitude 3,025 feet a crosscut tunnel has been driven 320 feet on a general S. 70° W. (mag.) bearing, with the objective of cutting a vein showing on the surface at 100 feet higher altitude. The face is in red andesite breccia. The tunnel cuts through a wide pyritized tuff-belt and two small shears, which have been drifted on and which show a few sparse streaks of galena and zinc-blende mineralization. Some open-cutting has also been done east of the tunnel on a vein 3 to 4 feet wide mineralized with veinlets of zinc-lead ore 1 to 4 inches wide.

Kitsault River Section.

The Kitsault River valley is about 22 miles long, extending from the divide into the Nass River valley to the head of Alice arm. The main river has its source in an immense ice-sheet which extends from the Kitsault glacier at its head to the Portland canal. The chief tributaries are Clearwater creek and Trout creek, heading in small lakes at about altitude 2,700 feet on the Nass River divide, West Fork and Evindsen creeks, heading in glaciers on the west side of the valley. The valley occupies a north-south aligned trough.

The important economic geological feature of the area is the eastern contact of the Coast Range batholith which parallels the Kitsault River valley about 4 miles to the westward. The valley consequently allows access to a stretch of the contact margin 22 miles in length. Bordering the contact on the east is the Dolly Varden formation of massive and fragmental volcanic rocks of Lower Jurassic age, with an estimated thickness of about 3,000 feet. Surrounding this formation and overlying it is the Kitsault River formation of argillite, quartzite, sandstone, conglomerate, and interbedded tuffs, of an estimated thickness of over 2,500 feet. These formations are tentatively correlated by Hanson (Geological Survey of Canada, Summary

Report, Part A, 1923) with the Hazelton group of probably Jurassic, in part Triassic, age. It would seem that the Kitsault River formation is in turn overlain in places by a younger series of pyroclastic rocks. Several outcrops were observed on the higher altitudes of the upper Kitsault River area and also the higher altitudes of the North-east fork, in which were fragments of Kitsault River formation argillite. Intrusive into these formations are numerous dykes of lamprophyre, some diabasic rocks, and small bosses of diorite and gabbro.

The area is generally featured by high-grade silver-zinc mineralization in quartz veins or zinc mineralization in shear-zones in the argillites; silver-lead deposits, with horizons of secondary enrichment, in the volcanic rocks; and a tendency to copper replacement mineralization in a partially silicified pyritized tuff-belt (so-called "copper-belt") of the Dolly Varden formation. Recent work has indicated the possibility for the occurrence of hitherto unsuspected replacement zinc mineralization in some of the porous fine fragmental and tuff beds of both the Dolly Varden and Kitsault formations. A tendency to gold values is also indicated in silicified replacement pyritized zones contiguous to what appears to be an intrusive mass of diorite or porphyrite occurring on the higher altitudes westerly of the foot of the Kitsault glacier. This area should be extensively explored with the object of determining its gold-bearing aspects.

Transportation into the area is achieved by means of gasoline-speeders on the Dolly Varden narrow-gauge railway for a distance of 18 miles from tide-water. A good trunk trail extends from the railway terminus at Camp 8 to the head of the valley. Numerous branch trails extend from this main artery to properties on the east and west sides of the valley.

Wolf. This property is adjacent to the Dolly Varden Railway at the outskirts of Alice Arm. It is owned by J. Fiva and associates, of Alice Arm. The ore occurrence consists of quartz veins carrying galena, zinc-blende, pyrite, chalcopyrite, grey copper, ruby silver, and occasionally some native silver, interbedded in an argillite country-rock. The deposit has been explored by about 460 feet of tunnelling and a 40-foot raise to a surface. Some nice lenses of high-grade silver ore in vein-widths from 8 to 14 inches have been exposed by this work. Small lots of sorted ore shipped in former years assayed: Gold, 0.27 oz. to the ton; silver, 306.4 oz. to the ton. Some further underground development was carried out by the owners during the 1930 season.

Esperanza Mines, Ltd. This company was organized in 1927 with a capitalization of $500,000, divided into 500,000 shares of the par value of $1 each. During 1929 the holdings of the company were increased by the acquisition of adjoining claims. The properties controlled by this company are described in the 1925, 1928, and 1929 Annual Reports. During 1930 one or two men have worked intermittently on this property. A raise from No. 3 to No. 2 tunnel was completed, but unfortunately, through failure to survey, broke into No. 2 only about 20 feet from the portal and is consequently superfluous. Some work was also done in No. 9 tunnel and the face turned about 38° to the west to achieve a more direct alignment to its objective. Some surface prospecting was also carried out farther up the hill.

Wildcat. This group is situated on the south side of Homestake creek, about 1 mile below the Dolly Varden Railway terminus at Camp 8. The property is owned by A. Davidson and associates, of Alice Arm. The main ore occurrence consists of a shear-zone in an andesitic rock, mineralized with veinlets of quartz and chalcopyrite. This is being explored by three tunnels and some open-cutting. Encouraging chalcopyrite mineralization is evident in places across widths of 3 to 6 feet. During the winter and intermittently during the summer months further work was done by the owner, resulting in an extension of the showings and the discovery of new mineralization.

Dolly Varden and Wolf. These properties of eight and four claims respectively are situated about 18 and 20 miles from tide-water. The ore occurrence and workings are described in the Geological Survey of Canada Summary Report, Part A, 1921, and in the 1916, 1917, 1922, 1928, and 1929 Annual Reports. In 1929 the properties were optioned to the Britannia Mining and Smelting Company, Limited, which carried out some additional diamond-drilling on the *Wolf* and completed several open-cuts on the *Dolly Varden*. Due mainly to the severe drop in the price of silver, which metal is the chief one in the ore-deposits of these properties, the option on these properties was relinquished in the early summer of 1930.

It would seem that the probable extension of the *Dolly Varden* ore-zone through the *Dolly Varden No. 2* claim is worth intensive exploration for the high-grade secondary-enrichment

ores such as have been found to occur in the main workings in association with cross-faults. On the *Dolly Varden No. 2* claim, at altitude 2,400 feet, a cut extended by the Britannia Company exposes the zone with a decided drag to the north-west along a well-defined depression striking north-west. It is quite possible this depression may occupy the location of a fault striking north-west which is the bearing of the secondary-enrichment faults in the old workings. Some galena mineralization is evident in this open-cut. At the extreme westerly end of the *Dolly Varden No. 2* claim some work was also done by the Britannia Company in a 40-foot open-cut across the ore-zone. At this spot also, five diamond-drill holes were put in by the original Taylor interests. This is the only work that has been done on the probable extension of the *Dolly Varden* ore-zone in this direction. In tracing the various surface exposures from the *Dolly Varden No. 1* through the *Dolly Varden No. 2* claim, cross-faulting is indicated in several places by changes in the strike of the vein, signs of dragging, and draw-depressions striking north-west across the line of strike of the vein. The westerly extension on the *Dolly Varden No. 2* claim warrants extensive diamond-drill exploration.

It is interesting to note that this silver-bearing deposit occurs on the easterly edge of the silicified pyritized tuff-belt from about 500 to 1,500 feet wide that constitutes the so-called "copper-belt." This belt lies between areas of purple breccia on the west and grey breccia, in part water-lain tuff, on the east. In conformity with the type-mineralization of these belts, as the probable westerly extension of the *Dolly Varden* vein enters the silicified tuff-belt, chalcopyrite begins to become evident in the mineralization.

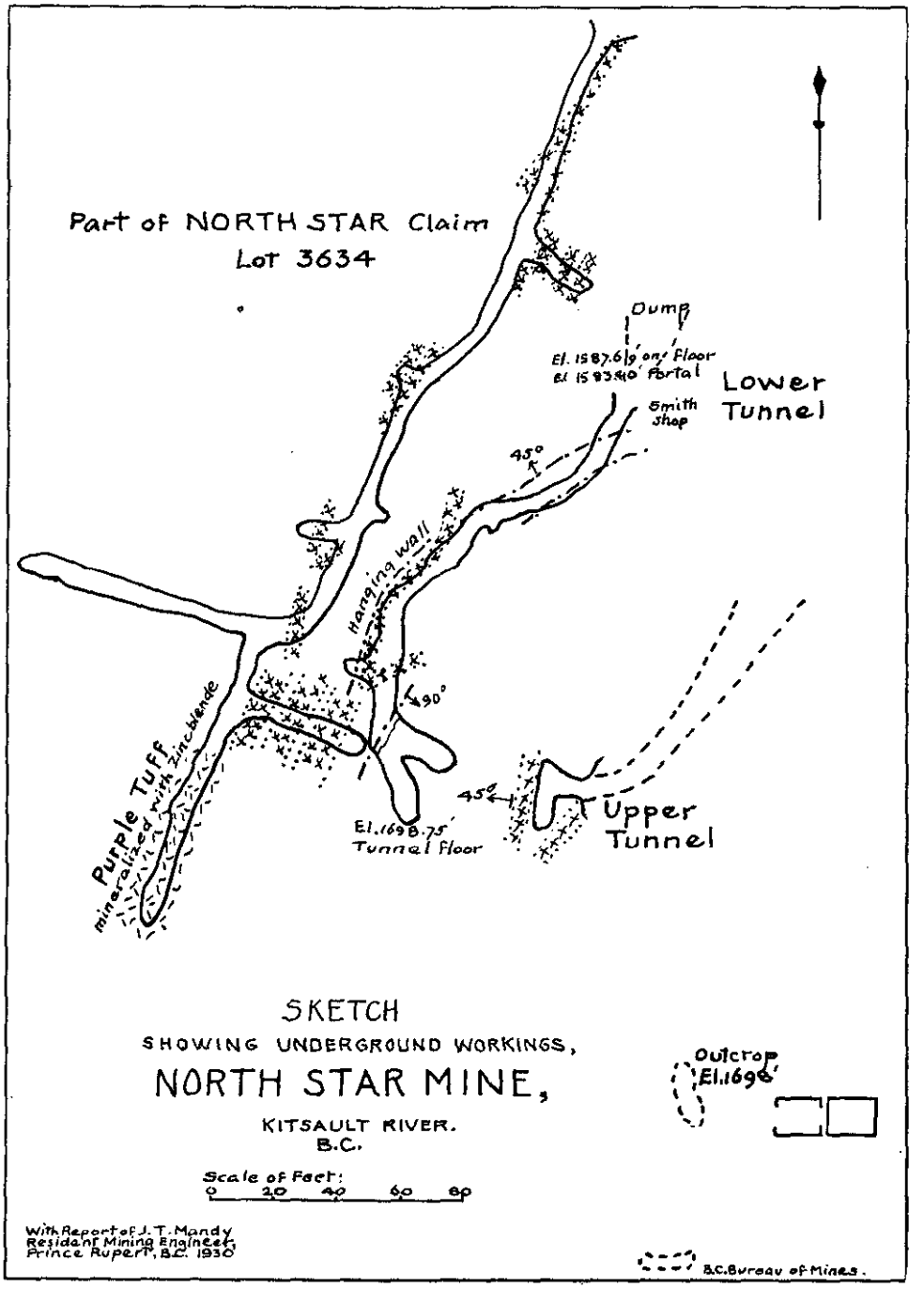
North Star. This property consists of a fractional claim owned by Gus Pearson and associates, of Alice Arm. It adjoins the *Dolly Varden No. 1* claim on the north. The cabin and showings are situated about 1,000 feet north of the *Dolly Varden* mine-camp, from which they are reached by a good trail. The ore occurrence consists of a northerly-striking sheared pyritized zone about 100 feet in width carrying quartz-barite veins 4 to 20 feet wide mineralized with pyrite, galena, ruby silver, argentite, and some native silver. The zone occurs in a greyish breccia contiguous to the foot-wall side of a belt of purple breccia. It is not clear whether the zone is the continuation of the *Dolly Varden* zone thrown out of alignment through faulting, or a branch from this. Lamprophyre dykes cut in and out of the zone more or less parallel to its strike.

The deposit has been explored by open-cutting and tunnelling. In the open-cuts between the upper tunnel and the cabin encouraging silver-lead mineralization is exposed across widths of 5 to 6 feet. At elevation 1,590 feet and 60 feet lower elevation than the cuts, a tunnel has been driven about 200 feet in a general south-westerly direction, with some side-swiping and a short raise. This shows the vein to strike in a generally north-easterly direction, with a 45° westerly dip. Some lenses of good-grade ore have been developed in this tunnel in more or less disjointed quartz segments in a decidedly sheared zone-structure.

At about elevation 1,520 feet a tunnel has been driven 320 feet in a south-westerly direction with the objective of picking up the downward extension of the upper tunnel showings. Some side-swiping, a crosscut 80 feet long to the west and one 40 feet long to the east, have also been completed from this tunnel. In these workings the zone is considerably sheared, cut by several lamprophyre dykes, and carries some segments of quartz showing galena mineralization in places. About 20 feet from the face the tunnel enters a purple breccia that is possibly the hanging-wall of the zone. This breccia was found to be mineralized in places with an appreciable quantity of resinous zinc-blende. A canary-yellow oxidation product along some of the seams suggests that the zinc-blende contains cadmium. An assay of a grab sample of the purple breccia taken from about 15 feet from the face, and from the face itself, assayed: Gold, trace; silver, 0.24 oz. to the ton; zinc, 7.2 per cent. This purple-breccia belt should be systematically sampled to ascertain the extent and distribution of the contained mineralization. It is also suggested that the tunnel be extended about 20 feet and a crosscut driven to the east to locate the possible continuation of the vein on the foot-wall side of the purple breccia, where it may not be affected by the dykes showing in the first east crosscut.

Torbrit Mining Co., Ltd. This company was incorporated in 1929 for the purpose of developing the *Toric* group holdings of the Toric Mines Company, Limited. The controlling interest in the Torbrit Mining Company, Limited, is held by the Britannia Mining and Smelting Company, Limited, with an option to purchase the remainder of the shares. The property is described in several former Annual Reports. Aggres-

sive development-work was continued during the first quarter of 1930. This consisted mainly of sinking a 200-foot winze below the main level at elevation 1,900 feet, and the driving of a crosscut on this level, with short drifts east and west. Some exploratory work was also done 125 feet above the 1,900-foot level. The results of this work were very encouraging from an ore standpoint. Owing, however, to the depressed and uncertain silver market, operations were suspended in April until better metal prices prevail.



Utility Mines (Number One), Ltd.

This company was incorporated in 1928 with an authorized capitalization of 5,000,000 shares of no par value, and had carried out development-work on the *Tiger* group, immediately north of the *Toric*. The *Tiger* group is described in the 1918, 1919, 1927, 1928, and 1929 Annual Reports. No further work was carried out in 1930. On October 30th the final payment due on the purchase of this group was made by the Utility Mines (Number One), Limited. It is stated by the secretary of the company that development plans are being held in abeyance until some clarity in the future price of silver becomes evident.

Red Point.

This group is situated on the west side of the Kitsault river, north of Evindsen creek, about 1½ miles from the end of the Dolly Varden Railway. It is reached by a good trail branching from the main trunk trail at the head of the canyon. The camp is at altitude 1,650 feet. The mineral occurrence consists of chalcopyrite, structurally associated with what appear to be quartz-filled major joint-planes striking N. 10° E. (mag.) and dipping east, in pyritized tuff. No zonal structure accompanying the mineralization is evident. In places silicified replacement areas mineralized with disseminated chalcopyrite appear to emanate from these jointed sections. Several of these occurrences have been explored by open-cutting and tunnelling at elevation 1,850 feet on the *Red Point No. 1* claim. At about 500 feet lower elevation a crosscut tunnel has been driven about N. 50° W. (mag.) for 590 feet, where it turns practically due west (mag.) for a further 430 feet, with the objective of exploring the possible downward extension of the exposures on surface. Only some sparse chalcopyrite mineralization was encountered in this work.

On the *Red Point Extension* at altitude 2,200 feet, about 1,500 feet north-east of the *Red Point No. 1* showings, an open-cut 40 feet long on the face of a bluff exposes a pyritized quartzose replacement belt, 12 feet wide, mineralized with some chalcopyrite at the south-west end of the cut.

Combine Fraction.

This claim, adjoining the *Red Point* on the north, has been restaked by Miles Donald, of Alice Arm. Good vein-widths, well mineralized with chalcopyrite, pyrrhotite, pyrite, and an unidentified dark-grey mineral in a quartz gangue, are exposed in one open-cut and two strippings over a distance of about 200 feet at altitude 2,200 feet. A sample of about 15 tons of ore from the dump of an old caved tunnel that could not be examined assayed: Gold, 0.22 oz. to the ton; silver, 2.2 oz. to the ton; copper, 2.1 per cent.; arsenic, *nil*. During the late fall, with assistance from the Department of Mines, the showings were connected by a trail from the *Red Point* camp. The showings are well worth further intensive exploration.

Moose.

This group of five claims is owned by John Strombeck and Miles Donald, of Alice Arm. It is situated about half a mile north of Trout creek, on the east side of the Kitsault river. The main showings are at elevation 1,500 feet, about 200 feet above the trunk trail. The ore occurrence consists of quartzose zones about 20 feet wide, erratically and somewhat sparsely mineralized with galena, zinc-blende, pyrite, chalcopyrite, and specularite, in pyritized tuff. In places a mill-grade ore is exposed across fair widths. Exploration has been carried out by short tunnels and extensive open-cutting. The zonal structure is not well defined and strikes between north and north-east, with a dip of 45° to 65° south.

Silver Horde.

This property consists of three claims and a fraction, Crown-granted. It is owned by A. Davidson and partner, of Alice Arm, and adjoins the *Wolf* group on the north. The cabin is at elevation 1,950 feet and about a quarter of a mile north of Trout Creek cabin. At altitude 1,425 feet on the *Silver Horde No. 1* a cut 12 feet deep has exposed a quartzose zone mineralized with some galena, zinc-blende, and small veinlets and patches of pyrite.

Between elevations of 1,900 and 1,925 feet, open-cutting exposes a brecciated quartz vein 5 to 6 feet wide somewhat sparsely mineralized with galena and chalcopyrite. At an elevation of 1,825 feet and directly below these cuts a crosscut tunnel has been driven 54 feet in a N. 35° E. *(mag.) direction. At this point the tunnel forks, one branch bearing off* N. 25° W. *(mag.)*, the other N. 75° E. (mag.). Evidently this branching is for the purpose of testing out two theories of possible zone-continuity. Nothing of importance has been developed in either branch so far. At the branching of the tunnel, however, there is a fault-fracture striking N. 65° W.

(mag.) and dipping 65° north. This is possibly the downward continuity of a similar fault-fracture exposed in the cut at elevation 1,900 feet. It would seem that the structure and quartz replacement exposed in the face of the left tunnel-branch is the faulted continuation of this surface exposure.

On the *Silver Horde* claim there are several cuts on the *Wolf No. 3* vein. These were not examined. Three ore-shoots are reported on this vein, one on the *Wolf* and two on the *Silver Horde*. Eight diamond-drill holes are reported to have been put in on these by the Granby Company in 1916, from which assays of from 4.5 to 13 oz. silver are reported to have been obtained.

Climax. This group of two claims adjoins the *Silver Horde* on the north and is owned by O. Besner, of Prince Rupert. It is situated on the east slope to Trout Creek valley. The cabin is at elevation 2,300 feet. At altitude 2,550 feet an open-cut has exposed a silicified replacement zone 7 feet wide, carrying a mill-grade mineralization of galena, zinc-blende, and pyrite. The zone strikes N. 50° W. (mag.), with a vertical dip. The country-rock is a calcareous tuff. At altitude 2,520 feet a tunnel has been driven along the foot-wall of the zone for a distance of 57 feet, with a diagonal crosscut from that point for 33 feet across the vein. The crosscut penetrates the hanging-wall at about 6 feet from the face. This work indicates an encouraging opportunity to develop a mill-grade of ore across a width of about 15 feet. At altitude 2,475 feet the zone has been stripped across an appreciable width, but shows no mineralization on the surface. It should be open-cutted here. At altitude 4,200 feet and about 400 feet north of the cabin extensive stripping and some open-cutting has again exposed the zone, showing very encouraging lead-zinc mineralization.

This property warrants extensive exploration for the possible development of an appreciable mill-grade tonnage of silver-lead-zinc ore.

Last Chance. This property consists of four claims and a fractional claim and is owned by Archie McPhail and partner, of Alice Arm. It is situated on the west side of Trout creek and adjoins the *Moose* group on the east. The cabin is at altitude 2,720 feet and is reached by the continuation of the trail through the *Climax*. The main showing consists of a brecciated quartz-barite-jasper zone about 20 feet wide, striking N. 40° E. (mag.) and dipping 80° west, mineralized with fine grains of pyrite, galena, some grey copper and argentite, occurring in a volcanic breccia country-rock. In places veinlets and small patches of the metallic minerals occur along jointing in the zone, which strikes N. 35° W. (mag.). The deposit bears a similarity in gangue composition, structure, and mineral distribution to the *Toric* occurrence and is of low- to medium-grade tenor. The zone has been explored by two open-cuts at elevations of 2,875 and 2,960 feet. About 1,000 feet south-west a third open-cut at elevation 2,875 feet elevation exposes a siliceous brecciated zone, heavily impregnated with iron and manganese oxides and carrying some chalcopyrite and galena, which is quite probably the continuation of the main zone. At elevation 2,725 feet a crosscut tunnel has been started in the face of a bluff and driven about 115 feet in a direction N. 30° W. (mag.) with the objective of cutting the possible vertical extension of the zone exposed in the cuts. At elevation 2,850 feet and several hundred feet north-west of this zone some open-cutting has exposed a pyritized siliceous replacement zone of undetermined width striking N. 72° E. (mag.) and dipping 60° south, and paralleling the draw of a small creek.

This property is worthy of extensive exploration for the possibility of developing a mill-grade tonnage of silver-lead ore.

Summit. This group of two claims is owned by A. Davidson and O. Evindsen, of Alice Arm, and is situated on the north slope of the ridge to Clearwater creek at an elevation of about 3,100 feet. It is reached by trail from the *Last Chance* or by a branch trail from the main Kitsault Valley trunk trail through the *Tyee* group, constructed this year with assistance from the Department of Mines. The cabin is at an elevation of 3,060 feet.

The mineral occurrence consists of brecciated quartzose fracture-zones generally sparingly mineralized with seams and veinlets of fine-grained galena and a very light straw-coloured zinc-blende, striking generally N. 40° E. and dipping 60° west. In the majority of the showings explored zonal structure is not well defined. The best mineralization and structure seems to favour a belt of fine-textured tuff lying between belts of coarse breccia. The contact between

these belts seems to strike about north and south along the brow of the ridge above the cabin, with the tuff-belt occupying the benched area easterly of the ridge.

Several occurrences of this type have been explored by stripping, open-cutting, and tunnelling, showing galena seams and stringers up to 4 inches wide across fracture-zones up to about 6 feet wide. At elevation 3,060 feet a crosscut tunnel has been driven 18 feet in a westerly direction to get under a mineralized fracture-zone outcropping about 65 feet higher up. At the portal the tunnel cuts through a zone 5.5 feet wide which shows a fairly well-defined structure and is mineralized with fine scattered grains of galena and seams and patches of a very fine-grained and light straw-coloured zinc-blende. A sample across 5.5 feet of this zone assayed: Gold, 0.01 oz. to the ton; silver, 1.2 oz. to the ton; lead, 1.1 per cent.; zinc, 3.6 per cent. The same type of mineralization occurs in the two cuts north of the cabin. The intervening ground should be explored for the continuation of this zone. Several hundred feet south at the foot of a ridge a crosscut tunnel has been driven 150 feet in a direction of N. 78° W. to cut the downward extension of a zone carrying several stringers of massive galena. It would seem this tunnel is on the foot-wall side of the zone. A crosscut to the left should pick up the possible downward extension of the surface mineralization.

On this property the belt of fine tuffs paralleling the base of the ridge shows the most promise for commercial mineralization and should be extensively prospected by open-cutting. If showings of sufficient interest are uncovered this should be followed by diamond-drilling.

Tyee. This group consists of six claims and is owned by Archie McPhail, of Alice Arm. The property is situated on the east side of the Kitsault river, south-west of the summit. It is reached by a branch trail from the main Kitsault Valley trunk trail. The cabin is at elevation 1,925 feet, near the *Highland* group line. The "Bluebird" vein strikes through the *Tyee* in a northerly direction, following a well-marked ridge, along which it outcrops in several places and can be traced a considerable distance in the direction of the *Summit* group. This is a brecciated vein 7 to 12 feet wide cemented with quartz and calcite, but mineralized very sparsely on the surface with a little galena. It has not been developed or explored to any extent. The "Bluebird" vein strikes N. 7° W. (mag.) and dips 40° west, and appears to lie conformably with the formation of interbedded tuffs and slate.

At altitude 2,725 feet an exploration tunnel has been driven east across the formation for 15 feet. This cuts the "Bluebird" vein, showing a width of 7 feet, and faces in a bed of fine-grained dark tuff. On the foot-wall of the vein is a width of 2 feet of sheared and heavily oxidized material showing some yellow bloom similar to that associated with the oxidation of zinc-blende containing cadmium. At elevation 2,375 feet a trench 80 feet long across the formation starts in a dark-coloured tuff adjacent to and east of the "Bluebird" vein, crosses a black argillaceous tuff-bed about 15 feet wide carrying massive galena in reticulated seams 1 to 2 inches wide, and enters a greyish tuff-bed. Bordering the latter is a belt of coarse breccia. At elevation 1,880 feet, directly below the cabin, a tunnel has been driven 10 feet on the foot-wall of the "Bluebird" vein. This shows similar sheared material to that exposed in the upper crosscut at elevation 2,725 feet.

The reticulated galena-showing exposed in the tuff-bed in the upper trench is a somewhat remarkable occurrence and warrants further exploration and tracing. For this purpose it is recommended that surface-trenching be carried out and a tunnel faced up at the drop-off down the creek at elevation 2,200 feet and driven along the foot-wall of the "Bluebird" vein. From this crosscuts should be driven to the west across the "Bluebird" vein and to the east across the tuff-beds. This would explore the "Bluebird" vein itself, the foot-wall shear, and the possible downward extension of the galena mineralization showing in the tuff-bed at altitude 2,375 feet.

Highland. This group of six claims adjoins the *Tyee* group on the south and is owned by Archie McPhail and associates, of Alice Arm. The mineral occurrence consists of erratic patches and stringers of galena up to 3 inches wide along joint-planes in tuff, with some impregnation of the walls along the jointing. This mineralization follows both the major and minor jointing and is discontinuous at the crossing of the two joint-plane directions. Four large open-cuts have been excavated on showings of this type in dark greenish tuff-beds between altitude 2,350 and 2,200 feet. It is possible that these showings may be confined to one particular tuff-bed; this, however, could not be definitely established.

Second Thought. This group adjoins the *Tyee* on the north and is owned by George Casey, of Prince Rupert, and John Graham, of Alice Arm. The cabin is situated at altitude 1,350 feet at the junction of the main *Homestake* trail and the branch trail to the *Vanguard*. The main workings are contiguous to the trail and about 150 feet east of the cabin. The mineral occurrence consists of brecciated quartz veins, 6 to 7 feet wide, striking N. 50° W. (mag.) and dipping 45° south, occurring in argillite. Mineralization consists of a sparse and erratic distribution of pyrite, chalcopyrite, argentite, and occasionally some native silver. It is recommended that cross-sectional samples be taken of these showings to determine whether they may possibly be gold-bearing. The occurrence is described in detail in the 1918 Annual Report.

Homestake. This property is situated at the head of the Kitsault valley on the west side above the glacier and about 8 miles from the terminus of the Dolly Varden Railway, whence it is reached by a good trail. Several years ago it was under option to the Consolidated Homestake Mining and Development Company, Limited, which carried out some stripping, open-cutting, and tunnelling.

The mineral occurrence consists of a main silicified zone up to about 30 feet wide striking N. 7° W. (mag.) and dipping north, mineralized in places with veinlets and disseminations of pyrite, galena, zinc-blende, and chalcopyrite. Several cross-veins striking about N. 70° E. occur on the lower side of the main zone. Open-cuts on one of these expose encouraging mineralization in places. In the main crosscut tunnel to the main zone some good quartz replacement widths have been penetrated carrying scattered, but sparse, mineralization. It would seem that the various showings are worth thorough sampling, and the quartz-zones in the tunnel should be channel-sampled carefully with the object of determining a possible gold content.

Kitsault River Mining and Development Co., Ltd. This company was organized in 1924 with a capitalization of $1,000,000, divided into 1,000,000 shares. The property consists of eight claims situated on the west side of the upper Kitsault valley, adjoining the *Homestake*, about 8 miles above the terminus of the Dolly Varden Railway. The camp is at altitude 3,910 feet. The mineral occurrence consists of silicified zones mineralized with pyrite, galena, zinc-blende, and chalcopyrite occurring in fine- to medium-textured volcanic tuffs and breccias. In addition to these is the so-called "Spar" vein, which is a calcareous, in part quartzose, argillite inclusion in a diorite or porphyrite intrusion occurring at from 4,700 to 5,000 feet elevation and traced for about two claim-lengths southerly towards the *Lucky Strike* group. The various showings are described in the 1928 Annual Report.

During the 1930 season a crosscut tunnel has been driven about 60 feet at altitude 3,900 feet to cut a vein striking north-east and dipping 60° west, which shows on the ridge about 20 feet above the tunnel. The vein shows a width of about 2½ feet in the face. It is a quartzose replacement with a fairly well-defined foot-wall in a dark-grey siliceous intrusive. An assay of $24 in gold was reported by the owners to have been obtained from this vein. Some further prospecting of other showings on the property has also been carried out. The operators are advised to ascertain by careful average sampling the gold-bearing possibilities of several unexplored siliceous pyritized zones occurring on the higher altitudes of the property, both in and contiguous to what appears to be a young intrusive diorite or porphyrite.

Lucky Strike. This group consists of the *Lucky Strike, Lucky Strike No. 1, Silver Crown, Sunnyside, Rambler, Iron*, and *Iron Fraction* mineral claims and is owned by John Hauber and partner, of Alice Arm. The property is contiguous to the holdings of the Kitsault River Mining and Development Company. The various showings can be reached by traversing north-westerly up the mountain from the trail about a quarter of a mile above the *Vanguard* cabin. The showings are described in the 1929 Annual Report.

Some good prospecting-work has been done by John Hauber during the 1930 season in an attempt to project the most encouraging showings. On the *Lucky Strike* a short crosscut tunnel has been driven to penetrate a 20-foot-wide brecciated vein at altitude 3,850 feet. The tunnel was in 4 feet at the time of examination and would have to be driven a further 5 feet to cut the vein. Good gold values are reported in this vein in a cut northerly from the tunnel. The owner is advised to concentrate on the further tracing and development of this vein.

At altitude 4,200 feet on the *Silver Crown* there is also an encouraging showing in a well-defined shear, about 2 feet wide, in a dioritic intrusive rock. Mineralization is massive

fine-grained galena, some chalcopyrite, grey copper, pyrite, and zinc-blende in ½- to 1-inch stringers in the shear-zone. A sample of selected galena ore from this showing assayed: Gold, 0.58 oz. to the ton; silver, 40 oz. to the ton; copper, *nil;* lead, 15.1 per cent.; zinc, 3 per cent.; antimony, *nil.* This showing should also receive further exploration.

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 the Dolly Varden Railway terminus. The cabin is at altitude 2,825 feet. The mineral occurrence is described in the 1928 and 1929 Annual Reports. In connection with further information regarding the values contained in the lower and upper tunnels, the following tabulation of assays may be of interest. These assays are from samples taken by an examining engineer in 1928 and are supplied by M. Peterson:—

Description.	Gold.	Silver.	Copper.
Lower tunnel—		Oz. to Ton.	Per Cent.
4 feet, south end face of crosscut	$0.80	0.8	0.25
4 feet at crosscut tunnel	1.60	15.2	4.54
3.8 feet, 15 feet north	2.40	7.0	5.72
4 feet, 15 feet north	2.40	2.2	1.77
5.5 feet, 15 feet north	0.40	2.1	1.63
6 feet, 15 feet north	0.40	2.8	4.26
6 feet, north face of drift	0.80	2.5	0.96
Upper tunnel—			
6.8 feet at crosscut tunnel	.....	.....	0.69
4 feet, midsection of drift	0.80	7.4	5.88
4 feet, north face of drift	0.40	4.5	9.32
Gold vein—			
Trench near upper cabin	21.60	0.9	0.23

NOTE.—In the lower tunnel a 15-foot interval was used regardless of the appearance of the vein, and results may be quite different a few feet on either side.

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 Portland canal. An important geographical feature is the fact that the west boundary of the Division, a length of about 130 miles, is formed by the Alaskan boundary.

From the standpoint of exploration and prospecting the Division is the most active in the district. Although there was a curtailment of development activity during 1930 by several of the smaller companies that had carried out exploration in 1929, it must be considered that 1929 was a boom year in mining generally and cannot consequently be used as a fair basis of comparison in this respect. During 1930 the Division, however, was not only quite active in comparison with normal years, but progressed in the matter of general stability. This was reflected in the bringing-in of two new producing mines, *Prosperity* and *Porter-Idaho;* progress in the exploration-development of the *Big Missouri*, which, if successful, will greatly expand the gold-production possibilities of the Portland Canal area; and an increase of approximately 30 per cent. in stable pay-roll. A constructive condition of sound conservatism and calculated optimism has evolved from the many factors governing mining conditions in the Portland Canal area. On the whole it can be said that the Division, and the Stewart area in particular, has emerged from 1930 with a sounder and more stable foundation, and consequently a brighter outlook, than that possessed during any period of its history.

Certain phases of importance to the Division are dealt with in the introductory section of this report. In this respect the phase relative to prospecting is sufficiently important to again stress here. A growing intimacy with the area indicates that much of the area, easily accessible from Stewart, on which claims have been staked and restaked for a number of years, is as yet only very slightly prospected. This area is definitely known to be well mineralized, commercial ore-bodies have been proved to exist, and geological conditions are favourable. It would seem

that intensive prospecting of this favourable and conveniently accessible ground could very logically result not only in improving the commercial aspects of showings already known, but in the discovery of new showings of definite commercial promise. As an example of possible achievement in this respect, the results that have materialized from this type of work during 1930 on the *Kenneth, Salmon Gold, A. & T.*, and *Palmer* groups are illuminating. It is recommended that prospectors intensify on this type of prospecting in the already known mineralized area immediately surrounding Stewart. It would seem that the complete utilization of this close-at-hand opportunity will rapidly embrace the development of the hinterland.

Heretofore a great amount of effort has been expended in the Portland Canal area on the development of high-grade veins with a view to the production of small tonnages of ore for shipment. The fact is possibly overlooked that sound capital from large operating companies is primarily attracted by the prospects of appreciable tonnages of not necessarily high-grade ore. Some prospects of the Portland Canal area have the aspects of low- to medium-grade possibilities which should receive greater attention. It can be said generally that the future of this area is dependent on the results of the effort to develop mill-grade ore and the bringing into production of properties containing fair tonnage possibilities. This hitherto much-neglected factor in the mining situation of the area should receive more attention.

Georgia River Section.

The important geological feature of this area is the presence of a large inclusion within the batholith of andesitic and sedimentary rocks extending eastward towards the head of Hastings arm. This inclusion is about 7 miles wide, with its southern boundary at approximately the mouth of the Georgia river and the northern boundary slightly south of Bulldog creek. The Georgia River valley cuts diagonally across this inclusion. Granitic rocks outcrop at intervals within the inclusion; in the divide area between the headwaters of Georgia river and Bulldog creek, batholithic rocks and their derivatives predominate and only small isolated segments and remnants of the inclusion remain. The section is typical of that immediately adjoining the eastern contact margin, indicated in the "Generalized Section" accompanying the 1929 Annual Report.

Georgia River Gold Mines, Ltd.

This company was incorporated in 1925 with a capitalization of $1,000,000. The present authorized capitalization is $3,000,000, divided into 3,000,000 shares of the par value of $1 each. The mineral occurrence and details of the operation have been described in former geological reports and more recently in those for the years 1928 and 1929.

During 1930 development was carried on during the season to about the beginning of October. The work accomplished during this period included the extension of No. 3 tunnel to the Bullion vein, which was drifted on for about 200 feet. A raise along the vein to connect with the Bullion tunnel is reported to have encountered encouraging mineralization. The plan of future development and exploration embraces the extension of No. 3 tunnel and crosscutting to tap the south-west vein and exploration for ore-shoots in it at this horizon.

North Country Mining Co., Ltd.

This company was incorporated in 1923 with a capitalization of $2,000,000 and shares of $1 par value each. The registered office is in Vancouver and the financing is being done by a group of Dakota business-men. The property is situated on the divide between the headwaters of Georgia river and Bulldog creek. It is reached by a good trail from the mouth of Bulldog creek, a distance of about 8 miles to the main cabin at altitude 2,450 feet.

The property consists of twenty-four claims along the westerly slope of the ridge bordering the swamp-basin draining to the headwaters of the Georgia river. The higher altitudes of this ridge are composed of granitic rocks. Along the lower slopes to the basin are numerous small isolated segments and remnants of crushed and partly silicified argillite sandwiched between granitic rocks and intruded by numerous basic dykes. These segments are more widely distributed towards the southerly end of the property and gradually give place to practically exclusively granitic rocks towards the northerly portion of the property near the Bulldog Creek slope.

Three groups of claims are controlled by the company along this area. Starting from the north, these are the *Glory, Glory Extension*, and *Venture* groups. Several tunnels and open-cuts have been excavated on scattered showings in crushed and partly silicified argillite segments

intensively intruded by granitic rocks and basic dykes and showing erratic and sparse mineralization of chiefly zinc-blende and some galena. Altogether about 585 feet of tunnelling has been completed on showings of this type in mixed argillite and granitic rocks. The main or No. 1 tunnel at elevation 2,460 feet just behind the main cabin has been driven in a direction of 400 feet N. 70° E., and illustrates the disturbed and erratic geological conditions of the basin-rim. The portal of this tunnel is in granite, which continues for a few feet, then alternates with belts of silicified sandy argillite cut by light and dark dykes, which alternation again gives place to granite for the last 48 feet of the tunnel. The objective of this tunnel is to crosscut a sparingly mineralized admixture of granite, basic dykes, argillite, and semi-absorbed argillite exposed in an open-cut at elevation 2,610 feet.

Towards the northerly end of the property, on the *Glory* group, a tunnel has been driven 278 feet entirely in granite and a lamprophyre dyke carrying a little pyrrhotite. At the portal of the tunnel some sparse zinc-blende and pyrite mineralization and frozen quartz-seams are sparingly developed along joint and cooling fractures in the granite. On this claim also, a winding tunnel at altitude 3,600 feet has been driven 747 feet entirely in a coarse-grained quartz diorite. A few frozen and barren bull-quartz veinlets are cut in this tunnel and no mineralization or vein-structure is exposed. This tunnel is reputed to have as its objective the crosscutting of a pyritic zone in granite occurring at about 4,500 feet altitude. Specimens from this zone indicate it to be a pyritized felsite dyke. Additional details of the showings and workings are contained in the 1927, 1928, and 1929 Annual Reports.

Nothing of commercial importance is exposed in the twenty-four different showings and workings examined on this property. It would seem a forlorn hope to expect commercial potentialities from the small scattered showings of sparse mineralization contained in the isolated inclusion segments of argillaceous rock sandwiched between the granitic rocks and numerous satellitic dykes. If exploration is continued the operators are advised to prospect for showings that have some commercial potentialities. It is possible the granitic rocks may contain gold-bearing quartz veins that may warrant exploration. If these are found they should be stripped, open-cut, and test-pitted before embarking on the expense of long deep-level crosscut tunnels that may not be warranted.

Marmot River Section.

Porter-Idaho Mining Co., Ltd.

This company was incorporated in January, 1925, with a capitalization of $2,000,000, divided into 4,000,000 shares of the par value of 50 cents each. The property, consisting of seven claims, is situated on the north side of the North fork of the Marmot river. Early in 1928 the Premier Gold Mining Company took over the operation and agreed to spend $500,000 on the property for the consideration of 1,651,406 shares remaining in the treasury. Extensive construction and installation of machinery was undertaken and completed and energetic development commenced.

The ore occurrence and showings have been described in former Annual Reports. The main underground workings are from "I" tunnel at elevation 4,222 feet, "H" tunnel at elevation 4,360 feet, and "D" tunnel at elevation 4,690 feet. Besides these, there are extensions into *Porter-Idaho* ground from the main workings of the adjoining and jointly operated *Prosperity* property. These are the 304 and 305 drifts south from the No. 3 tunnel at elevation 5,085 feet and 201 south drift from No. 2 tunnel at elevation 5,245 feet.

During 1930 development has been concentrated on "D"-tunnel drift north-west on the most easterly vein on "D"-level horizon. Some good-grade and width of ore in irregular shoots has been encountered in this work and stoping on them carried out, with the result that this property has been brought into production. The veins on this horizon are similarly oxidized and loosely sheared as on the higher horizon on the *Prosperity*. On "D"-level drift horizon in *Porter-Idaho* ground the vein shows widths up to about 18 feet with an excessively sheared structure, with shoots or lenses of ore very irregularly distributed and with no definite attitude. This is the characteristic of the vein-structure developed in the *Prosperity* vein system from No. 3 tunnel at altitude 5,085 feet. Characteristics of the mineralization on "D"-level horizon are also similar to those exposed in the higher horizon *Prosperity* workings. It would seem, however, that some of the higher-grade ore composed seemingly of primary sulphides may have derived increased value from secondary enrichment. Whereas the occurrence of high-grade primary silver-bearing ores such as those of the grey-copper group may be characteristic of the *Porter-Idaho* and *Prosperity* vein system on the lower horizons, their definite occurrence has yet to be

TEA POT DOME
L 1857

PROSPERITY
L 1858

GARGOYLE
L 1866

MELVIN N°1 FR.
L 1868

NETTIE L
L 4730

LUCILLE
L 4729

SUNDAY
L 4731

PRICKLY HEAT FR.
L 4737

PRICKLY HEAT
L 4734

Edge of Glacier

OC 304
OC 303
OC 302
Open Fissure
65°
168°
45°
55°
A Tunnel
302 x cut
301 DR
301 X CUT
304 DR N
304 DR S
305 DR Z
201 DR S
10 DR Z
Prosperity N°2 Tunnel
Portal of Prosperity N°1 Tunnel
3E #2
MYRSE
Tunnel
Portal of N°3 Tunnel Prosperity El. 5085'
Tram Terminal
Prosperity Bunk House
PORTER IDAHO AERIAL TRAM
302 RSE
305 S RSE
Portal of B Tunnel
Portal of C Tunnel
43A
Portal of D Tunnel El. of Back 4691'
El. of Back of Level 4738'
El. of Back 4241'
El. of Back of Level 4480'
El. Shaft Tunnel Lower Level 4445'
Shaft Tunnel E
Camp Tunnel F El. 4490'
Porter Idaho Bunk House
old house
NEVER SWEAT FR. L 4736
El. of Back 4422'
Portal of SLIDE Tunnel "G"
Portal of H Tunnel El. of Back 4360'
GEM OF THE MOUNTAINS FR. L 4736
Portal of I Tunnel
El 4224
Compressor
I Tunnel approach
Vert. bluff
Canyon
Shearing
Fault
Open Fissure
Bluff
40°
120°

PLAN OF WORKINGS,

PORTER IDAHO - PROSPERITY

PORTLAND CANAL MINING DIVISION
B.C.

Scale of Feet:
0 100 200 300 400 500

With Report of J. T. Mandy,
Resident Mining Engineer,
Prince Rupert, B.C. 1930.

B.C. Bureau of Mines.

established. It is significantly interesting to note that as the "D"-level drift advances northerly into the mountain and enters *Prosperity* ground with a back of about 450 feet the vein continues with its characteristic intensively sheared structure, but with scattered low-grade mineralization associated in places with secondary silver minerals, from which an occasional high assay may be obtained. The possibility for the establishment of an ore-horizon conforming approximately to the slope of the mountain and with a back dependent on the depth of erosion is a factor of interest to be considered. On this hypothesis the ore-deposit would be subdivided into the following vertical column:—

(1.) Zone of primary sulphides and secondary-enrichment ores.

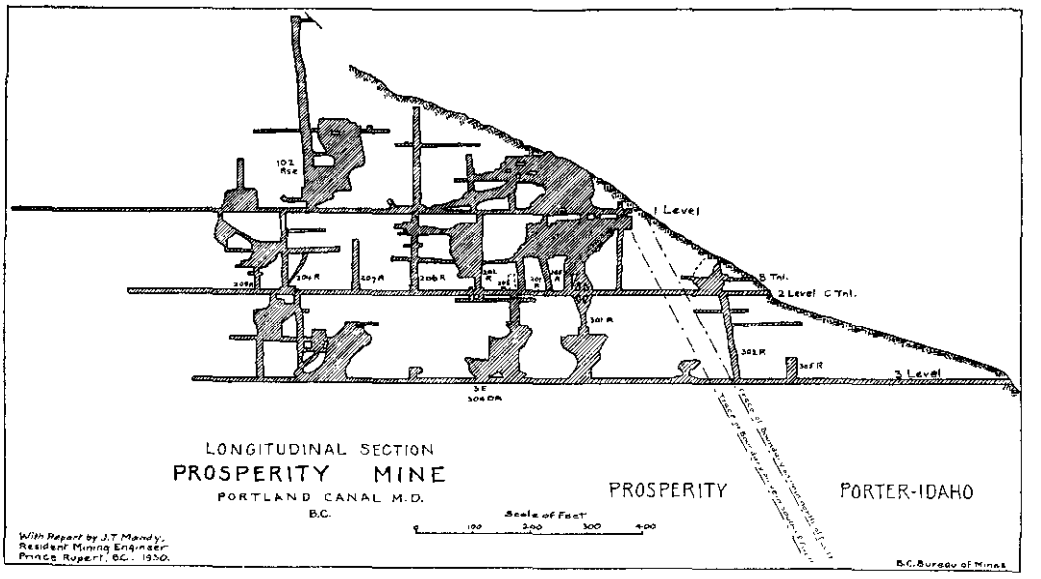
(2.) Zone of decreased primary sulphides with some secondary enrichment.

(3.) Continuation of vein-structure, no primary sulphides and some secondary silver ores.

The apparent irregularity of the lenticular ore-shoot occurrence in the *Porter-Idaho* and *Prosperity* vein systems offers much technical difficulty in underground development. It may, however, be found that certain tuff-beds of the volcanic rock-complex through which the veins strike are favourable for ore-deposition and others not. Should this be established the veins will show zones of lenticular ore-shoots conforming to the favourable beds and some guide to ore-shoot location would be furnished.

During the year a subsidiary aerial tramway connecting "D" tunnel with the main tramway terminal at No. 3 tunnel has been completed. A new compressor has been installed at "I" tunnel and a new approach to this tunnel, to avoid slides, has also been completed. Some diamond-drilling has also been carried out. Some work was also done from 305 drift south and a raise put through from this drift to No. 2 level, with two sub-levels. Gus Anderson is the foreman in charge.

Prosperity. This property is also being operated by the Premier Gold Mining Company, with Gus Anderson foreman in charge of the work. About 100 men are employed in the *Porter-Idaho* and *Prosperity* operations. The ore occurrence has been described in former Annual Reports. During 1930 this property was brought into steady production, with a total output of about 1,400,000 oz. of silver, and is the third largest



producer of silver in the Province. Exploration and development has continued actively throughout the year, with some curtailment in December coincident with the inability of the smelter to accept the total output of ore. The vein system has been explored on three levels from No. 3 tunnel and new ore-shoots have been discovered and developed. Some diamond-drilling was carried out from No. 3 level.

Vein-mineralization characteristics are identical to those on the adjoining *Porter-Idaho*. Features in this respect are bunchy ore-shoots of shipping-grade (over about 25 oz. silver),

interspersed irregularly in a general low-grade silver mineralization, some of which may be of milling-grade. So far no regular attitude or rake of the high-grade ore-shoots has been established. These characteristics, coupled with the extremely broken nature of the ground, necessitate much close timbering and intensive intermediate-level exploration and close sampling. To avoid the loss of stoped ore through caving of the stopes, broken ore must be removed as it is mined. Care must also be exercised to prevent the shipping-ore from being diluted during stoping; this is also assisted by hand-sorting by the trammers. In the face of these difficulties and the difficult conditions governing construction, the successful results achieved by the Premier Mining Company organization and staff in the development of the *Prosperity* and *Porter-Idaho* is a most creditable achievement.

During 1930 work has progressed on the main *Prosperity* vein on three levels. This has been drifting on the main levels to the north, raising, sub-level drifting, and stoping out any ore-lenses encountered. "D"-level drift has been continued through *Porter-Idaho* into *Prosperity* ground to the north, exploring the 303 vein in this direction. In this section the vein is offset about 20 feet to the west, with three subsidiary shear-structures in the foot-wall country east of the main drift. The vein in this section is composed of sheared material carrying only a slight amount of iron-oxidation products, some sparsely scattered and finely divided primary sulphides, and in places in the hanging-wall some filaments of argentite and native silver (*see* brief discussion under *Porter-Idaho* heading). Development on No. 3 and No. 1 levels in the northerly section with appreciable backs shows a similar unoxidized and sparsely scattered mineralization which suggests a correlation of the horizon condition briefly discussed under the *Porter-Idaho* heading.

Besides the main north-south vein system on this property there is the indication of an east-west system which has yet to be explored.

During the year the bunk-house was completed, the portal of No. 3 tunnel equipped with drier, blacksmithy, and drill-sharpening shop, and a closed-in connection with the tramway terminal constructed.

Marmot Engineer Syndicate.

This syndicate was formed to explore the *Engineer* group of five claims. The property is situated on the south side of the Marmot River South Fork glacier, with the camp at elevation 2,500 feet. The formation is mainly argillite, intruded by some feldspathic dykes, close to the main contact of the batholith. The showings at about 3,000 feet elevation consist of shears in siliceous argillite carrying sparse lenses of zinc-blende and galena. These have been explored by some cuts and tunnelling. At a lower altitude a quartzose shear-zone 7 feet wide, striking N. 30° W. and dipping 65° north, is exposed in an open-cut and is sparingly mineralized with chalcopyrite and some specks of what appears to be stibnite. About 250 feet northerly from this cut and at about 75 feet lower altitude a tunnel driven in a semicircular direction to avoid coming out to talus, and now facing south (mag.), has been driven for 265 feet. The face of this tunnel is approximately at the projection of the zone on this level.

Bi-Metallic Syndicate.

The property of this syndicate is situated on the north slope of the mountain overlooking the Marmot river and almost opposite the mouth of the North fork, about 3 miles from tide-water. It consists of five claims and is reached by a fair horse-trail for about two-thirds of the distance, and then a steep foot-trail for the rest of the way. The ore occurrence and showings are described in the 1929 Annual Report. During 1930 exploration was carried on with a small crew continuously during the season until late in the fall. Work was concentrated on the extension of the main drift and surface prospecting. The results of this work have not yet been examined.

Bear River Section.

Molly B.

This is a Crown-granted claim owned by W. Davidson and associates, of Stewart, and is situated on the east side of the Bear river, about 1 mile from the town of Stewart. About a quarter of the westerly portion of the claim, including the showing along the rim of the river, is on the Skamakounst Indian reserve. The property is reached by crossing the Bear River bridge and following the flats on the east side of the river to the showings. Some interest has been taken in the property recently on account of its molybdenite content.

The formation of the locality consists of segments of crystalline garnetiferous and chloritic schists overlying granite. The locality is on the main contact of the Coast Range batholith. The schists probably represent altered sediments that have been eroded to a thickness that is probably not very appreciable above the granite. The showing consists of a silicified zone in the schist mineralized with pyrite, pyrrhotite, and some molybdenite, striking N. 80° W. (mag.) and dipping south. In a cut at the edge of the flat and one about 50 feet above this a width of about 4 feet of fair molybdenite mineralization is exposed. A sample of this taken from the upper cut assayed: Gold, trace; silver, trace; MoS_2, 0.7 per cent. Several other cuts are reported located above this one, but were not examined.

The commercial possibility of this deposit is mainly dependent on the depth of the schist in which the mineralization occurs and the intensity of the molybdenite mineralization; neither, however, is encouraging.

Silverado Consolidated Mines, Ltd. This company was organized in 1928 to assume ownership of the Silverado Mines, Limited. A controlling interest in Silverado Consolidated Mines, Limited, was at the same time obtained by the Premier Gold Mining Company for the purpose of carrying out exploration and development of the property. The main ore occurrence consists of a series of four shear-zones containing lenses of high-grade silver-lead-zinc ore, similar to the deposits on the *Porter-Idaho* and *Prosperity* on the westerly side of the same ridge. The mode of occurrence of the *Silverado* deposits are also similar to these latter, and it is quite possible that the genetic and erosional influences briefly discussed under the *Porter-Idaho* heading may apply also to the *Silverado*. The showings are described in detail in the 1928 Annual Report and the progress of development in the 1929 Report.

Early in 1930 operations on this property by the Premier Gold Mining Company, Limited, were suspended. About the middle of June, 1930, development and exploration were resumed and continued to the beginning of September, when operations were again suspended. Results of this exploration were similar to those in 1929 and were not encouraging.

United Empire Gold & Silver Mining Co., Ltd. This company was incorporated in February, 1928, with a capitalization of $2,000,000, divided into 4,000,000 shares, for the purpose of developing the *Gold Cliff* group of claims. The property is situated on the west side of the Bear River valley, about 4 miles from Stewart, adjoining the *Bayview*, and is reached by a steep, rocky trail branching from the Bear River road at the bridge. The ore occurrence and showings are described in the 1928 and 1929 Annual Reports. Towards the end of the 1930 season two men were employed and advanced the tunnel at elevation 3,350 feet a further 4 feet. An examination of a chip sample taken across the face by Billy Dann showed encouraging mineralization with grains of galena accompanied by ruby silver, which should give a fairly high silver assay. This property has a showing that warrants further intensive exploration.

Argentine Syndicate. This syndicate was formed late in 1929 for the purpose of developing the *Kenneth* group (old *Mobile*). The syndicate is composed of Clay Porter, L. Legg, and H. Gibson, of Stewart. The property consists of nine claims situated on the south side of Glacier creek, at around 4,000 feet altitude, and directly south of the old Portland Canal Mining Company property. It is reached by a good trail from the *Dunwell* mill, which was improved during 1930 with assistance from the Department of Mines.

The characteristic mineral occurrence consists of banded and brecciated shear-zones 2 to 15 feet wide, in argillite of the Bitter Creek formation, mineralized lenticularly with zinc-blende, galena, and pyrite in a quartz gangue. In places native silver, ruby silver, and grey copper also occur. The showings have been described in the 1927 and 1929 Annual Reports.

In former operations "C" tunnel at 3,710 feet altitude was driven about 550 feet to crosscut "A" vein exposed in surface cuts to the south-east. This did not encounter anything of importance, but should be surveyed to definitely correlate its position with the projection of the surface showings. About 70 feet above this a drift-tunnel shows about 18 inches of vein-matter in the face.

During 1930 work was concentrated on the development of the vein in "A" tunnel at altitude 3,840 feet. This is a drift and at the time of examination had advanced 76 feet. Some high-grade ore carrying native silver was encountered in a lens about 40 feet in from the portal and a 20-foot raise excavated on it. About 60 feet in, another high-grade lens occurred and a

small winze was excavated on it. The face shows slightly mineralized sheared and brecciated vein-matter. A sample across 45 inches of "A" tunnel-face assayed: Gold, 0.03 oz. to the ton; silver, 10.1 oz. to the ton; lead, 0.2 per cent.; zinc, 1 per cent. It would seem that where the high-grade ore occurs it is confined to a hanging-wall and foot-wall secondary enrichment pay-streak up to about 12 inches wide, with mill-grade ore between these. About 60 feet westerly of the tunnel portal an open-cut exposes the vein about 5 feet wide, well defined and showing a remarkably clear quartzose banded and brecciated structure, with encouraging mineralization. This vein has been traced up the hill for several hundred feet above "A" tunnel on the north side of a light-coloured dyke.

At altitude 3,650 feet and several hundred feet south-westerly of "A"-vein workings a crosscut tunnel has been faced up. This has as its objective the exploration of "B" vein outcropping in a creek-bed and showing a width up to about 20 feet. This vein is heavily oxidized on surface, but exhibits well-defined shear-structure. There are several other showings on the property that are worthy of intensive development.

Five tons of sacked ore was shipped to the Tacoma smelter in October from the development of "A" vein in "A" tunnel. Smelter assays on this showed: Gold, 0.11 oz. to the ton; silver, 323.86 oz. to the ton; zinc, 10.8 per cent.; arsenic, 4.14 per cent.; antimony, 1.01 per cent.

Ben Bolt Mining Co. This property is situated near the head of the South fork of Glacier creek, about 4 miles from the Bear River road. The claims were Crown-granted in 1912 and extensive, though not conclusive, exploration was carried out on some of the showings several years ago. The property is referred to in the 1929 Annual Report. During 1930 the *Alice* claim, recently acquired by this company, was prospected by G. Clark, who reports the discovery of an encouraging showing of zinc-blende, galena, and pyrite mineralization. A parallel vein east of the main "Portland Canal fissure-zone" is also reported to have been traced about 500 feet, showing encouraging width and mineralization.

Mayon Gold Copper Co., Ltd. This company was incorporated in 1928, with the registered office in Stewart. The property consists of thirty claims and is situated on the north side of Bitter creek, about 3 miles east of the Bear River road and about 13 miles from Stewart. The ore-showings are described in the 1929 Annual Report. During 1930 active underground exploration was continued up to late in the season. To determine the advisability of further exploration on this property a thorough examination was carried out by a mining engineer at the end of the season.

Mayflower Mining Co., Ltd. This group of eight claims is situated on the east side of Bear river, about 6 miles from Stewart, and is reached by a good trail, a distance of about half a mile, from the Bear River road. The cabin is at altitude 410 feet. The showings consist of quartzose shear-zones mineralized with pyrite and chalcopyrite and carrying gold values, occurring in a stock of quartz diorite intrusive into the Bear River formation. Two veins have been prospected by open-cuts about 42 feet apart at altitude 460 feet. The most northerly of these is 4 to 5 feet wide, well mineralized with pyrite, strikes N. 25° W. (mag.) and dips 75° north. The showing south of this consists of a similar vein about 2 feet wide striking N. 45° W. and dipping 80° south. A shallow shaft was sunk on this about twenty-four years ago. In a cut contiguous to this, 18 inches of sheared quartz and pyrite is exposed. This is apparently cut off by a minor joint-plane striking N. 45° E.

At altitude 390 feet a crosscut tunnel 105 feet in length intersects a quartz vein 2.5 feet wide, carrying some pyrite and exhibiting some shear-structure. This strikes N. 58° W. and dips 75° south. A drift 39 feet long to the south shows about 12 inches of quartz moderately mineralized with pyrite. A selected sample of well-mineralized pyrite from a small dump at the tunnel portal assayed: Gold, 0.3 oz. to the ton; silver, 2.5 oz. to the ton. The indications are that the crosscut tunnel has not intersected the vein showing in the most northerly cut, which is structurally the more encouraging of the two veins. The pyrite carries encouraging gold values. It is considered that the extension of the tunnel to explore the possible vertical extension of this vein would be worth while.

Lucky Date. This group of six claims is owned by W. Younkin and O. McFadden, of Stewart, and is situated near the head of the North fork of Bitter creek, about 7 miles by trail from the Bitter Creek bridge. Four adjoining claims are also owned by the same men. The rock formation of the locality consists of a complex of syenite, porphyrite,

and gabbro, with dykes of quartz rhyolite and dark lamprophyre, intrusive into argillite and quartzite of the Bitter Creek formation. The main showing consists of what appears to be a fractured and slightly sheared dyke about 3 feet wide, mineralized with patches and veinlets of pyrite, some grey copper, and an unidentified dark mineral, in a quartzose gangue. The country-rock has the character of porphyrite and is pyritized contiguous to the vein. This vein follows a steep, narrow ravine, along which it can be traced for several hundred feet up the mountain-side from altitude 3,400 feet. A crosscut tunnel started to one side of the ravine had advanced 15 feet and should intersect this vein at about 40 feet from the portal.

At altitude 3,500 feet and about 1,500 feet north of this vein a banded and reticulated quartz vein 2½ feet wide, well mineralized with galena, zinc-blende, and pyrite, occurs in porphyrite country-rock. This is exposed in an open-cut and several small strippings up the 60° mountain-slope to 4,000 feet altitude. Several other showings are reported, but were not examined. The showings seen are well worth further exploration.

Windsor. This property is owned by W. George, of Victoria, and is situated on the west side of Bitter Creek glacier. The property is reached by the Bitter Creek trunk trail to the foot of the glacier and then across the glacier. The main mineral occurrence consists of a quartz vein up to about 4 feet wide in argillite of the Bitter Creek formation, mineralized with pyrite, zinc-blende, and some galena, and carrying encouraging gold values.

This showing has been explored by tunnels and several open-cuts. During the 1930 season work was continued in two tunnels and additional surface-tracing carried out by open-cutting. It is understood this work encountered further encouraging values in gold.

A. & T. This group, consisting of twelve claims and seven fractions, is situated at about 2,500 to 3,000 feet altitude, on the west side of the Bear River valley, about 11 miles from Stewart. It is owned by W. R. Tooth and associates and is reached by a good horse-trail from the road, a distance of about 4 miles. The ore-showings consist of shear-zones in an andesitic country-rock, irregularly mineralized with chalcopyrite, pyrite, and pyrrhotite. The formation is cut by broad granitic dykes which strike north-westerly, and also by small basic dykes. Two mineralized zones striking N. 15° E. (mag.) occur. The upper zone strikes across the claims at about 3,500 feet altitude and has been explored by several open-cuts and pop-holes. The lower zone occurs at from about 2,400 to 3,000 feet altitude and can be traced south-west for several hundred feet. Towards Fitzgerald creek, on the north-east, the formation merges into the broad belt of closely spaced dykes that cut across the country in a north-west direction from Bitter creek to beyond the Salmon River glacier. During 1929 the Consolidated Mining and Smelting Company did some diamond-drilling on a section of this zone that appears to be a shallow included segment between granitic intrusives, and later relinquished the option.

During 1930 the owners discovered chalcopyrite mineralization in a somewhat indistinct shear-structure connecting the lower and upper zone between altitude 2,925 and 3,500 feet. Two cuts have been excavated across this structure at its junction with the lower zone at altitude 2,925 feet. These show irregular chalcopyrite mineralization in several places in the cross-structure over a zone-width of about 70 feet. A small cut at altitude 3,000 feet excavated on the west wall shows stringers, seams, and patches of chalcopyrite in a dark andesitic rock. A sample across 3 feet of this assayed: Gold, 0.18 oz. to the ton; silver, 1.3 oz. to the ton; copper, 2.7 per cent. This zone should be extensively open-cut between the lower and upper zones in order to ascertain the distribution and extent of the chalcopyrite mineralization.

Independence Gold Mining Co., Ltd.—The property of this company is situated on the north side of Fitzgerald creek, on the west side of the Bear river, and about 12 miles from Stewart. The showings are described in the 1929 and former Annual Reports. During 1930 no work was carried out on this property.

Palmey. This property is a restaking of the old *H. & T.* group. It is owned by W. R. Tooth and associates, of Stewart, and is situated on the west side of the Bear River valley. It adjoins the *Dalhousie* on the south-west and is reached by the *A. & T.* and *Dalhousie* trail, then across the glacier to the showings. The rock formation of the area consists of tuff, breccia, lava, and argillite of the Bear River formation.

Prospecting during 1930 resulted in the discovery at about 4,000 feet altitude of a silicified zone mineralized in places with zinc-blende, galena, and pyrite, occurring in a grey tuff. The

zone strikes north-west and dips steeply south and can be traced about 250 feet. At the southerly end it is about 14 feet wide, but seems to wedge out towards the north. A selected sample of the best-grade ore exposed across 14 feet in a cut at altitude 4,000 feet assayed: Gold, 0.03 oz. to the ton; silver, 2.3 oz. to the ton; lead, 13.3 per cent.; zinc, 6 per cent. This zone should be open-cut at the foot of a small bluff at the southerly end of the tracing, where some mineralization is evident and the zone is intensely silicified across a width of about 14 feet.

Bornite. This group is a restaking of the old *Black Bear* and consists of six claims adjoining the *Red Top* and the *Barite*. It is situated on the north side of the upper Bear River valley, about 10 miles from the end of the Bear River road and 21 miles from Stewart. It is owned by Nick Gillof and partners, who prosecuted energetic surface prospecting during the season and report the discovery of encouraging galena and chalcopyrite showings carrying values in copper, gold, silver, and lead.

George Gold Copper Mining Co., Ltd.—Control of this company is owned by the Consolidated Mining and Smelting Company of Canada. The ore occurrence is described in former Annual Reports and referred to in the 1929 Annual Report. No development or exploration has been carried out on this property during 1930.

George Enterprise Mining Co., Ltd. This company was incorporated in 1928 for the purpose of acquiring the *Enterprise* group of claims situated near the head of the Bear River valley on the north side, about 23 miles from Stewart. Subsequently the *Heather* group on the south side of the valley was also acquired. The showings have been described in the 1928 and 1929 Annual Reports. During the 1930 season further prospecting was carried out with a crew of seven men. Tunnels "A" and 15 were also extended and additional open-cutting done. This work is reported to have resulted in several new discoveries of mineralization.

Southern Cross. This group of claims is owned by E. C. Morris and partner, of Stewart, and is situated on the east side of Bear River glacier at altitude 2,500 feet. The ore occurrence consists of quartz veinlets mineralized with chalcopyrite, grey copper, and some zinc-blende, in a formation complex of tuffs, breccias, and argillite. Further stripping and open-cutting was carried out on these, and four parallel veins carrying hæmatite, magnetite, pyrite, and some galena along small fractures were also prospected during the 1930 season.

American Creek Section.

Keystone. This group consists of the *Galena Farm*, *Galena Farm No. 1*, *No. 2 Fraction*, *Keystone*, *Tiger*, and *Poorman*. The claims are situated towards the mouth of American creek, about 1 mile from the road, and are owned by Sam Deschamps, of Stewart. On the *Galena Farm* claim a tunnel has been driven 65 feet on a fault-vein striking north and dipping 45° east. The portal of the tunnel is in andesite, but the rest is in very sheared and crushed argillite. Some stringers of quartz occur, but no mineralization is evident. Eighty feet north-west of the tunnel an oxidized quartz vein 20 inches wide is uncovered, striking north-west and dipping 60° east. Two hundred and fifty feet north-west of the tunnel a quartz vein 20 inches wide is exposed in an open-cut; this strikes north-west and dips 70° east in silicified argillite and is mineralized with chalcopyrite, galena, and zinc-blende, with about 4 inches of fair ore on the foot-wall.

In the old *Bonanza* workings on the *Galena Farm* and *Galena Farm No. 1* east of the shaft some work was done several years ago on a shear in argillite striking N. 25° W. and dipping 80° west. This was traced for about 300 feet and showed some galena and zinc-blende mineralization in a brecciated quartz-calcite-argillite gangue.

Morning Jubilee. This group of twelve claims is situated about 2 miles from the mouth of American creek on the east side and is owned by Sam Deschamps and associates, of Stewart. A well-constructed cabin is connected with the main trunk trail by a branch trail a quarter of a mile long. Work has been concentrated on the *Morning* claim, where a 65-foot tunnel has been driven into the andesite canyon-face about 15 feet above the creek-bed. About 12 feet from the face a quartz-calcite vein 3 inches wide angles across to the south side of the tunnel-face. This shows some scattered patches of black zinc-blende and pyrite. A selected sample of the sulphides assayed: Gold, trace; silver, 1.3 oz. to the ton. On the surface this vein is traced up a creek-bed for 150 feet by two open-cuts, where it strikes a north-east slip and apparently heads into the north bank.

Mountain Boy Mining Co., Ltd.

This company has a capitalization of 6,000,000 shares of no par value and its head office is at 112 St. James Street, Montreal. The property comprises eight claims and three fractional claims and 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 ore occurrence and showings are described in former Annual Reports and details of recent work are given in the 1929 Annual Report.

Underground operations were suspended in January, 1930. Early in the summer operations were resumed, but were restricted to a systematic plan of open-cutting, stripping, and structure mapping inaugurated and supervised by F. R. McDonald. This has as its purpose the solving of the structural complications of this ore occurrence before proceeding further with underground exploration and is a sound and efficient plan of preliminary exploration fitting the character of this occurrence. It will result in the saving of what might otherwise be much abortive expenditure. This work was completed at the end of the season and the further policy of exploration will be based on the engineer's report relative to these structural problems.

Shuniah Mines, Ltd.—This company carried out no work on the thirteen claims contiguous to the *Mountain Boy*, which were optioned and partially explored by it late in the 1929 season. It is understood these options have been relinquished.

American Creek Mining Co., Ltd.

This company controls about sixty claims on the west side of American creek. The camp is at altitude 1,275 feet, about 2 miles north of the *Mountain Boy*. The property is being prospected for showings that may warrant further exploration. During the 1930 season this work was under the supervision of Joseph Morin, with Joe Miller assisting. The rocks of the area are comprised of argillites, tuffs, and altered andesite. The argillite outcrops for long stretches along the valley-bottom of this area approximately to the foot of the glacier, a distance of about 4 miles; beyond this, to the head of the valley, they occur in a series of folds, the crests of which show at intervals above the valley-bottom. It is possible they may be correlated with the upper limit of the Bitter Creek series. Overlying the argillite are bedded tuffs and fine breccias to about altitude 2,550 feet, from which elevation to about 3,500 feet altitude there is a wide distribution of an altered andesitic lava, which in turn is overlain at the crest of the range by a complex of tuffs and coarse breccias. The volcanic series may possibly be correlated with the Bear River series.

Some of the tuff-beds are extensively pyritized and in places partially silicified, particularly those towards the crest of the range at the northerly end of the property. These pyritized beds are very similar to those in the Dolly Varden series of the upper Kitsault valley in the neighbourhood of the *Red Point*. Some open-cutting has been done in these tuffs on the *Silver King M*, *Silver King O*, *Silver King Q*, and *Free Gold Fraction*, between 3,200 and 4,700 feet altitude. The only suggested possibility of value in this pyritized formation is that it may be gold-bearing in some of the siliceous sections. The prospects for this are not particularly encouraging, but they can be only definitely negatived by a series of systematic samplings. A sample from a typical exposure assayed: Gold, 0.02 oz. to the ton; silver, 0.37 oz. to the ton.

Some work has also been done on the *Silver King No. 2 Fraction* at altitude 1,400 feet in a crushed, calcareous, and graphitic slate showing quartz and calcite stringers mineralized with pyrite. A sample from this showing assayed: Gold, trace; silver, trace. On the *Silver King B* a cut at altitude 1,500 feet exposes a pyritized zone on the south side of a small creek. A sample across 4 feet of this assayed: Gold, trace; silver, trace.

On the *Silver King Fraction*, *Silver King Q*, and *Silver King M* a somewhat imperfect shearing structure in andesitic lava between 2,500 and 3,550 feet is being prospected. In places the exposures show some chalcopyrite and pyrite in a quartzose replacement gangue. A sample across 4 feet sparsely mineralized with chalcopyrite, pyrite, and some specularite assayed: Gold, 0.01 oz. to the ton; silver, 0.28 oz. to the ton; copper, trace.

On this property, of the showings examined those exhibiting some structure in the andesitic lava should be further prospected. At the same time surface prospecting for showings of more commercial promise should be continued.

Excelsior Prospecting Syndicate.

This syndicate was formed in 1929 for the purpose of exploring the *B.L.K.*, *Bryant*, *Dundee*, and *Virginia K.* groups, situated towards the head of American creek, about 12 miles from the Bear River road. The claims are reached by a trail along the west side of American creek and across the glacier to the camp-site at altitude 2,300 feet. A horse could be used over this trail for about

the first 9 miles. The ground covered by the claims on the west side of American creek extends from the valley-bottom at altitude 1,550 feet to the crest of the glacier at about 4,500 feet altitude. On the east side the *Virginia K.* extends from the valley-bottom to about altitude 3,800 feet. Very little work other than superficial prospecting has been carried out on these holdings. The general geology of the area conforms to that described briefly under the heading of American Creek Mining Company.

At altitude 1,550 feet on the *Camp No. 2* claim a quartz vein 12 feet wide mineralized with pyrite outcrops on the west side of the creek. A sample across 4 feet of this assayed: Gold, trace; silver, 0.24 oz. to the ton. On the *Bryant No. 7* at altitude 4,200 feet and about 300 feet below the glacier a siliceous replacement zone mineralized with stringers and veinlets of resinous zinc-blende and some galena outcrops. A representative sample of this occurrence assayed: Gold, trace; silver, trace. Although this sample shows no values, this zone warrants some further prospecting. At altitude 3,300 feet and about 1,000 feet north-east of this showing a sample from an extensive altered pyritized porphyrite zone assayed: Gold, 0.02 oz. to the ton; silver, 0.28 oz. to the ton. On the *Dundee No. 8* a carbonate tuff-bed has been explored by three small cuts and traced for about 700 feet from altitude 3,650 to 3,750 feet. This is mineralized in places with galena on the hanging-wall and in cross-veinlets. This showing warrants further prospecting. The *Virginia K.* was not examined. No work has been done on this group as yet and it is very slightly prospected.

Although the showings on these holdings do not show commercial values, two of the showings warrant some further exploration and the large area covered by the claims is worth detailed prospecting.

Northern Aerial Prospectors, Ltd. This company controls a group of fifteen claims situated about 3 miles north of the Excelsior Syndicate camp on the west side of American creek. The camp-site is at altitude 3,100 feet and the main showing is on the *Moonlight* claim at altitude 3,900 feet. This consists of a carbonate tuff-bed mineralized with galena, some zinc-blende, and a little chalcopyrite, occurring just above the crest of the folded underlying argillite. This tuff-bed is heavily oxidized and contains appreciable siderite. It is exposed in two cuts and shows from 4 to 12 inches of fairly solid galena along both the hanging and foot walls, with cross-veinlets of mineralization emanating into the bed from the walls. The bed strikes N. 60° W. (mag.) and dips 40° south and has been traced for about 70 feet, with the described degree of mineralization probably continuing for this distance. This showing warrants extensive exploration and should be traced by surface cuts at reasonable intervals. The company plans to prospect these holdings with the objective of uncovering showings of sufficient commercial promise to warrant further development by an operating company.

Several other groups have been staked in the upper American Creek area by individual prospectors and slightly prospected.

Treaty Creek. This group of sixty claims, controlled by the Consolidated Mining and Smelting Company of Canada, is 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 were referred to in the 1929 Annual Report. Consolidated Mining and Smelting Company of Canada engineers examined these holdings towards the end of the season. It is understood the values in the mineral occurrence may be too low grade considering the remote location of the claims and that the Consolidated has relinquished its option.

Salmon River Section.

Premier Gold Mining Co., Ltd. This mine is the largest producer of gold and the second largest producer of silver in the Province. The property was brought into production in 1918, since which time a total of 1,870,411 tons of ore, yielding 1,097,621 oz. of gold and 26,969,570 oz. of silver, has been produced, and over $15,000,000 in dividends disbursed to its shareholders. The ore-deposit and operations have been described in former Annual Reports. Under the heading of "Geologic Discussion," introductory to this report, several factors relative to this property are referred to.

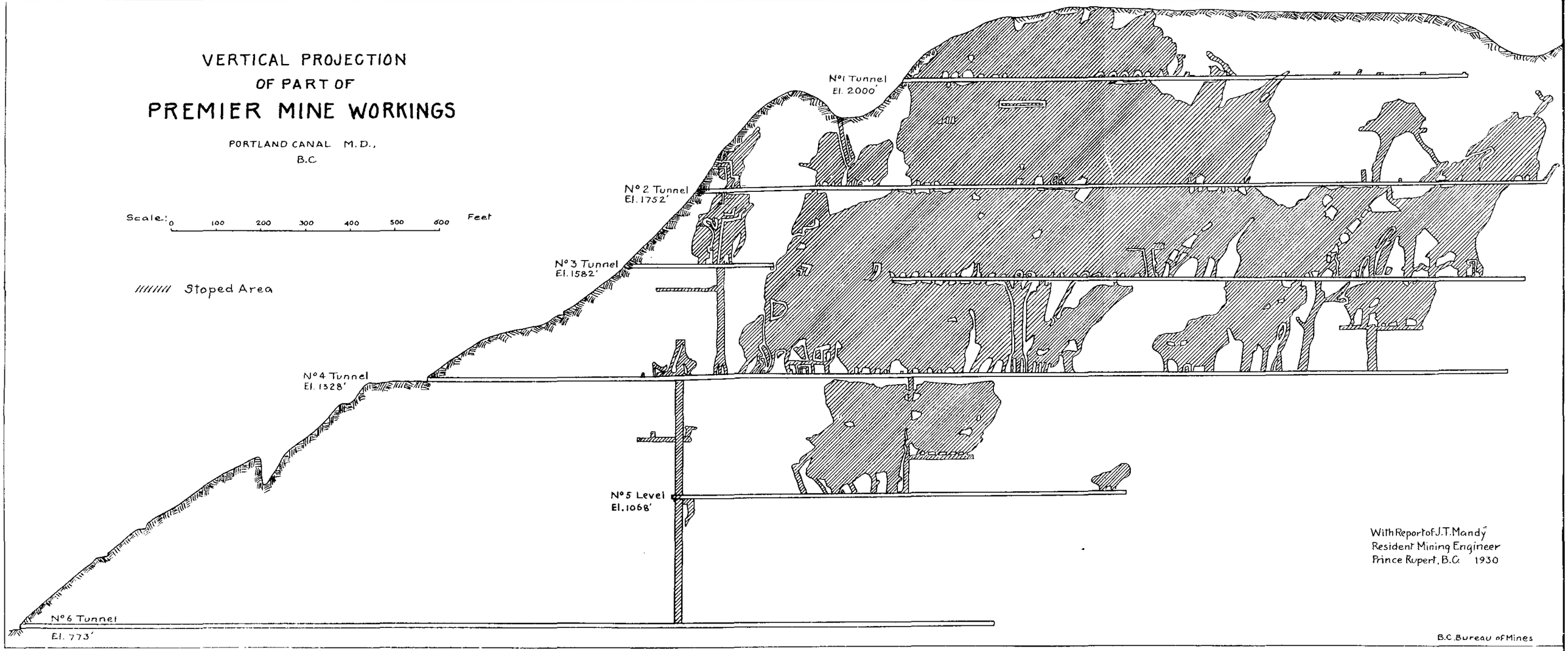
During 1930 operations were carried on continuously. A normal tonnage was produced until late in December, when a slight curtailment was necessitated by the inability of the smelters

VERTICAL PROJECTION
OF PART OF
PREMIER MINE WORKINGS

PORTLAND CANAL M.D.,
B.C.

Scale: 0 100 200 300 400 500 600 Feet

//////// Stoped Area



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Resident Mining Engineer
Prince Rupert, B.C. 1930

B.C. Bureau of Mines

to handle the usual quantity of the siliceous *Premier* ore. This is a direct result of the general curtailment of copper production, in the smelting of which ore, siliceous ores are a necessary fluxing adjunct.

Earnings of the company are naturally adversely affected by these factors and especially by the low price of silver prevailing during 1930. Although a substantial profit is still being realized, the lowered earnings have necessitated a 50-per-cent. reduction of the dividend rate.

Energetic prospecting and development work were carried out during 1930 with drifting, raising, and diamond-drilling, and search for new ore-bodies and ore-shoots has been very active. Development of the sixth level ore-shoot has been steadily carried on. New ore is being picked up from time to time in small good-grade shoots lateral to the main zone between No. 2 and No. 3 levels. These lateral shoots are an important adjunct to the ore reserves and additional possibilities of this category still remain to be explored on the lower horizons. Should these be discovered it is expected the grade, conforming to the character of the main zone, will be proportionately lower. Consequently, on account of their smaller size, there may not be as many commercial-grade lateral shoots in the lower as in the upper horizons. Intensive search for new lateral zones has been carried on with three diamond-drills on the higher-altitude ground, crosscutting the formation east of the main ore-zone, but so far nothing of importance has been discovered.

The sixth level is at elevation 773 feet and the ore-zone at this horizon enters intensively faulted and sheared ground. The ore-shoot is being explored and developed by raising in the hanging-wall of an extensive fault that strikes northerly and dips west through the zone. This raise breaks through the fault on the foot-wall side at about 70 feet above the sixth level, but with the exception of some dragged ore in the crushed zone of the fault showed no ore on this side. The raise was being continued to explore the horizon towards No. 5 level at 1,068 feet elevation. The ore-shoot in the sixth level is characterized by irregular silicification, erratic values, and a difference in character and associated values of the mineralization. It is possible the ore-development on No. 5 and No. 6 levels may be the downward extension of the "4 H" ore-body on a flat rake.

Good progress has been made in the mill-treatment of *Premier* ores and improvements that promise increased efficiency have been worked out.

Premier Border Mining Co., Ltd.

Operations on this property, adjoining the *Premier* on the north and the *B.C. Silver* on the west, were suspended in June. The work carried out consisted of advancing the crosscut to about 1,800 feet and some short lateral work. Diamond-drilling in six holes, totalling 1,350 feet, was also completed. The tunnel is at elevation 1,131 feet, which is about 55 feet above the *Premier* No. 5 level. The face of the tunnel is in tuffs that seem to dip north-easterly towards the *Sebakwe*. About 600 feet of silicified porphyry is penetrated by this tunnel from the portal, after which it penetrates a mixed complex of greenstone, tuff, and some porphyry. An occasional stringer 2 to 24 inches wide, carrying fair silver values, has been encountered in the silicified porphyry in the course of this exploration. Generally, however, the values encountered have been very spotty and low.

Sebakwe and District Mines, Ltd., and B.C. Silver Mines, Ltd.

A total of 500,533 shares of Sebakwe and District Mines, Limited, is 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. During 1930 work on the *Sebakwe*, which had been concentrated on the extension of No. 6 level (about *Premier* No. 4 level horizon) towards *B.C. Silver* ground, was discontinued in January on account of excessive water. Through the courtesy of the management the following information regarding the main developments on *B.C. Silver* is available:—

During the year the greater part of the work was confined to No. 6 level, which is approximately the same horizon as the *Premier* No. 4 main haulage-level. Some work was done southwest of No. 2 shaft on the ore-bodies already exposed on this level. Further minable widths were shown to exist by side-swiping and in test-holes into both the foot and hanging walls. One raise was advanced 50 feet on the main ore-body, showing good commercial values throughout. Diamond-drilling from a long crosscut in the hanging-wall of the zone intersected the main ore-body at a depth of 100 feet below No. 6 level.

North-east of the shaft on No. 6 level an extensive low-grade ore-body was developed by drifting and crosscutting. Some raising was also done on the north-easterly ore-zones above No. 3, the main haulage-level. These met with varying success.

Approximately 3,000 feet of work was done during the year, including lateral development and raising. In addition 1,478 feet of diamond-drilling was completed and interesting results obtained therefrom.

Under the heading of "Geologic Discussion" and "Development," introductory to this report, reference is made to factors relative to the *B.C. Silver-Sebakwe* area.

Woodbine Gold Mining Co., Ltd.

The diamond-drilling started on this property in November, 1929, was completed in February, 1930. Following this drilling, underground exploration by means of a winze off 209 drift was commenced about the middle of August. It is hoped this will determine whether the indications encountered in the drilling have sufficient continuity to constitute a commercial ore-body. About sixteen men were employed. Due to inadequate pumping facilities work ceased in October.

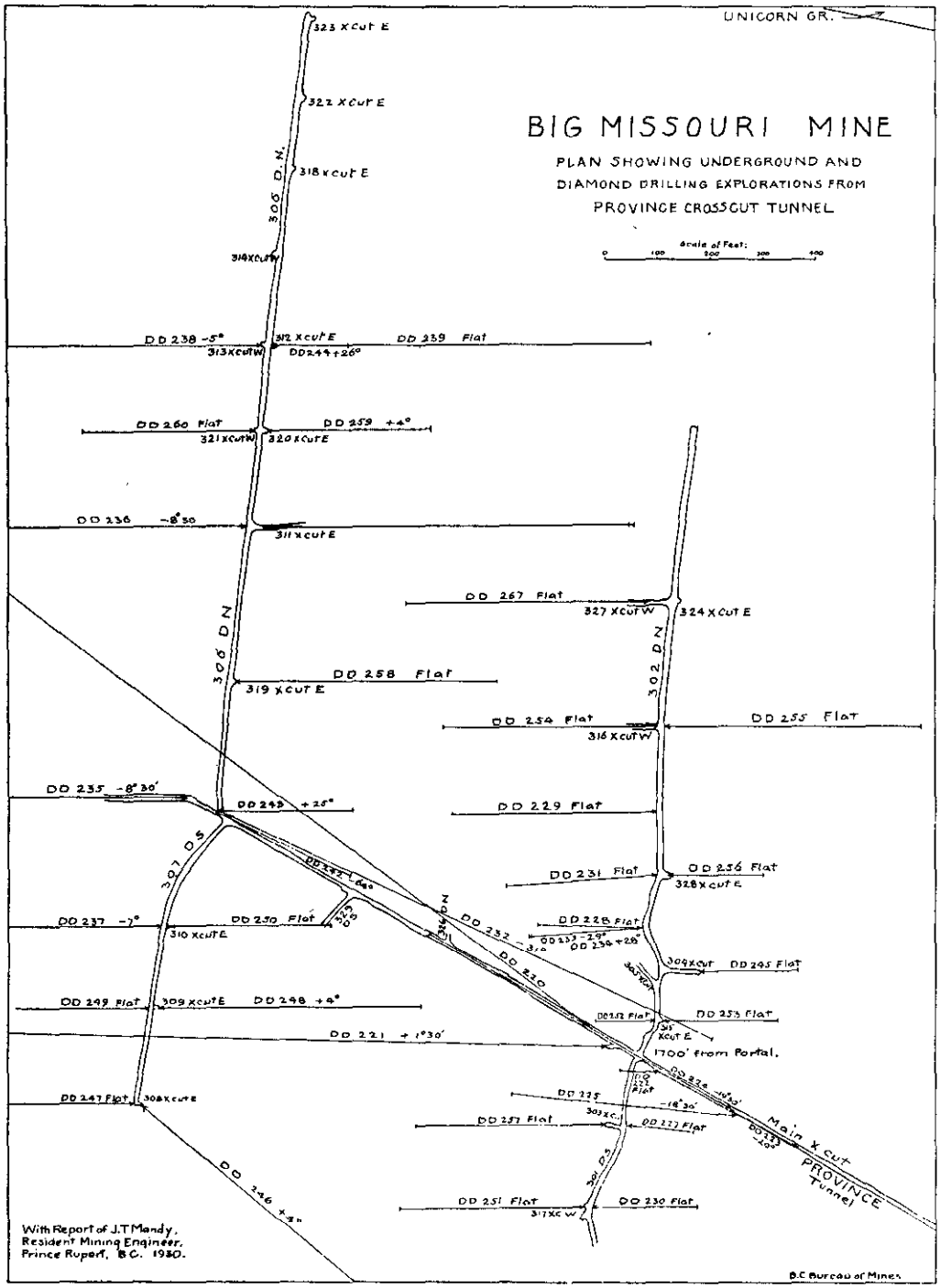
Big Missouri.

This property, situated in the upper Salmon River valley, is controlled and operated by the Consolidated Mining and Smelting Company of Canada, Limited. Extensive diamond-drilling of the silicified zone has been continued with a view to delineating its dimensions and obtaining some criterion of the distribution of values in it. About midsummer the erection of a 100-ton concentrator was decided on. The primary purpose of this mill is to ascertain by careful run-of-mine sampling through the mill whether the erratic distribution of values indicated in the silicified zone by the diamond-drilling may constitute a large-tonnage, low-grade, commercial ore-body. Construction of the mill and new camps was completed and the mill turned over in the middle of December. About ninety men were employed and a winter crew of about seventy men will be employed between the mine and mill. A creditable adjunct to the rapid construction was the efficient hauling of construction material and machinery by the Crawford Transfer Company, of Stewart, in the face of many difficulties. To facilitate the progress of the work the Department of Mines and the Department of Public Works co-operated in every way possible in the matter of road conditioning and repair.

Should the *Big Missouri* operation materialize into a profitable undertaking, it will reflect great credit on the efficiency and persistence of the Consolidated Mining and Smelting Company's engineering staff and will be of the utmost importance to the progress of the mining industry of the Portland Canal area. The Consolidated Company is to be commended for rectifying, through the medium of the public press, misleading statements that have been published concerning this property.

The general rock formation of the *Big Missouri* ridge consists of hornblende andesite, andesite, and hornblende andesite porphyry, which rocks have been extensively altered by kaolinization, saussuritization, and silicification. Generally low-grade gold and silver values occur in the silicified saussuritized porphyry zones in apparently small, scattered, and detached lenticular areas, in association with pyrite, galena, and zinc-blende. The main silicified zone which is being explored strikes generally north-south with an indicated length of about 900 feet, and an indicated width of over 175 feet at its southerly end, about 300 feet in the central section and about 300 feet at the northerly end. Beyond this northerly point the zone appears to swing north-westerly for a further distance of about 500 feet, with a width of about 150 feet at that end. Northerly of this the zone appears to finger out into alternations of silicified porphyry and country-rock, which condition seems to become intensified beyond the northerly boundary of the *Province* and into the *Buena Vista* claims. In this area several bands of silicified porphyry 10 to 50 feet wide, separated by wide stretches of country-rock, occur. On the *Buena Vista* claim a change in the colour and texture of the formation seems to occur north of a hornblende-andesite dyke 20 to 40 feet wide that strikes north-west. Apparently scattered through the silicified zone irregular and generally low-grade gold values occur; in places high assays are obtained and occasionally free gold is found.

The zone has been extensively explored by drifting, crosscutting, and diamond-drilling. During 1930 diamond-drilling, extensive ditching to carry off excessive water, and some mining was carried out. With completion of mill-construction mining was started with two shifts in 330, 316, and 311 crosscuts with the objective of exploring the drilled areas of these sections and ascertaining the contained distribution of values by sampling through the mill. From the


UNICORN GR.
BIG MISSOURI MINE
PLAN SHOWING UNDERGROUND AND
DIAMOND DRILLING EXPLORATIONS FROM
PROVINCE CROSSCUT TUNNEL
Scale of Feet:
0 100 200 300 400
323 X cut E
322 X cut E
318 X cut E
306 D.N.
314 X cut W
DD 238 -5°
313 X cut W
312 X cut E
DD 244 +26°
DD 239 Flat
DD 260 Flat
321 X cut W
DD 259 +4°
320 X cut E
DD 236 -8°30
311 X cut E
306 D N
DD 267 Flat
327 X cut W
324 X cut E
302 D N
DD 258 Flat
319 X cut E
DD 254 Flat
316 X cut W
DD 255 Flat
DD 235 -8°30'
DD 243 +25°
DD 229 Flat
307 D S
DD 231 Flat
DD 256 Flat
328 X cut E
DD 237 -7°
DD 250 Flat
310 X cut E
DD 228 Flat
DD 233 -29°
DD 234 +28°
DD 232 -3°
DD 230
309 X cut
DD 245 Flat
DD 249 Flat
309 X cut E
DD 248 +6°
DD 253 Flat
DD 221 +1°30'
1700' from Portal.
DD 247 Flat
308 X cut E
DD 246
DD 225
-18°30'
DD 257 Flat
DD 227 Flat
Main X cut
PROVINCE
Tunnel
DD 251 Flat
317 X cut W
DD 250 Flat
With Report of J.T Mandy,
Resident Mining Engineer,
Prince Rupert, B.C. 1930.
B.C Bureau of Mines

results obtained from this thorough test-work, which may be of comparatively long duration, the policy of future operation will be decided.

Unicorn Mining Co., Ltd.

This property is situated between Harris creek and the Missouri ridge, immediately north of and adjoining the *Big Missouri*. Systematic exploration by open-cutting, stripping, and tunnelling has been carried out on a series of silicified zones, some of which are of the same character and attitude and possibly relative to those occurring on the *Big Missouri*. Generally, however, they seem to be of smaller dimensions and in this respect resemble more the northerly fingering occurrences of the main *Big Missouri* zone described on the *Buena Vista* claim. The showings have been described in the 1929 and former Annual Reports.

During 1930 exploration was concentrated on the extension of No. 3 crosscut tunnel driven along a N. 60° W. (mag.) bearing at the south end of the *Good Hope* claim and adjacent to the *Big Missouri* boundary. At the time of the last examination (October 6th) the tunnel had advanced 340 feet, and the management reports a further 10 feet had been driven before closing for the season. A lithological relationship of possible importance disclosed in this work is what appears to be a tuff-porphyrite contact striking northerly, parallel to which and in the porphyrite are zones of silicification carrying low-grade values in gold and silver, with one parallel vein carrying some native gold. This contact area is well worth intensive exploration. The formation from the portal of the tunnel to about 170 feet in has the appearance of pyritized tuff. At this point a zone of possibly silicified porphyrite in which are sections of intense silicification erratically mineralized with pyrite strikes northerly across the tunnel. The border of this zone is followed to about 260 feet in, where it cuts across the tunnel into the east wall. At about 300 feet from the portal a quartz vein 2 feet wide, striking N. 30° W. (mag.) and dipping steeply east, was encountered, carrying some free gold associated with pyrite, zinc-blende, and galena mineralization. This was drifted on for 40 feet where it strikes into the east wall. At this point a short crosscut to the east is reported to have intersected the vein, showing a width of 6 feet, well mineralized with pyrite. The objective of No. 3 tunnel is to crosscut "A" vein, which should be intersected about 700 feet from the portal. The work is at present being done by hand-drilling.

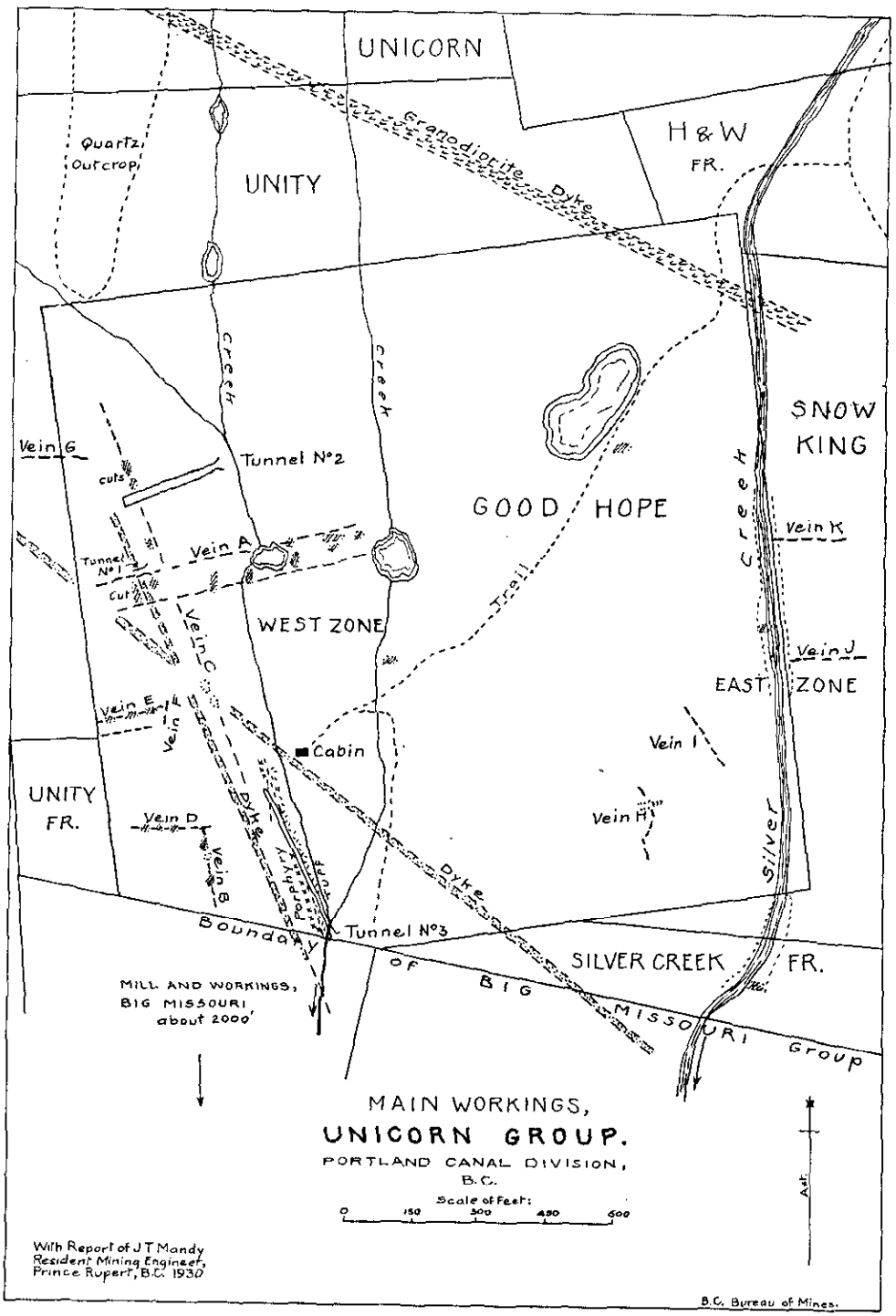
During the season a snow-shed to protect the portal of No. 3 tunnel was constructed. Foundations for the eventuality of machinery installation and increased bunk-house facilities were also prepared. Four hundred feet of 2-inch pipe-line was laid with a head of 100 feet to the tunnel portal for the purpose of a water-blast ventilation system. The ventilating blast-box is 10 by 10 inches and is connected with the 8-inch ventilating-pipe at the tunnel portal and works very satisfactorily. Two men were employed, with John Howland in charge of the work. The work was closed down on December 1st, but it is understood operations may possibly be resumed early in 1931.

Salmon Gold.

This group of twenty-six claims is situated on the west side of Summit lake, at the divide between the Salmon River and Nass River drainage-basins, and is owned by Ted Morris, of Stewart, and associates. Some of the claims are a restaking of the old *Columbia* group. The claims are located on the easterly slope of "Murphy" mountain to Summit lake at from 2,720 to about 4,000 feet altitude. The property is about 8 miles north of the end of the *Missouri* road and is reached by a fair horse-trail to near Summit lake, which Ted Morris crosses by means of an improvised raft.

The formation of the area consists of what appears to be augite porphyrite, argillite, and possibly some tuff-beds, about 2 miles to the west of which is a wide intrusive spur of what appears to be porphyritic hornblende diorite striking north-easterly. At the time of examination (July 26th) three siliceous replacement zones had been discovered in augite porphyrite, heavily mineralized with massive pyrrhotite and associated with some pyrite, chalcopyrite, zinc-blende, and galena.

No. 1 zone outcrops at 3,650 feet altitude and can be traced about 200 feet, striking N. 55° W. (mag.). Continuity on the north is obscured by ice and on the south by talus. This zone seems to be lenticular in character and at one place is about 25 feet wide, with 9 feet of massive pyrrhotite on the south side. The general structure of the zone is massive pyrrhotite reticulations through intervening spaces of silicified rock heavily impregnated with pyrrhotite. The country-rock is also generally impregnated with pyrrhotite with varying intensity. A section of this zone was "bulldozed" and a sample across 5 feet of this assayed: Gold, 0.24 oz. to


UNICORN
Granodiorite Dyke
H & W
FR.
Quartz Outcrop
UNITY
creek
creek
SNOW
KING
Vein G
Tunnel N°2
cuts
GOOD HOPE
Creek
Vein K
Tunnel N°1
Vein A
Cut
WEST ZONE
Trail
Vein C
Vein J
EAST ZONE
Vein E
Vein F
Cabin
Vein I
UNITY
FR.
Vein D
Vein H
Vein B
Porphyry Dyke
Dyke
Silver
Boundary
Tunnel N°3
SILVER CREEK FR.
OF BIG MISSOURI Group
MILL AND WORKINGS,
BIG MISSOURI
about 2000'
MAIN WORKINGS,
UNICORN GROUP.
PORTLAND CANAL DIVISION,
B.C.
Scale of Feet:
0 150 300 450 600
North
With Report of J T Mandy
Resident Mining Engineer,
Prince Rupert, B.C. 1930
B.C. Bureau of Mines.

the ton; silver, 0.4 oz. to the ton; copper, *nil*. Samples taken by other mining engineers from this zone verify a consistent gold content with the following interesting results:—

Description.	Gold.	Silver.
	Oz. to Ton.	Oz. to Ton.
No. 1 zone, pyrrhotite	2.68	1.56
No. 1 zone, pyrrhotite	1.24	2.04
No. 1 zone, pyrrhotite	1.56	1.32
No. 1 zone, across 10 feet	1.52	1.48
No. 1 zone, across 10 feet	0.42	0.58

No. 2 zone, about 100 feet north of No. 1, is from 2 to 4 feet wide and shows some shearing structure and is traced for 300 feet along the foot of a bluff to the edge of the glacier. It strikes east-west (mag.) and is mineralized with pyrrhotite, pyrite, and some zinc-blende in a quartz-calcite-siderite gangue. This also carries encouraging gold values.

No. 3 zone outcrops at altitude 3,725 feet about 30 feet north of No. 2 zone. It is a replaced quartzose fracture-zone mineralized with reticulated stringers and masses of massive pyrrhotite accompanied by some chalcopyrite, zinc-blende, and galena. It is about 7 feet wide and strikes east-west (mag.). A sample across 6 feet assayed: Gold, 0.32 oz. to the ton; silver, 0.7 oz. to the ton; copper, trace.

Samples taken by other mining engineers from this zone show a consistent gold content with the following interesting results:—

Description.	Gold.	Silver.
	Oz. to Ton.	Oz. to Ton.
No. 3 zone, 5 feet at west end	1.22	4.74
No. 3 zone, 3 feet	0.50	11.42
No. 3 zone, 200 feet west of cut	0.32	1.36
No. 3 zone	0.28	1.24
No. 3 zone	0.72	1.52
No. 3 zone	0.32	0.72
No. 3 zone, pyrrhotite	1.24	1.32
No. 3 zone, across 4 feet	0.53	1.36
No. 3 zone, across 8 feet	0.88	2.96
No. 3 zone, across 4 feet	0.88	1.76
No. 3 zone, sulphides (A)	0.42	Trace.
No. 3 zone, spot sample 100 feet north-west of (A)	2.44	0.06
No. 3 zone, across 1 foot (B)	0.86	0.24

Ted Morris reports that since the examination in July other zones and extended mineralization have been discovered. Galena float has also been picked up which assayed: (1.) Gold, 0.08 oz. to the ton; silver, 615.72 oz. to the ton. (2.) Gold, 0.32 oz. to the ton; silver, 340.32 oz. to the ton.

A definite east-west structure seems to feature the locality and on the higher altitudes around the tongue of the glacier oxidized outcrops can be seen that are worth prospecting. This property is recommended to examining engineers as being decidedly worthy of extensive exploration.

Troy. This property is owned by Charles Lake and partner, of Stewart. It is situated on the west side of Mount Dilworth on the Nass River slope of the Salmon River glacier. The camp is at about 2,700 feet altitude, adjacent to the shore of Daisy lake. The original *Troy* group of nine claims was bonded to the Northland Mining Company in 1925, but on account of default of option payments reverted in 1926 to the original owners. A description of this operation is contained in the 1925 Annual Report. The *Missouri*–Tide Lake trail passes through the property, which is about 6 miles from the end of the *Missouri* road.

The formation of the area consists of interbedded slates, argillites, sandstone, and conglomerate, possibly belonging to the Salmon River or Nass formation of Upper Jurassic age, to the west of which is a belt of tuffs, breccias, and altered andesitic lava. Two types of mineral-

zation occur. Irregular narrow and lenticular quartz veins occur in argillite, mineralized mainly with zinc-blende and galena, with which is associated some chalcopyrite and grey copper. These have been explored in several places by open-cutting, stripping, and short tunnels, but with results that are not encouraging.

The second type consists of silicified and pyritized replacement zones in the volcanics. Recent work has been confined to tracing and exploring these zones with the objective of discovering a possible gold content. Towards the close of the season the owners report the discovery of sections containing low-grade values.

Pioneer. This property of two groups is situated on the west side of Tide lake, in the Nass River drainage basin, and is owned by W. and F. Jancowski and associates. It is reached by the *Missouri*–Tide Lake trail, a distance of about 12 miles from the end of the *Missouri* road. The mineral-deposit consists of irregular, possibly torsion-shears that are not very continuous and which have been partially replaced by quartz, occurring in a large crushed area of pyritized altered tuff. The quartz occurs in stringers and is accompanied in places by massive granular pyrite and occasionally some zinc-blende and galena. High gold values sometimes occur in the narrow bands containing zinc-blende and galena. Such occurrences are, however, comparatively rare. A selected sample from one of these streaks assayed: Gold, 0.5 oz. to the ton; silver, 32 oz. to the ton. Generally very low-grade and spotty gold values can be obtained over a wide area. This property was under option to the Consolidated Mining and Smelting Company of Canada, which carried out a diamond-drilling plan of exploration during the 1929 and 1930 seasons. Results that were not encouraging were encountered and the drilling was suspended in the late summer. It is understood the Consolidated option on the property has been relinquished.

Unuk River Section.

Several prospecting-parties penetrated this area during the season, but no discoveries have yet been reported. Of importance in the matter of future access to the mineralized section of this area is the discovery and traversing of a more accessible route than up the Unuk river proper by Arthur Skelhorne, prospecting for the Mining Corporation of Canada. This route follows Lake Creek valley across the Alaskan panhandle and crosses a comparatively low divide to the headwaters of Gracey creek on the British Columbia side. Gracey Creek valley is followed to the South fork of the Unuk river and Sulphur creek.

STIKINE AND LIARD MINING DIVISIONS.

These Mining Divisions constitute over 70,000 square miles of the North-western Mineral Survey District. Transportation facilities and general geological features of the area are described in the 1929 Annual Report.

From a lode-mining aspect interest in the Stikine Division is comparatively new and from year to year is receiving more attention from prospectors. Although nothing of definite economic importance has as yet materialized, much information is being gained and comparatively unfavourable areas are being eliminated. An immense area along the eastern contact margin is accessible from the Stikine River drainage-basin, and this will take many years to prospect. During 1930 several prospecting-parties, including three representing Eastern operating companies, were active in the Stikine Division. Some interest was also displayed in placer-gold opportunities along the Stikine river proper.

Peach and Apricot. These two claims are a restaking of the old *Central* group, situated on the westerly slope of Devils Elbow mountain, and are owned by Peter Hamel, of Telegraph Creek. Hamel's Landing, where the owner resides, is at the foot of the mountain and the claims are reached by a good trail to the cabin at 1,700 feet altitude.

The occurrence consists of a silicified fracture-zone in an inclusion of silicified argillite and intercalated limestone in the batholith. At the time of examination the zone had been traced by four cuts for a distance of about 100 feet, striking N. 65° W. (mag.) and dipping 70° north. An aligned outcrop about 300 feet west may possibly be a continuation of the same zone. The zone is mineralized with pyrite, chalcopyrite, galena, and zinc-blende in a gangue of garnetite, silicified argillite, and epidotite, and would average about 4.5 feet in width where exposed. Further cross-trenching will probably show increased widths of mineralization. A sample across

4.5 feet in No. 4 cut assayed: Gold, 0.01 oz. to the ton; silver, 6 oz. to the ton; copper, 1.6 per cent.; lead, 1.8 per cent.; zinc, 10 per cent.

Drapich. This property of thirty claims is owned by S. Barrington, of the Barrington Transportation Company, Wrangell. It is situated on the west bank of the Stikine river, directly across from Green river and about a quarter of a mile southerly of Jackson's Landing. The locality is about half a mile north of the main contact of the Coast Range batholith with the interior sedimentaries and volcanics and consequently falls in what is designated as the "Disturbed Area" in the batholithic cross-section illustrated on page 48 of the 1929 Annual Report. In the locality of the showings the formation consists of included segments of bedded and contorted altered limestone lying between spur-belts of granitic rocks. The limestone-bedding strikes north-westerly (mag.) and dips steeply north, with joint-planes striking north-easterly (mag.) and dipping steeply north.

The mineral-deposit is a contact-metamorphic occurrence of chalcopyrite accompanied by magnetite along the bedding-planes of limestone altered to garnetite. Three such occurrences had been uncovered at the time of examination (June 18th), each occurring within a few feet of a spur of quartz diorite cutting across the limestone-bedding and satellitic to the main batholith. These occurrences had been explored by open-cuts at altitude 550, 650, and 660 feet, and are individual deposits along different bedding-planes, with the mineralization starting within 10 to 15 feet from the crosscutting intrusive contact. The best development of mineralization seen at the time of examination is about 14 inches in width of massive chalcopyrite stripped for about 5 feet in length, at elevation 550 feet. Some disseminated chalcopyrite and a heavy development of oxidation products, malachite and azurite, extends into the limestone for 3 or 4 feet from this.

The initial work done was an open-cut at an acute angle across the limestone-bedding (practically along the strike) for a distance of 40 feet at the copper-showing at 550 feet elevation. Over this distance the rock is heavily stained with copper carbonates and gave the discoverers the impression the ore-body was about 30 feet wide, instead of 3 or 4 feet as is the case.

The showing at altitude 650 feet is about 150 feet west of the lower showing. An open-cut 6 feet long across the limestone-bedding exposes garnetite sparsely mineralized with chalcopyrite, magnetite, specularite, and pyrite, associated with quartz, siderite, and rhodochrosite. A sample of 14 inches of quartz and siderite on the foot-wall to test for gold content assayed: Gold, trace; silver, 1.6 oz. to the ton. The mineralization of this showing commences, as is the case with that at 550 feet elevation, about 15 feet north of a crosscutting quartz-diorite spur contact.

The showing at elevation 660 feet is about 600 feet north of the showing at 650 feet elevation. In this a small cut exposes 3 feet of decomposed material heavily stained with copper carbonates and containing some chalcopyrite and massive magnetite. This occurs about 6 feet north of a crosscutting quartz-diorite spur contact.

A crew was put to work to explore for a possible continuity of mineralization along the limestone bedding-planes and by cross-trenching for the possible occurrence of other mineralized sections. The result of this work has not been reported.

Jackson. This group of twelve claims, owned by Frank Jackson and associates, of Jackson's Landing, is situated at altitude 3,500 feet on the south side of the Chutine river and about 4 miles from the mouth of the river. The showings on this property were described in the 1929 Annual Report. Some further exploration was carried out during the 1930 season, but the owners devoted most of their time to the construction of a trail from the mouth of the Chutine to the claims.

Limpoke. This group of eleven claims is owned by S. Barrington, Wrangell, Alaska. It is situated about 2 miles north of Limpoke creek on the west bank and in the canyon of Barrington river (Chutine River North fork), about 23 miles from the Stikine river at Latimer's Landing. It is reached by a trail up Shakes Creek valley to 20-Mile cabin on Latimer lake (1,475 feet elevation above the Stikine river), whence a trail descends to the Barrington River cabin at 650 feet elevation above the Stikine at Latimer's Landing. Barrington river is crossed by a wire suspension bridge and the steep east bank is ascended to the showing at about 100 feet above the river-bed. The canyon at this locality continues about 5 miles north, and about 12 miles south to within 2 miles of the Chutine river.

The rock formation of the area is featured by a wide distribution of irregular chonolithic injections (or igneous masses) of a chiefly pink feldspathic rock into altered andesitic lavas. The intrusive rock has the appearance of a young injection and might possibly be classified as orthoclasite or syenite pegmatite.

The occurrence consists of an indistinctly sheared fracture-structure striking N. 15° W. and dipping 60° west that seems to be chiefly confined to a large mass of the pink feldspar rock. The fractured zone carries some copper carbonates, but very sparse sulphide mineralization. A tunnel has been driven westerly for 23 feet diagonally along a quartzose cross-fracture about 4 inches wide carrying some chalcopyrite and bornite and from which some copper carbonates emanate into the sheared fracture-zone. From this point the tunnel is driven 24 feet in a N. 48° W. direction through barren andesite. This occurrence does not appear to be of commercial importance.

August. This claim is situated at elevation 3,000 feet on the east side of the Stikine river, about 2 miles from Kirk's ranch landing, and is owned by L. Kirk (post-office address, Telegraph Creek.) It is reached by a good trail from the owner's ranch on the bank of the Stikine river. The occurrence consists of three quartzose replacement zones or possibly faulted segments of the same zone, in andesite, and is located about 6 miles easterly of the main contact of the batholith. Mineralization consists of chalcopyrite, bornite, and possibly chalcocite and in places has been exposed in encouraging quantity across widths of from 2 to 15 feet. The showings have been explored by stripping, open-cutting, and tunnelling. The main working is a tunnel at elevation 3,175 feet, to explore a zone striking north-east. Here a tunnel starting as a crosscut has been driven south-east 50 feet to the zone, then north-east for 80 feet diagonally across it to the east wall, then at right angles across it for 15 feet to the west wall. Although the tunnel is crooked, this is a very good plan of preliminary underground exploratory work and exposes encouraging mineralization of a possible mill-grade copper ore. Great credit is due to the owner, who is quite advanced in age, for the type and quantity of work he has done alone.

Glenora and King. The *Glenora* group of eight claims and the adjoining *King* group of four claims were staked in 1929 by Mining Corporation of Canada prospectors under the direction of A. Skelhorne. The property is situated on a ridge north of the north slope of Glenora mountain, about 3 miles north of the west bank of the Stikine river and about 7 miles westerly of Telegraph Creek. The camp is at elevation 2,810 feet above the Stikine river and the showings are on the ridge-slope about 1,700 feet above the camp. The property is reached by a fair horse-trail from the mouth of 4-Mile creek.

The rock formation of the locality consists of generally silicified and pyrrhotized porphyrite and altered andesitic lavas. The locality of the claims is cut by five cross-sectional gullies through the formation, which have assisted in naturally exposing some of the mineralization.

The mineral occurrence consists of lenticular replacements mineralized with massive pyrrhotite carrying some chalcopyrite. These are very restricted in surface horizontal continuity and exhibit no defined zonal structure. The best exposure seen at the time of examination (June 14th) was in the old discovery on the west side of No. 2 gully. Here, across a width of 4 feet, some structure is evident and the zone strikes N. 40° E. (mag.) and dips 80° west. On the foot-wall is 6 inches of brecciated, calcareous gangue, then about 3 feet of massive pyrrhotite finely impregnated with chalcopyrite. An average sample of this exposed in a small cut assayed: Gold, 0.32 oz. to the ton; silver, 2.1 oz. to the ton; copper, 9.7 per cent. At this spot there is a lens about 30 feet long of this type of material, but no continuity to the east could be located and trenching proceeding at the time to the west did not show encouragement for continuity in that direction.

For a short time during the 1930 season a crew in charge of C. F. Cockshutt explored the claims for the Mining Corporation of Canada, but, on not finding sufficient encouragement to meet requirements, withdrew early in the season.

PLACER-MINING.

No placer gold was produced from the Stikine Division during 1930. From the Liard Mining Division, however, 322 oz. of placer gold, valued at $5,474, has been recovered.

Prospecting for placer-gold possibilities has been comparatively inactive in the Stikine River area in recent years. It would seem there are latent possibilities in this respect worth investi-

gating in both the Stikine and Liard Divisions. Activities have been practically restricted to the streams originally discovered by the old-timers. Although the old-timers were exceptionally good placer prospectors, it cannot be concluded they discovered the only gold-bearing streams existing in the region. It must be realized that gravels passed up by the old-timers as not of sufficient grade for their purposes may quite possibly be amenable to modern methods of placer-mining. In this connection it is suggested that the lava-buried gravels occurring along the banks of the Stikine river in the region around Telegraph Creek may warrant extensive exploration. In a section of the canyon above Telegraph Creek the present river-course is seen to cut through a lava-buried gravel that has the appearance of occupying an old channel of the river. It is significant also that from the bars of the present river below this section old-timers recovered appreciable quantities of gold. Some of the depression and trough areas on the east side of Dease lake also do not appear to have been investigated. No apparent reason is evident why this drainage section should not contain gold-bearing gravels along old buried channels, as well as those on the west side of the lake.

Barrington Co., Ltd.—During the season this company employed a crew of five men drilling the Stikine River bars at the mouth of Glacier creek. Nothing of importance was discovered up to the time of closing operations for the season. Some interest was also mooted later in the season regarding further drilling of the Chutine River leases.

Gold Pan Creek.—Vickery and Moody and two men worked their ground on this creek for a short time on a co-operative plan. Ben Cambron carried out preparations to work his ground and will remain on the creek during the winter, whip-sawing timber.

Dease Creek.—Dease Creek Mines Corporation was engaged all season in drilling its ground on this creek. Future operations will be based and planned according to the results of this work.

Cassiar Hydraulic Mines, Ltd. This company took advantage of high water and started operations during the snow run-off early in the spring and about 68 oz. of gold was recovered. The result of this work was sufficiently encouraging to warrant a continuation and the completion of the ditch as planned. In piping the gravel off the outlet seven buried old-timers' tunnels were uncovered. In moving the sluice-flume to a more advantageous position it was found necessary to blast through rim-rock for a distance of about 100 feet. This work was completed and a sluice-flume of seven boxes, 12 feet long and 5 feet wide, was installed and angle-iron riffles placed in readiness to run gravel in the spring of 1931. About eighteen men were employed.

The pipe-line consists of 400 feet of 30-inch and 400 feet of 26-inch diameter, 12-gauge pipe to the gates, from which three field-lines of 16-, 14-, and 12-inch pipe run to the giants. It is planned to put three No. 4 monitors in service under a head of 300 feet to bed-rock. With the exception of 1,625 feet of flume to be built in 1931, all ditching was completed. During the season 9,716 feet of ditch and 1,400 feet of flume were constructed. The total length of the main water-supply system is 30,625 feet, made up of 26,520 feet of earth ditch and 4,105 feet of flume. The ditch is 2 feet deep and 7 feet wide and has a capacity of 75 second-feet. The Cassiar Hydraulic Mines, Limited, is privately financed by Wrangell people who were familiar with this property. The company is limited to fifty shareholders.

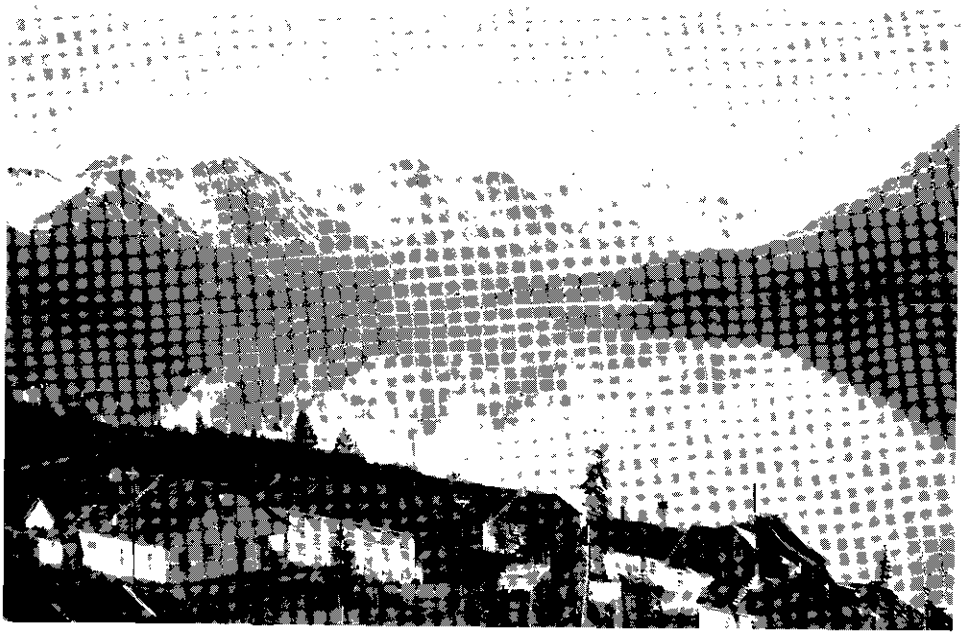
Mosquito Creek.—The property operated on this creek by the Gibson Hydraulic Association was described in the 1929 Annual Report. During the 1930 season the bed-rock flume was extended. About 94 oz. of gold was recovered by picking from bed-rock during the course of this work.

McDame Creek.—Some prospecting was carried out in this area by two or three parties, but no extended operations were proceeding.

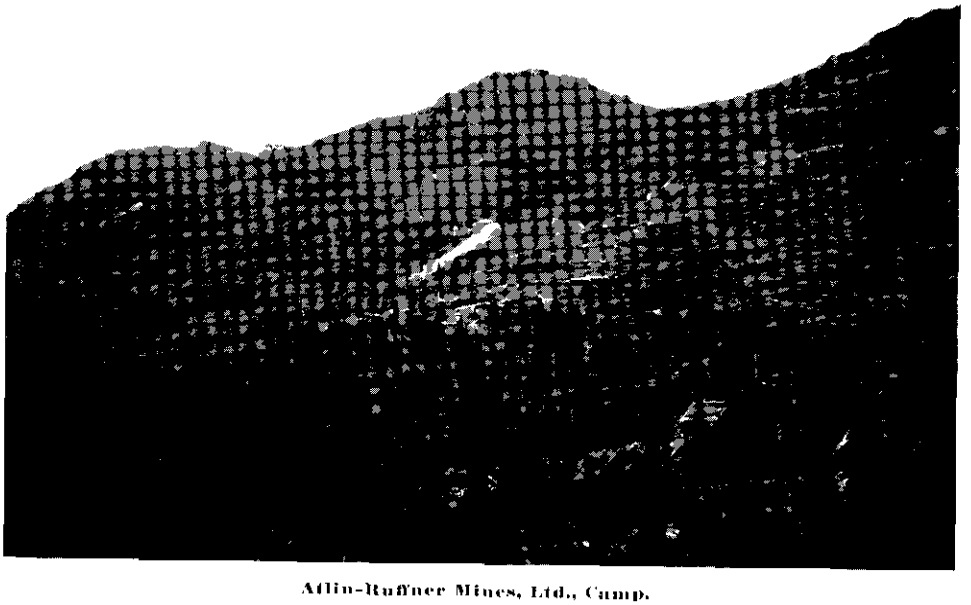
ATLIN MINING DIVISION.

Taku River Section.

Depression in the metal and stock markets were contributing factors in a curtailment of expected exploration in this section. Much staking had been carried out during the late winter months, and when the snow disappeared legitimate prospectors found extensive areas of the most accessible ground blanketed with stakes. This is a deplorable condition, for which some remedy should be found. During the season about 100 prospectors were active in the section. Many examining engineers representing various mining companies visited the section during the season.



Engineer Mine Camp, Atlin M.D.



Atlin-Ruffner Mines, Ltd., Camp.

Ruby Creek, Atlin—Lava overlying Gravels.

Spruce Creek, Atlin—Placer-workings.

Improved river transportation was inaugurated by Alaska Juneau Gold Mining Company interests. Several dwellings, a store, bunk-house, and restaurant were constructed. A post-office was opened and a Customs official, Deputy Mining Recorder, and Provincial constable temporarily appointed.

Several discoveries were made, but these were generally of antimoniferous ore-bodies containing only low or no gold values, or pyritic zones carrying low-grade gold values. An interesting discovery of what appears from reports to have possibilities of a large low-grade pyritic gold-bearing zone was made late in the season by Neil Forbes on the *Red Cap*.

Surveyor. This group of ten claims is owned by Joe Hill and partner, of Tulsequah. It is situated on the west slope of Sittakanay mountain, on the left bank of the South fork of the Taku river, about half a mile from its mouth. The property is reached by trail along the South fork or from the east end of Hill lake. The mineral occurrence consists of a well-defined shear-zone about 11 feet wide, striking N. 50° W. (mag.) and dipping 50° south. This has been traced up the mountain from elevation 50 feet to elevation 190 feet above the river. The zone is banded and reticulated in structure and well mineralized with streaks, bunches, and veinlets of massive and disseminated stibnite, accompanied by a fine dissemination of pyrite, in a gangue of quartz with some calcite. In places the stibnite has been extensively weathered to antimony oxide. In some sections the gangue contains greenish diffusion bands. A similar occurrence on the *Council* group has been identified by the Bureau of Mines to be an "insoluble silicate, coloured by chromium, with some iron and a trace of nickel." These bands may possibly, therefore, be due to a very fine distribution of mariposite. The country-rock is an altered arkosic argillite, in places quartzitic.

A sample of the quartzose part of the zone mineralized with pyrite and a little stibnite, taken from the big cut at the upper end, assayed: Gold, *nil;* silver, *nil;* arsenic, *nil;* antimony, 37 per cent. The total absence of gold and silver values shown in these samples is remarkable. It is not impossible, however, that other sections of the zone may contain values in gold, as is the case with a similar occurrence on the *Whitewater* group. Like the latter occurrence, the antimony ore of this deposit is remarkably free from refractory adulterants and may possibly be of commercial importance on this account. (*See* Bulletin No. 1, 1930, Report on the Taku Area.)

Council. This group of six claims is located near the mouth of the South fork of the Taku river, about 1 mile south-west of the *Surveyor*, and is owned by Joe Hill and associates, of Tulsequah. The occurrence consists of a well-defined shear-zone traced by several cuts along the west bank of a creek for about 300 feet, from 110 feet elevation to 160 feet elevation above the river.

The zone, which is remarkably similar to that on the *Surveyor*, strikes N. 50° W. and dips 60° south. In the upper cut a width of 9 feet is exposed, but in no place has the width been entirely crosscut. Mineralization consists of massive and disseminated stibnite, with some finely disseminated pyrite, in reticulated structure in a quartz gangue with some calcite. Oxide of antimony is widely distributed. A green diffusion band 18 inches wide of an insoluble silicate coloured by chromium with some iron and a trace of nickel (possibly mariposite) is an interesting feature of the gangue exposed in the upper cut. A sample of this band assayed: Gold, trace; silver, trace; copper, *nil;* nickel, trace. A sample of dark quartzose-sheared material with antimony oxide from the lower showing assayed: Gold, trace; silver, trace. A sample from the same cut of quartzose gangue seamed with stibnite and mariposite (?) assayed: Gold, *nil;* silver, *nil*.

Several other properties were staked up the South fork and some work done on them. Time did not permit an examination to be made of these.

Alaska Juneau Gold Mining Co., Ltd. This company carried on continuous and energetic exploration of the *Manville*, *Hill*, *Sparling*, *Moose*, *Walker*, and *River* groups until late in the season. Discouraging results on the *Manville*, coupled with severe option terms and failure to discover anything of sufficient importance on the other holdings, compelled a cessation of the operations and a relinquishment of its options by this company. This is unfortunate, as this company carried out some creditably systematic surface prospecting and completed extensive diamond-drilling and underground exploration.

On the *Manville* group 2,000 feet of drifting, 950 feet of crosscutting, and 5,000 feet of diamond-drilling was carried out. The results of this work indicated that the apparent spectacular surface showings were not a general characteristic of the deposit and that the dispersal

of mineralization referred to in Bulletin No. 1, 1930, occurred to a somewhat acute degree in the explored sections. The general mode of ore occurrence in the sections of the zone explored was found to be in small irregular lenses.

On the *Hill-Sparling* groups several hundred feet of surface-trenching and 860 feet of diamond-drilling were completed. The diamond-drilling did not disclose ore of commercial value.

On the *Moose*, *River*, *Walker*, and other miscellaneous claims systematic surface exploration did not uncover showings that justified work on any extended scale.

Whitewater. This group of claims, owned by Art Headman and associates, of Juneau, Alaska, is situated on the right bank of the Tulsequah river, about 4 miles south-west of the *Tulsequah Chief*. The ore occurrence, consisting of antimoniferous shear-zones carrying good gold values, was described in the 1929 Annual Report and in Bulletin No. 1, 1930.

The owners report exploration during the 1930 season extended the continuity and widths of the original discovery and also resulted in a new discovery about 1,000 feet below these showings. A chip sample was submitted by the owners and reported by them to have been taken from a depth of 6 feet on the original showing. This contained sparse sulphide mineralization and assayed: Gold, 1.04 oz. to the ton; silver, 0.6 oz. to the ton; antimony, *nil*. Another chip sample submitted by the owners and reported by them to be from the new discovery contained only slight sulphide mineralization, and assayed: Gold, 0.5 oz. to the ton; silver, 0.3 oz. to the ton.

Taku Mines Co., Ltd. This company was incorporated in December, 1929, with a capitalization of $5,000,000, divided into 5,000,000 shares, for the purpose of developing the *Tulsequah Chief* group. Controlling interest in the company is held by the United Eastern Mining Company and money required by this company for the development-work is supplied by the United Eastern Mines Corporation. The *Tulsequah Chief* property is described in the 1929 Annual Report and in Bulletin No. 1, 1930.

Due to financial depression and low metal prices the contemplated extensive further development during the 1930 season of the *Tulsequah Chief* group did not materialize and no work of any kind was carried out. As this work would have shed much light on the possible commercial importance of the deposit, this is regrettable. All maturing payments have, however, been met and the property is held in good order. Offers for a transfer of interest have been considered by the United Eastern Mines Corporation, but so far no arrangements that are considered equitable have been reached. In the meantime it is uncertain when operations will be resumed.

Red Cap and Red Cap Extension. These groups of twelve claims, owned by Neil Forbes, of Alice Arm, and partner, are situated about midway between Niagara creek and King Salmon creek, about 14 miles up the Taku river from Tulsequah. The claims are located at about 4,000 feet altitude on the westerly slope of Mount Lester Jones. The discovery was made late in the season and was not examined. The following information is from a report submitted by the owner: In an area of igneous rocks estimated at about 1 mile square are silicified zones carrying mispickel and pyrite with some galena. Some of the quartz stringers carrying galena assay up to $36 in gold. Interesting gold values were obtained from indiscriminately taken samples. In one section a sample that seemed representative of an area about 400 feet long and at least 100 feet wide assayed $4.75 in gold and 1 oz. in silver. The owners plan continuing exploration of the property during the 1931 season.

Rainy Hollow Section.

This section was not examined during the 1930 season. Mr. Bunting, of Vancouver, reports, however, that the old *Stampede* group has been restaked by him and is now the *Gold Cord*. He also reports that further prospecting of this group was carried on. On the *Yellow Jacket*, a new claim staked in the *Gold Cord* group during 1930, fifteen new veins carrying low values in gold have been discovered.

Atlin Lake Section.

Engineer. Further exploration of this property was resumed early in the season with a small crew. Development was being concentrated on the extension of the main crosscut with a view to exploring the commercial possibilities of the large replacement shear from which the small high-grade veins radiate. This work was carried on

efficiently and continuously throughout the summer season and late into the fall, when financial complications arose. These operations were sponsored by C. V. Bob, of New York. It is understood that further exploration of this property may possibly be undertaken by other interests.

Happy Sullivan. This property, owned by Clarence Sands and associates, of Atlin, is situated about 3 miles north of the *Engineer* and about 2 miles from the south end of Taku arm, Tagish lake. The claims are at altitude 3,700 feet on the north side of Sheep creek and about 2 miles from the shore of the lake. The ore occurrence is a large pyritized shear-zone containing gold values in quartz stringers, occurring in bedded sandstone of the Laberge series of Lower or Middle Jurassic age. Surface-trenching and a limited amount of tunnelling carried out under a former option are not conclusive regarding the potentialities of this property. The deposit warrants further exploration. A sample of bluish quartz with some mariposite and a little pyrite chipped from several stringers and quartzose sections at different places in the zone assayed: Gold, 0.26 oz. to the ton; silver, 1.10 oz. to the ton.

Surface-trenching between 3,650 and 3,930 feet altitude has exposed the zone for a width of from 60 to 80 feet, striking north-south across the formation; quartz stringers and quartz replacement sections are distributed throughout the zone where exposed. At 3,800 feet altitude a tunnel 40 feet long has been driven along a rusty quartz stringer 12 inches wide, from which high gold values have been obtained. It is quite possible that other stringers and siliceous areas of the zone may contain commercial gold values. These should be explored for by extending this tunnel and crosscutting the zone at intervals. Systematic sampling should accompany this work.

Atlin Ruffner Mines, Ltd. This company was formed under the sponsorship of C. V. Bob, New York, for the purpose of continuing exploration of the Atlin Silver-Lead Mines property. The holdings consist of some twenty-four claims situated on Leonard mountain, about 14 miles from Atlin. The property is located about 10 miles up Fourth of July creek and is reached by a motor-road branching from the main Surprise Lake road. With substantial assistance from the Department of Mines the latter part of the road to the property was reconditioned during the 1930 season. The ore occurrence has been described in former Annual Reports and in Summary Report, 1925, Part A, of the Geological Survey of Canada.

The bulk of Leonard mountain is composed of granitic rocks which probably represent an outlying spur of the Coast Range batholith. Numerous lamprophyre dykes, probably representing basis differentiates from the granitic magma, cut through the granite. This probably Upper Jurassic intrusive mass is surrounded on the north by Carboniferous, or possibly older, quartzites, slates, and limestone, and on the south-east by the "gold series" of Upper Palæozoic and Mesozoic age, consisting of a complex of pyroxenite, peridotite, and greenstone.

The ore occurrence consists of galena, zinc-blende, mispickel, pyrite, and some chalcopyrite in a gangue of quartz, calcite, and some ankerite. This mineralization is intimately associated with the basic dykes and seems to represent the filling of fracture-planes and shattered areas of these dykes, occurring as the last gaseous and aqueous effusion from the consolidating granitic magma. Nos. 1, 2, 3, and 4 veins are the main occurrences of this type that have been explored. Former exploration was somewhat scattered over a wide area of surface and had not progressed to the point of ascertaining the character of the deposits at depth. The plan of the present operators is to concentrate exploration at a lower horizon, particularly on No. 2 vein. At the death of J. M. Ruffner in 1929, development of the property by the Atlin Silver Lead Company ceased.

Development of this property was resumed early in the 1930 season under the sponsorship of C. V. Bob, of New York, with a crew of about fifteen men. Work was concentrated on drifting and raising on No. 2 vein from 2 D level at altitude 4,350 feet. A main crosscut was also started at 4,140 feet altitude to tap Nos. 1, 2, and 3 veins. This tunnel is about 1,700 feet east of 2 D tunnel and, besides cutting the projection of Nos. 1 and 3 dykes, will crosscut the projection of No. 2 vein about 1,000 feet below the outcrop.

Late in the year financial difficulties caused a temporary curtailment of the operation. A readjustment of affairs was subsequently effected and the development of the property was continued in association with Buffalo interests.

Placer-mining.

The placer-gold production of Atlin Division for 1930 was 3,141 oz., valued at $53,397, as compared with $53,958 for 1929. This shows a steady maintenance, and on account of the growing interest and still latent possibilities in this phase of mining in the section expansion of output may be expected in the future. With the exception of the Compagnie Française des Mines d'Or du Canada, which came into partial production this year, the larger operations were still engaged in preparatory work. Further general reference to placer-mining in this section will be found in the introductory portion of this report.

Pine Creek. Twenty-one leases of about 40 acres each were being operated on this creek by Discovery Mining and Power Company, sponsored by C. V. Bob, of New York. Financial difficulties which arose late in the season were subsequently adjusted and operation will be continued in 1931 by the Golden Centre Mines, which has taken over the holdings and arranged finances for future development.

During the 1930 season stripping was continued at the north end of the old pit. Whereas the 1929 stripping had as its objective a presumed old channel southerly of the pit-end, the present objective is to get into a presumed old channel about 1,000 feet northerly. Up to the present no information has been acquired as to values, but it is understood the ground will be drilled in 1931. At the present hydraulicking-site there is 25 feet of stripping and 30 feet of gravel below this, making a section of 55 feet to be moved to bed-rock.

The pit operation is being carried out by two 6-inch and one 7-inch nozzles. There is a good water-supply from Surprise lake delivered by about 8½ miles of ditch and about 11,000 feet of 28- to 20-inch pipe-line. The working-lines take off at 20 to 18 inches and finish at 16 inches. The season's operation was with about 5,000 feet of 16-inch line. An electric power plant for lighting is operated by a water-wheel driven by a 2½-inch monitor reduced from 12 inches and with water tapped from the main pipe-supply.

Boulder Creek. This creek is operated by Consolidated Mining and Smelting Company of Canada through control of the Boulder Creek Placers. The objective of the present preparatory work is to get into anticipated "pay" in virgin ground lying southerly of the creek-bed. At the time of examination (July) it was estimated that about 5,000 feet still remained to be cut through. Due to water-shortage and a hard-pan that has to be blasted, advance is slow. Piping is being carried out with a 4-inch monitor operating under a head of 100 feet. Some trouble is also realized from insufficient grade for dump-disposal into the lake, causing frequent blocking and necessitating continuous moving of the dump-flume. Were it possible to lower the lake-level 1 or 2 feet this difficulty could be easily obviated.

In the old workings on this creek "pay" was mined in gravel up to about 18 feet above bed-rock, with an overburden of about 50 feet. It is anticipated that future operations will be by both underground and hydraulicking-work, a combination which may offset to some extent the water-shortage. During the 1930 season a crew of twelve men was employed, with McLeod White as superintendent and H. P. Pearce as foreman. With the natural difficulties of this operation it cannot be accurately forecast when it may reach production.

Ruby Creek. This creek is somewhat unusual in the Atlin section in that it has a granite bed-rock, whereas most of the other creeks have slate bed-rock. An interesting feature also is a bed of young lava about 100 feet thick, covered with volcanic ash, that buries the old channel-gravels bordering the banks of the present creek-bed. About 18 inches to 2 feet of the buried gravel roof is baked and cemented, and consequently stands well for mining operations. Between this and bed-rock is from 6 to 8 feet of cemented gravel. The best "pay" is found up to about 2 feet above bed-rock. The granite bed-rock is well fractured and weathered for a thickness of about 12 to 18 inches and in the old channels contains good "pay" and "slugs" which have worked down into the fractures and crevices. In mining, this consequently has to be picked off and bed-rock carefully cleaned. The creek is also notable in that it contains the coarsest gold in the Atlin Lake section. Operations on this creek are conducted by both hydraulicking in the creek-bed and mining under the lava.

Up from the mouth of the creek Matson and Schultz are working a lay on the ground held by the Lake Surprise Mining Company, Limited. Bed-rock was imperfectly cleaned during the former operation and it is expected that a good recovery will result from reworking this old ground. It is also intended to work some virgin ground under the lava. During the early part of the season 2,000 feet of sluice and 2,000 feet of main pipe-line were completed and operations

were in full swing. Early in July, however, a severe cloudburst and attendant flood destroyed the plant about a week before a clean-up was planned. The boxes have since been recovered and repairs completed. At the close of the summer season, winter mining operations were started under the lava with a crew of five men.

Above this operation Emil Turnquist owns two leases and is working a lay on another lease. His operation consists of mining under the lava and is meeting with good success. During the latter part of the season work was concentrated on the driving of a drainage incline to a lower tunnel. This has been completed, the boxes are now installed underground, and operations are continuing during the winter.

Above this operation Morrison, McKay, and Johnson are mining under the lava on a lay on the Frank Fitch *Ophir* lease. At the time of examination the tunnel had been advanced to 420 feet from the portal. Of this the first 160 feet is old work on the lease adjoining the *Ophir*. The rim comes in about 50 feet from the portal, sloping north-east. The plan of operations is to continue the tunnel to the south-west rim-slope and then crosscut east through the old channel, which will be drifted on. Damage caused by the flood was energetically squared up and in November "pay" was struck and the old channel drifted on. The operation is continuing through the winter with an extra man employed.

Wright Creek. At the upper end of this creek John Hyland and partner are working a bench lease from which they have taken out several slugs of gold during the season, including one valued at about $400. It is estimated about 60 oz. of gold has been recovered from this bench operation. Below this operation J. E. Moran and L. T. Hodges are hydraulicking into bed-rock below the shallow workings of old-timers. The old-timers worked in shallow ground down the creek until the ground became too deep. It is surmised that the values continue down creek into the Moran-Hodges lease. From the present working-site about 2,000 feet of this virgin ground is available for work up the creek. The gravel in this is about 40 feet deep, which includes 6 feet of what is considered pay-streak above bed-rock. The method of operation planned is to strip the heavy material in the top gravel by moving it to one side (the fine gravel will go through the sluices) and just sluice the pay-streak. It was expected that bed-rock would be reached at the end of the 1930 season. Hydraulicking is being carried out with a 4-inch monitor under a 40-foot head of water from Wright creek.

Otter Creek. This creek flows into Surprise lake on the south side and is controlled and operated by the Compagnie Française des Mines d'Or du Canada, capitalized at 6,000,000 francs, with the head office at 19 Rue d'Aumale, Paris, France, under the local management of J. E. Moran. Prospecting of the creek for an appreciable distance from the mouth is reported to have shown good values.

The gold-bearing gravel of Otter creek has been completely buried by glacial drift of appreciable depth. The creek is consequently not adapted to the operations of individual miners. It is understood that bed-rock was never reached by the old-timers. It is claimed, however, that old-timers recovered about $250,000 from exposed sections of rim-rock and from gravel overlying hard-pan.

The method of operation being conducted by the Compagnie Française consists in starting the workings at the farthest possible point down-stream and as near as possible to Surprise lake. In this way, when the sluices reach bed-rock, a maximum area of the valley-gravel will lie ahead. All the heavy debris from the moving of the gravel from the sluices is stacked by monitors working at the dump. A large yardage of the finer and lighter material finds its way into Surprise lake. At the time of examination (July 1st) two monitors were operating in the pit about 500 feet from the shore of the lake. These were equipped with 5- and 6-inch nozzles working under a head of 165 feet, with a water-supply of 1,200 miners' inches drawn from Otter and Wright creeks.

The extensive scale of operation planned necessitated initially, however, the collecting of a sufficient supply of water. This has been achieved by tapping the water from Otter, Snake, Wright, Idaho, Casino, and Union creeks into the main system of ditch and flume. Should it be found necessary it is also intended to tap Quartz creek, situated about 2 miles north of Union creek. The present water system totals about 8 miles, commencing at Union creek at the north end, about 830 feet above Surprise lake (altitude 2,700 feet). Of this, more than 3 miles is of metal flume carried along a rough and broken mountain-side where ditching is impossible. This

is constructed of No. 36 galvanized Economy metal flume shipped by the Engineering Corporation, of Vancouver. This material is delivered in flat 24-gauge sheets and is easily bent on the ground to the required half-round curve and mounted (nailed) on a skeleton lumber frame that can be very flexibly adapted to practically any contour of rough terrain. The joints are secured by galvanized bands drawn tight by a patent lock-nut. The edges contacting with the lumber frame are made water-tight with a packing-strip of tar-roofing. It is understood that this Economy flume costs 43 cents a foot at Vancouver complete with bands, tar-roofing, staples, nuts, and washers, and about 51 cents a foot delivered at Atlin. Installed at the operation the cost is estimated at about $1 a foot, which is about the same as the cost of the ditch-construction. The Economy flume is installed at this operation on a grade of 5 feet in 1,000 feet and will carry 800 miners' inches with 4 inches of free-board. The ditch is carried on a grade of 1/10 foot per 33 feet and is 18 inches deep and 4 feet wide at the bottom.

During the 1930 season energetic preparatory work was carried on, yielding at the same time a significant gold recovery. Besides construction, piping-work was concentrated on advancing the drain-sluice towards bed-rock and good progress was achieved. For a portion of the season the direction of this sluice traversed gravel carrying remarkable values in comparatively fine gold from the surface down. Towards the end of August the sluice cut through this exceptional deposit, the continuation of which will be explored at some future time. About $10,000 in gold was recovered in cutting through this section. At the conclusion of the season the management reports the drain-sluice had seemingly penetrated up to a stratum of gold-bearing gravel about 40 feet below the surface. It is thought this might be the bed-rock deposit of the main run of the old channel of Otter creek. Should this prove to be the case during the 1931 season, the preparatory work of the operation will have been completed with greater facility than was expected.

Spruce Creek.

Interest in this creek centres in the number of individual operations distributed along its confines. The depth of gravel and difficulty in obtaining sufficient sluice-grade would possibly preclude successful hydraulicking operations. The gravel of the creek-bed bench apparently increases in depth from near the mouth to the canyon about 4 miles up. The most important present operations are confined to shaft-sinking to bed-rock and mining along the old channel bed-rock. Some shovelling of old-timers' creek-bed workings and patches of remaining virgin ground is also carried out. In the shaft-work Cornish pumps operated by water-wheels are in general use. Many ingenious and picturesque installations of water-operated wheels, girdys, scraper-drains, etc., are still in use.

The uppermost working is that of Marco Viola and Marco Pini working on a lay from Angus Beaton. The operation is through a shaft 93 feet deep to bed-rock. The old channel in these workings seems to strike S. 35° E. (mag.) and consists of 8 to 12 feet of gravel roofed by 2 feet of "chicken-feed" lying below glacial drift. At the time of examination a drift was being run up-stream to connect with an old shaft. From $1.50 to $2.50 to the car (about 7 cubic feet) was being recovered. This operation is continuing through the winter with a crew of twelve men and it is understood very encouraging results are being achieved.

Below this operation Koppacher, Morse & Co. were working from J. Brown's old workings to connect with and drain the Koppacher works. This has been completed and mining is going on in good ground. This is also a shaft operation.

I. Matthews and a crew of twelve men are working three leases with a shaft to bed-rock. He has a good equipment of water-wheel, Cornish pump, and sky-line trolley car-hoist to the sluice.

James Nedved, adjoining Matthews, is sinking a new shaft and expects to reach bed-rock within 55 feet.

Jack Tintinger and J. Cole have a shaft to bed-rock, with a Cornish pump and equipment and are mining along bed-rock.

Joe Clay, at the time of examination, was shovelling in hard, dark cemented ground about 3 feet above bed-rock in the creek-bed. Of the 1,000 feet of ground he is working, about 50 per cent. is virgin. The equipment consists of two wheels for hoisting to the sluice and draining the pit.

Otto Miller is shovelling tailings from old-timers' workings and reports an encouraging recovery.

Maurice Bride is working the Lynx Creek lease. At different times this man working alone has started sinking several shafts without pumping-rigging and has been forced out by excessive water. During the season he planned excavating a drain.

O'Donnel River. It would seem that this river may have possibilities for more extensive work than has hitherto been carried out on it, and might be worth investigation for the possibility of an hydraulicking operation. N. Murphy and Tom Prpich have adjoining leases and are doing fairly well by drifting during the summer and shovelling during the winter.

McKee Creek. This creek is controlled by the Delta Gold Mining Company, Limited, with George Adams as manager. In the early days a considerable amount of coarse gold was taken out. A good description of the creek is contained in the 1929 Annual Report. Recent work has been confined to prospecting for a lost old channel, but so far without success.

Lincoln Creek. This creek drains into the south side of Gladys lake, which is situated about midway between Atlin lake and Teslin lake. Prospecting of the creek is reported to have shown very encouraging results, indicative of possibilities for a comparatively extensive hydraulicking operation. Several leases have been taken out by Atlin men and optioned to R. W. Foster, of New York. Late information is to the effect that the operation on the creek will be proceeded with during the 1931 season.

In Memoriam.

It is fitting to close the 1930 report on the Atlin section with a solemn tribute to the memory of Captain E. J. A. Burke, who, as pilot of pioneer aeroplane exploration flights into the interior wilderness from Atlin, was forced down in the upper Liard River country and succumbed to the effects of starvation and exposure. No tragedy of recent times has so stirred the north. A sterling flyer, man, friend, and pioneer has been added to the toll of this country, but the memory of "Paddy" and his constructive efforts to advance the frontier of progress into the unexplored hinterland will always remain.

NORTH-EASTERN MINERAL SURVEY DISTRICT (No. 2).

REPORT BY DOUGLAS LAY, RESIDENT MINING ENGINEER (HEADQUARTERS, HAZELTON).

INTRODUCTION.

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 master-feature of the topography is that of a great central plateau, the Nechako plateau, which merges gradually westwards in the Coast range of mountains, eastwards in the Rocky mountains, northwards in the mountains of the Cassiar system, and southwards in the Fraser plateau.

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 and widespread intrusions of batholithic rock throughout the district, with which mineral occurrence is associated.

The district exhibits within its confines a wide diversification of mineral occurrence, and offers every indication of potential wealth in lode-minerals, in non-metallic minerals, and in coal, and also oil possibilities. In spite of the fact that the placer-mining field has been under extraction for the past seventy years, field-study confirms the view that this field is far from exhaustion and still offers major possibilities.

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 and 1929 Annual Reports are listed reports on the district published during those years. During 1930 the following reports on the district were issued:—

Name of Author.	Publication.	Year.	Page.
A. H. Lang	Summary Report, Part A, G.S.C., Owen Lake Mining Camp	1929	62
A. H. Lang	Summary Report, Part A, G.S.C., Mineral Deposits at Buck Flats	1929	92
C. W. Moore	Bulletin No. 2, British Columbia Department of Mines	1930	34
Douglas Lay	Annual Report, Minister of Mines, B.C.	1929	143
Douglas Lay	Bulletin No. 3, British Columbia Department of Mines	1930	28

It is germane to the subject-matter of this report to chronicle two events which concern the mining industry:—

The visit of the B.C.-Alaska Highway Caravan to the district in June, apart from its special purpose, was the means of directing attention to the mineral resources of the district.

At Quesnel on June 26th a memorial erected as a tribute to the pioneer placer-miners of the Cariboo was unveiled by His Honour the Lieutenant-Governor. This memorial, sponsored by the British Columbia Division of the Canadian Institute of Mining and Metallurgy, and aided by the Department of Mines, took the form of re-erecting at Quesnel the first Cornish pump brought into the Cariboo and its operating water-wheel.

Inspection trips were made by the Resident Engineer during the year to certain portions of the northern Omineca Mining Division not hitherto inspected. An account of these will be found in the body of this report.

The writer desires to express his thanks to the prospectors, operators, and mining men of the district for many courtesies extended.

GENERAL SUMMARY.

Lode-mining.

The serious declines in base-metal prices, accompanied by very unsettled financial conditions generally, which characterized the year, checked the expansion of base-metal mining operations in the district.

Silver-lead-zinc properties were the first to feel the effect, and in March, Duthie Mines, Limited, the most important producing property in the district, suspended operations entirely.

For a short time prospects for copper remained more hopeful, but the sudden drop of 4 cents a pound in the price of copper on April 15th, followed by further declines in the price of this metal, rendered the immediate outlook for copper properties equally unfavourable.

In consequence, actual production of lode-mineral ceased early in the year and several companies suspended operations entirely. Nevertheless, a very considerable amount of development took place, an amount which was greatly in excess of that which might have been expected under prevailing conditions.

A feature of the year was the very determined attempt on the part of the prospector and small-scale operator to work out his own salvation by developing his property himself. Never before has so much work in this respect been carried out at so many points in the immense area embraced by this district, and in many cases at points hundreds of miles from the railway.

Of signal service to the district were the operations of the Consolidated Mining and Smelting Company of Canada, Limited. This company carried out a large amount of development at the *Emerald* group in the Sibola section; at its recently acquired *Driftwood* group, west of the Driftwood river; at its property in the vicinity of the Nation river; and also at its property in the vicinity of Timothy mountain. In addition, this company maintained prospecting-parties in the northern portion of the Omineca Mining Division throughout the field season.

Among other companies more or less actively engaged may be mentioned: Ingenika Mines, Limited, at the *Ferguson*, on the Ingenika river; Columario Gold Mines, Limited, at the *Valhalla* and *Kleanza* groups, Usk; American Copper Mines, Limited, at the *Diadem* group, Usk; Babine Bonanza Metals, Limited, at the *Cronin* mine in the Babine mountains; and Cariboo Gold Quartz Mining Company, Limited, at its property on Lowhee creek, in the Cariboo Mining Division. Duthie Mines, Limited, as has been mentioned, suspended operations entirely in March. In the early fall small-scale operations were carried out by Lorraine Copper Silver Mines, Limited, and also by Omineca Silver King Mining Company, Limited, at the respective properties of these companies in the Babine mountains.

The large number of railway and other survey parties engaged during the year in the northern portion of the Omineca Mining Division aroused much interest. Doubtless this was the means of stimulating the extensive prospecting and initial development which took place in this region. Several new discoveries were made and much light thrown on the regional geology.

In spite of the depressed metal market, decided interest was evinced by the large operating companies of the Province in the examination of base-metal prospects. Interest in gold properties was naturally very marked.

Among important features of development may be mentioned:—

(1.) The very fine surface showings uncovered by Duthie Mines, Limited, on the *Canary* claim.

(2.) The results obtained by the owners (C. Matheson and D. Heenan, both of Topley) of the *Golden Eagle* group.

(3.) The encouraging results obtained at the *Cronin* mine.

(4.) At the Cariboo Gold Quartz Mining Company's property on Lowhee creek, in the Cariboo Mining Division, the results obtained during the year were decidedly encouraging.

Promising results were obtained at several other properties, to which reference will be made in the body of this report.

Placer-mining.

This branch of the mining industry witnessed considerable activity during the year. As in the case of lode-mining, the efforts of individual owners were a noteworthy feature of the year.

The purchase of a Keystone drill by one ownership (C. R. Carfrae and O. Sandberg, of Horsefly), followed by systematic drilling of the ground, exemplifies the enterprise evinced by this class of operator.

Prospecting was quite active, and new discoveries are reported on Rainbow creek, a tributary of the Nation river, by George Snell, of Vanderhoof; and also on Canyon creek, in the Cariboo Mining Division.

The present would seem to be a particularly opportune time for the investigation of placer-gold deposits which bear the earmarks of promise. Attention is again directed to the fact that there are many major possibilities in this direction which await such investigation.

Much information on the subject will be found in "Placer-mining in British Columbia," published by this Department during the year. Further information has been derived as the result of examinations subsequent to the issue of the publication mentioned and is given in this report.

In connection with the investigation of certain of the old channels mentioned in these reports, it seems likely that valuable criteria might be ascertained at comparatively small expense by the application of geophysical methods by way of preliminary. In this connection might be mentioned depth to bed-rock at given points and bed-rock grade.

Important features of the year were: the success gained by B. Boe on Cedar creek; the continued operation of Lowhee Mining Company, Limited, in productive ground; and the reopening of the *Bullion* mine by the Quatsino Sound Mining Company, Limited.

Among new operations started during the year may be mentioned: those of R. N. Campbell and associates on Antoine creek, in the Horsefly section; those of Placer Engineers, Limited, on 4-Mile creek, a tributary of Keithley creek; those of J. Shaw and L. J. Auten on the North fork of the Quesnel river; those of George Kuchan and associates on the Hobson mine tailings on the Horsefly river; and the investigation of dredging possibilities on the Fraser river, between the Goat river and Loos, by means of Keystone-drilling undertaken by a syndicate under the direction of Gordon F. Dickson.

In the Omineca Mining Division much work was done by R. C. McCorkell and associates, of Vanderhoof, in the Manson section, and by George Snell and associates on tributaries of the Nation river.

Keystone-drilling was carried on at several points in the Cariboo and Quesnel Mining Divisions.

Coal-mining.

The coal areas of the district attracted much attention during the year. In the Quesnel Mining Division the Cariboo Coal and Clay Company, Limited, carried out much exploratory work by diamond-drilling and surface prospecting in the coal area in the vicinity of Australian, where several wide seams occur. In the Omineca Mining Division, near Telkwa, F. M. Dockrill obtained a lease from the B.C. Coal and Land Company of Sections 391 and 401, adjoining the property of Telkwa Collieries, Limited, on the south, and has opened up a large seam of coal 12½ feet in width. This operation has no problem of overproduction to contend with, the local demand being very active between Prince George and Prince Rupert.

Oil.

The oil possibilities of the region in the vicinity of Quesnel have excited much attention during the year. An oil-drilling rig was set up on the Yorston ranch just east of the Fraser river, about three-quarters of a mile north of Australian creek, and an oil-well spudded in on October 2nd. These operations are being carried out by Frank A. Patrick on a royalty basis under contract with Cariboo Coal and Clay Company, Limited. Drilling operations are in charge of J. F. Harrison. The outcome of this enterprise will be awaited with much interest.

Production.

Lode-mineral.—Owing to the low metal-market prices prevailing, production ceased completely in March.

The following is a list of shipping-mines in the No. 2 District for 1930:—

Name.	Crude Ore shipped.	Ore milled.	Lead Concentrates.	Zinc Concentrates.	Gold.	Silver.	Copper.	Lead.	Zinc.
Omineca Mining Division—	Tons.	Tons.	Tons.	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.
Duthie mines	.....	2,756	190	202	94	64,574	.....	212,908	173,388
Silver Cup	.....	520	52	.....	1	6,768	.....	24,446	.....
Totals	.....	3,276	242	202	95	71,342	.....	237,354	173,388

Placer Gold.—The value of the total production was $84,660, as compared with $66,912 in 1929.

Coal.—The output of coal was 1,029 long tons, as compared with 1,505 long tons in 1929.

Non-metallics.—The output of diatomite was 146 tons, as compared with 175 tons in 1929.

Roads and Trails.

Substantial aid was rendered by the Department of Mines in connection with mining roads and trails at all points of the district.

Among the items of major importance undertaken this year may be mentioned the Sakumtha Pass route from the Dean channel on the Pacific coast to the chain of large lakes in the interior. The trail extends from Kimsquit on the Dean channel to Pondosy bay on Eutsuk lake, and will, it is anticipated, be completed next year. Much work was done on the trail this year, and a light surface portage tramway between Whitesail and Eutsuk lakes was almost completed. A full description of this route, with maps, will be found in the Annual Report for 1926 on pages 147, 148, and 149.

New Discoveries.

Among new discoveries may be mentioned:—

(1.) *Childhood's Dream* group—a promising lead-zinc mineralization in dolomite, situated on the Osilinka river, discovered by A. O. Swiggum, of Finlay Forks.

(2.) *Wedge* group—a very large quartz vein, which reaches a width of 130 feet at one point and which can be traced on the surface for several thousand feet; mineralization is copper pyrites. Situated in the Rocky mountains, about 25 miles east of the Finlay river, on Pesika (Wedge) creek. Discovered by Mort Teare and associates, of Prince George.

(3.) *Blue Ridge* group—a batholithic intrusion mineralized with copper minerals, situated at the headwaters of Duck creek, a south-flowing tributary of the Omineca river. Not inspected by the Resident Engineer, but described by an experienced examining engineer as a prospect of outstanding interest owing to the vast tonnage of low-grade copper material apparent. Unfortunately, however, the copper content seems to fall below commercial grade at the present time. This discovery was made by F. Weber, of Fort Grahame.

(4.) *Weber* group, situated a few miles west of the *Childhood's Dream* group, on the opposite side of the Osilinka river—a lead-zinc mineralization in siliceous dolomite. Discovered by F. Weber and W. McPhee, of Fort Grahame.

(5.) A rock consisting wholly of the mineral tremolite, situated about 15 miles south of Vanderhoof, discovered by natives, and brought to the attention of the Department by George Ogston, of Vanderhoof. The asbestiform habitat of the crystals has only been partially assumed in the exposures of rock in place, but boulders of float show asbestiform mineral of commercial grade, and further search for the origin of such is warranted.

The foregoing are here listed to facilitate reference. A full account of these, excepting the third mentioned, will be found in the body of this report.

Prospecting.

Lode-mineral.—Reference is invited to the Annual Report for 1929, wherein, on pages 146 and 147, will be found an outline of the more favourable portions of the district, and also references to other reports in which much information is given on the subject of prospecting. Much valuable general information will be found in "Prospecting in Canada," recently published by the Geological Survey of Canada. It is unnecessary to repeat detailed information already given in these reports, but it is desired to emphasize the fact that an appreciation of the signifi-

cance of the two great batholiths—the Coast Range and the Cassiar-Omineca batholith—likewise a knowledge of their exact geographic position, are essential to intelligent prospecting. Further, while the zones of contact of these batholiths with other rocks are well known and, generally speaking, favourable for lode-mineral occurrence, nevertheless the position of outlying bodies of batholithic rock, or satellites, remains to be determined by local prospecting. The region surrounding these satellites is usually highly favourable for lode-mineral occurrence.

Reconnaissance during 1930 indicated promising possibilities in the following areas:—

(1.) Region immediately west of the Driftwood river and north end of Takla lake. No outcrops of intrusive igneous rock were observed in this region, but the copper mineralization at the *Rainbow* group and at the *Driftwood* group is such as to justify further prospecting in this region, which is fairly accessible and reached either by boat from Fort St. James or by pack-trail from Hazelton.

(2.) The eastern contact-zone of the Cassiar-Omineca batholith with other rocks, which is to be found at or near the headwaters of the Finlay river and its easterly-flowing tributaries. The discovery of the *Blue Ridge* group at the headwaters of Duck creek indicates the advisability of prospecting east of this point in the vicinity. The *Childhood's Dream* group, although a considerable distance east of Duck creek, probably owes its origin to the mineralizing influence of the Cassiar-Omineca batholith. The Omineca river above Duck creek, and its tributaries, also obviously merits close prospecting.

(3.) Region immediately west of the "mica-belt." When the *Ferguson* mine was first examined it was noted that it occurred in limestones immediately west of the rocks in which occur the mica-bearing pegmatites near Fort Grahame, and it was at that time suggested that bodies of lead might be found in limestones occurring west of the mica-belt south of Fort Grahame. The discovery of the *Childhood's Dream* group, which occurs in dolomite just west of the mica-belt, rather suggests that the latter belt of rocks, which is very readily recognizable, might be followed south of the Osilinka river and any limestones or dolomites adjoining it on the west prospected for lead.

(4.) The region between the North-west arm of Takla Lake-Middle river-Trembleur lake-Tachie river-Stuart lake water systems and Babine lake. At the North-west arm of Takla lake a belt of granite some miles in width outcrops, and from what is known of the intrusions of batholithic rock on islands in Babine lake, on the north shore of this lake, and at the southern end, it is quite evident that this region merits close prospecting. Moreover, it possesses the advantage of being readily accessible.

(5.) The country surrounding the headwaters of Lorne, Porcupine, and Fiddler creeks merits prospecting for gold-quartz veins.

(6.) The region about 15 miles due south of Vanderhoof, in the vicinity of the 124th meridian, is intruded by granitic rocks. Close prospecting in this region is justified not only for lode-mineral, but also for the asbestiform mineral tremolite. A further account of the occurrence of tremolite in this area will be found in the body of this report.

In connection with prospecting in the region north of Takla lake, which is at present devoid of railway transportation, prospectors are advised not to concentrate effort on slender mineral-showings. It is also worth bearing in mind that a projected railway route between Finlay Forks and the Pacific coast follows from Finlay Forks the Omineca river to the Fall river, thence the latter to Takla lake. The north shore of the lake and the Driftwood river are then followed to Bear lake, from which point the Bear river is followed to the Skeena river.

Placer Gold.—Although new bonanza discoveries are perhaps likely to be rare, nevertheless each year additional evidence is afforded of the fact that valuable finds still await the prospector even in the old placer-gold sections. These the prospector may not be able to work himself in some cases, but they may be turned to good advantage. Among the older sections, the Horsefly region undoubtedly offers much promise and merits much further investigation. Attention has previously been directed to the general promise of the region between the Willow and Fraser rivers, where a new discovery was made during the year on Canyon creek.

Reference is especially invited to Bulletin No. 2, 1930, "Placer-mining in British Columbia," published by the Department of Mines, which contains much general and specific information of use to prospectors.

Non-metallic Minerals.—Prospectors might note that there is now a market in British Columbia for a certain amount of *ground* mica. For this reason additional interest centres on

mica-deposits which are close to existing transportation facilities. Mica-bearing pegmatite dykes should also be examined for cassiterite, for radioactive minerals such as pitchblende, and for beryl (the demand for this mineral is increasing).

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.

In the 1929 Annual Report on page 147 will be found particulars relating to costs of transport by railway, by motor-truck, by pack-horse, and by boat, as prevailing in this district.

Lectures to Prospectors.

During the winter George Winkler was retained by the Department of Mines for the purpose of giving a systematic course of lectures at various centres on economic geology and elementary mineralogy. These lectures were given at Smithers, Prince George, and Quesnel, and were supplemented by addresses given by the Resident Engineer at a number of points throughout the district.

OMINECA MINING DIVISION.

Skeena Section.

Usk.

Diadem. This group is owned by B. Shannon, of Usk, and was operated under option during the year by American Copper Mines, Limited, a British Columbia incorporation of $500,000 capitalization in $1 par shares. This property, together with the *Mitts* group on the North fork of Chimdemash creek, was originally optioned by R. E. Doan, and Canadian Copper Mines, Inc., was incorporated under the laws of Delaware to take over these properties. Canadian Copper Mines, Inc., has a capitalization of $5.000,000 (all common stock), with shares of $1 par. R. E. Doan was originally president of this company, but it is understood his connection with the company was recently severed. It is also understood that the properties of Canadian Copper Mines, Inc., have been transferred to American Copper Mines, Limited, and in return for the properties a large block of American Copper Mines, Limited, stock has been transferred to Canadian Copper Mines, Inc.

Literature issued during 1930 by or on behalf of Canadian Copper Mines, Inc., containing quotations from alleged reports by R. E. Doan, contained much misleading information and many statements not in accordance with the facts regarding the *Diadem* and *Mitts* properties. One bulletin concerning the *Diadem* was a gross violation of the truth. The directorate of this company has recently been reorganized, and the new Board of Directors has expressed strong disapproval of such very questionable methods as were formerly followed by this company.

Apart from some surface prospecting, operations carried on during the year by American Copper Mines, Limited, comprised the erection of camp buildings by the railway-track about 2 miles east of Usk; the installation of air-compressing plant; and the running of two crosscut tunnels. These latter are being run at points about 4,000 feet apart, a short distance from and above the railway-track. Near the portal of each tunnel a 36–42-horse-power Petter semi-Diesel engine and small Gardner belt-driven compressor have been installed.

As approximately determined by aneroid barometer, the elevation of No. 1 tunnel, the more easterly, is 470 feet above sea-level (Usk 294 feet elevation); that of No. 2 tunnel is about 60 feet below this. The objectives of these tunnels are the probing in depth of the *Diadem* ore-showings, which are more particularly described on page 144 of the 1928 Annual Report, and also certain other surface showings situated about 4,500 feet south-west of the former and at a considerable higher elevation. The bearing of these tunnels is between N. 43° W. (mag.) and N. 65° W. (mag.), approximately at right angles to that of the *Diadem* vein system. No. 1 tunnel is approximately 420 feet vertically below the short adit-drift run by operators in 1928 at the bottom of the shaft previously sunk on No. 1 vein. No accurate survey has been made by this company, so that the exact position of these tunnels in relation to the surface exposures is not known.

These tunnels were examined on December 30th and 31st. At this time driving had been suspended, but two men were employed in making various preparations at the portal of No. 1 tunnel for the resumption of work, which, it is understood, is to take place shortly.

As measured on December 30th, the total length of No. 2 tunnel was 132 feet; that of No. 1 tunnel, 930 feet. No. 2 tunnel calls for no comment, as the workings disclose country-rock only.

The country-rock exposed in No. 1 tunnel is similar to that enclosing the original surface showings, which lie to the north of and some hundreds of feet above this tunnel. The country-rock is dark grey in colour, fine-grained, and appears to be an acid silicified volcanic flow-rock of rhyolitic composition. It strikes north-westerly and dips north-easterly at a steep angle. No. 1 tunnel starting on a bearing of N. 65° W. (mag.) at first cuts diagonally across the bedding-planes. The last 300 feet of the tunnel has a bearing of N. 43° W. (mag.), which more nearly coincides with the strike of the bedding-planes. The direction of all shear-zones encountered in this tunnel, and hereinafter described, is approximately N. 45° E. (mag.) and the dip 50° to 60° south-east, similar to that of the mineralized shear-zones on the surface, described in the 1928 Annual Report.

At 760 feet from the portal a vein about 3½ feet in width was passed through. This is a shear-zone and the filling is quartz and country-rock. It is sparsely mineralized with chalcopyrite and pyrite. After passing through this shear-zone the tunnel continues in country-rock, which exhibits signs of shearing to some extent continuously until a zone of distinct, although not intense, shearing is met with at 890 feet from the portal. The true width of this shear-zone is about 13 feet; the horizontal distance across the shear-zone as measured on the tunnel-walls is 15.5 feet. The filling of this shear-zone is country-rock and quartz. The latter is "frozen" to the rest of the filling and the shear, although quite distinct, is tight. The shear-zone is only slightly mineralized with very small amounts of pyrite and chalcopyrite. A few small seams of quartz, about 3 inches in width, branch from this shear into the country-rock. One such seam, 3 inches in width, shows in the face of the tunnel running diagonally across the tunnel. Another is exposed on the north-west wall of the tunnel beyond the main shear-zone. These seams are mineralized with chalcopyrite, bornite, and pyrite. After the zone of distinct shearing mentioned is passed through, the country-rock up to the face shows only signs of slight shearing. The face shows slight pyritization in addition to the small seam of mineralized quartz mentioned. Immediately preceding the main shear-zone mentioned is a band of light-coloured siliceous rock a few feet in width. This may be an aplitic dyke. It is very slightly mineralized. Until an accurate transit survey has been made, no correlation of the shear-zones encountered in this tunnel with those of the original surface workings is possible.

There is no exposure in No. 1 tunnel which, so far as the amount of visible mineral is concerned, even remotely suggests commercial ore. However, the following samples were taken, largely to determine any precious-metal content: A sample across 6 feet at the face of No. 1 tunnel at 930 feet from the portal assayed traces in gold, silver, and copper.

A sample taken along the north-east wall of No. 1 tunnel, representing the last 18 feet of this tunnel, assayed traces in gold, silver, and copper.

A sample taken horizontally across the main shear-zone, 13 feet in width, on the south-west wall of the tunnel, length of tunnel-wall sampled, 15.5 feet, assayed: Gold, *nil;* silver, *nil;* copper, trace.

A sample of a small quartz-seam, 3 inches in width, showing chalcopyrite and bornite, at the face of the tunnel, assayed: Gold, trace; silver, 0.4 oz. to the ton; copper, 1.2 per cent.

The surface showings, described on page 144 of the 1928 Annual Report, were again examined during the year to determine the results obtained by the operators in 1928 in running the adit-tunnel on No. 1 vein from the bottom of the shallow shaft previously sunk by earlier operators, and where was exposed the best mineralization. This adit comprises only a few feet of tunnel beyond the shaft and is preceded by about 60 feet of open-cut. The result was disappointing; the face of the adit, immediately below the good mineral showing in the shaft, shows a shear-zone 3 feet 2 inches in width, containing but little quartz or copper pyrites. There is, of course, still the possibility that the mineral may rake into the mountain in an inward and downward direction. The elevation of this adit-drift as determined by aneroid is 890 feet.

Some surface prospecting was done during the year on some upper showings, distant about 4,500 feet south-west of the above-described workings, and situated at a considerably higher elevation. These, with the exception of one, were inspected on May 12th. The showings not inspected is considered by the management as being the best, but it was covered with snow on

the date of inspection. Those inspected lie between elevations 1,050 and 1,450 feet. Further surface work is warranted at some points, but no obvious commercial possibilities were apparent. The best of the showings seen was exposed mainly by natural agencies in the bed of Canyon creek (the main creek between Lowrie and Nicholson creeks) at elevation 1,050 feet. Here a width of possibly 50 feet shows a little copper pyrites and copper-stain at various points. It is not clear from existing exposures whether this is a highly silicified belt of volcanic rocks or a dyke. Further work is required to form an opinion as to commercial possibilities. A short distance from this point on the right bank of the creek some narrow seams of chalcopyrite, bornite, and quartz follow the jointing and bedding planes of the volcanic country-rock. A selected sample of this mineral assayed: Gold, 0.7 oz. to the ton; silver, 38 oz. to the ton; copper, 8 per cent.

The running of the crosscut tunnels on this property is regarded as being very ill-advised for several reasons. In the first place, the running of long crosscut tunnels to intersect the possible downward continuation of unprobed surface showings is unjustified, and to attempt such without first having an accurate survey made is largely a matter of groping in the dark. In the second place before these crosscut tunnels were started it was known that the results of probing the best showing of mineral in No. 1 vein (called "No. 3" by the present operators) by the adit-drift previously run at 890 feet elevation were not altogether reassuring, and the necessity of further work prior to any deep development was plainly indicated. In the third place, the topography east and north of No. 1 tunnel in the vicinity of the older workings is such that depth can be gained *by adit-drift*, so there is no necessity for running a crosscut tunnel.

In planning any future work the matter must of course be viewed in the light of the fact that No. 1 tunnel has already been driven a distance of 930 feet. Before any further mining operations are carried out the first step is obviously to have an accurate survey made of the workings. It should then be possible to form an opinion as to what might advisedly be done in connection with any further work. Refer also to Annual Reports for the years 1923, 1925, 1926, 1927, 1928, and 1929.

Mitts. This group, owned by E. Mitts and O. Berg, of Usk, has been operated in a small way during the year by American Copper Mines, Limited. The property is situated on the North fork of Chimdemash creek, on the left bank of the creek. The cabin on the property is situated on the right bank of the creek about 9 miles distant from Usk.

It was not possible to visit this property during the ordinary field season, but owing to the misleading statements concerning it published by Canadian Copper Mines, Inc., and attention to which was drawn at the close of the year, the Resident Engineer visited the property in company with E. Mitts on December 28th and 29th. At this time, owing to snow, it was not possible to inspect any of the surface showings, but the tunnel, 271 feet in length, which is being driven to probe the downward continuation of one of the surface showings was examined.

E. Mitts stated that there are three principal surface showings on this property. These are somewhat widely separated and are as follows: (*a*) Those inspected by F. P. Caddy, Assistant Resident Engineer, in 1929, and described in the 1929 Annual Report; (*b*) a vein stated to be about 15 feet in width mineralized with chalcopyrite and bornite, distant about 1,500 feet from (*a*) and at a considerably lower elevation: (*c*) the best surface showing is stated to consist of bornite and chalcopyrite, which is stated to extend over a width of 25 feet, and is situated about 1,500 feet distant from (*b*) in a southerly direction, whereas showing (*a*) lies 1,500 feet in a northerly direction from (*b*).

The tunnel examined, 271 feet in length, is situated at elevation 2,430 feet on the left bank of the North fork of Chimdemash creek and is directed towards showing (*b*), from which the portal is some hundreds of feet distant and at a lower elevation. The tunnel starts in volcanic country-rock striking S. 28° E. (mag.) and dipping south-west, but for the greater portion of its length follows a shear-zone sparsely mineralized with chalcopyrite and bornite, with an average strike of S. 68° E. (mag.) and dip from 45° to 68° to the north-east. The width of the shear-zone is between 4 and 5 feet, and the filling mainly country-rock, with a small amount of quartz. The continuity of this vein is interrupted, temporarily at any rate, about 8 feet from the face of the tunnel, by a fault or slip, which crosses the tunnel at an angle somewhat greater than a right angle and dips downward into the hill at an angle of about 60°. This vein is said to have a similar strike to that exposed on the surface above. It was estimated by E. Mitts

that the face of the tunnel would require to be advanced about 400 feet to reach a point immediately below the surface exposure.

E. Mitts also stated that two tunnels, each 35 feet in length, had been started to probe the surface showings mentioned under (*a*) above, but, their situation being above timber-line and the ground loose, they had to be abandoned owing to the difficulty of getting timber.

While it was not possible to inspect the surface showings on this property this year, it is apparent that even if these surface showings possess considerable merit, as is quite possibly the case, nevertheless they are quite unproved. Over-optimistic statements circulated during the year in literature issued by Canadian Copper Mines, Inc.—such as: "I expect to have overhead in shipping-ore, over $5,000,000 worth before snow flies . . . this in the Mitts alone"—are wholly unsupported by the facts and serious exception is taken to such statements. Refer also to the 1929 Annual Report.

Smyth Fissure. A trail was constructed to this property during the year, with aid from the Department of Mines, by the owners, A. A. Macdonald, of Usk, and R. C. Smyth, of Calgary. The property is situated at the head of the North fork of Chimdemash creek and has not yet been examined by the Resident Engineer.

Cordillera. Small-scale operations were resumed at this property in August by L. H. McGuire and associates under option from the Usk Mining Company. Underground operations consisted in raising from the lower to the upper tunnel in blind vein No. 2. At the time of inspection on September 30th this raise had advanced to a point 35 feet above the lower tunnel, and it was estimated that this raise would hole through in about another 18 feet. Refer also to the Annual Reports for 1917, 1918, 1919, 1920, 1921, 1922, and 1923, under "Kitsalas Mountain Copper Company."

Little Wonder. This group, owned by I. Lougheed, of Usk, is situated on an unnamed creek immediately east of Lowrie creek. The showings consist of slightly mineralized shear-zones and volcanic beds and some ramifying quartz veins. At 950 feet elevation on the right bank of the creek an open-cut shows a very slightly mineralized shear-zone in the volcanic country-rock. On the opposite side of the creek, just above water-level, are exposed some ramifying quartz veins varying from a few inches to 5 feet in width. These are slightly mineralized with copper.

At 1,350 feet elevation, just below the junction of the two forks of the creek, on the right bank of the creek, the volcanics are highly altered and silicified and show a considerable amount of specularite. A sample of the latter showed upon assay no gold or silver values.

Just above the point of forking, at 1,400 feet elevation between the forks of the creek, the volcanics show much alteration and are pyritized. A sample of the pyritized breccia showed upon assay no gold or silver values.

At 1,375 feet elevation on the right bank of the main creek an altered band of the volcanics is pyritized and a good deal of quartz is developed. A sample taken failed to disclose gold or silver values.

Copper River Exploration Co., Ltd. This company was incorporated during the year. The directors are H. L. Batten, of Vancouver, and John Willman, of Usk. The property owned consists of the *Toulon*, *Balbrennie* (formerly *Peerless*), *Copper King*, *Low Pass*, *Butte*, *London*, *Albernie*, and *Montana* groups. The first mentioned is situated on the left bank of Chimdemash creek; the remaining groups are situated between the headwaters of Kleanza creek and the Zymoetz river. A force of three men was employed for six weeks on the *Toulon*, a description of which will be found in the 1929 Annual Report. Besides this work, the company had a force of six men engaged for two months in prospecting its other groups. A description of the *Peerless* and *Montana* and also much general information concerning the mode of mineral occurrence in this region will be found in the 1917 Annual Report. No large amount of work has been carried out since 1917.

Columario Gold Mines, Ltd. This company acquired under option in 1929 the *Valhalla* and *Kleanza* groups. Under the management of John Willman a crew of twelve men was employed from April to September, 1930. The management reports that fairly satisfactory results were obtained and it is expected further work will be carried out in 1931. This property is described in the Annual Reports for 1920, 1921, 1925, 1927, 1928, and 1929; also in the Summary Report, Part A, Geological Survey of Canada.

VALHALLA N°3
L 6749

VALHALLA N°2
L. 6748

L C FRACTION
L 6750

COLUMARIO GOLD MINES. LTD. (N.P.L.)

PLAN OF TUNNELS ON N° 4 VEIN, DAKOTA TUNNEL, OUTCROPS AND OPEN-CUTS.

Scale of Feet:
0 30 60 90 120 150

S 89° 20' E
1500'
PORTAL
El. 2058
12" Quartz Vein outcropping on bluff "Tenderfoot" or "Norman"
NORMAN FR.
L 6751
Dakota Tunnel
Vein N° 6
N 10° 37' E
189.9
PORTAL
El 2016
Tunnel Vein N° 5
Vein 4 ft wide
1950'
2000'
Trail
Vein outcrops
Vein N° 5
Vein not exposed
40°
Vein 18" wide
Blind vein 16" wide
Distance between Veins, 10 ft.
Blind vein 30" wide.
48°
Distance between veins 6 Ft.
40°
Vein 12" wide
Face 30-1
Vein N° 2
Outcrop & Cut
Strike 53° W (True)
El. 1950
PORTAL
El 2015'
2100'
2200'
Crosscut to Vein N°3 not completed, 1 1 30
Lower Tunnel
Outcrop Vein 12" wide
Outcrop Vein 12" wide
Upper Tunnel
Probable Fault
12" Quartz
Vein pinches out
Crosscut to Vein N° 4
Vein N° 4
Face 1-1-30
Quartz N° 5 Vein Dip 40° N.E.
Vein N° 5
40°
10' Quartz
Dyke
Pinches here
Face Jan. 1930
Astro
Approx only
1167.3
568' from portal
N 15° 34' E
PORTAL
(BELTZ)
El. 2108'
Outcrop on bluff Strike S 30° E Dip 60° N.E
El 2100'
Vein N° 3
Vein N° 4
Vein 3 Faults 20'
Vein 4 Faults
El. 2210
Open cut on Vein Strike S 10° E El 2160'
Crosscut to N°3
Open cut Vein 5" El 2267'
Vein 3
Vein pinches
18" Quartz
2300'
Open cut on vein 14" wide Strike S 35° E Dip 55° N.E
El. 2220'
Open cut on vein 30" wide Strike S 25° E Dip 45° N.E
Open cut on 4" vein Strike S 25° E Dip 50° N.E
Quartz Outcrop on face of bluff Strike and dip doubtful Approx S 25° E and 45° N.E
Quartz 30" wide
Quartz 48" wide
Vein is stringer only.
Face 1-1-30
Stringer pinches out
Crosscut to vein 3
Stringer
Face 1-1-30
Face, 1-1-30

With Report of D. Lay
Resident Mining Engineer
Hazelton, B.C. 1930.

B.C. Bureau of Mines.

Some work was carried out on the *Lucky Jim*, Kleanza creek (*see* Annual Reports for 1923, 1928, and 1929), by the owner, Fred Forrest, of Usk; and on the *Diorite*, Pitman (*see* Annual Report for 1929), by the owner, J. M. Dechene, of Pacific.

Promising developments are reported on the *Grotto* group, Pitman, owned by G. Alger, of Usk. It is stated that an attempt will be made to ship ore this winter.

The owners of the *Waverley* group, H. Macdonald and M. Orr, of Pacific, and Russell Smith, of Smithers, with aid from the Department of Mines, constructed a trail to their property from Dorreen. This property is situated at the head of Oliver creek, on the western slope of Seven Sisters mountain, and a description of it will be found in the 1929 Annual Report.

North Fork of Lorne Creek.

Discoveries of gold-bearing quartz veins having been reported at the head of the North fork of Lorne creek, an inspection of this area was made during July. With the aid of the Department of Mines a trail was constructed by A. Martinson, A. Johnson, and N. Lundberg from their base camp, distant about 2½ miles from Ritchie, a flag-station on the Canadian National Railway, to the headwaters of the North fork. The total distance from Ritchie is about 20 miles.

A short distance above its junction with the Skeena river, Lorne creek, flowing almost due east, passes through a short, deep, and narrow canyon. Above this the creek occupies a deeply dissected canyon-like valley, the sides of which are many hundreds of feet in height, for some miles. The valley occupied by the North fork is wider and much less steep, and in the upper reaches of the creek the valley is at least a mile in width and meadows flank both banks.

Numerous rock-exposures show that the area is practically entirely underlain by sedimentary rocks, quartzites, argillites, and conglomerates of the Hazelton series, with frequent intrusions of granodiorite. The sedimentaries are thickly bedded, and the bedding-planes are horizontal or nearly so, save in the vicinity of intrusions. Numerous quartz veins outcrop in the region, which are the undoubted source from which the placer gold of this creek was originally derived. (An account of the buried ancient channel near the mouth of Lorne creek will be found in this report under "Placer-mining.") All the veins, with one exception, were in the sedimentaries, the exception being in granodiorite. The widest vein noted was 3 feet, and the mineralization, which was sparse (save in the case of the vein in granodiorite), consisted of chalcopyrite, galena, zinc-blende, and pyrite. Generally speaking, the veins are entirely characteristic of a placer-gold region. No good gold values were noted, although there is no reason why further prospecting should not result in the discovery of such. Further, it is to be noted that good gold values were reported in one vein in the region, which unfortunately was covered with snow on the date of inspection, July 16th. Porcupine creek, which rises in this region, would seem to be well worth prospecting, especially near its headwaters.

Occurrences of graphitic, coal-like beds, classed as super-anthracite, but of little value as fuel, are not by any means uncommon in the Hazelton sedimentaries. One such, discovered by A. Martinson, situated on a small south-easterly-flowing tributary of the North fork, was examined. The location is about 6 miles distant from the head of the North fork. Exposure was by natural agencies and it was not possible to form an opinion of the width. A selected sample yielded the following analysis: Moisture and volatile matter, 6 per cent.; fixed carbon, 59.4 per cent.; ash, 34.6 per cent.

Bermaline and Granite. These groups are owned by A. Martinson, A. Johnson, and N. Lundberg, of Ritchie, who have carried out much painstaking prospecting in this region. The groups are situated at the head of Lorne creek and its tributary, North fork. The showings lie between elevations 4,820 and 5,420 feet above sea-level. The region is immediately east of Goat mountain, at the western extremity of the Omineca Mining Division; in fact, some of the claims are situated in the Skeena Mining Division. Mineral-showings inspected on these groups consist of quartz veins varying in width up to 3 feet, sparsely mineralized with chalcopyrite, galena, zinc-blende, and pyrite, the country-rock being sedimentaries of the Hazelton series, and one a shear-zone of maximum width 2½ feet in granodiorite, well mineralized with chalcopyrite and stained with copper carbonates.

Close to the divide between the North fork and Douglas creek on the *Bermaline* group at elevation 4,850 feet a shear-zone about 6 feet wide strikes N. 87° E. (mag.), dips south-east at 75°, and shows a quartz-seam 1 foot wide on the foot-wall and another narrower seam of quartz on the hanging-wall. Mineralization consists mainly of chalcopyrite, galena, and pyrite. A sample of selected mineral assayed: Gold, 0.03 oz. to the ton; silver, 1.4 oz. to the ton;

lead, 3.5 per cent. About 250 feet south-west of the above a very sparsely mineralized quartz vein is exposed by natural agencies at intervals for 150 feet. This strikes S. 23° E. (mag.) and dips steeply south-west. An assay of the best portions showed only traces of gold, silver, and copper. In the more immediate vicinity of the above exposures there is stated to be another vein which shows good gold values, but which was covered with snow on the date of inspection.

On the north slope of the steep mountain ridge between the North fork and Lorne creek, at 5,420 feet elevation, there is exposed in granodiorite, largely by natural agencies, a shear-zone about 2½ feet in width well mineralized with chalcopyrite. This strikes S. 80° E. (mag.) and dips north-east at about 40°. A sample across 2½ feet at the point of best mineralization assayed: Gold, 0.05 oz. to the ton; silver, 4.7 oz. to the ton; copper, 4.3 per cent.

The owners of this property did good work in constructing a pack-trail from their base camp near Ritchie to the headwaters of the North fork, which is of great general utility.

Ritchie.

Canadian Swede. This property, owned by A. Johnson, of Ritchie, is situated close to the base camp of the owners of the above-mentioned *Bermaline* and *Granite* groups, about 2½ miles from Ritchie flag-station. A description of this property will be found in the 1928 Annual Report, since when further work has been done by the owner.

The adit-drift at 630 feet elevation has been advanced a total distance of about 100 feet. At 50 feet from the portal another vein joins that hitherto followed and the strike changes somewhat from this point onwards; the tunnel appears to be in the foot-wall of the vein at the face. A sample of quartz mineralized with pyrite taken near the face showed upon assay traces only of gold and silver.

About 500 feet north-west of the portal of the tunnel, at a somewhat higher elevation in the bed of an unnamed creek, a shear-zone, of which the exposed width is 12 feet, occurs in quartzites underlain by argillites. Small quartz-seams follow the bedding and jointing planes and are also ribboned through the country-rock. In places the quartz-seams show a little copper-stain and molybdenite. A sample of the best mineralized portions assayed: Gold, 0.02 oz. to the ton; silver, 1.8 oz. to the ton. This sheared zone strikes N. 80° W. (mag.) and dips south-west at 60°.

Black Bear. This group, owned by A. Johnson, of Ritchie, is situated on the left bank of Lorne creek, about half a mile above the canyon. At several points on this group of eight claims are exposed by natural agencies quartz veins which cross the creek approximately at right angles, striking N. 20° W. (mag.) and dipping north-east at an angle of about 45°.

One such vein is exposed by a small open-cut at elevation 1,340 feet. The enclosing rocks are sedimentaries of the Hazelton series. The vein varies from 1 to 2½ feet in width and is mineralized with copper pyrites and copper-stain. Some small stringers branch from the vein. A sample of selected portions of the quartz assayed: Gold, 0.01 oz. to the ton; silver, 1.3 oz. to the ton; copper, 1.1 per cent.

Silver Sisters. Much prospecting was done by the owners, F. McLean and W. Moberley, of Cedarvale, on this property. New discoveries were reported which could not be inspected owing to lack of time. The property is situated on Coyote creek, near Cedarvale.

Morning Star. This property, owned by D. C. McGregor, of Woodcock, is described in the Annual Reports for 1927 and 1929, to which reference is invited. Further work was done by the owner during the year, consisting of surface pits sunk at the fringes of the batholithic stock. These show well-mineralized rock, mineralization consisting mainly of arsenopyrite and pyrite, but assays of samples taken at the time of inspection did not show appreciable values in gold or silver in pits sunk this year. Much painstaking work is carried out each year by the owner and the region is generally one of undoubted geologic promise.

HAZELTON SECTION.

Rocher Déboulé Mountain.

Rocher Deboule. An option on this property was obtained by Hazelton Copper Mines, Limited, and small-scale operations were commenced early in the year under the direction of W. S. Harris. It was hoped by the management that it would be found possible by selective mining methods and by close hand-sorting to ship at a profit ore

from No. 2 vein and any remaining surface ores from the No. 4 or Main vein. That there were grounds for such anticipation, under metal prices prevailing at the time the idea was entertained, is supported by the fact that, in 1929, 72 tons of hand-sorted ore was shipped from this property (by Aurimont Mines, Limited), assaying: Gold, 0.14 oz. to the ton; silver, 40 oz. to the ton; copper, 4 per cent. This shipment was made in midwinter, when conditions were very unfavourable for close sorting. Shortly after repairing the surface gravity-tram, and before any actual mining operations had been commenced, the material declines in the prices of copper and silver compelled cessation of operations by Hazelton Copper Mines, Limited.

In the 1918 Annual Report will be found a report on this property which gives essentially the position at the present time.

Summit, True Blue, and Black Pilot.

These claims are situated at the headwaters of Mud and Porphyry creeks, on the north-eastern slopes of Rocher Déboulé mountain, and are owned by Dan MacDonald, of Hazelton. They are situated in the immediate vicinity of the contact of granodiorite with the sedimentaries and volcanics of the Hazelton series. On the *Summit* claim, on a small tributary of Mud creek, at elevation 4,500 feet, a vein of average width of 3 feet, striking north and south (mag.) with steep dip, is exposed by open-cut on the left bank of the creek and followed into the right bank of the creek by a tunnel 40 feet in length. The vein is fairly well mineralized in places with arsenopyrite. A sample of selected portions of the vein assayed: Gold, 0.08 oz. to the ton; silver, 1.10 oz. to the ton.

On the *True Blue* claim, situated on the left bank of a small tributary of Porphyry creek at elevation 4,600 feet, an open-cut, somewhat caved at the time of inspection, exposes pyritized volcanics. The total width over which mineralization extends is said to be 16 feet. A sample of the most heavily mineralized portion assayed: Gold, trace; silver, 0.16 oz. to the ton. A sample of another portion of volcanic rock showed upon assay a trace of copper.

On the *Black Pilot* group, situated at the headwaters of Porphyry creek, on the left bank of the latter, the country-rock is mainly argillite with a certain amount of interbedded volcanic rock, intruded by tongues of granodiorite. The argillites are pyritized, and oxidized on the surface over a wide area. Workings consist of various open-cuts, an inclined shaft about 40 feet in depth, and a short tunnel. These workings are situated at elevations of somewhat over 5,000 feet. On the *Black Pilot No. 2* claim two samples were taken from open-cuts in the pyritized argillites, but only traces of gold and silver were disclosed by assay. A sample taken from a highly oxidized seam in the inclined shaft showed upon assay a trace only of gold and silver.

On the *Black Pilot No. 1*, at elevation 4,910 feet, a tunnel is run a distance of 15 feet, following a granodiorite tongue which shows a little pyrrhotite and a very small amount of copper-stain. A sample of the more heavily mineralized portions assayed: Gold, trace; silver, 0.16 oz. to the ton. At the request of the owner this last sample was assayed for tin, with negative results. Refer also to the Annual Report for 1926, under "MacDonald Properties," pages 126 and 127.

Smithers Section.

Hudson Bay Mountain.

Duthie Mines, Ltd.

Owing to depressed metal-market conditions operations were suspended entirely by Duthie Mines, Limited, in March. A feature of the year's developments at this property was the very fine surface showing on the *Henderson* vein uncovered on the recently acquired *Canary* claim. At one point of particular promise, at 4,700 feet elevation, samples taken by the company's staff average: Gold, 0.11 oz. to the ton; silver, 16 oz. to the ton; lead, 11 per cent.; zinc, 9 per cent., over a width of 91 inches. On page 108 of the 1922 Annual Report will be found a map showing the position of the recently purchased *Humming Bird* and *Canary* claims.

Mayflower.

This group, owned by L. S. McGill and associates, of Smithers, immediately adjoins the *Canary* claim on the north-east. An account of it will be found in the 1929 Annual Report. During the year the owners exposed by open-cut on the *Canary Fraction* claim of the group, at elevation 5,010 feet, at a point about 550 feet north-east of the upper open-cuts on the *Canary* claim of Duthie Mines, Limited, what is presumed to be the continuation of the *Henderson* vein. The open-cut is 25 feet in length, and

of this a length of 20 feet is sparsely mineralized with galena, zinc-blende, and pyrite. A sample of the best mineralized portions assayed: Gold, 0.04 oz. to the ton; silver, 1.6 oz. to the ton; lead, *nil;* zinc, 5.6 per cent.

Victory. Further work on this group was done during the year by the owner, D. C. Simpson, of Smithers, with, it is understood, gratifying results. Recent sampling of this property by examining engineers has demonstrated the presence of noteworthy gold values in the northern portion of the Main vein.

Glacier Gulch. This property, owned by S. F. Campbell, Grover Loveless, and Wesley Banta, of Smithers, was the scene of an interesting discovery of auriferous telluride of bismuth in 1929. Much further work in the form of open-cuts was done during the year by the owners to better expose the various bismuth-showings.

The mineral was identified as tetradynite (telluride of bismuth) by the Bureau of Mines. Some specimens are highly auriferous, as shown by the following assay of a selected sample: Gold, 13.2 oz. to the ton; silver, 1.8 oz. to the ton; bismuth, 5.2 per cent. Samples, however, indicate a wide variation in the gold ratio to the unit of bismuth. The occurrence of this mineral in immediate juxtaposition to coal is of noteworthy interest. The host-rocks are the sedimentary members which enclose the near-by Lake Kathlyn anthracitic coal-seams. In the vicinity of the bismuth mineralization the quartzites and argillites are in places intensely pyritized, but the bismuth occurs exclusively in white-coloured irregular zones of replacement and alteration which cross the sedimentaries. An analysis of this white-coloured rock shows it to consist of essentially silica, alumina, and calcium carbonate. The width of these replacement zones varies from several feet to a few inches only, within a distance of a few feet. At the time of inspection on June 24th open-cuts made by the owners within a vertical range of 160 feet and a horizontal range of 500 feet had exposed the bismuth mineralization at eight different points. The widths of the white alteration zones varied from a few inches, showing but little bismuth, to a width of 7½ feet, showing a good mineralization. A sample across the best exposure, 7½ feet wide, assayed: Gold, 0.43 oz. to the ton; silver, 0.10 oz. to the ton; bismuth, 2 2 per cent. This property well merits further development. Refer also to the Annual Reports for the years 1926, 1927, 1928, and 1929.

Smithers Copper. This group is owned by R. C. Mutch and associates, of Smithers. A description will be found in the Annual Report for 1929. During the year a winze was sunk a few feet in the floor of the short tunnel 20 feet in length, mentioned in the 1929 Annual Report. This disclosed a sparse mineralization of chalcopyrite and bornite in a sheared zone 6 feet in width. An open-cut below this tunnel to intercept the downward continuation of this mineralization was contemplated by the owners.

Babine Mountain.

Rainbow. This group is owned by Jas. Wright and associates, of Smithers. Its exact location is shown on the map on page 166 of the 1928 Annual Report. On this property are several shear-zones exposed by open-cuts and short adit-tunnels. While no noteworthy continuity of these has so far been proved, the mineralization, which consists of pyrite, chalcopyrite, and tetrahedrite, shows good gold and silver values and encourages further development. The strike of these shear-zones varies from about N. 55° E. (mag.) to N. 87° E. (mag.); dips vary from north-west to south-east. The contour of the hill is such that they can be developed by adit-drift, although in places the covering of drift is heavy.

A new vein was discovered during the year, somewhat south of those previously found. On the date of inspection on June 17th this had been followed from the surface by a short adit-drift 15 feet in length at elevation 4,085 feet. Only a narrow seam of chalcopyrite showed in the face. The strike of this vein is N. 87° E. (mag.) and the dip is to the north-west at a steep angle. A selected sample of mineral taken by the owner from this tunnel assayed: Gold, 2 10 oz. to the ton; silver, 36 oz. to the ton; copper, 14.3 per cent. Refer also to the 1929 Annual Report.

Judges. This group, owned by J. S. Kelly and G. Gazely, of Smithers, adjoins the *Rainbow* on the north-east. At 4,485 feet elevation, two strong-looking, apparently parallel, shear-zones are exposed, striking N. 55° E. (mag.) and dipping south-east into the hill. An open-cut, now partly caved, shows one to be well mineralized with copper-stain, chalcopyrite, and tetrahedrite. A sample taken at this point in 1921 by

John D. Galloway, then Resident Engineer, assayed: Gold, trace; silver, 13.6 oz.; copper, 5.4 per cent., across a width of 4½ feet. This showing would seem to merit further work. Refer also to the Annual Report for 1921, under "*Rainbow*."

Silver King. A company was incorporated during the year for the operation of this property—namely, Omineca Silver King Mining Company, Limited. Small-scale operations were carried on by this company during the year, with, it is stated, distinctly successful results. It is the stated intention of this company to continue operations during the winter.

Victoria. Further work was done during the year by Lorraine Copper Silver Mines, Limited, comprising, it is stated by the management, continuation of the cross-cut tunnel and surface work on the West vein. The result of the latter is stated to be encouraging.

Four Lakes and Silver Saddle.—The owners of these groups, B. F. Messner and A. T. Harrer, of Smithers, state that they carried out further work with encouraging results.

Harvey.—This property is owned by C. G. Harvey and associates, of Smithers. Some further work was carried out by R. L. Gale, of Smithers.

Telkwa Section.

Cronin Mine. On this property small-scale operations were carried out by Babine Bonanza Metals, Limited. It was not possible for the Resident Engineer to visit this property during the year, but an account of the satisfactory results gained is given by George McBean, foreman, as follows:—

"In No. 2 tunnel (No. 2 vein) a raise was started at a point about 100 feet south of the main tunnel. The distance raised was 40 feet. Good ore was continuous and a width of 38 inches shows in the back of the raise.

"Tunnel C (No. 2 vein) was continued south-west for about 45 feet, striking a width of 16 inches of clean ore.

"Tunnel B was continued about 160 feet and showed ore all the way about half-way up the face. Ore has recently shown over the full height of the drift, the face of which shows a width of 20 inches of clean sulphide ore.

"The junction of Nos. 1 and 2 veins appears to take place near the face of tunnel No. 1. It would appear a promising piece of development to follow south of this junction in anticipation of finding an ore-body south of the junction."

Refer also to the Annual Reports for the years 1917, 1920, and 1929, also to Geological Survey of Canada, Summary Report, 1924, Part A. These reports contain complete descriptions of this property.

The trail to Hunter basin was badly damaged by floods during the year. O. A. Riegle, of Telkwa, was engaged in repairing the trail to his properties in this basin.

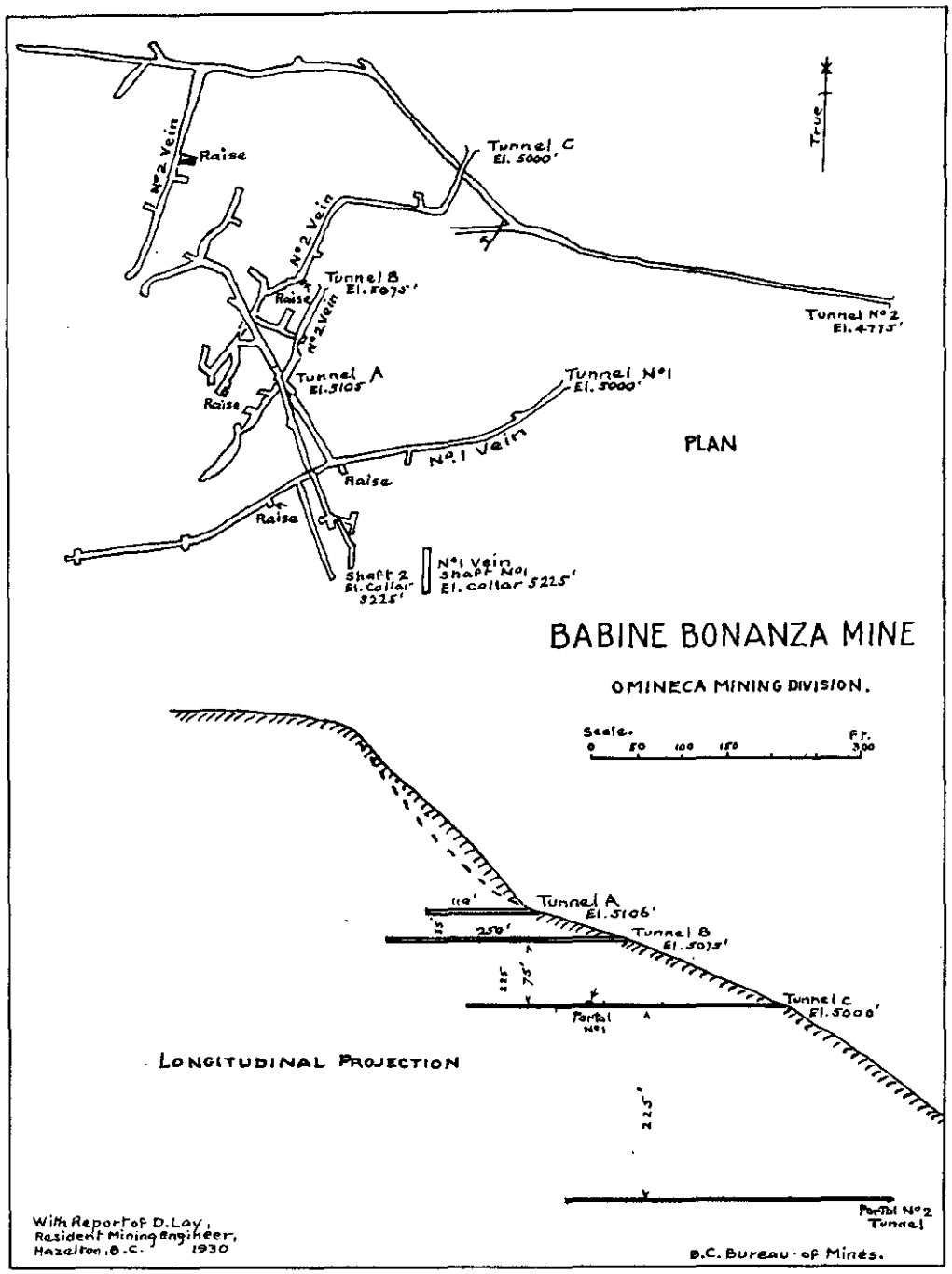
Houston Section.

Owen Lake Mining and Development Co., Ltd. The option on the controlling interest in this company was relinquished by Noah Timmins early in the year. As a result of the efforts of the late Frank H. Taylor, development was resumed at this property in March, some diamond-drilling being carried out. Operations were suspended entirely shortly after the regrettable death of Mr. Taylor on April 27th. Refer also to the Annual Reports for 1928 and 1929, and to Geological Survey of Canada, Summary Report, 1929, Part A, page 62 *et seq.*

Morice Mountain.

Morice mountain is distant in a straight line about 11 miles south-west of Houston and is situated between the Morice river and Peacock creek, a tributary of the former. The mountain is roughly elliptical in shape and its major axis trends approximately due north and south. The country-rock consists of volcanics and sedimentaries intruded by diorite and granodiorite, and, generally speaking, the region is favourable for lode-mineral occurrence.

Considerable prospecting has been done by R. J. Douglas on the western slopes of the mountain, and by N. Morrison, J. Quinn, and Frank Madigan on the eastern slopes and in the vicinity of Peacock creek.



Sholto. This claim is situated on the south-western slopes of Morice mountain and is owned by R. J. Douglas, of Houston. On the right bank of Douglas creek are exposed thinly bedded dark-grey limestones, much epidotized from a near-by intrusion of granodiorite. Small seams of chalcopyrite occur in the limestone and copper-staining is somewhat in evidence. A sample of selected portions of the seams assayed: Gold, 0.03 oz. to the ton; silver, 1.8 oz. to the ton; copper, 4.9 per cent. The limestone strikes N. 27° E. (mag.) and dips steeply south-east.

Croesus. This claim lies somewhat south of the *Sholto* at a higher elevation and is also owned by R. J. Douglas. At an elevation of 3,800 feet occurs an exposure of granodiorite mineralized with chalcopyrite. A sample of the best mineralized portions assayed 0.3 per cent. copper, but no gold or silver values. At a somewhat higher elevation alaskite outcrops. This is well pyritized and shows a trace of copper, but assay of a sample failed to disclose more than a trace of gold and silver.

Subsequent to inspection of this property on May 19th further discoveries were reported by the owner, which have not yet been inspected.

Black Hawk. This group, owned by Frank Madigan, of Houston, is situated on the eastern slopes of Morice mountain on a tributary of Peacock creek. At the time of inspection on July 3rd the creek was too high to enable the workings to be inspected. The workings consist of a short tunnel run in the left bank of the creek at elevation 4,560 feet on a bearing N. 60° W. (mag.), and about 500 feet distant from this tunnel at elevation 4,660 feet a shallow shaft sunk on the right bank of the creek. Both workings were under water on the date of inspection. The country-rock in the vicinity consists wholly of andesitic volcanics, which are sheared and pyritized in places, and slightly mineralized with copper where sheared. Minerals observed were pyrite, chalcopyrite, copper carbonate, and specularite.

A sample of selected mineral taken near the collar of the shaft assayed: Gold, 0.04 oz. to the ton; silver, 2.4 oz. to the ton; copper, 0.8 per cent.

O.K., Hazelton, Morrison, Quinn, and Bull Moose. These groups, situated on and near Peacock creek, are owned by J. Quinn and N. Morrison, who spent the season prospecting in this area. Showings on these claims were not inspected as they were discovered after the visit of the Resident Engineer to the region. It might be mentioned, however, that on the *Copper King* claim, a member of one of these groups, crystals of amethystine quartz were observed in cavities in the volcanic rocks on the left bank of Peacock creek.

Bellefield. Some further work was done by R. Hayes, of Houston, the owner, on the *Risk* and *Hope* claims of this group, which are described in the 1928 Annual Report. The nature of the topography and heavy drift-cover render the following-up of the mineral-showings laborious. This group is situated on the ranch owned by R. Hayes, and the showings are close to the Houston–Wistaria road and are distant about 10 miles from Houston.

Lucky Day. This claim, owned by W. H. Simpson, of Hazelton, is situated on the southern slopes of the mountains east and north of Houston. A trail to the property leaves the main highway between 3 and 4 miles east of Houston. A cabin has been built on the property at elevation 2,950 feet, and somewhat above this open-cuts in the amygdaloidal volcanic country-rock disclose a sparse copper mineralization. Further prospecting of the surface seems advisable before doing any more work on the showings inspected. At elevation 3,595 feet, on neighbouring ground owned formerly by A. Martinson, a timbered shaft is sunk 20 feet on a strong-looking shear-zone striking N. 50° W., with steep dip. Full width of the shear-zone could not be determined from exposures, and it was not possible to get down the shaft with the means available. A dump at the collar of the shaft shows some promising mineral consisting of chalcocite, bornite, azurite, and malachite. A sample of selected pieces from the dump assayed: Gold, 0.03 oz. to the ton; silver, 13 oz. to the ton; copper, 11.9 per cent.

Topley Section.

Golden Eagle. The owners of this property, C. Matheson and D. Heenan, of Topley, have done a large amount of surface work during the year. This comprised pits, open-cuts, and stripping, to better expose the new vein discovered by them in 1929 and mentioned in the Annual Report for that year. The new vein is nearly parallel to that on which work was previously done, and is distant from the latter about 70 feet in a southerly direction, and dips in the same direction, but at a much steeper angle.

When inspected on June 12th, various pits and one shaft 21 feet in depth had been sunk on the outcrop of the new vein at various points over a length of 355 feet. In all of these was exposed high-grade mineral consisting of galena, zinc-blende, and grey copper, varying in width from a few inches up to 18 inches and occurring mainly on the foot-wall of the vein. The shaft,

21 feet in depth, which is situated directly opposite the main shaft in the original vein, showed a total vein-width of 5.2 feet. Of this width, 6 inches of high-grade material occurred on the foot-wall, the remainder consisting of quartz and crushed country-rock. There seemed to be a tendency for the quartz to widen in depth. The pitch of the vein was 70° to the north-east and strike N. 66° W. (mag.).

A sample of the foot-wall seam from the shaft assayed: Gold, 0.34 oz. to the ton; silver, 820 oz. to the ton; copper, 7.5 per cent.; lead, 14 per cent.; zinc, 16 per cent. A sample from the shaft across the full vein-width, excluding the rich foot-wall seam, assayed: Gold, 0.02 oz. to the ton; silver, 4 oz. to the ton; lead, *nil;* zinc, 3.6 per cent. A sample from a pit 270 feet south-east of shaft across 9 inches assayed: Gold, 0.32 oz. to the ton; silver, 300 oz. to the ton; lead, 20 per cent.; zinc, 8 per cent.

There is also evidence of the existence of branch veins, and in view of the fact that on the *Box* group, which adjoins this property on the south-west, there are two veins parallel to the veins of the *Golden Eagle* group, it seems quite possible that there may be another vein or veins south of those already discovered on the latter. It is a point which should be borne in mind when underground development is undertaken. The flat topography and mantle of drift render surface prospecting slow and laborious.

Much credit is due the owners of this property for the important results gained in a comparatively short time after operations were suspended by Topley Silver, Limited. Refer also to the Annual Reports for the years 1927, 1928, and 1929.

Evergreen. This group is owned by L. Kylling and B. McCrea, of Topley. L. Kylling was engaged during the year in running a tunnel following a shear-zone 6 feet in width in volcanic country-rock, striking N. 35° W. (mag.) and dipping north-east at about 67°. The filling consists of much altered and silicified country-rock and shows in places a little galena and chalcopyrite. On the date of inspection, June 18th, the tunnel had been advanced a distance of 50 feet from the portal. This tunnel is situated on the northern slopes of Huckleberry mountain and is about 400 feet vertically below the other showings on this property, which are described in the 1928 Annual Report.

L. Kylling has displayed ingenuity in constructing a thoroughly serviceable mine-car, with rollers instead of wheels, running on a wooden track. This was made almost entirely from timber growing on the property, and it might be noted that this type of car was made by the pioneer placer-miners of the Cariboo.

Gold Pot. This group is owned by J. Mulholland, of Topley, and is situated on the western slopes of Huckleberry mountain. At elevation 4,365 feet the owner has done a very large amount of trenching to expose the country-rock, a sheared and altered volcanic porphyry breccia, in the hope of finding the place of origin of some highly pyritized float found at this point on the surface. The float may, however, have originated from a distant point; moreover, assay of a portion of it showed no values in gold, silver, or copper.

About 600 feet south of the point of trenching a shaft has been sunk to a depth of 24 feet, it is stated, in pyritized and oxidized volcanics. The shaft was under water on the date of inspection, but a sample from the dump upon assay disclosed only traces of gold and silver.

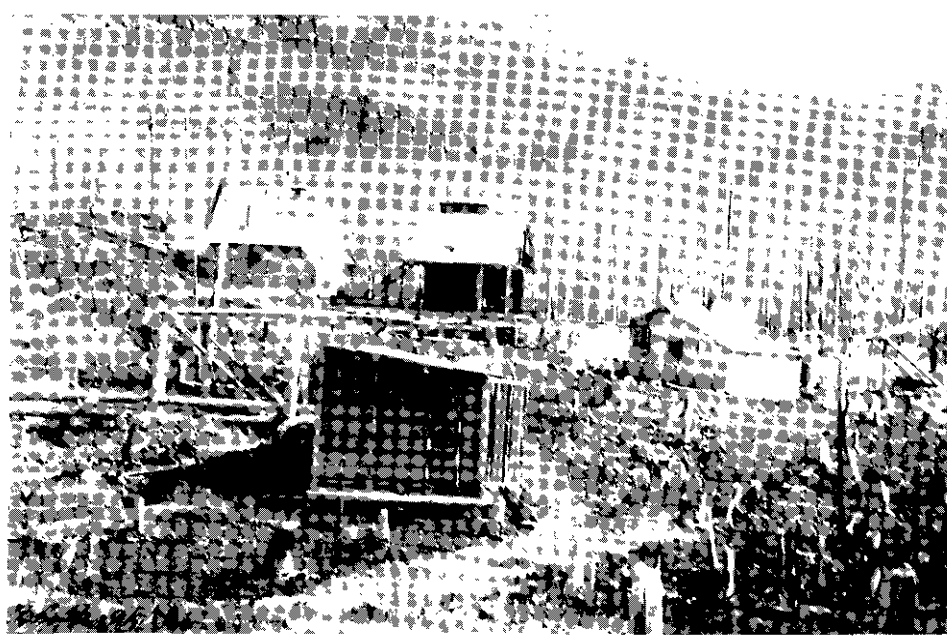
Cup. This group, owned by Matthew Sam, of Topley, is described in the Annual Reports for the years 1924, 1927, and 1928. A new discovery was made by the owner during the year. This consists of a flat-dipping vein 4 feet in width, exposed by open-cut at elevation 3,665 feet on the left bank of Richfield (Findlay) creek, and distant about 500 feet in an up-stream direction from the original workings on this property. The vein-filling consists of oxidized gangue-matter and on the hanging-wall a seam of galena, zinc-blende, and grey copper a few inches in width occurs. Further work was required to form an opinion as to the strike at the date of inspection. A sample of the best mineral showing assayed: Gold, 0.04 oz. to the ton; silver, 117 oz. to the ton; copper, 4 per cent.; lead, 24 per cent.; zinc, 4 per cent.

Jack Rabbit. This group, owned by Matthew Sam and Johnny Davis, of Topley, is described in the 1928 Annual Report. The property was under option to the late F. H. Taylor in 1928, and in that year a drift was run a distance of 75 feet on a bearing S. 65° E. (mag.) into the left bank of the creek following the promising exposure of mineral on the surface. The results gained by this drift were disappointing, and the owners

Lorne Creek, Omineca M.D.

Rainbow Claim, Takla Lake, Omineca M.D.

Driftwood Claim, Takla Lake, Omineca.



Golden Eagle Mine, Topley, Omineca M.D.

this year ran a crosscut north from the face for a length of 36 feet to explore the foot-wall, but without noteworthy result.

About 800 feet down-stream from the above workings, on the left bank of the creek, the owners uncovered some copper-stained rock, which shows also some chalcopyrite, although mineralization is rather sparse. A sample of selected portions assayed 1.2 per cent. copper, but showed no gold or silver values, whereas the gold content of the chalcopyrite was a noticeable feature of the mineral exposed higher up the creek, and justifies further prospecting.

Joker. This group, owned by B. Ailport, O. Kalhood, G. V. Watson, and associates, of Topley, is situated on the left bank of the West fork of Ailport creek. A trail leads to the property from G. V. Watson's ranch, from which it is distant about 4 miles. Watson's ranch is situated somewhat east of Topley.

At elevation 3,715 feet a tunnel is run in a direction N. 65° E. (mag.) a distance of 25 feet in coarsely crystalline feldspar porphyry breccia to intercept the downward continuation of a vein outcropping 80 feet vertically above this point, and striking N. 20° W. (mag.) and dipping steeply north-easterly into the hill. The vein is 1.5 feet in width and the gangue consists almost entirely of barite. Mineralization consists of chalcopyrite mainly. A sample of this vein assayed: Gold, trace; silver, trace; copper, 1.8 per cent.; lead, *nil.*

A few feet above this vein is a smaller seam of barite slightly mineralized with chalcopyrite, 4 to 8 inches in width. The crosscut tunnel mentioned requires to be driven some considerable distance yet to reach its objective. The larger vein of the two mentioned is exposed at several points south on the left bank of the creek. Some distance south of the tunnel, at elevation 3,765 feet, an open-cut exposes a shear-zone in the volcanics 8 feet in width, with seams of barite, slightly mineralized with chalcopyrite, parallel to the walls. Appreciable mineralization is, however, confined to a seam of barite 2 feet in width on the hanging-wall.

Burns Lake Section.

Three Star. This group, owned by V. Schjelderup, P. Sandnes, and K. Nysven, is situated on Boo mountain, about 2 miles south-east of Palling Station. Both the Canadian National Railway and the Provincial highway are situated at the base of this mountain, north-east of the latter. This property was optioned last year by Topley-Richfield Mining Company, and operations were carried on under the direction of J. C. McCutcheon until March 9th of this year, when the option was relinquished.

The mode of mineral occurrence is that of a sheared zone in andesitic volcanics between 20 and 25 feet in width. This was shown by numerous open-cuts to have a length of 300 feet on the surface. Minerals present are chalcopyrite, pyrite, and specularite, with a considerable amount of quartz. This shear-zone strikes N. 80° W. (true) and dips steeply into the mountain at an angle of about 80°. A crosscut tunnel of a total length of 180 feet was run, penetrating the shear-zone at a depth of between 50 feet and 85 feet below the line of open-cuts on the surface. The direction of the crosscut is somewhat west of south. This crosscut exposed on the foot-wall a width of 4.2 feet of fairly well-mineralized quartz and country-rock; a sample across this assayed 1.2 per cent. copper and traces of gold and silver. On the hanging-wall was exposed a similarly mineralized width of 3.2 feet; a sample across this assaying: Gold, trace; silver, 0.2 oz. to the ton; copper, 2 per cent. The ground between the foot- and hanging-wall mineralizations is sparsely mineralized.

This property is very favourably situated for economic mining. Broadly speaking, the mineralization parallels the railway-track, above which it is situated somewhat under 1,000 feet. Under normal financial and metal-market conditions this property would seem to warrant some further development. Refer also to the Annual Report for 1929.

Gamble. This group, owned by W. J. C. Cummins, of Calgary, appears to be a relocation, in part at any rate, of the *Cymric* (*see* Annual Report for 1925). It is distant about 1½ miles north of the *Mona* group and is situated on a hill known locally as Bald hill, lying north-west of and close to the west end of Tchesinkut lake. This hill rises to a height of about 500 feet above the surrounding country. As the name implies, this hill is devoid of timber, but its slopes are grass-covered, and outcrops of diabasic volcanic rock are of frequent occurrence. At or near the summit and on the northern slopes are to be found considerable amounts of quartzose float, some pieces of which contain galena, zinc-blende, pyrite, and copper-stain. Occasionally pieces of float may be found containing quite large amounts of

the minerals mentioned, but, considering the float as a whole, the proportion of mineral to gangue is small.

Last year a considerable amount of trenching was carried out on the summit of the hill and on the northern slopes when the property was under option to the late F. H. Taylor. It is understood that this work failed to disclose evidence of any vein in place, the purpose of this work being to endeavour to find the origin of the float previously mentioned. At the time of inspecting this property, May 2nd, all these trenches had been filled in to avoid chance of injury to grazing cattle. It was seen, however, that trenching is in place quite extensive and has in general a magnetic north-and-south direction.

About 100 feet below the summit of this hill on the south side, a tunnel known as "Newman's tunnel," 20 feet or so in length, appears to crosscut a vein between 2 and 3 feet in width near the portal, striking N. 45° E. (mag.), and the north-easterly continuation of this vein would seem to be exposed by an open-cut 150 feet distant and farther up the hill. This vein is a quartz vein mineralized with galena, zinc-blende, and copper-stains. A sample of the best portions of it assayed: Gold, 0.04 oz. to the ton; silver, 1.6 oz. to the ton; lead, 1.6 per cent.; zinc, 2 per cent. It is possible that the float on the north slope of this hill originates from a vein of similar strike to this at or near the summit of the hill. Such a vein might be discovered by systematic trenching at right angles to this strike. At the same time the amount of work justified in connection with an attempt to find the origin of the float depends upon the values in the latter. First-hand evidence secured by the Resident Engineer does not indicate high values, and it is problematical if the vein from which originated the float is any better than that mentioned, which has been already exposed by Newman's tunnel, and upon which the owner might do a little more work.

Red Mine. This group is owned by J. R. Stanyer, of Francois Lake, and is situated on Nourse creek, which flows into Francois lake on the north side of the latter, about 9 miles west of the ferry-landing. In its upper reaches Nourse creek has cut down to a depth of several hundred feet through highly oxidized volcanic rocks, vesicular and amygdaloidal lavas, and breccias, which have weathered in places to picturesque pinnacles. Lithification of these rocks suggests Tertiary age. Numerous calcite-seams cut across the beds and the breccias contain much biotite. An open-cut on the left bank of the creek close to water-level exposes a bed of decomposed breccia stained red and crimson, showing much biotite and some pyrite. Samples taken in two places from these decomposed volcanic beds failed to disclose appreciable values in gold or silver.

Wee McGregor. This claim, owned by J. Roberts, of Francois Lake, is situated south of Francois Lake and is distant about half a mile south of Danskin Post-office. In well-lithified andesitic volcanics occur several small, more or less parallel, veins of the shear-zone type within a belt of country-rock about 350 feet in width. These strike from N. 37° E. (mag.) to N. 60° E. (mag.). Mineralization consists of chalcopyrite with small amounts of galena and zinc-blende. These minerals also follow to some extent small cracks in the country-rock and also occur as a sparse dissemination. The best exposure of mineral is that in a shear-zone 2½ feet in width, which shows two small seams of mineral. A sample from the foot-wall seam 6 inches in width assayed: Gold, 0.02 oz. to the ton; silver, 0.56 oz. to the ton; copper, 1.7 per cent.

About half a mile north-east of the foregoing, in the bed of a small creek flowing into Francois lake, there is exposed a bed of rhyolitic rock, much pyritized. Assay of a sample disclosed traces only of gold and silver.

Golden Glory. This group is owned by W. Reed and R. H. Gerow, of Burns Lake, and is situated on Reed creek, which flows into Decker lake from the south, about opposite the settlement of Decker Lake, situated on the north shore of the lake. Work done since that described in the 1927 Annual Report indicates that a somewhat wide belt of the volcanic country-rock in the region of the oldest workings on this property (which lie to the north of those described in the 1927 Annual Report) is mineralized with copper. The exact width of this belt, likewise its commercial possibilities, remain to be determined by future work, but investigation is merited.

A width of about 125 feet of country-rock appears to be sheared in a direction N. 80° E. (mag.) and to be well mineralized in places with chalcopyrite and copper-stain. The oldest workings on the property are within this belt and comprise two tunnels, one of which is caved

and the other is stated to have yielded a shipment of ore in 1915. The latter is 35 feet in length and shows a mineralized shear-zone in the face. Near the caved tunnel an open-cut shows a fair mineralization of chalcopyrite. About 100 feet north of the caved tunnel a new tunnel has been started a short distance above the creek-level on a south-westerly bearing to crosscut the mineralized belt mentioned. This has advanced a distance of 52 feet and appears to be just entering the northern limit of the latter. About 450 feet distant in an easterly direction from the portal of this tunnel on the opposite side of Reed creek, George Culp has run an open-cut 80 feet in length in a direction S. 30° E. (mag.) on his adjoining property, and the face of this cut shows evidence of copper mineralization.

A sample of selected portions of chalcopyrite from a surface open-cut near the caved tunnel mentioned above assayed: Gold, 0.02 oz. to the ton; silver, 5.6 oz. to the ton; copper, 10.5 per cent. Refer also to Annual Reports for 1926 and 1927.

Silver Glance.

This claim is owned by J. C. McLean, of Burns Lake, and immediately adjoins the *Golden Glory* on the south. On the left bank of Reed creek, just above the creek-level and about 65 feet up-stream from the *Golden Glory* workings on the right bank, a tunnel has been run 85 feet in a direction S. 75° W. (mag.), following a vein mineralized with galena, zinc-blende, and chalcopyrite. At 40 feet from the portal a south crosscut shows a width of 2 feet, in which are seams of the minerals mentioned. A sample of selected portions of this mineral assayed: Gold, 0.02 oz. to the ton; silver, 3.1 oz. to the ton; lead, 29.8 per cent.; zinc, 18.2 per cent. A short distance beyond the crosscut a fault interrupts the vein and no mineral shows in the tunnel for a further 20 feet. A southerly branch tunnel near the face of the main working shows a narrow seam of zinc blende.

Vanderhoof.

Tremolite.—An interesting occurrence of this mineral was brought to attention by George Ogston, of Vanderhoof, to whom samples had been handed in by Indians who originally made the discovery.

The showings lie about 15 miles in a direct line approximately due south of Vanderhoof, somewhat to the east of the 124th meridian. A car can be got to within about 8 miles of the exposures, which are by natural agencies only, but this remaining distance is across country covered with fallen timber and rapid progress cannot be made.

In this region a mountain situated about 6 miles south-west of Hogsback lake, and the elevation of the summit of which is 4,580 feet, consists almost wholly of the mineral tremolite. On one flank of this mountain gneiss outcrops. The tremolite rock shows a small amount of green actinolite, and the calcium magnesium silicate has only partly assumed the asbestiform habitat—insufficiently so to make this particular exposure of commercial interest. Nevertheless, it is evident that search should be prosecuted in this region for a commercial occurrence of this mineral, because near this mountain is a large boulder which exhibits asbestiform mineral of commercial grade. It might be mentioned that float is scattered over an area of many square miles in this region.

While tremolite usually results from metamorphism of magnesian limestone or dolomite, the view held of this occurrence is that there is exhibited in this region magmatic differentiation by the large intrusion of batholithic rock, and metamorphism of the differentiate has resulted in the formation of the tremolite. Indirect support to this view appears to be lent by the report of a discovery of nickel on Sinkut mountain, not far distant from the tremolite occurrence, made by Messrs. McHenry and E. F. Wynne Heath. This was not reported until late in the year and has not yet been investigated. It is, however, interesting to note that samples received show pyrrhotite, and garnierite associated with hornblende in what appears to be a batholithic rock.

SIBOLA SECTION.

Time did not permit of inspection of any properties in this section during the year. A hurried trip was, however, made from Burns Lake to Kimsquit, on the Dean channel, via the Sakumtha pass, for the purpose of inspecting the trail under construction between Eutsuk lake and Kimsquit. The trail between these points and the surface tramway across the portage between Whitesail and Eutsuk lakes is not yet quite finished. Further mention of this route will be found under "Roads and Trails" in this report, and a detailed account of it is given in the 1926 Annual Report, pages 147, 148, and 149.

Emerald.—A large amount of work was carried out at this property by the Consolidated Mining and Smelting Company of Canada, Limited, the optionees. It is learned, however, that the results were somewhat disappointing.

MANSON SECTION.

Takla Lake.

Takla lake is readily reached either by motor-boat from Fort St. James via the Stuart lake-Tachie river-Trembleur lake-Middle river water system, or by pack-train from Hazelton. Considerable activity was manifested during the year in the region immediately west of Bear lake, the Driftwood river, and the north end of Takla lake. Two properties were visited in this region, the *Rainbow* and *Driftwood* groups, both copper mineralizations.

Rainbow. This group is owned by Frank Martin, A. Michell, and associates, of Hazelton. It is situated in a basin at the head of a small tributary of Ankwil creek, which flows into Takla lake from the west, about 4 miles below the head of the latter. At the time of inspection a very fair foot-trail, some 14 miles in length, had been constructed from a point on the lake somewhat below the mouth of Ankwil creek to the property. Since then the owners have constructed a branch trail from the head of the lake, where pack-horses can be procured, so that the property can now be reached on horseback.

The mode of mineral occurrence exhibited is that of volcanic beds mineralized mainly with bornite and malachite. The volcanics are vesicular and amygdaloidal lava-flows. The bornite occurs as amygdules and also in disseminated form, and to some extent follows small fractures and jointing-planes. The apparent width is between 31 and 35 feet, which is exposed over a vertical range of 300 feet. The mineralization is distinctly good. Exposures are by natural agencies entirely, and occur at elevations of between 5,700 and 6,000 feet on the north-east wall of the basin mentioned. The walls are steep, in places precipitous. The geologic structure, as observed in the basin, appears to be quite regular. The walls are composed of the lava-flows mentioned, which strike about N. 60° W. (mag.) and dip at from 50° to 60° to the south-west. In the floor of the basin some interbedded tuffs are exposed in which a little chalcopyrite occurs.

The chief mineral exposure of bornite and malachite described above shows some prominent fracturing crossing the bedding-planes of the volcanics, but the mineralization seems likely to follow the direction of the latter rather than that of the fracturing. However, a short crosscut in the mineral-exposure at right angles to the bedding would throw much light on the matter.

Three chip samples were taken of the exposure across the full width at different points, yielding the following results:—

Upper portion, across 35 feet: Gold, trace; silver, 0.8 oz. to the ton; copper, 2.1 per cent.
Middle portion, across 31 feet: Gold, trace; silver, 1 oz. to the ton; copper, 2.1 per cent.
Lower portion, across 31 feet: Gold, trace; silver, 0.6 oz. to the ton; copper, 2.4 per cent.

Driftwood. This group is owned by A. W. Davis and associates and was operated under option during the year by the Consolidated Mining and Smelting Company of Canada, Limited. It is situated west of the Driftwood river, north of Takla lake, and is reached by following the Bear Lake trail for about 14 miles north of Takla lake, crossing the Driftwood river at that point, and following the newly constructed trail to the property, about 9 miles in length.

The main showings are situated on the ridge between two adjoining basins at the head of an unnamed creek flowing into the Driftwood river and lie at elevations of between 5,600 and 5,800 feet. The country-rock is chiefly flat-dipping volcanic tuffs, interbedded with which are fossiliferous limestone-beds on the south of the mineral-showings, which latter are enclosed wholly by the tuffs mentioned. A system of fracturing, striking N. 60° W. (mag.), with a steep south-west dip, crosses the beds of tuffs, and a mineralization consisting essentially of bornite and malachite follows the fracturing and is in part disseminated through the country-rock. Quite subordinate amounts of chalcopyrite and chalcocite were observed. The greatest width of mineralized country-rock noted was 75 feet, but mineralization is on the whole sparse, although it is exposed at intervals over a length of several hundred feet. The best exposure occurs on the north wall of the more southerly of the two basins mentioned at elevation 5,660 feet. At this point a width of 23 feet is well mineralized and a further width more sparingly mineralized. A chip sample taken at this point across 23 feet assayed: Gold, 0.01 oz. to the ton; silver, 2.2 oz.

to the ton; copper, 1.2 per cent. A sample taken by A. W. Davis at this point assayed: Gold, trace; silver, 2.8 oz. to the ton; copper, 1.9 per cent. At the time of inspection the mineralization was being followed by open-cuts at intervals along the strike.

North-west Arm of Takla Lake.

Adda. This claim is owned by Abraham Williams, of Fort Babine, and is situated on the west side of the arm just above the lake-shore. Volcanic rock of andesitic composition shows at this point a few seams of chalcopyrite, 2 or 3 inches in width, and some narrow seams of calcite. Selected portions of the chalcopyrite assayed: Gold, trace; silver, 0.16 oz. to the ton; copper, 10.6 per cent. While such showings as these do not in themselves exhibit any commercial promise, nevertheless it is evident that the region is one of general geologic promise, by reason of the fact that just south of these showings a belt of granite 4 or 5 miles in width is exposed on both sides of the arm.

Further particulars of the geology of the Takla Lake region will be found in the Annual Report for 1929, pages 185 and 186.

FORT GRAHAME SECTION.

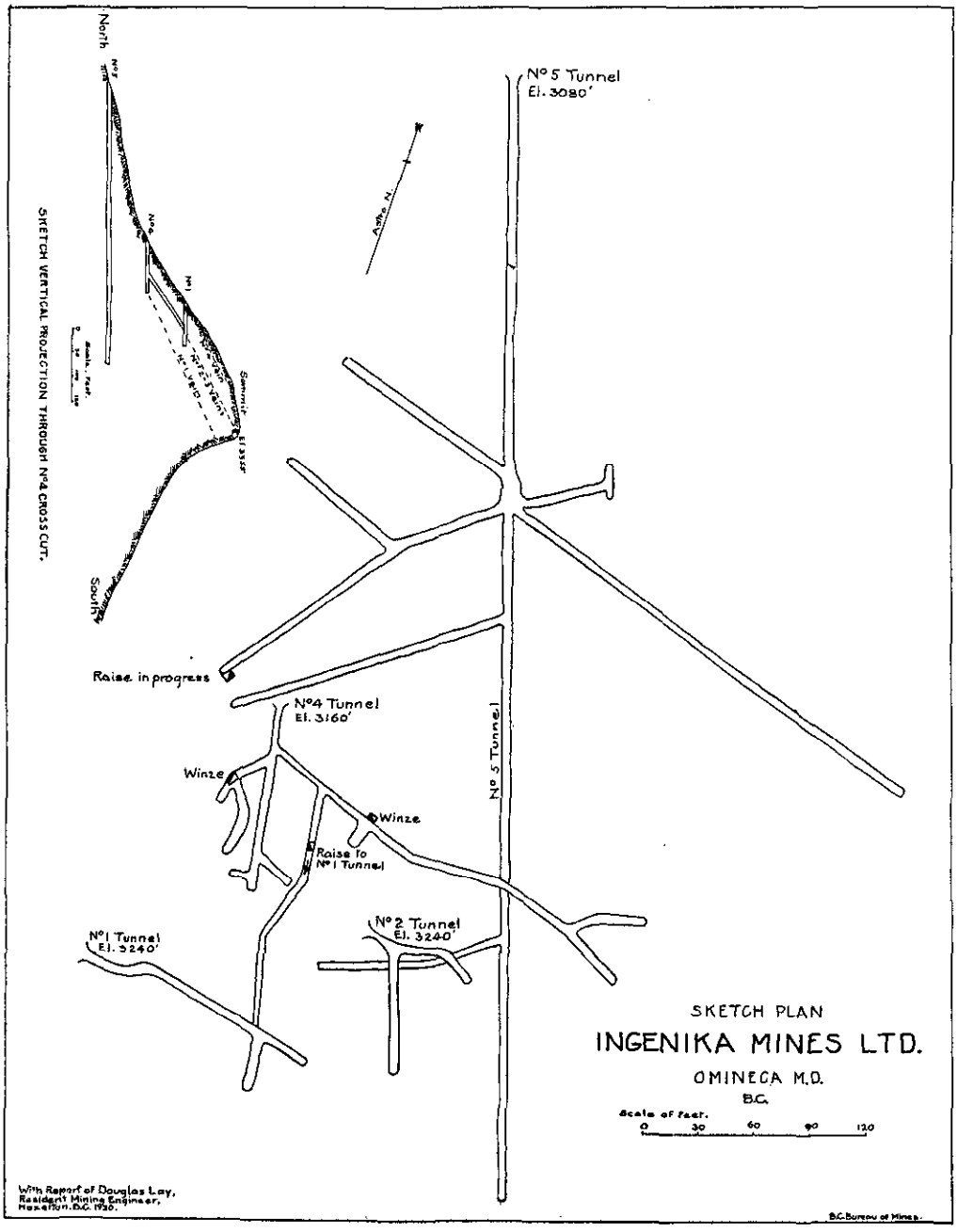
In view of the depressed state both of the metal market and of financial conditions generally, the amount of development and prospecting that took place in this far-distant section was remarkable. For the convenience of prospectors and others a Deputy Mining Recorder has been appointed with a sub-recording office at Whitewater (a Hudson's Bay Company's post), on Finlay river, just above its junction with the Kwadacha river. The number of survey parties in the field engaged in railway and other reconnaissance surveys doubtless had a stimulating effect generally. Active development was carried on at the *Ferguson* by Ingenika Mines, Limited, and much intelligent and painstaking surface work was performed at the *Wedge* and *Protection* groups, situated east of the Finlay river, by the owners. R. W. Wilson was engaged for most of the season in prospecting some copper-showings situated on Ruby creek, a tributary of the Finlay river, situated at the most northerly point of the latter. A new discovery exhibiting a good lead-zinc mineralization, the *Childhood's Dream* group, was made by A. O. Swiggum on the Osilinka river.

A necessarily brief, although somewhat comprehensive trip was made through this section during the year. The route followed was from Summit lake north of Prince George by motor-boat, following the river systems described in the 1926 Annual Report. The Finlay river was ascended as far as Deserters canyon, from which point the *Wedge* and *Protection* groups were reached by back-packing 25 miles east. The Ingenika river was ascended as far as the river camp of Ingenika Mines, Limited, and the *Ferguson* and *Onward* groups inspected. Returning south, the Omineca river was ascended as far as the mouth of the Osilinka river, and the *Childhood's Dream* and *Weber* groups were reached from this point by back-packing and canoeing a further 30 miles. Finally the Peace river was descended as far as Taylor's Flat.

The Omineca river is a difficult and dangerous river to navigate and calls for a high degree of navigating skill. The Black canyon can only be run at low water, and there are many stiff rapids above this point and between it and the mouth of the Osilinka river. The ascent of the river was on this occasion made at the end of August and the descent during the first week of September.

Ferguson. Much underground development has been carried out at this property by Ingenika Mines, Limited, during the past two years. Development has been expedited by the installation of a Sullivan portable air-compressor and machine-drills. The accompanying sketch-plan shows the position as viewed on August 23rd. Development during the past two years comprises workings in or directed to the No. 2 and No. 3 vein-zones. It might be noted that while the management distinguishes two veins, these are so close together that to all practical intents and purposes they may be regarded as one. The true width of this zone seems to be about 12 feet, but as the zone dips at about 30° the width as disclosed in horizontal workings is of the order of 25 feet. The best underground exposure of ore in this zone is that given by No. 1 tunnel. As determined by aneroid, No. 4 tunnel is approximately 80 feet vertically below No. 1 tunnel. The total mineralized length of ore-zone at this horizon is approximately 240 feet, but mineral is not continuous for this distance. The best showing of ore on this level is in the neighbourhood of the winze shown about 65 feet east

of the crosscut portion of this tunnel. A raise 131 feet in length was put through from this tunnel to No. 1 tunnel, starting from the end of a crosscut in the former, as shown on the plan. This raise emerges in the back of No. 1 tunnel. It is stated that good ore was met with in this raise in places. Crosscutting from the raise to the foot and hanging wall at one or two points



would seem advisable eventually to delimit the walls of the zone. No. 5 tunnel starts under very shallow cover, approximately 80 feet below No. 4 tunnel, and shows very little mineral. This tunnel consists of approximately 600 feet of main crosscut and approximately 800 feet of branch tunnels therefrom.

It is evident that both topographic and geologic considerations must be borne in mind in connection with crosscut tunnels run at or near the base of this knoll to probe the downward continuation of this ore-zone. The ore-zones appear to follow the bedding-planes of the limestone, and, if the structure is synclinal, will flatten in that case as the trough of the syncline is reached, and a crosscut run below the critical point will not penetrate the ore-zone. Unfortunately the bedding-planes are very obscure in No. 5 tunnel. Careful survey correlating surface topography and underground workings and detailed study of geologic structure are necessary before a definite opinion can be expressed in the case of No. 5 tunnel, beyond the fact that the margin of safety does not appear to be very great. It is understood that the management believes that No. 5 level penetrated the vein-zone, and that although the branch tunnelling on that zone did not disclose any material amount of ore, nevertheless the upper workings disclose a strong *eastward* and downward rake of ore within the vein, and that it is therefore quite possible that further drifting eastwards on No. 5 tunnel may encounter ore. Refer to Annual Reports for 1926 and 1928, and also to Geological Survey of Canada, Summary Report, 1927, Part A, page 37.

Onward. This group is situated south of Delkluz lake. Just above the lake-level on the south shore of Delkluz lake some tunnelling has been carried out to probe the downward continuation of some promising surface showings disclosing bunches of galena in places, and exposed about 40 feet above the tunnel portal. At this point a main tunnel is run 124 feet south-easterly (mag.), and one easterly branch therefrom 36 feet in length, and another south-westerly branch 69 feet in length. Apart from the fact that the last-mentioned branch shows some pyrite, these tunnels disclosed no material amount of mineral. The first few feet of the main tunnel disclose schist dipping at a flat angle northerly. Subsequently sheared limestone was met with dipping mainly southerly.

A considerable distance south of these workings extensive trenching has been carried out, and one shaft has been sunk 25 feet, following surface mineralization, but nothing of importance has been disclosed.

Wedge and Protection. This property, owned by Mort Teare, D. Miner, J. Blanchard, L. Smaaslet, and associates, of Prince George, is situated on Pesika (formerly Wedge) creek, about 25 miles east of the Finlay river, and lies within the Rocky Mountain system. Pesika creek is a large stream, navigable for small craft in high water, it is stated, for a portion of its length up to a canyon. It occupies a valley between one-quarter and one-half mile in width. On both banks of the creek are wide benches timbered with spruce and poplar, and the supply of horse-feed is good. The gradient of the creek is not much over 35 feet to the mile, and the topography generally lends itself to economic road or trail construction.

Pesika creek receives large tributaries both from the north and south, and its right bank at a point some miles from its mouth, where it is joined by a north-flowing tributary, is flanked by rather remarkable silt-like glacial deposits. The weathered, castellated summits of these cream-coloured deposits, which rise 200 feet or more above the valley-bottom, are a conspicuous feature of the landscape. Analysis of this material showed it to consist almost entirely of calcium carbonate. A well-worn game-trail to the deposit indicates that its medicinal properties are much sought after by game. It might be mentioned that the occurrence of silt-like glacial deposits at elevations high above the present valley-bottoms is generally characteristic of the northern portion of the Finlay River valley and its tributaries.

The *Wedge* and *Protection* groups adjoin and are reached by a good trail constructed by the owners with the aid of the Department of Mines. This trail leaves the Finlay river at the lower end of Deserters canyon, joins "The Trail of '98," and follows that trail for a mile or so; then swings off it up Pesika creek, following the left bank of the latter at first, and crossing the creek by a good bridge about 10 miles from the starting-point. Thereafter the right bank is followed to the property, which is situated between a tributary and the main creek on the north side of the latter.

The mode of mineral occurrence exhibited is a large quartz vein, mineralized with chalcopyrite sparingly. The vein reaches a width of 134 feet at one point and is exposed on the surface for several thousand feet. Its strike is about N. 10° W. (true), with steep westerly dip. The enclosing country-rock is limestone. Exposures, which are by natural agencies and by an extensive system of trenching, lie between elevations of 4,760 and 5,440 feet. Mineral-

ization consists of chalcopyrite, pyrite, and copper-stain. This is a shear-zone fissure and the filling consists of brecciated country-rock cemented with quartz. It is evident that after the fissure was first formed it was reopened and again filled; mineralization with chalcopyrite took place on both occasions.

Mineralization is generally somewhat sparse, or appears so on the surface, but in some places open-cuts show a width of 6 feet quite well mineralized. A sample across a width of 6 feet at one such point assayed: Gold, trace; silver, trace; copper, 2.9 per cent. A sample of selected ore from this cut assayed 6.9 per cent. copper and showed traces only of gold and silver. These samples were taken at the north end of the property, at which end depth can only be gained by sinking or long crosscuts. At the south end, on the other hand, where the vein is exposed in the main valley of Pesika creek, depth can be gained by drifting. Further at this point the best natural exposure was observed. Here a width of 23 feet is sparsely mineralized. A sample across this width assayed: Gold, 0.02 oz. to the ton; silver, 0.20; copper, 0.3 per cent. It will be noted that this sample disclosed a very much higher ratio of precious metal to the unit of base metal than is disclosed by samples taken at the north end of the property. Too much stress should not be laid on the results of such a few samples, but further samples should be taken to ascertain if such is the case or not, and the attention of the owners is directed to this point. The owners were advised to do further work at the south end because the natural exposure seems best at this end in any case, and, moreover, they had in mind winter tunnelling, and it was obviously preferable to drift at this point rather than to crosscut at the northern end.

This vein, like some other quartz veins observed, appears to be bleached white on the surface, presumably by reason of the fact that surface waters in some localities carry reducing solutions. In such cases the true criterion of surface mineralization is not at the actual surface, but at a few feet below it. The immense size of the vein, the favourable topography from the practical mining standpoint, and the fact that mineralization, although sparse, occurs at points several thousand feet apart horizontally and several hundred feet apart vertically are all favourable features which justify some further work. The geographic position of the property is interesting. No granitic intrusive was seen in the vicinity.

Ruby. This group, owned by J. Lehti, of Finlay Forks, is situated on a creek known locally as Ruby creek, which rises in the Butler range and flows south-easterly into the Finlay river. The property is reached by a trail about 9 miles in length, which leaves the Finlay river by J. Lehti's store, about 14 miles below Fort Grahame.

Exposures are by natural agencies only. The formation exposed is the characteristic mica-belt country-rock, which is mineralized in places with pyrrhotite. The property is about 8 or 9 miles south of the Ravenal mica property, described in the 1928 Annual Report, page 183. The formation of the *Ruby* group differs only from that observed at other points of the mica-belt on Mica mountain and described in the 1926 Annual Report, in the respect that the igneous origin of the schists is very strongly suggested. The rocks are gneissic rather than schistose and have the appearance of parallel bands of granitic rock of different phases, the width of each band being a few feet. Pyrrhotite occurs in the more basic phases and is inter-crystallized with the other constituent minerals. In places pyrrhotite shows over a width of 20 feet. A sample of selected pyrrhotite only showed upon assay a trace of gold and silver and no nickel or copper. While this property does not appear to be of any commercial significance, the showings are of geologic interest.

Childhood's Dream. This property, owned by A. O. Swiggum, F. Eklund, and Allan McKinnon, of Finlay Forks, is situated on a small unnamed creek about 1 mile north of the Osilinka river and about 20 miles above the mouth of the latter. The property is reached most conveniently by motor-boat (when the stage of water permits) from the Finlay river, following the Omineca river as far as the mouth of the Osilinka river. From the latter point a trail follows the right bank of the Osilinka river as far as End lake, 16 miles from the mouth, below which point this river cannot be navigated. The owners keep a small boat on End lake, and by this means the end of the trail to the showings may be reached. The length of the trail from the river to the showings is about 1 mile, but the straight-line distance is probably about half a mile.

Rocks of the mica-belt are exposed at the mouth of the Osilinka river, and also at other points some miles up-stream. Adjoining this belt on the west are limestones, dolomites, and

quartzites, which evidently extend west for some miles, as such were observed on the Osilinka river about 10 miles west of the *Childhood's Dream* group.

The mode of mineral occurrence exhibited on this property is that of galena, zinc-blende, and pyrite occurring as a replacement following fracturing in dolomite. Exposures are very meagre and are afforded by natural agencies mainly, apart from a few small open-cuts. They occur on the left bank only of a small creek which flows S. 10° E. (mag.) and which has cut down to a depth of about 100 feet, occupying a gorge-like valley in the region of the exposures. Within a distance of 350 feet there are three distinct zones of mineralized fracturing, and the dolomite between these zones shows a sparse dissemination of the minerals mentioned. The strike of the fractured zones seems to be about N. 75° E., but exposures are inadequate to form any definite opinion. The width of the best fractured zone is 27 feet, but the walls of all the zones lack definition. A sample across this width of 27 feet assayed: Gold, trace; silver, 0.32 oz. to the ton; lead, trace; zinc, 6.2 per cent. A sample across the best portion of this, 6 feet in width, assayed: Gold, 0.01 oz. to the ton; silver, 0.7 oz. to the ton; lead, 2.6 per cent.; zinc, 11.2 per cent. A sample across another fractured zone 6 feet in width assayed: Gold, 0.01 oz. to the ton; silver, 0.56 oz. to the ton; lead, 2.8 per cent.; zinc, 8.6 per cent.

As mentioned, mineralization is confined to one side of the creek only and is not exposed on the right bank. Although there is a considerable amount of surface vegetation on the latter side, the country-rock is fairly well exposed, and mineralization might be expected to continue on this side, but could not be perceived. The explanation may be that the creek occupies a fault-plane, and further prospecting might result in the dislocated portions of the zones being found on the west side of the creek. Immediate attention should, however, be focused on an attempt to better expose the mineral on the left bank, to enable a more intelligent opinion to be formed as to potentialities. This is a very fair prospect, unfortunately situated in a region which is at present rather remote, but which nevertheless is fairly close to the "Fall River" railway route from the Peace River district to the Pacific coast.

Weber. This group, owned by F. Weber and W. McPhee, of Fort Grahame, is distant about 9 miles by water from the *Childhood's Dream* and is situated about 1 mile from the Osilinka river, on the south side of the latter. The Osilinka river is navigable for small craft from End lake to the *Weber* group, except for one log-jam by A. O. Swiggum's trapping-cabin, about 7 miles below the *Weber* group.

The mode of mineral occurence on this property is that of a dissemination of galena, zinc-blende, and pyrite in a siliceous dolomite, containing a noticeable amount of barite. The showings are exposed by two open-cuts about 150 feet apart, one of which shows a sparse dissemination of the minerals mentioned occurring over a width of 17 feet. The other open-cut shows one or two seams a couple of inches or so in width of compact mineral.

A sample taken across 17 feet in the first-mentioned open-cut assayed: Gold, 0.02 oz. to the ton; silver, 1 oz. to the ton; lead, 1.6 per cent.; zinc, 3.6 per cent. A sample of selected portions of the mineral showing in the other open-cut assayed: Gold, trace; silver, 2.2 oz. to the ton; lead, 9 per cent.; zinc, 8.8 per cent.

This property merits some further prospecting by the owners. No intrusive igneous rocks were seen in the vicinity of this property or of the *Childhood's Dream*. The nearest known intrusive is distant about 20 miles west of this point and is situated at the head of Duck creek on the *Blue Ridge* group. Time did not permit of inspection of the latter, but mention of it will be found under "New Discoveries" in this report.

Coal.

The output of coal for the year was 1,029 long tons, as compared with 1,505 long tons in 1929.

Considerable interest was evinced in the coal areas of the district during the year. The operations of F. M. Dockrill in the coalfield near Telkwa, inaugurated during the latter part of the year, were of great importance and interest to the area affected. A considerable amount of diamond-drilling and prospecting was carried out by the newly incorporated Cariboo Coal and Clay Company in the lignite-coal area in the vicinity of Australian and Alexandria, in the Quesnel Mining Division, where this company has acquired extensive holdings. In the Zymoetz (Copper) River coalfield some prospecting was carried out by F. B. Chettleburgh on the holdings the ownership of which is controlled by Yorkshire and Pacific Trust Company.

Telkwa Collieries, Ltd.—Operations at the colliery of this company were carried on only in the spring. Descriptions of the property will be found in the Annual Reports for 1926, 1927, 1928, and 1929.

Operations of F. M. Dockrill.—F. M. Dockrill, obtaining a lease of Sections 391 and 401 from the B.C. Coal and Land Company, erected camp buildings and a 300-ton bunker on this property, and commenced shipments of coal towards the close of the year. This property immediately adjoins that of Telkwa Collieries, Limited, on the south (*see* map on page 158 of the 1926 Annual Report; Lot 391 is immediately south of Lot 401).

Mining operations were commenced on the large seam of coal, 14 feet in width, which outcrops on Lot 391, on the right bank of Goat creek, close to the point at which the Hunter Basin road crosses this creek. The depth of cover over the seam at this point is in the neighbourhood of 300 feet. Somewhat less than 100 feet vertically above this seam, another large seam outcrops. The seam on which mining operations have commenced strikes approximately due north and south (true bearing) and dips east into the creek-bank at 12°.

As viewed on March 26th, 1931, the workings consisted of two adit-tunnels, Nos. 1 and 2, situated 50 feet apart (No. 1 being the more northerly), following the dip of the seam for distances of respectively 173 feet and 220 feet from the surface. From No. 1 tunnel a branch tunnel follows the seam northwards a distance of 63 feet, at 115 feet from the portal. Preparations were being made to mine by the room-and-pillar system, and with this end in view it is proposed to run from No. 1 tunnel, at 157 feet from the portal, a tunnel southwards connecting with No. 2 tunnel, and following the strike of the seam for a considerable distance beyond the latter, and finally connecting with the surface at a convenient point by a branch tunnel.

Save from a shale-parting seam, from 2 to 3 inches in width at about the middle of the coal-seam, the latter consists of clean coal. The quality is shown by the following analyses:—

Description.	M.	V. and C.	F.C.	Ash.	S.	B.T.U.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Sample across 8.5 feet, excluding shale-parting	1.4	25.0	62.4	11.2	0.54	13,516
Selected sample above shale-parting	1.4	28.5	63.4	6.7	0.76	13,981
Selected sample below shale-parting	1.1	23.9	68.9	6.1	0.74	14,601
Sample 9 feet wide, above shale-parting, "blacksmith" coal	1.1	23.8	67.1	8.0	0.58	14,136

The workings disclose no evidence of any disturbance of importance, and prospects so far as the supply of coal is concerned are satisfactory. Much credit is due F. M. Dockrill for the commendable enterprise evinced in commencing this operation, which well merits that strong support from local coal consumers, which to a large extent must gauge the measure of success which it is found possible to achieve. The coal-bunkers are distant about 7 miles from Telkwa Station and are situated close to the Hunter Basin road from Telkwa, which was improved during the year by the Department of Public Works.

PLACER-MINING.

Lorne Creek.

Lorne creek flows into the Skeena river from the west, about midway between the flag-stations of Ritchie and Dorreen on the Canadian National Railway. It is probably the most important of those placer-gold creeks which lie without the placer-gold belt. Its total production to date has been estimated at $70,000, but field evidence supports the view that a much greater amount of gold than this lies in the buried pre-Glacial channel, formerly known as "Dry Hill," and now covered by the lease held by Stewart A. Corley, of Pacific.

The early history of this creek is given in the Annual Reports for the years 1899 to 1906, inclusive, and 1914, a brief résumé of which follows:—

Placer was first discovered on this creek in 1884 by Harry McDame, after whom McDame creek in the Dease Lake area is named. For the next fifteen years apparently small-scale operations were carried on by individual operators. In 1899 apparently the existence of a buried ancient channel was recognized, and attempts to win its gold content by hydraulicking

commenced, water for the purpose being derived from the headwaters of a tributary of Porcupine creek; the point of attack being, of course, the outlet end of the ancient channel known as "Dry Hill," which lies about three-eighths of a mile north of the present creek. Early attempts were evidently distinctly encouraging, and in 1902 the Dry Hill Hydraulic Mining Company commenced hydraulic operations on a larger scale than heretofore, constructing a dam on Lorne creek and fluming water from that creek for mining purposes. The scale of operations was still further increased in 1914 by the construction of a larger flume, but complete cessation of hydraulic operations took place in 1917. Nothing further took place until 1923 and 1924, when Stewart A. Corley, who had in the meantime acquired the ground, single-handed drove a tunnel some 300 feet in length from the face of the pit, but above bed-rock. Since then operations have been confined to desultory "sniping" by individuals at various points.

The total amount recovered as the result of hydraulic operations is not known, but such information as is available shows that while at times gratifying clean-ups were made, such were less than the cost involved. For example, in 1905 it is recorded that the clean-up amounted to $12,800 and mining costs amounted to $20,000; in 1916, Stewart A. Corley states that the clean-up was $10,000 and the costs involved $14,000.

Inasmuch as, in spite of early financial failure, the amount of gold recovered indicates high enough values to constitute a profitable hydraulic, and because it is obvious that the ancient buried channel is still largely virgin ground (of a total length of about 2,000 feet, only about 350 feet in length has been piped out), this property was studied somewhat closely in an effort to arrive at some possible plausible reason for past failure. A detailed account follows:—

Pre-Glacial Channel.—Lorne creek is situated, far distant from the "placer-belt" of the Province, in a belt of typical gold-bearing quartz veins. This belt seems to be about 20 miles in width, and extends in an easterly and westerly direction from the headwaters of the Telkwa river to Kitsumgallum lake, and includes such streams as tributaries at the head of the Telkwa and Zymoetz rivers, Kleanza, Lorne, Fiddler, Douglas, and Wesach (formerly Hall) creeks. This belt lies within a region where the maximum effects of alpine glaciation were felt, and were it not for this fact there is every reason to suppose that there would be found within it rich placer-gold deposits.

In a region which has been so actively glaciated it would seem remarkable that on Lorne creek there has been left a pre-Glacial channel about 2,000 feet in length, apparently uneroded, were it not for the reasons afforded by local topography. The outlet of this ancient channel is found in the Skeena River valley, about three-eighths of a mile north of the modern channel of Lorne creek, and it is this outlet, known as "Dry Hill," on which the attention of placer operators has been focused for many years. In the mouth of Lorne Creek valley is a dome-shaped mountain on the south side of which the modern creek emerges through its canyon. The ancient channel occupies a depression between the mountain mentioned and the main left rim of Lorne Creek valley. The topography therefore not only very strikingly suggests the possibility of the existence of an ancient channel, but localizes its exact position, even when viewed from a distance. The upper end of the ancient channel is cut through by the modern creek about 2,000 feet distant from the mouth of the "Dry Hill" hydraulic pit in a westerly direction. An excellent cross-section of the channel is given at this point. Here it appears as a drift-filled canyon-like channel. The bed-rock is about 30 feet above that of the modern creek. The width at the bottom is 50 feet. Up to a height of about 50 feet above bed-rock the walls are almost vertical; above this point they become gradually less steep. The total depth of drift-filling exposed is about 300 feet, but the depth of drift somewhat lower down the ancient valley increases to probably a maximum of about 400 feet, and then again decreases. The face of the "Dry Hill" pit is about 150 feet above the floor, but the latter is not on bed-rock at the face at any rate. There is apparently no continuation up-stream of this ancient channel above the point at which it is cut as described by the modern Lorne creek. It probably occupied a position in this region immediately adjoining the modern creek on the south and parallel to it, occupying what is now known as "Butcher's Bench" and points above this as far as the site of the old "Hardscrabble" mine. The old "Penrose" and "Hardscrabble" claims, which formerly covered jointly 1 mile of Lorne creek above the intersection of the ancient channel, undoubtedly yielded some gold, and still afford opportunity for "sniping," and probably contain a few remnants of the ancient channel-gravels, although they are relatively quite unimportant and have not been examined by the writer at close range.

Lorne creek emerges from a canyon into the Skeena valley. This canyon commences immediately below the point at which the ancient channel was cut through. Above this point for some miles the creek occupies a narrow, crooked, V-shaped rocky valley a great many hundreds of feet in height and runs on bed-rock at all points. The walls of this valley are steep and precipitous. (The general characteristics of the segment of the ancient channel preserved is precisely similar to that of Lorne creek.) Rock outcrops at all points. The country-rock is the Hazelton series of sedimentaries, argillites, quartzite, and conglomerates. These are thickly bedded, the bedding-planes being horizontal or nearly so, and are cleaved and jointed at right angles to the bedding. Outcropping at numerous points are slightly mineralized quartz veins of various widths, which cross the creek practically at right angles and which are the undoubted source of the placer gold.

From the description of the valley it will be apparent that the glacier which formerly existed in it was very tightly keyed in, and it is impossible to imagine that a glacier so imprisoned could have exerted any material influence in eroding the bed-rock gravels. It must have melted and deposited its burden of drift practically in situ. When drainage was subsequently restored Lorne creek cut its way down south of the old channel, this being the lowest part of the then drift-filled valley. It is also apparent from the character of Lorne Creek valley that this would be comparatively rapid and very thoroughly cleared of its burden of drift, the valley-sides being so steep as to afford no lodgment. It is probable that the gold found near the mouth of the modern Lorne creek by the earliest miners resulted from a reconcentration of the contents of the old channel cut through by the modern creek.

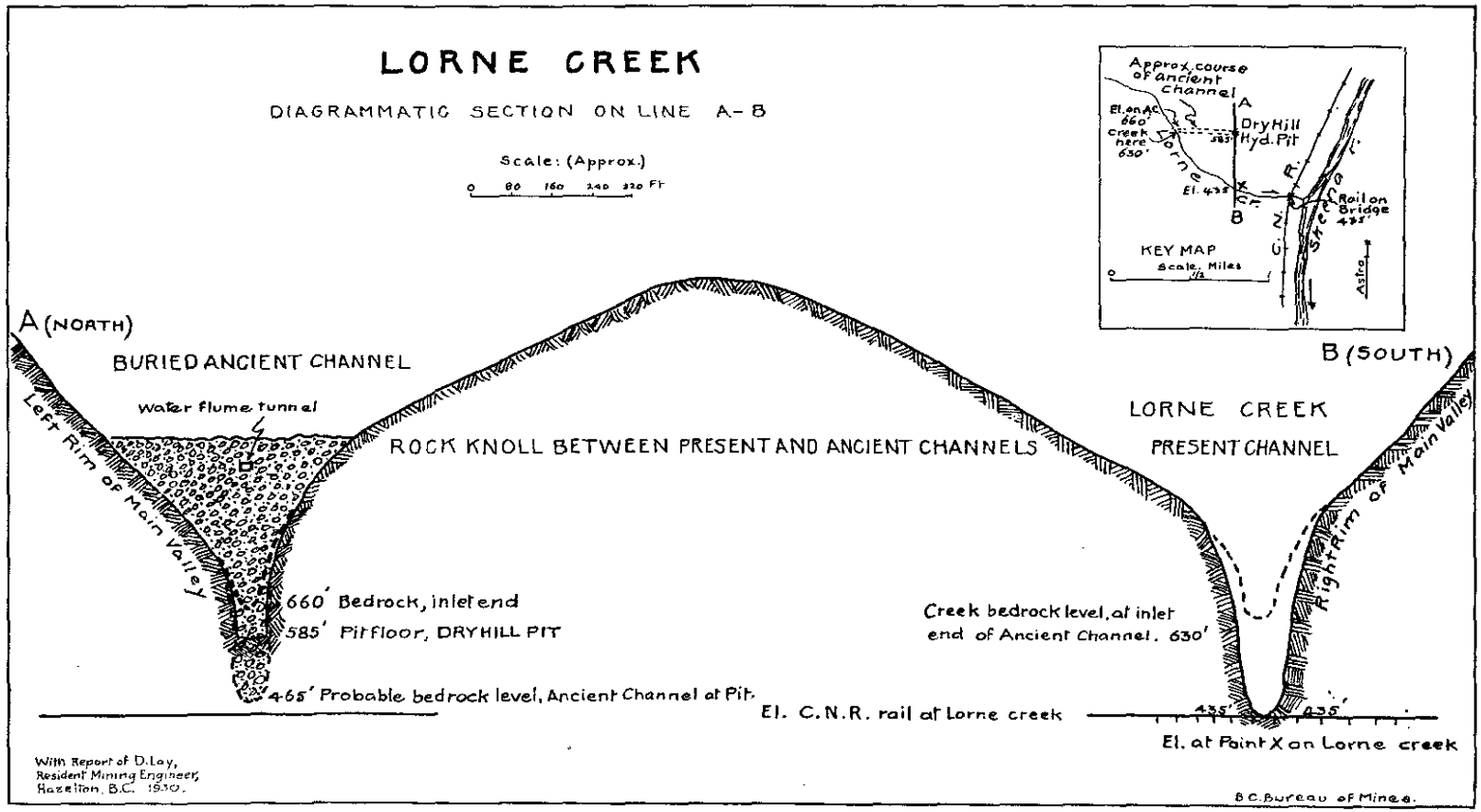
In connection with the ancient channel the following features are of importance:—

(1.) Grade. This cannot be determined directly, because while bed-rock is clearly exposed at the upper end where cut by Lorne creek, the other point of expected exposure—namely, the floor of "Dry Hill" pit—is covered with débris and bed-rock cannot be seen at this point. But field evidence does not support the view that the old sluice-flume on the floor of this pit is on bed-rock. If the sluice-flume was brought in above bed-rock this may be the crux of the reason why hydraulic operations to date have failed to result in profit. Various levels were taken with an aneroid and, while necessarily not strictly accurate, they are sufficiently so to illustrate the argument which follows. Levels were as follows:—

	Feet.
Elevation of C.N. Rly. at Lorne Creek bridge	435
Elevation of floor of Dry Hill pit	585
Elevation of mouth of Lorne creek at lower end of canyon, Skeena valley	435
Elevation of bed-rock, ancient channel at inlet	660
Elevation of Lorne Creek bed-rock at point of intersecting ancient channel	630
Elevation of highest point of surface of ancient channel	995

From these elevations it will be noted that the floor of Dry Hill pit is about 150 feet above the level at which the modern Lorne creek enters the Skeena valley, and very much higher than the point at which bed-rock of the ancient channel might be expected at this point. At the inlet end the ancient channel is only 30 feet above the modern. There appears to be no reason why the outlet of the ancient channel should not be found at about the same height above the modern channel. There is no evidence whatever that the Skeena valley was deepened in this vicinity by glacial erosion and that therefore the valley of the ancient channel of Lorne creek is now left as a hanging-valley. On the contrary, all creeks in the vicinity on both sides of the Skeena enter the valley of the latter on normal grade and there are no hanging-valleys. Evidence therefore inclines the view that the sluice-flume was not brought in on bed-rock in the "Dry Hill" pit. If this be the case, that might be the reason why hydraulic operations were not a financial success in the past. It is a most important point, and it is quite essential that bed-rock of the ancient channel be found at the outlet end before any further mining operations, whether drifting or hydraulicking, are resumed. It has already been mentioned that the tunnel run from the face of the pit in 1923 and 1924 by S. A. Corley is evidently some distance from bed-rock. When this was being run, Corley states that he came across an earlier tunnel, of which there is no other record, immediately below that run by him.

(2.) Nature and values of the gravels. There is every reason to suppose that the bed-rock gravels in this channel and their gold content have been largely undisturbed by glacial erosion. In view of the nature of the bed-rock, which has already been described, and of the fact that this channel was evidently occupied by a swiftly running stream, gravels on and near bed-rock


LORNE CREEK
DIAGRAMMATIC SECTION ON LINE A-B
Scale: (Approx.)
0 80 160 240 320 Ft
A (NORTH)
B (SOUTH)
BURIED ANCIENT CHANNEL
Water flume tunnel
Left Rim of Main Valley
ROCK KNOLL BETWEEN PRESENT AND ANCIENT CHANNELS
LORNE CREEK
PRESENT CHANNEL
Right Rim of Main Valley
660' Bedrock, inlet end
585' Pit floor, DRYHILL PIT
465' Probable bedrock level, Ancient Channel at Pit
Creek bedrock level, at inlet end of Ancient Channel. 630'
El. C.N.R. rail at Lorne creek
435'
435'
El. at Point X on Lorne creek
Approx. course of Ancient Channel
El. on AC 660' creek here 630'
Dry Hill Hyd. Pit
El. 435'
Rail on Bridge 435'
KEY MAP
Scale, Miles
Astra
With Report of D. Lay, Resident Mining Engineer, Hazelton, B.C. 1930.
B.C. Bureau of Mines.

are of large but not excessive size. Examination of tailings-dump does not indicate that these gravels would be so coarse as to offer any serious obstacle to hydraulicking. Incidentally it is interesting to note that the physical conditions prevailing in pre-Glacial times as to character and grade of bed-rock might be deemed unfavourable for the retention of gold and the formation of a placer deposit. That gold was retained in pre-Glacial times is undoubtedly the case, and this ancient channel is merely another striking instance in support of the fact that coarse gold is not carried far from its source by a stream of water. Overlying the bed-rock gravels are the finer glacial gravels, and as viewed in the Dry Hill pit there seems to be a layer of boulder-clay about 10 feet in thickness immediately underlying the soil and overlying the glacial gravels. Ordinarily one would not expect the glacial gravels to average higher than from 5 to 10 cents a cubic yard, but in this case the evidence indicates materially higher values than this. S. A. Corley, who has first-hand knowledge of the last hydraulic operations carried on in 1916, states that all gravels above bed-rock gravels can be relied upon to average between 10 and 12 cents a cubic yard. This seems a fair, perhaps even a conservative, estimate, because from his account of the clean-up in 1916, which amounted to $10,000, and the portion of the channel piped during that year, which was all above bed-rock, the yardage piped in that year would seem not to have exceeded 35,000 cubic yards. During the period 1905 to 1916 there must surely have been more than two clean-ups, which total $22,800. The total yardage of the old channel piped out to date cannot exceed 100,000 to 125,000 cubic yards, so that the average grade of gravels piped is well up to hydraulic requirements.

The character of gold from the lower gravels is stated to be coarse; that from the upper glacial gravels is said, as might be expected, to be considerably finer. Relating to early hydraulic operations, the following excerpt from the Annual Report for 1906 by the late W. Fleet Robertson, then Provincial Mineralogist, is quoted:—

"The ground undoubtedly contains gold in considerable quantities, but its recovery is rendered difficult by an exceedingly irregular bed-rock, and the presence of a great number of boulders, which require to be broken up before they can be removed by the stream of water at present available through the existing pipe-line and plant."

It is to be noted that some eight years after this report was written, in 1914, the hydraulic plant was enlarged and improved by the Dry Hill Hydraulic Mining Company, 2¼ miles of water-flume of cross-section 3½ by 3 feet being constructed, conveying water from Lorne creek to a penstock giving a piping-head at the pit of 350 feet. It might be mentioned that this flume passes over the top of the ancient channel, save that at one point it is contained in a tunnel 800 feet long driven at a depth of about 50 feet below the surface. This flume is now in a state of entire disrepair.

(3.) Yardage of gravels still available. It is quite evident, of course, that hydraulic operations to date have made but comparatively little impression upon the total yardage still available. Of a total length of about 2,000 feet, a length of only about 350 feet has been piped out, and a length of 1,650 feet approximately still remains. Assuming an average channel cross-section of: width at bottom, 17 yards; width at top, 85 yards; depth, 80 yards; and the length being approximately 550 yards, there is a total yardage of close on 2,250,000 cubic yards.

(4.) Practical mining considerations. Two methods of attack can be followed:—

(*a.*) Mining bed-rock gravels only by drifting. This, while leaving glacial gravels untouched, possesses the advantage that only small initial capital outlay is required. It is, of course, essential that bed-rock be found first at the outlet end of the channel before tunnelling is started. Preliminary trenching at this point might disclose bed-rock. If not, a cross-section of Keystone drill-holes would be necessary to determine it.

(*b.*) Hydraulicking the entire deposit. This would involve very appreciable capital outlay, as it would mean practically entirely new and adequate hydraulic equipment and 2¼ miles of water-flume bringing water on the ground from Lorne creek. An essential preliminary in this case also would be locating bed-rock at the outlet end of the channel by trenching or Keystone-drilling and subsequent cross-sectioning of the channel by Keystone drill-holes to ascertain values. Hydraulicking the entire deposit may be entirely justified of course. As to water-supply, no particulars are available as to the minimum supply available at low-water season from Lorne creek, but this appears to be distinctly good, althought preliminary measurements are necessary. The grade of bed-rock in the ancient channel is certainly favourable and exceeds that required for sluice-flume. Bed-rock at the inlet end, as previously mentioned in this

report, is 75 feet above the pit-floor near face, which is above bed-rock at this point, so that bed-rock grade exceeds 4.5 per cent. Dump facilities can only be determined with accuracy after the bed-rock level has been ascertained at the outlet end. This is another reason why it is so essential to ascertain this bed-rock level by way of preliminary. Even if the bed-rock level proves to be distinctly lower than the floor of Dry Hill pit, it may still be found possible to secure dump by swinging sluice-flume southerly from the mouth of the pit into Lorne creek.

Attention is directed to this property as one possessing many meritorious features which warrant close investigation. Being situated virtually on the Canadian National Railway line, its unique accessibility is a very happy feature.

Manson Section.

It was not possible to visit this section during the year, but the following information is kindly supplied by the operators respectively concerned:—

R. C. McCorkell and associates, of Vanderhoof, were operating a drag-line scraper on Manson creek at the mouth of Skeleton gulch, and sunk several prospect-shafts at the head of Germansen creek, with, it is stated, promising results.

Nation River.

George Snell and associates, of Vanderhoof, carried out much work on Philip and Rainbow creeks, tributaries of the Nation river. A new and promising discovery was reported by George Snell as having been made by him on Rainbow creek.

Buck River.

On Buck river and its tributary, Bob creek, near Houston, R. R. Macdonald and associates, of Houston, were engaged in testing their ground.

PEACE RIVER MINING DIVISION.

An inspection trip was made through this Mining Division during September on the return from the northern portion of the Omineca Mining Division.

But little mining activity was apparent. T. Wiggin was engaged during the year in testing various bars on the Peace river above the Rocky Mountain Canyon portage with a gold-saving appliance of his own invention. Neil Gething has completed the sawmill installation on Johnson creek, mentioned in the 1928 Annual Report, on his coal leases, but no coal was mined during the year.

Very marked activity was apparent in the agricultural section of this Mining Division, both on the north side of the Peace river in the vicinity of Fort St. John, and also south of the river. The E.D. & B.C. Railway has now been constructed to Pouce Coupe. It seems reasonable to anticipate that activity in the agricultural sections will stimulate the market for coal.

CARIBOO MINING DIVISION.

The placer production for the year was $42,483, as compared with $38,845 in 1929. Water conditions during the year were distinctly favourable for the operation of hydraulic mines. The chief contributor to the output was the Lowhee Mining Company on Lowhee creek, which continued operations in productive ground. Other important contributors to the output were the various Chinese operators at the *Point* and neighbouring hydraulics on Slough creek, and M. Sundberg on Donovan creek. The customary activity was evinced by the numerous small placer operators in this Mining Division. A new discovery was reported on Canyon creek, but time did not permit of inspection.

Keystone-drilling was carried out at the *Trehouse* hydraulic mine on Cunningham creek under the supervision of C. W. Moore, acting for Robert McKee, optionee of the property. The dredging possibilities of the Fraser river between the Goat river and Loos were investigated by means of Keystone-drilling undertaken by a syndicate under the direction of Gordon F. Dickson.

Prince George Section.

Hixon Creek.

Hixon creek, flowing on a gradient of not over 2 per cent., has cut down to a maximum depth of about 200 feet in the surrounding plateau. While this region affords superabundant evidence of the former presence of the ice-sheet, it is equally evident that it did not suffer to any material

extent from glacial erosion. A detailed account of country-rock exposures on the creek is given in the 1927 Annual Report, which will not be repeated herein.

There are several different modes of placer-gold occurrence on this creek, some of which are unusual, and a better understanding of them is obtained by study of the neighbouring, parallel-flowing, Terry creek, distant a few miles south, on the banks of which particularly informative sections of gravel strata and country-rock are exposed.

As to the modes of placer-gold occurrence on Hixon creek: There is probably true bed-rock gold; Glacial and post-Glacial runs on false bed-rock consisting of both pre-Glacial and post-Glacial detritus, the detritus being kaolinized; and bench deposits in the upper portion of the creek-valley, which quite possibly represent the remnants of a pre-Glacial run left stranded as the creek deepened its bed. Finally, there are occurrences of residual gold.

From the practical mining standpoint there has to be considered the recovery of: (1) True bed-rock gold; (2) gold on false bed-rock, which occurs on low-lying benches; (3) gold in the high-lying benches.

The supply of water from Hixon creek itself is good. The Water Rights Branch of the Department of Lands estimates that a minimum of 1,600 horse-power can be developed at the foot of the falls. It is also understood that a further supply could be obtained from the Willow river. Careful investigation would be necessary before an opinion could be expressed as to the practicability of this scheme.

There is abundant evidence of the efforts of the early placer-miners on this creek, which proved productive, and these efforts were mainly directed to the recovery of gold from the low-lying benches, which were comparatively easy to work. Some attempts were made to reach bed-rock, but these early attempts, at any rate, appeared to fail owing to the obvious difficulties involved with the means available.

Field evidence strongly suggests that the pre-Glacial channel lies to the north of the present creek for about 3½ miles above the falls, whereas in the region of the latter the ancient channel lies south of the modern.

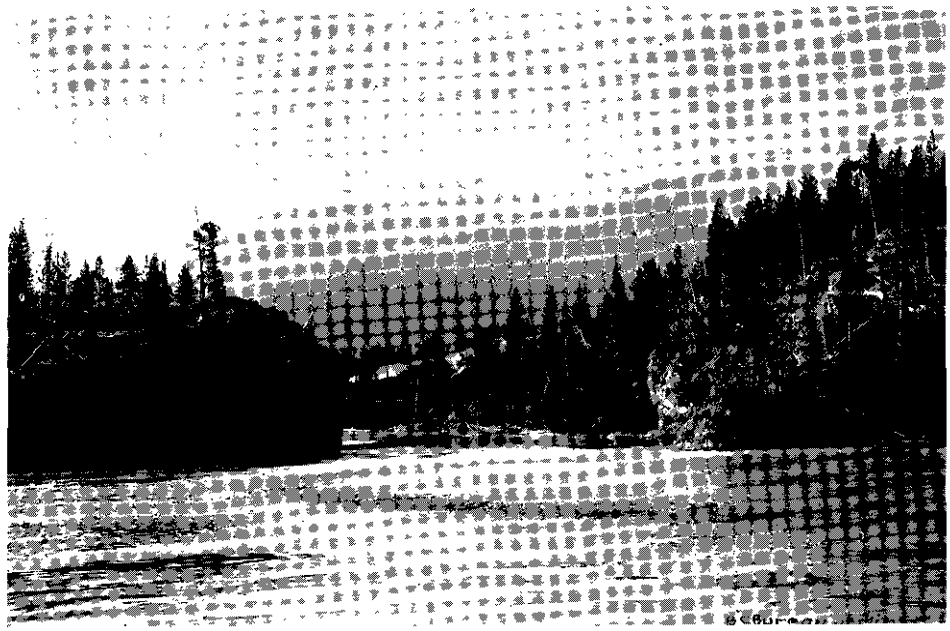
Did bed-rock grade permit, all forms of placer-gold occurrence might be won by hydraulicking, starting from some point below the falls, piping up-stream, and recovering bench deposits by laterals. Unfortunately, however, as has been mentioned, bed-rock gradient is only about 2 per cent. There are also many large boulders in the bed of the creek, so that dredging prospects are not obviously favourable. Doubtless the high benches can still be won by hydraulicking.

Very nice gold is at the present time being recovered from the lease held by E. Hann and J. Strbac, and such evidence as is available concerning other parts of the creek most certainly warrants thorough investigation of the possibilities—by Keystone-drilling, for example—and of the best method to adopt to recover the gold. At the same time it should be very clearly understood that so far quite insufficient testing has been carried out to warrant any material capital outlay in the installation of recovery plant. But little actual mining was carried on on this creek during the year.

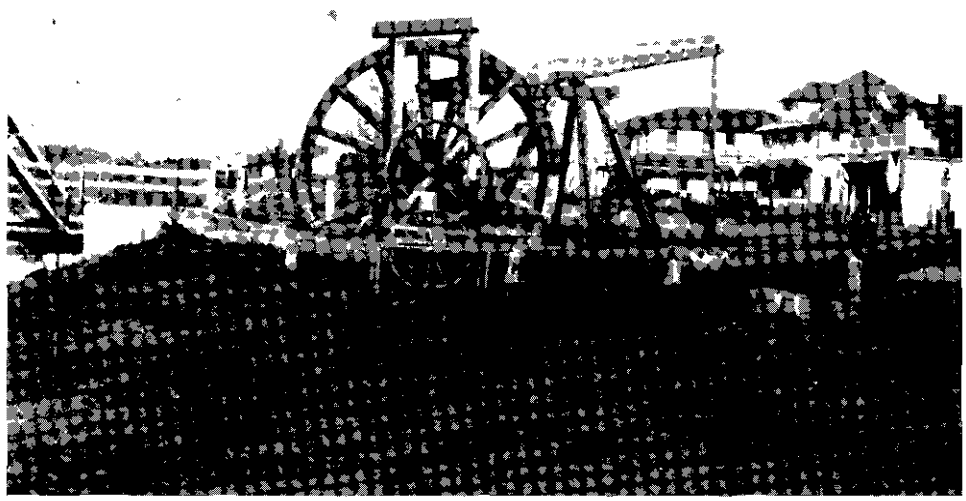
Golden Reward Placers, Ltd.

This company owns or controls applications for seven creek leases, commencing from a point just below the falls and extending from this point for 3½ miles up-stream to the lease held by E. Hann and J. Strbac. All of these applications cover previously staked mineral claims and Crown grants owned by the Quesnel Quartz Mining Company, and it is not known precisely what leases were granted.

No actual mining operations were carried out by the company during the year. During the past two years B. Briscoe, of Prince George, sunk four shafts on his lease (now the uppermost of those owned or controlled by this company), which immediately adjoins down-stream that of E. Hann and J. Strbac. These shafts all lie within a radius of 75 feet and are situated about 85 feet north of the creek. These are filled with water and are not open for inspection. One distant about 135 feet from the creek is said to be 15 feet in depth and to have bottomed on the carbonaceous schist, an exposure of which is to be found on the creek about 100 yards up-stream from this point. Two shafts about 25 feet apart, situated about 50 feet south of the last mentioned, were, it is stated by B. Briscoe, each sunk to a depth of about 54 feet. One was lost owing to "jack-knifing" of timbers at this depth, and the other, it is stated, reached bed-rock gravels, which carried high values, gold values to the extent of $75 being recovered from about 1½ yards of gravel. The dumps at the collars of these shafts show the characteristic salmon-pink-coloured kaolinized sericitic schist bed-rock of this vicinity, which contains many quartz-



Tahtsa River above Emerald Landing.



Old Cornish Pump set up as a Memorial at Quesnel.

Pondosy and Whitesail Lakes, Omineca M.D.

Ingenika Mines, Ltd., Camp.

particles. Owing to the fact that the country-rock on this creek weathers in situ to a kaolinized mass, hardly distinguishable from weathered detritus, it is extremely difficult to differentiate between true bed-rock and weathered detritus at certain points, and but little is to be learned by inspection of the dumps from the shafts mentioned.

During the winter of 1929–30 a sawmill operated by a steam-tractor was installed on this property, and about 300,000 feet B.M. of logs were cut and placed on skidways close to the shafts described above. These logs were intended, it is understood, for purposes of flume-construction.

While this property merits further testing—by Keystone-drilling, for example—very little investigation has been carried out to date beyond the shafts mentioned and some surface prospecting. It is known, of course, that bench-gravels carry promising values in places. These have indeed at times received a considerable amount of attention from individual operators.

It is believed that this property is the one referred to in certain literature issued by the Golden Eagle Mines, Limited. This literature contains such unwarranted and misleading statements regarding this property that it is considered advisable to summarize the salient features of the property as follows:—

(1.) Altogether inadequate investigation has been carried out so far to warrant any material capital outlay in installation of hydraulic or other equipment for the recovery of gold values.

(2.) From first-hand evidence the opinion is formed that preliminary investigation by means of Keystone-drilling is warranted.

(3.) Hydraulicking can doubtless be applied to recover gold values in high-lying benches, but can only find limited application in recovering bed-rock gold owing to low bed-rock gradient.

(4.) What method, if any, can be economically applied to recover bed-rock gold must depend entirely upon values disclosed by drilling, and much other information supplied by this means of investigation.

Lease of E. Hann and J. Strbac.—A fairly full account of this will be found in the Annual Report for 1927. The gold occurrence on this property is unusual. Pay-gravels are coarse, consist of granite and mica-schist, and are underlain by white clay, apparently false bed-rock. Overlying the pay-gravels are fine gravels, and overlying these are two successive forest-growths of large timber, a modern one still growing, and an ancient one a few feet below the former.

The white-clay bed-rock may be residual; that is to say, true bed-rock weathered in place or it may be kaolinized detritus. Owing to the nature of the rocks in the vicinity and the exposures of gravel at this point, this point is indeterminate. The whole forms a bench deposit, low-lying, and but a few feet above the creek, and gold-recovery is in consequence somewhat laborious. Much good work has been accomplished by the owners and some nice coarse gold has been recovered. This does not show much signs of wear, and that most recently obtained from the face of the pit close to the valley-rim presents much the appearance of residual gold.

Lode-mining.

Considerable interest was evinced in Hixon creek during the year by examining engineers. The quartz veins exposed on this creek as exemplified by the property of the old Quesnel Quartz Mining Company, now under option to the Cariboo Lode Mines, Limited, were the subject of attention in the earliest times. An account of this will be found in the Annual Report for 1929. The occurrence of spotty gold values in the tunnel on the *Cayenne No. 2* claim of the *Cayenne* group, owned by E. Hann and J. Strbac, of Hixon, conveys the suggestion that a somewhat wide belt of the schist country-rock may prove auriferous. This is a point, however, which requires thorough investigation, although the possibilities warrant such. An account of this property will be found in the 1929 Annual Report.

Terry Creek.

Terry and Hixon creeks, both tributaries of Canyon creek, flow parallel to one another from 4 to 5 miles apart. Terry creek being the more southerly.

Terry creek, like Hixon creek, has cut down to a maximum depth of about 200 feet in the plateau, and also runs on low gradient, which prevents any extensive hydraulicking of bed-rock gravels.

Such occurrences of placer gold on Terry creek as were observed were, while unusual, clearly post-Glacial. A stratum of red-coloured slightly auriferous gravels appears to have a fairly wide distribution in this area. This immediately overlies boulder-clay, which again overlies pre-

Glacial detritus composed of partially kaolinized and decomposed fragments of granite and mica-schist, resting upon a true bed-rock of green-coloured schist. Terry creek itself and its tributaries cutting down through the slightly auriferous red gravels mentioned have effected a reconcentration of these upon the pre-Glacial detritus, which forms an excellent false bed-rock. That the detritus is of pre-Glacial age is proved by the fact that boulder-clay overlies it and by the fact that it contains lignite.

Operators on this creek at the time of inspection were T. H. Campbell, of Hixon, who has been working on the creek for some considerable time, and B. Briscoe and associates, of Prince George.

Lease of T. H. Campbell.—This lease is situated about 4 miles from the mouth of the creek, at the point of junction of a small tributary, locally known as Tom creek, on the south side of the main creek. Much intelligent, painstaking effort is reflected in what the owner of this lease has accomplished single-handed.

Somewhat up-stream from the point of junction of the tributary mentioned, the owner constructed a wing-dam for the purpose of enabling him to wash the gravels in the bed of the main creek. More recently he has been making preparations for the installation of a small hydraulic plant to pipe out the reconcentration of gold gravel, which has been effected by the small tributary creek mentioned. An informative exposure of strata is afforded on the left bank of Terry creek by the wing-dam mentioned. Here underlying vegetation are, in descending order, red-coloured gravels 20 feet thick, slightly auriferous; boulder-clay 20 feet thick; partially kaolinized detritus consisting of decomposed and agglomerated fragments of granite and schist, 25 feet in thickness, resting on true bed-rock of green-coloured schist exposed just above the creek-level. It is evident, therefore, that Tom creek has effected a reconcentration, of the red-coloured slightly auriferous gravels, on the detritus, which forms an excellent false bed-rock. Reasons have been assigned above for classifying this detritus as pre-Glacial.

It is the owner's intention to install a small hydraulic plant on Terry creek at the mouth of Tom creek to pipe out the reconcentrated gravels lying on the false bed-rock. With this end in view he has constructed a ditch-line from the headwaters of Tom creek on top of the left bank of Terry creek, which will give a head of 200 feet or thereabouts at the monitor.

Lease of B. Briscoe and Associates, of Prince George.—In these holdings are comprised nineteen creek leases and six bench leases, the former commencing from the mouth of Terry creek. The owners have done a considerable amount of prospecting and testing, mainly of surface gravels in the bed of Terry creek, somewhat below the lease of T. H. Campbell, and on the north side of the creek. There are many large boulders in the bed of the creek, and pay-gravels immediately overlie the pre-Glacial detritus false bed-rock mentioned in the above description of T. H. Campbell's lease. The gold is doubtless a reconcentration of the stratum of red-coloured gravels also previously mentioned. Various bench deposits on the banks of the creek could quite possibly be hydraulicked, but these call for detailed investigation prior to material capital outlay on hydraulic plant.

Bench leases cover a depression observed on the plateau on the north side of the creek. This depression intersects Terry creek at a slight angle, at a point about 3 miles above the mouth of the latter, and may be an ancient drift-filled channel. Its possibilities can only be determined by much testing.

Fraser River.

Ancient Channel near Woodpecker.—There is exposed on the right bank of the Fraser river, about 200 feet vertically above the latter and some considerable distance from it, what appears to be a segment of an ancient channel, the direction of flow indicated being south-easterly. This is situated about opposite Dale's ranch on the east bank and is conveniently reached by crossing the river at this point and following a trail leading to it from the west side of the river. On the occasion of the visit of the Resident Engineer, Mr. Dale kindly provided means of crossing the river and accompanied him to the spot. The left rim of this channel is well exposed and it is understood that surface gravels give promising indications of gold values. Encouraging values are also said to have been obtained on the gravels of the Fraser river at a point 1½ miles or so distant south of the ancient channel exposure, and where presumably the latter is intersected by the former.

The question naturally arises as to whether this is another segment of the ancient channel exposed at the *Tertiary* mine in the Cottonwood canyon. This may be so, but data available

are insufficient to warrant the expression of a definite opinion on the matter, although further investigation is clearly warranted. It is quite possible that there has been a reversal of the drainage in that portion of the Fraser river between the mouth of the Blackwater river and the point at which the south end of the ancient channel is cut by the Fraser river, and that the latter may have formerly occupied a position east of its present channel at points south of this. In this connection it might be noted that the north-westerly-flowing portions of the Quesnel and Cottonwood rivers and of Canyon creek are approximately in line. In view of the very large valley occupied by the portion of Canyon creek mentioned, the advisability of field-study is indicated to determine the possibility of an ancient valley having been continuous between the points mentioned.

Canyon Creek.

A discovery of placer was reported on this creek, but time did not permit of inspection.

BARKERVILLE SECTION.

A detailed account of placer properties in this section, embracing the surrounding glacial geologic features, will be found in Memoir 149, by W. A. Johnston and W. L. Uglow, published by the Geological Survey of Canada. Technical information concerning properties therein described will not be repeated herein.

Lowhee Creek.

Lowhee Mining Co., Ltd.

A satisfactory year was experienced by this company, which operates the most important hydraulic mine in this Mineral Survey District. The face of the pit has now advanced somewhat beyond the mouth of Watson's gulch, and the latter, of course, offers a lateral hydraulic possibility as well as the continuation of Lowhee creek. This company contemplates moving its camp-site from its former position some considerable distance below the present pit-head to the head of the creek. With this end in view construction of a new road up Stouts gulch to the new camp-site has already been started, assistance in connection therewith having been given by the Department of Mines.

Eight-mile Lake.

M. McComish and M. Anderson have been busily engaged during the year in clearing out and restoring the tunnels previously run southwards from the face of the *Thistle* hydraulic pit, with a view to continuing the same. The grade of the interglacial pay-streak was so low that it could only be followed by the early hydraulic operations for a limited distance from the lake. There seems every reason to anticipate an extension of this run beyond the face of the *Thistle* pit, and quite possibly it is closely connected with the run in the Rees hydraulic pit, about half a mile south of this point. The region between Shepherd creek and the *Thistle* pit appears to offer considerable promise and warrants some systematic Keystone-drilling, which, besides giving information as to yardage and values, would also throw much light on the best method to adopt for recovery of the gold.

The grade of the track from the portal of the tunnel in the face of the *Thistle* pit to the dump is adverse, and novel means, showing considerable ingenuity, were devised by the operators for hoisting cars. The expedient was adopted of erecting a hoist at the end of the dump; an impulse water-wheel made on the ground, direct-connected to the hoist, and operated by the monitor, supplying the motive power.

Valley Mountain.

D. McIntyre and W. Thompson own two leases situated on a high bench on the west side of Valley mountain. A considerable amount of work was done by the owners during the year in prospecting the ground by means of shafts, and operations were continued during the winter. It is understood that the owners contemplate drilling their ground. The possibilities of a southward continuation of the *Thistle* pit run of gold, which is the subject of comment in this and previous Annual Reports, affords warrant for a thorough investigation of this area.

Pine Creek.

J. P. Roddick was engaged on his leases and is considering bringing water on to his property from Jubilee creek. The point at which it is proposed to set up the monitor is 210 feet vertically below the mouth of Jubilee creek, which is also virtually the highest point reached by the Barkerville–Bear Lake road.

Cunningham Creek.

Trehouse Hydraulic.

An option on this property was taken by Robert McKee and Keystone-drilling operations under the supervision of C. W. Moore were commenced in the fall. At the time of inspection on October 12th the drill was being moved to the property, but drilling had not commenced. It was proposed to commence drilling a line of holes in a direction approximately at right angles to the creek on the right bank of the latter, about 150 yards down-stream from the hydraulic pit.

Dragon Creek.

A very great deal has been accomplished by L. Ford and R. McDougall, of Barkerville, at their lease on Dragon creek. The objective here is the hydraulicking of the buried ancient channel in the lower portion of the creek, which has previously been explored by earlier tunnelling, which has afforded an idea of values. The present *modus operandi* was fully explained in the 1927 Annual Report, to which reference is invited. A dam-penstock and pipe-line were installed some considerable time ago, and the 40- by 36-inch sluice-flume has been advanced a total distance of 636 feet at the time of inspection on October 10th on a grade of 5 inches in 12 feet. Piping operations have disclosed a run of gravel of considerable size, which appears to have a course approximately parallel to the Willow river. This may be an old channel, but seems most likely to be a continuation of the system of benches, which is characteristic of the left bank of Slough creek and on which are located the *Point* and other hydraulic mines now operated by Chinese, and the sum total production from which is an important contribution to the placer-output. The *Point* mine is stated to have been in operation for forty years. The discovery mentioned on Dragon creek is quite distinct, of course, from the original objective of the present operations of L. Ford and R. McDougall, and constitutes an additional possibility which well merits investigation by means of Keystone-drilling.

Slough Creek.

The *Point* and neighbouring hydraulic mines on the left bank of Slough creek, operated entirely by Chinese, had a successful season and the total contribution to the placer-output was of decided importance.

Devils Lake Creek.

The *Ketch* mine was under option to F. S. Munson during the year. At the time of inspection on October 27th drifting was being tried in place of hydraulicking, W. J. Howser being in charge of operations. Among the gold recovered during the year was one nugget valued at $100, it is stated.

Among individual operators in the vicinity of Barkerville may be mentioned R. D. Rees at Shepherd creek; E. W. Giddings at his *Hurdy* real-estate claim on Williams creek; and D. McIntyre.

Lightning Creek and Tributaries.

Ah Quay.

Recent work by the owner of this claim, J. F. Williams, of Stanley, at a point about 25 feet above the level of Lightning creek has been directed in the hope of discovering a high run of Lightning creek. That is a possibility, inasmuch as proof is afforded that Lightning creek deepened its bed in pre-Glacial times, forming benches such as Butcher bench and Dunbar flat, and, further, that gold left on those benches was not entirely eroded by ice-action. At the point mentioned on the *Ah Quay* claim there is exposed a depression in the valley rim-rock on which rest some gravels containing coarse gold. This depression seems likely to extend up-stream in the form of a bench, but further work is necessary to form a definite conclusion on this point. At higher points in the hydraulic pit, bed-rock appears to dip easterly and is immediately overlain by slum, on top of which are auriferous glacial gravels. At the highest point of exposure in the pit the bed-rock is immediately overlain by about 25 feet of gravels and shows no evidence of easterly dip.

Dry Gulch.—At his property on this gulch J. F. Williams has constructed a sluice-flume and commenced ground-sluicing.

Cariboo Eagle Mine.—This hydraulic, situated on Houseman (Eagle) creek, was worked during the year by Mrs. Murphy and associates. Inspection was not possible, but it is learned that no clean-up was made..

Donovan Creek.—Satisfactory results were gained, it is understood, by M. Sundberg at his hydraulic on this creek, which is described in the 1927 Annual Report, but which was not visited during the year.

Lovett Creek.—A considerable amount of work was, it is understood, carried out on this creek with promising results by Harry Jones and associates, of Beaver Pass. Aid has been given by the Department of Mines in the matter of constructing a bridge across Lightning creek at this point.

Anderson Creek.—Some work was done on this creek by E. M. Falck, of Stanley.

Mosquito Creek.

Leases of W. C. Slade.—Mosquito creek flows into Lightning creek somewhat below Wingdam from the south. Two creek leases on this creek are owned by W. C. Slade and associates, of Cottonwood. The former has accomplished, single-handed, much painstaking work.

Field evidence points to the fact that a buried ancient channel lies in the left bank of Mosquito creek near its mouth. Tunnels run by early miners in the left bank of the creek show that this possibility was recognized in early days. W. C. Slade's operations focus on an attempt to break into this channel by hydraulicking immediately west of an old pit, known as "McPhail's pit," opened up just opposite the old *Bonanza* mine on the left bank of Lightning creek. The bed-rock exposed in the pit is argillite intruded by biotite granite. W. C. Slade's pit shows similar bed-rock overlain by a thickness of about 25 feet of glacial gravels and boulder-clay interstratified. A road leads to this property from the Quesnel–Barkerville road, from which it is distant about half a mile.

Consolidated Gold Alluvials of B.C., Ltd.

This company has been incorporated for the purpose of acquiring and developing the leases on Lightning creek held by the Lightning Creek Gold Mines, Limited, and also *La Fontaine* mine property, covering a total length of about 22½ miles of Lightning creek. The capital of the newly formed company is $2,500,000, divided into 2,500,000 shares of $1 each. The head office is at Rogers Building, Vancouver, and the secretary is Alexander Grant.

Attention is drawn to the statements in the prospectus of the company, dated January 10th, 1931, that "there are probably gold contents of fifty million pounds (sterling) in the 21 miles of this creek owned by the company." Study of authentic records indicates a total production *from the entire Cariboo district to date* of about $45,000,000. Even granting that official records may not take account of all the gold produced, the statement under comment assigning to a portion of Lightning creek a probable gold content vastly in excess not only of that of the entire Cariboo district, but also that of the Klondyke placer-field, is obviously a great exaggeration of what can reasonably be anticipated. Furthermore, it is at variance with this company's own statement of the values indicated by Keystone-drilling. On the following page of the prospectus appears the statement: "In the absence of drilling results over the full length of the company's property, the Board considers it inadvisable to give any estimate of the total gold contents. . . . The gold contents of the 5,000 feet (section 6) bored are calculated at the conservative figure of £10 per cubic yard over an average width of 60 feet and depth of 6 feet." On this basis of computation the total gold contents per 5,000 running-feet of creek would be $3,300,000, or $660 per running-foot. The statement under criticism assigns a probable gold content of about $2,200 per running-foot, a value more than three times as great as that stated to be indicated by Keystone-drilling, and without the bounds of probability.

This property is one which careful study indicates as being worthy of thorough investigation with the reasonable possibility of there being rich bed-rock gravels, the profitable extraction of which will call for skilled engineering ability.

At a time which seems particularly opportune for directing attention to the commercial possibilities offered by the placer-mining field, it seems particularly unfortunate that extravagant and conflicting statements should appear in the prospectus of this company.

LODE-MINING.

The results gained to date at various gold-bearing quartz vein properties in the Cariboo and Quesnel Mining Divisions are undoubtedly such as to justify not only the further intelligent development of the particular properties at which encouraging results have been obtained, but also that of other neighbouring properties.

Cariboo Gold Quartz Mining Co., Ltd.

At the time of inspection in October no large amount of underground development had been carried out since last year; nevertheless, distinctly favourable and encouraging results were obtained. A rich gold mineral was found at several different points in the large cross-vein struck last year, and also in a small cross-vein struck near the face of the crosscut directed towards the *Rainbow* group. As to the rich mineral mentioned, investigation by the Bureau of Mines indicates that it is a combination of lead and bismuth sulphides, apparently intimately admixed so as to form one homogeneous mineral, having apparently the approximate composition of chiviatite.

It might also be mentioned that in 1925 the mineral bismuthinite, carrying high gold values and showing free gold, was observed on the surface of the *Rainbow* group. There is no reason to infer that large amounts of the rich mineral discovered will be a characteristic of the veins encountered in the present workings; nevertheless, its presence at this horizon is encouraging. The small cross-vein struck this year has been followed by drifts north and south of the crosscut for a total distance of about 45 feet. In the face of the north drift there is exposed some of the rich mineral with free gold. Three samples were taken at intervals in the drift, each across a width of 6 inches. Of these, two showed merely traces of gold and silver, and the third assayed: Gold, 0.24 oz. to the ton; silver, 0.1 oz. to the ton.

There appear to be three objectives of immediate major importance which call for investigation at the horizon of the present workings, namely: (1) The further investigation of the large cross-vein encountered; (2) the probing in depth of the promising surface exposure of quartz mentioned in the 1929 Annual Report; and (3) the investigation of the area immediately below the *Rainbow* showings.

The chief activities of the company during the year have focused on the construction of a power-house and camp buildings, and installation of Diesel engine and air-compressor at a point about 100 feet above Jack of Clubs lake.

At this point, which is about 375 feet vertically below the present crosscut tunnel and drifts therefrom, it is proposed to run a crosscut tunnel, the length of which is stated by the management as being about 2,500 feet, to probe the vein system at this greater depth. Veins other than those mentioned above are known to occur on this property, but the commercial possibilities of these are largely unknown. It is quite possible that the long crosscut tunnel may penetrate such, and also others the existence of which is as yet unknown. The management anticipates that one vein will be passed through by the crosscut at about 200 feet from the portal.

A reinforced-concrete building, comprising power-house, changing-room, and blacksmith-shop, has been erected, and a 409-cubic-foot Ingersoll-Rand air-compressor and 94-horse-power Ruston & Hornsby Diesel engine have been installed, also a 10-kw. generator. Camp buildings are also to be erected adjacent to the new tunnel-site. Refer also to the Annual Reports for the years 1927, 1928, and 1929.

Westport.

This group, owned by F. J. Tregillus and T. Blair, of Barkerville, is situated between Barkerville and Richfield and exposures are within a few yards of the road between the places mentioned, on the banks of Williams creek. By the roadside a short distance above the mouth of Stouts gulch, an open-cut, followed by a tunnel a few feet in length, exposes what appears to be a cross-vein, 3 feet in width, heavily mineralized with arsenical-iron pyrites. The strike cannot be accurately determined from the exposure. A sample at this point across 3 feet assayed: Gold, 2 oz. to the ton; silver, 0.6 oz. to the ton.

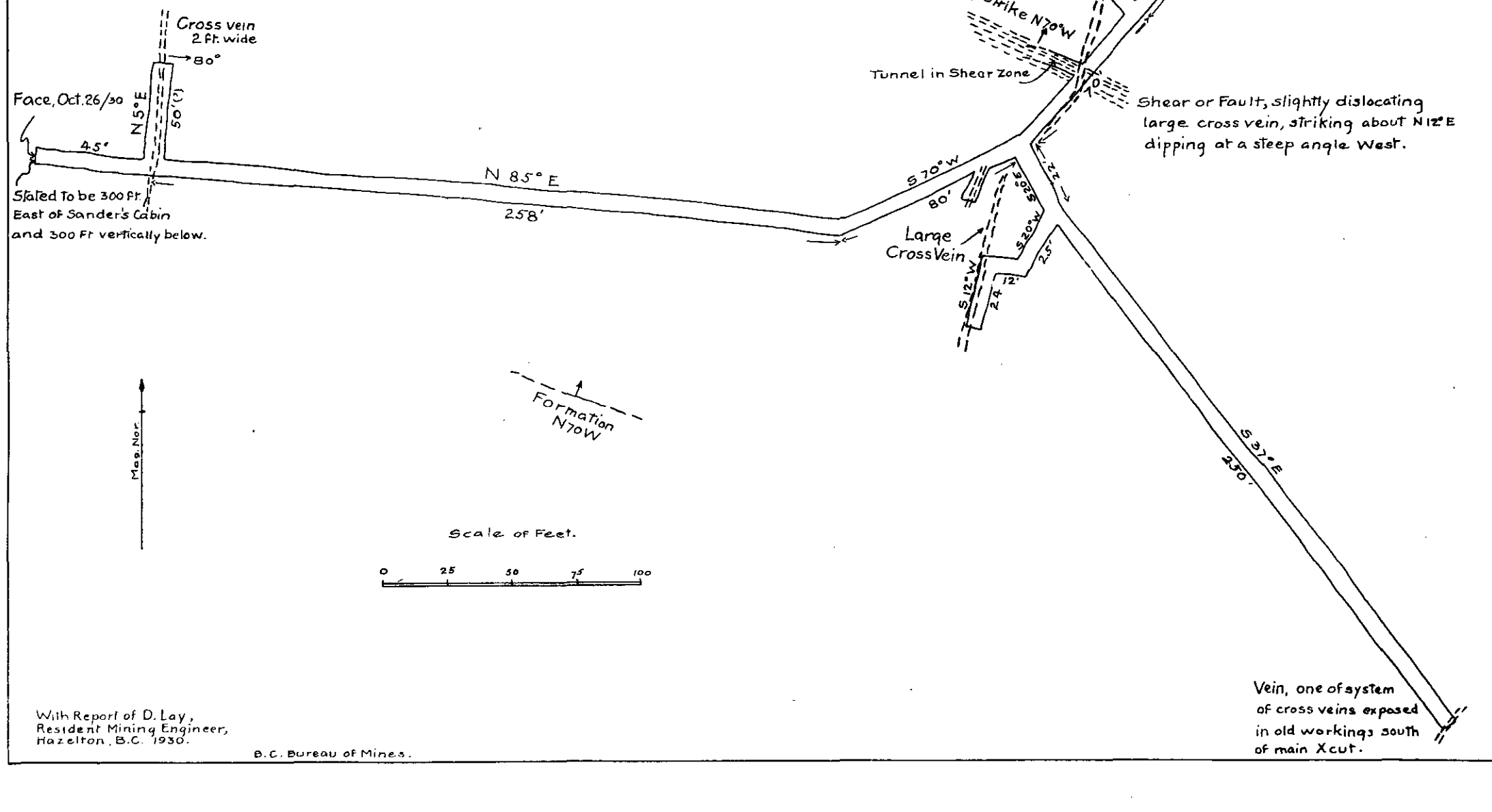
About 65 feet south of the above, and also within a few yards of the road, a well-mineralized vein 3 feet in width strikes N. 45° E. (mag.) and dips south-east. Exposure is by open-cut. A sample across 3 feet at this point assayed: Gold, 0.8 oz. to the ton; silver, 0.2 oz. to the ton.

In the bed of Williams creek, immediately below the first-mentioned exposure, a crosscut tunnel has been run a distance of about 32 feet on a bearing N. 55° W. (mag.). In the face of this tunnel a cross-vein 1 foot in width is exposed. It would seem highly advisable to drift on the good exposure showing by the roadside above, in preference to crosscutting. The additional depth gained by the latter alternative is hardly worth consideration, and further information is required as to the strike of the vein in any case. In Black Jack gulch, close to the road, a cross-vein 6 inches in width is exposed. A sample of this assayed: Gold, trace; silver, 2 oz. to the ton. The first two exposures mentioned well merit further investigation.

Plan of Workings

CARIBOO GOLD QUARTZ MINING CO. LTD

on Lowhee Creek
B.C.



With Report of D. Lay,
Resident Mining Engineer,
Hazelton, B.C. 1930.

B.C. Bureau of Mines.

Proserpine. On the *Pani* claim of this group, owned by C. J. Seymour Baker, of Barkerville, the owner has exposed on the left bank of Williams creek, by means of two open-cuts about 50 feet apart, a large quartz vein fairly well mineralized. Mineralization of pyrite, galena, and zinc-blende appears to extend over a width of 25 feet. A sample of selected mineral assayed: Gold, trace; silver, 5 oz. to the ton; lead, 6 per cent.; zinc, 2 per cent. C. J. Seymour Baker also carried out some work on his Island Mountain properties.

Hudson.—Much interest was evinced by examining engineers in this group, situated on Cunningham creek and owned by I. E. Moore and F. Wells, of Barkerville. This is a prospect of merit. Refer to the 1929 Annual Report.

QUESNEL MINING DIVISION.

The placer production of the Quesnel Mining Division for the year was $37,179, as compared with $20,417 in 1929. A feature of the year was the success gained by B. Boe on Cedar creek. The *Bullion* mine was reopened during the year by the Quatsino Sound Mining Company, G. C. Bagley being in charge of operations.

Among new operations started during the year may be mentioned: Those of R. N. Campbell and associates, of Horsefly, on Antoine creek, where there is evidence of the existence of metals of the platinum group in addition to gold values; those of Placer Engineers, Limited, on 4-Mile creek, a tributary of Keithley creek; those of George Kuchan and associates, of Horsefly, on the Hobson mine tailings, Horsefly river; and those of J. Shaw and L. J. Auten on the North fork of the Quesnel river. On Black creek, a tributary of the Horsefly river, Rountree Mines, Limited, was engaged in hydraulic operations.

A limited amount of Keystone-drilling was carried out by Aero Mineral Locators, Limited, on Drummond flats. Careful investigation of this area subsequent to the drilling inclines the belief that further investigation is fully warranted. Keystone-drilling was carried out by C. R. Carfrae and Sandberg at the leases of the former in Beaver valley. Individual operators were active at many points.

The Cariboo Coal and Clay Company carried out much exploratory work by diamond-drilling and surface prospecting on the coal areas in the vicinity of Australian. The oil possibilities of the region in the vicinity of Quesnel excited much attention during the year, and an oil-well was spudded in on October 2nd on the Yorston ranch, near Australian.

QUESNEL SECTION.

Quesnel River.

A few days were spent by the Resident Engineer during the year in field-study of that portion of the Quesnel river upwards of 30 miles in length between Gravel creek (26 miles above Quesnel) and Morehead creek. A fair road, passable for cars in dry weather, leads to Gravel creek from Quesnel, from which it is 18 miles distant, and passes along the entire stretch of river mentioned. Extensive flats, both high- and low-lying, known respectively as Sardine, French, and Drummond flats, and others unnamed, flank the left bank of the river in this region, of which they are a noteworthy topographic feature.

Old workings render evident that this region engaged the attention of the very early placer-miners. The old hulls of dredges at three different points on the river bear witness to subsequent activities. More recently in 1912 a certain amount of hydraulicking was carried out on Morehead creek, where occurs one of the major hydraulic possibilities of the district, an account of which will be found in the Annual Report for 1927 under "Morehead Mining Syndicate." Started in 1918, the operations of the Quesnel Hydraulic Mining Company on Birrell (20-Mile) creek, on the north side of the Quesnel river, were not a financial success. During the present year a certain amount of Keystone-drilling was carried out by Aero Mineral Locators, Limited, on Drummond flats, and the enterprise of the prospector was reflected in the mobile pump-hydraulic equipment installed by A. E. McGregor and associates, of Quesnel, to test one of the flats.

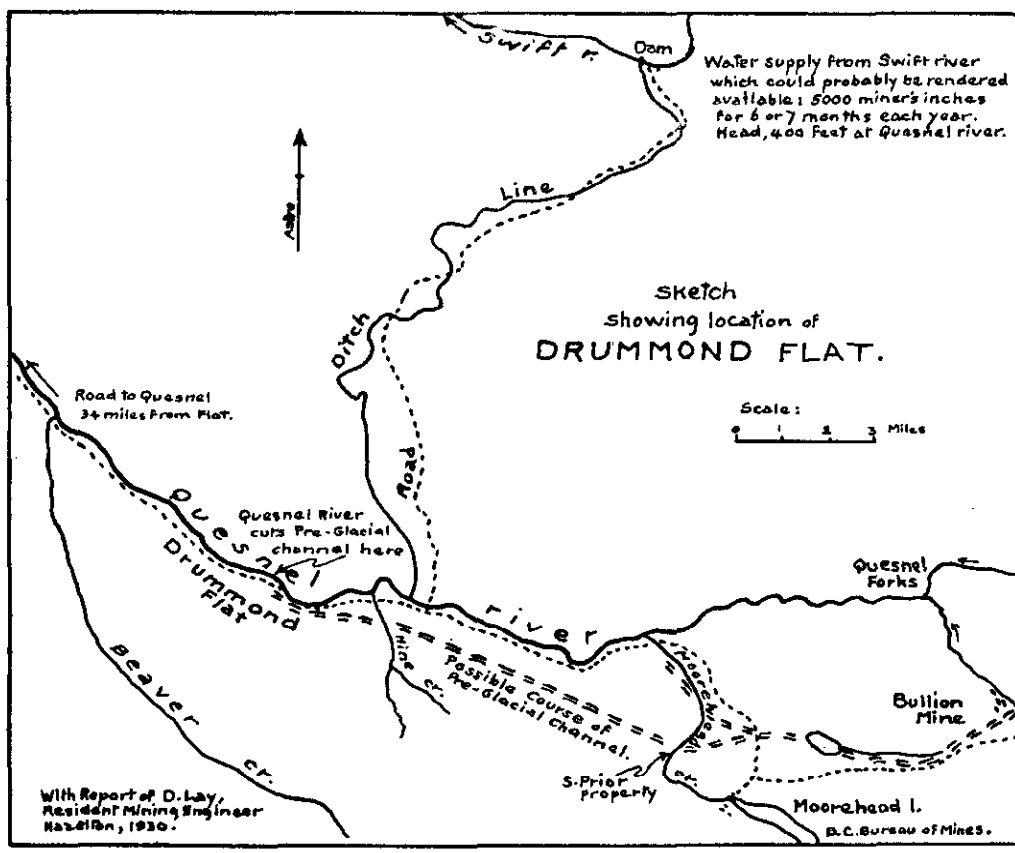
Field-study during the year inclined the view that the following possibilities exist and merit the investigation necessary before they can be assured:—

(1.) Hydraulic possibilities of major importance at Drummond flats, where a buried ancient river-channel is exposed.

(2.) Dredging possibilities may exist at the sites of the old dredges.

(3.) Another segment of an old river-channel exists at the upper end of French flats on the lease of A. E. McGregor.

Drummond Flat.—(A lease at this point is owned by John Strand, of Quesnel.) This flat lies 330 feet vertically above the Quesnel river and lies between Beaver and China creeks, and is reached by road from Quesnel, from which it is distant about 34 miles. There is every indication that a pre-Glacial channel of the Quesnel river was cut through at this point by the modern river in the vicinity of the mouth of Dredge creek, where the hull of an old dredge lies. It seems quite likely that the upper end of this old channel is exposed on Morehead creek, some 10 miles distant, on the property of S. Prior (refer to 1927 Annual Report). Creeks which cut across this channel between Dredge creek and China creek, and therefore effected a reconcentration of the gold contents, were worked by the early miners. No creek is known to cross the channel



between China creek and Morehead creek. The latter was actively worked in the region of its intersection of the ancient channel. This ancient channel is deeply buried beneath glacial drift. The right rim of the channel is plainly exposed just below the mouth of Dredge creek, and below this creek also two tunnels close to one another, both now caved, were run in a direction S. 15° E. (mag.) at a point about 240 feet above the Quesnel river. This year the Keystone-drilling carried out by Aero Mineral Locators, Limited, was also on a line north of Dredge creek and between this creek and the tunnels mentioned. It is understood that a complete cross-section was not obtained by this drilling and that the results were considered somewhat disappointing. But it is desired to point out that there was evidently complete failure of the right rim of the ancient channel by Dredge creek, and this indicates that Keystone-drilling should be carried out *above* Dredge creek; that is, at points up-stream in the old channel from that point at which there was failure of the rim. The site of the old dredge and the workings of the early miners in the vicinity of Dredge creek would seem to lend force to this argument. It is under-

stood that it was the original intention of this company to drill several cross-sections of holes, but the drill was placed on the ground in winter and snow conditions rendered it impossible to get the drill higher up-stream at the commencement of operations.

As to the fundamental requirements of hydraulicking and the extent to which they are exhibited, there is every indication of immense yardage, but average values are of course quite unknown; the supply of water from the Swift river which could be rendered available is highly satisfactory; dump facilities for tailings-disposal and bed-rock grade are unknown.

The water-supply amounts to 5,000 miners' inches for six or seven months of the year (refer to 1918 Annual Report, page 142, and to "Placer-mining in British Columbia," page 43). Dump facilities depend upon the height of the channel bed-rock above the Quesnel river, and the extent to which the channel can be hydraulicked up-stream depends upon the bed-rock grade (not considering the question of elevating gravels below sluice-flume grade). Bed-rock grade may not be very different from that of the *Bullion* channel, which is 1 per cent. It is possible, if low grade of bed-rock renders such necessary, that a sluice-flume in a tunnel run from the Quesnel river below bed-rock might enable additional advance to be made after the sluice-flume in the channel had advanced as far as practicable. This possibility depends, of course, upon the height of the channel bed-rock above the Quesnel river.

While average values can, of course, only be arrived at by Keystone-drilling, and while the only direct information as to values is afforded by the known fact that modern streams crossing this channel effected profitable reconcentrations, nevertheless it is possible to make a more or less intelligent guess as to the kind of average values that may be expected. These latter may be of the order of those inferred from preliminary investigation of the neighbouring "Morehead channel" and given in the 1927 Annual Report; that is to say, of the order of about 20 cents a cubic yard. Bed-rock values *per se* are likely to be much higher as the figure given relates to the deposit as a whole. Upper glacial gravels cannot be expected to contain other than very low values. Assuming that the necessary investigation discloses average values of the order mentioned, and also that favourable hydraulic-mining conditions are indicated, in view of the large amount of water available commercial possibilities of major order will be presented. Whether or not bed-rock values could be recovered *per se* is also a matter which can only be determined by investigation.

In view of the importance of first ascertaining the depth to bed-rock at various points and the grade of the bed-rock, it would seem that investigation might advisedly commence with an application of geophysical methods to determine these factors, which in themselves would be of the utmost importance, as necessary prerequisites to the formulation of any plans for hydraulicking, and incidentally they would give a close idea as to the cost of any subsequent Keystone-drilling. There are several companies that specialize in such work, and there is every reason to suppose that an expenditure of from $1,250 to $2,500 in this way would yield far more valuable information than a corresponding amount spent on Keystone-drilling in the first instance in this particular case. It seems a reasonable anticipation that these gravels may contain metals of the platinum group as well as gold.

McGregor Lease.—On the lease of A. E. McGregor, of Quesnel, about 10 miles down-stream from Drummond flat, at the upper end of French flats, in the vicinity of Pre-emption Lot 9887, is exposed another segment of an old river-channel, west of the present river and immediately adjacent to the left valley-rim of the Quesnel river. It is clear that the moraine of an alpine glacier, the crest of which is 100 feet above the surface of the channel, caused the river to cut a rock channel which it now occupies east of the old channel. The surface of this old channel is not more than 25 feet or so above the surface of the present river. Old workings bear witness to the fact that the top gravels of the old channel were productive, and the present owner is contemplating working some of the remaining portions of the surface if a mobile small pump-hydraulic equipment can be made to apply. Depth to bed-rock is quite unknown. Some preliminary Keystone-drilling of this channel and the portion of French flats below it would seem well warranted to determine dredging possibilities. It is possible that this is the down-stream continuation of the Drummond Flat channel, but an opinion upon this point cannot be definitely formed until depths to bed-rock have been determined.

The quasi-artificial appearance of the morainal dam is somewhat striking, and the surroundings in their entirety afford an interesting illustration of the numerous occurrences in glaciated countries of old channels at the side of modern canyons.

Lease of A. E. McGregor, G. F. McGregor, and C. Stanfield, of Quesnel.—This lease is situated about 3 miles up-stream from that above described, on the right bank of the Quesnel river. At this point several low-lying terraces were the object of attention by early miners, who left behind them interesting evidences of their ingenuity, among which may be mentioned a car run on rollers instead of wheels. Values in the top gravels were evidently good, but the problem which confronted the early miners was that of getting water on the ground for the purpose of washing the gravels, and their method, although clearly revealed, was somewhat unusual. This consisted in shovelling the top gravels from a bench about 25 feet vertically above the river into the car mentioned, and tramming to a chute delivering to a bin situated but a few feet above water-level. Water for washing the gravels was obtained from a well sunk close to the bin. Although the collar of the well is only a few feet vertically above the river, the horizontal distance from the river is at least a hundred yards, and the sinking of the well eliminated the laborious task of carrying water from the river.

The present operators, with commendable enterprise, have installed a mobile pump-hydraulic plant for the purpose of working these terraces, some of which are quite extensive, and at several points promising values have been found in the top gravels.

The equipment devised by A. E. McGregor consists of a 4-inch centrifugal pump delivering 60 cubic feet of water a minute operated by a Cadillac car-engine. A 4½-inch canvas hose is coupled to the pump discharge and the monitor is attached to the canvas hose. This type of equipment can be used to good advantage in testing many low-lying benches which have no convenient water-supply adjacent, and which, while not offering prospects of large-scale operation, may yet be turned to good account by the individual operator.

Dredging Possibilities.—The hulls of three old dredges are to be found along this section of the Quesnel river—one at the mouth of Morehead creek, another at the mouth of Dredge creek by Drummond flat, and the third at the lower end of French flats. The position of the last mentioned is shown on the Quesnel sheet of the pre-emptors' maps as "Old Hall Dredge."

It is hardly necessary to say that these dredges were not of modern design. Failure may have been due to mechanical defect or unsuitable design. What is certain is that these dredge-sites mark in each instance the point of intersection of an ancient channel by the present river. To the effects of such reconcentration are to be attributed the gold values at these points, and for that reason they are more deserving of investigation than would be the case were they bars of the modern river. These former dredge-sites merit further investigation and Keystone-drilling to determine dredging possibilities with modern equipment.

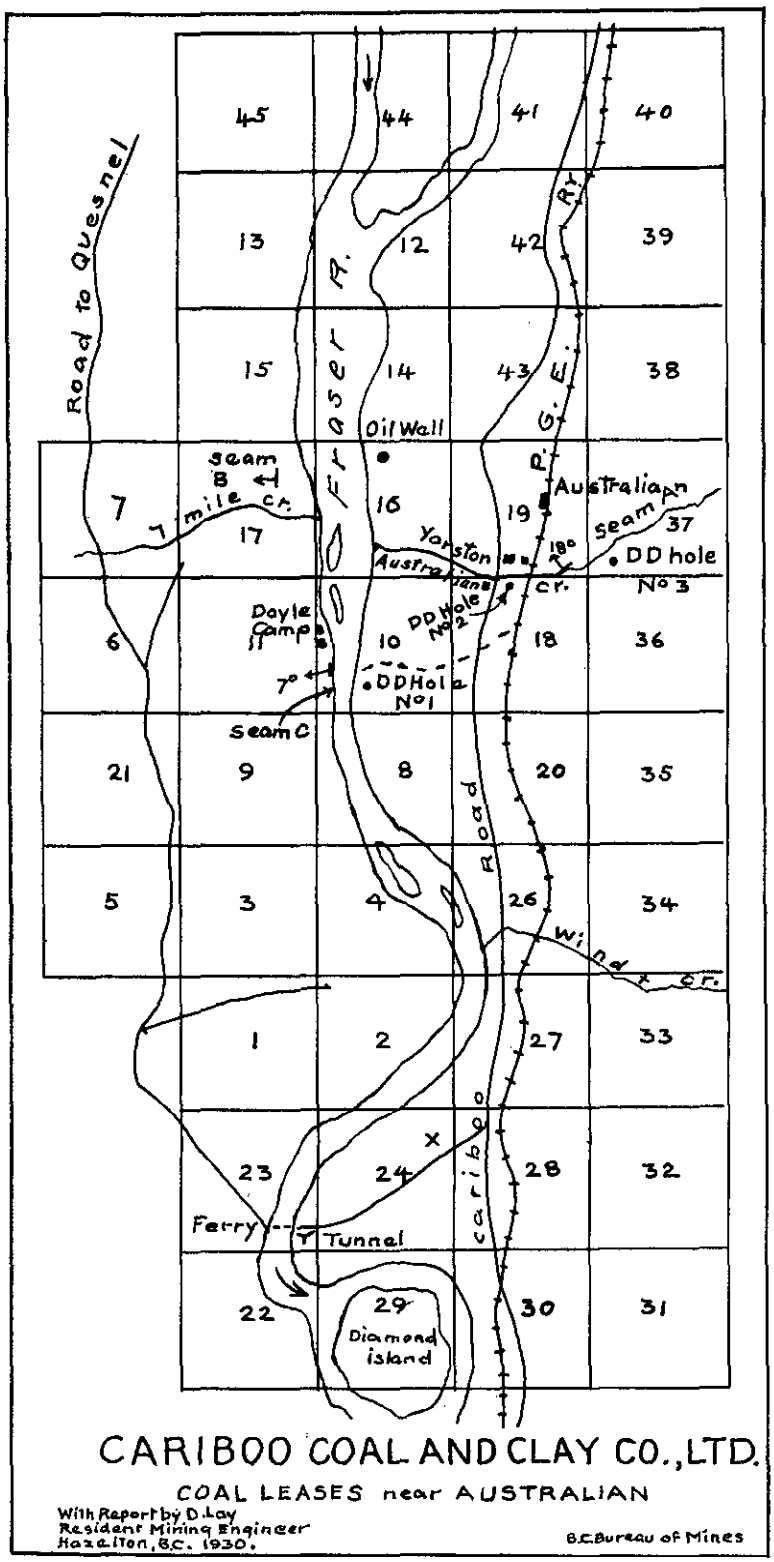
Iron King. This group is owned by Harry Crooks and Emil Johnson, of Quesnel, and is distant about half a mile north of the Quesnel–Barkerville road, somewhat east of the 13-Mile House. On this property are exposed basic volcanic flow-rocks, striking about N. 45° W. (mag.), with steep northerly dip. The presence of free gold and platinum in these rocks was reported by the owners as being disclosed by panning tests.

Pieces were chipped from a large number of places and combined to form one sample. Upon assay this showed negative results in gold and platinum values. This rock is not a typical ultrabasic rock which might be expected to contain platinum in minute quantities, but even were this the case assay of one sample would not signify that the rock-mass was devoid of minute quantities of precious metals. It is also well to bear in mind that expert panning will readily disclose minute quantities of precious metals, which are devoid of commercial significance so far as lode-mining operations are concerned.

B.C. Refractories, Ltd. This company reports steady progress in its efforts to expand the consumption of diatomite in the Province. With aid from the Department of Mines, a branch road has now been constructed from the Bouchie Lake road to the diatomite-deposits in the vicinity of the Big Bend of the Fraser river.

In the last-mentioned area, adjoining the property of B.C. Refractories, Limited, on the south, G. H. Turner has staked some mineral claims, with a view, it is understood, to commence the manufacture of mineral pigment. A small force was engaged in building a branch road to a camp-site on this property during the year.

Cariboo Coal and Clay Co. This company was incorporated during the year with an authorized capital of $1,000,000, divided into 1,000,0000 shares of $1 each. The office is at 781 Dunsmuir Street, Vancouver, B.C. The manager and secretary-treasurer is P. S. Ryan. The company owns the coal, petroleum, and natural-gas rights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Fraser R.
Oil Well
seam B
7 mile Cr.
Australian
seam
37
DD hole No 3
Yorston
Dayle Camp
DD Hole No 2
DD Hole No 1
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seam C
Road
Cariboo
Ferry
Tunnel
Diamond Island
CARIBOO COAL AND CLAY CO., LTD.
COAL LEASES near AUSTRALIAN
With Report by D. Lay
Resident Mining Engineer
Hazelton, B.C. 1930.
B.C. Bureau of Mines

in an area of approximately 29,000 acres in the vicinity of Australian and Alexandria, and in addition controls certain marl, fireclay, and diatomaceous-earth rights within this area. The accompanying map shows the area mentioned. This company supplied the Department with very full information as to the reports of various geologists and mining engineers on its property. It is desired to express appreciation of this commendable attitude.

Operations were in charge of A. J. Arland, and comprised diamond-drilling, surface prospecting, and a tunnel started in the large seam of coal which outcrops on the east side of the Fraser river close to the Alexandria ferry.

The location of the diamond-drill holes is shown on the accompanying plan. The information given out by the company concerning the results of diamond-drilling is that hole No. 1 during the first 320 feet cut four seams of coal varying in width from 4 to 14 feet, and that hole No. 2 at a depth of 5 feet cut a seam of coal 15 feet in width, and at a depth of 484 feet penetrated a seam 72 feet thick.

In the Annual Report for 1923, on pages 125, 126, and 127, will be found an account of coal-showings in this area. The coal-showings were again inspected in May and a short supplemental account follows, but it is unnecessary to repeat herein details given in the report mentioned.

Coal-seams west of the Fraser river dip westerly and those on the east side of the river easterly and north-westerly, and an anticlinal structure is suggested, the Fraser river following the crest of the anticline.

The seam west of the Fraser river on Doyle's ranch has been further exposed by surface pits on the banks of the river and is evidently of considerable width. It strikes about true north and south, with a slight westerly dip.

The seam exposed close to the Alexandria ferry on the east side of the Fraser river is about 14 feet in width, strikes N. 40° E. (mag.), and dips south-easterly. It is the most conveniently situated immediately available seam. A feature of all seams in this area is the high resin content.

Samples were taken of what appeared to be the best coal showing in the Australian Creek seam, in the large seam on Doyle's ranch west of the Fraser river, and in the seam by the Alexandria ferry, with the following results:—

Australian Creek seam: Moisture, 19.2 per cent.; volatile combustible matter, 29.3 per cent.; fixed carbon, 39.2 per cent.; ash, 12.3 per cent.

Large seam on Doyle's ranch: Moisture, 21 per cent.; volatile combustible matter, 25.5 per cent.; fixed carbon, 31.8 per cent.; ash, 21.7 per cent.

Seam by Alexandria ferry: Moisture, 16.6 per cent.; volatile combustible matter, 27 per cent.; fixed carbon, 50.9 per cent.; ash, 5.5 per cent. The split volatile ratio of these samples ranges from 1.3 to 2.1, and in accordance with Dowling's classification the coal would be classed as lignite.

Oil.

The oil possibilities of the area between Quesnel and Australian attracted attention during the year. The Cariboo Coal and Clay Company gave a drilling contract to Frank A. Patrick for the petroleum and natural-gas rights on its property on a royalty basis. An oil-drilling rig was set up on the Yorston ranch just east of the Fraser river, about three-quarters of a mile north of Australian creek, and an oil-well was spudded in on October 2nd. Drilling operations were in charge of J. F. Harrison. The outcome of this enterprise will be awaited with considerable interest.

Likely Section.

Cedar Creek.

Operations of B. Boe.—B. Boe, having, it is understood, purchased the property of the Cedar Creek Mining Company and obtained a lay on the *Platt* and *Lyne* leases held by E. T. Fitzsimmons, continued pump-hydraulic operations throughout the season. Operations to date have very clearly proved the persistent north-west and south-east run of the pay-streak, the exact direction of which is very clearly indicated on the map on page 198 of the Annual Report for 1928. During the year the pay-streak was followed south-easterly on the *Platt* lease and the width varied up to a maximum of 175 feet.

The pump-hydraulic system has been developed by B. Boe to a high state of efficiency. The practice now followed is to blast the ground first, as it is stiff owing to the amount of

boulder-clay present. The "coyote-hole" mining system is adopted, black powder being the explosive used. With this system it is found that under average favourable conditions about 300 cubic yards a day can be piped. A Peerless automobile-engine is used to operate the tailings-pump, the monitor pump being run by a steam-engine, for which 120 boiler horse-power is available.

The seemingly abrupt north-westward termination of the pay-streak is being prospected by G. and K. Finlayson under agreement with B. Boe, a tunnel being run in the face of the hydraulic pit at this end. It is stated that some hopeful indications have been secured.

Out of much that has in the past been obscure concerning this rich placer deposit, one striking and quite indisputable fact emerges—the remarkably straight course of the pay-streak, and the persistence of pay, if not of bonanza values. Added to this is the fact that in many places the richness and general mode of occurrence of the gold suggest an ancient and largely undisturbed placer. In places gold occurs in boulder-clay, appearances being that of the pay-gravel streak being rolled up in the boulder-clay and suggestive of slight disturbance by a glacier. The whole information to date suggests that the deposit is of local origin, that it was laid down by an ancient stream of low gradient. The advisability of close prospecting on the north side of Cedar creek at this elevation is indicated. Refer also to the 1928 Annual Report, wherein also will be found references to other reports on this property.

Leases of C. Lackie.—A considerable amount of piping was done by C. Lackie, of Likely, on his property during the year. Operations to date have disproved the idea at one time entertained that an ancient channel of Poquette creek might have flowed westward and southward through this property. The owner therefore now intends to pipe out the remaining portion of Poquette creek on the upper part of his ground. Refer to Annual Reports for 1925, 1927, and 1928.

South Fork of Quesnel River.

Bullion. This property was reopened during the year by the Quatsino Copper-Gold Mines, Limited, G. C. Bagley being in charge of operations. A large opening has now been made at the end of the sluice-flume tunnel to the floor of the hydraulic pit, such as to prevent any possibility of further choking. It is understood that this year's operations are in the nature of a test to determine just what values may be expected. It is stated that about 60 or 70 per cent. of the gold values are in fine gold, and the matter of installing additional equipment for the recovery of fine gold is under contemplation. In the present sluice-flume there are steel-rail riffles (placed at right angles to the length of the flume) for the first 160 feet and an undercurrent at the end of the flume.

North Fork of Quesnel River.

Matthias Gold Mining Co. At the time of inspection in October two men were engaged under the direction of G. A. Alexander investigating the possibility of the existence of an ancient buried channel parallel to and north of the present river. It is claimed that evidence of this was found at the face of the hydraulic pit at the lower end of the property; on Wolverine creek about 3,000 feet east of the pit mentioned; and in old tunnels run in a dry gulch adjoining Wolverine creek on the east.

Investigation during the year focused on Wolverine creek. This creek flows south into the North fork and in its lower portion occupies a rocky gorge. Above the point of entrance to the river-valley the grade flattens, and the creek in this region occupies a valley about 75 feet deep. It is claimed that the channel crosses the creek just above the point of emergence of the latter into the river-valley. Considerable hard work was done at this point during the year, two shafts being sunk about 100 feet apart in the left bank of the creek. One shaft, said to be 28 feet deep, with a drift of 18 feet in length, was inaccessible, being full of water at the time of inspection. It is said that gold to the extent of $3 was recovered from 12 cubic yards of gravel from this working. The other shaft is 22 feet deep, with a tunnel run from the bottom of the shaft 38 feet in a north-easterly direction, which at the time of inspection had just broken into gravel in the roof.

In the dry gulch adjoining Wolverine creek on the east it is stated that two tunnels were run in the right bank at points 30 feet apart vertically. The uppermost is stated to be 90 feet in length and to have run out of bed-rock into gravel. The lower tunnel was driven with the

idea of reaching the gravels at the level of bed-rock, but was discontinued before reaching its objective. Time did not permit of inspecting the last-mentioned workings. Evidence of the existence of a channel at the point inspected was inconclusive. The matter could, of course, be readily proved one way or the other by Keystone-drilling. Refer also to the Annual Reports for the years 1925, 1926, 1927, 1928, and 1929.

Lease of F. Wissler, W. J. Hill, and W. Westenheiser, of Likely.—This lease is situated on a river-bench immediately below the most westerly of the hydraulic pits of the Matthias Gold Mining Company. At this point a thickness of between 10 and 25 feet of auriferous gravels overlie boulder-clay. This is a typical example of post-Glacial concentration on false bed-rock, and was effected by the river as it cut down through the glacial débris in the valley. The owners constructed a ground-sluice in the first instance, but as the false bed-rock dips downwards towards the valley-rim they are following the gravel by a tunnel on the boulder-clay. Coarse gold is said to be obtained running up to $2 pieces.

Lease of C. Shaw.—This lease is described on page 176 of the 1927 Annual Report, to which reference is invited. The recovery of gold from river-bench gravels, when there is no water-supply on or above the bench, offers some practical difficulties. One of the best solutions appears to lie in the mobile pump-hydraulic system. Such an installation, of which there are several examples in the district, was made at the close of the year by the owners, C. Shaw and L. J. Auten, of Quesnel Forks. It consists of a 65-horse-power Continental Motors Corporation gasoline-engine direct-connected to a Pump & Powers double-suction centrifugal pump, with 8-inch suction and 8-inch discharge. This is set up at the water's edge and to the pump-discharge is connected a No. 1 monitor with 3-inch nozzle. The pump delivers 1,000 gallons a minute, against a head of 150 feet. The cost laid down at Quesnel Forks (from which the lease is only half a mile distant) was $3,000. Gasoline costs 41 cents a gallon laid down at the lease. It might be noted that this plant was conveyed from Vancouver to the site by motor-truck for the entire distance.

Morehead Mines, Ltd.

This company was incorporated during the year for the purpose of developing the hydraulic property formerly held by the Morehead Mining Syndicate and a description of which will be found on pages 177 and 178 of the 1927 Annual Report. No mining operations were carried on during the year, but E. C. Annes was engaged in a comprehensive survey of watershed areas tributary to the property. He states that careful computation indicates a watershed area of 70 square miles, sufficient to give 2,000 miners' inches of water under a head of 500 feet.

McAuley-Dwyer Leases.—These leases are situated on the left bank of the North fork of Quesnel river, below the mouth of Spanish creek. Work was carried on during the year by A. W. Alliott and W. C. Creighton, of Likely. The operators hold the view that on this ground is a buried ancient channel of the North fork. Justification for this view is that, some years ago, tunnels known as the Poleara tunnels, totalling in length 1,600 feet, were run at a point 25 feet above the river into the left rim and penetrated this ancient channel, and it is alleged that gold to the extent of $48,000 was recovered. Down-stream from this point an open-cut was made by ground-sluicing, and it is stated that encouraging values were obtained from this.

The present operators are running a tunnel about 2,000 feet down-stream from the Poleara tunnels and a few feet above the river. This tunnel had on the date of inspection on October 20th advanced a total distance of 35 feet, preceded by about 30 feet of open-cut. The distance driven was entirely in rim-rock. This property would seem to merit Keystone-drilling. Unless the level of bed-rock is known beforehand, it is obviously impossible to determine at what point to start a tunnel to penetrate the channel at bed-rock level.

Black Bear Creek.

Cariboo Gold Development Syndicate.

This syndicate holds the leases from the falls up, formerly held by Western Canada Gold Mines, Limited. A description of this property will be found in the 1928 Annual Report. B. Gostling was engaged on the property at the time of inspection in October. Field evidence supports the view that there is a buried ancient channel lying immediately north of the creek in this region. This channel appears to be cut through by the modern creek in the region of the Sutherland and Owens leases. At lower points the modern creek uows outside the left rim of the

ancient channel, and the gold gravels on the modern creek probably result from reconcentration of the gold contents of the former where it is intersected.

The old channel is deeply buried and its profitable exploitation must obviously entail considerable expenditure. There is therefore involved a careful investigation beforehand as to values, yardage, available water and dump facilities. Such investigation seems fully warranted.

D. Dobson's Lease.—D. Dobson, of Likely, holds a lease on the right bank of the creek opposite the Owens lease. He is driving a rock tunnel, which has to date advanced 100 feet to intercept the downward continuation of a gravel-filled depression which trends across the creek-valley and the depth of which is not known.

Spanish Creek.

Leases of A. Anderson and A. Sutherland, of Likely.—These are situated on the left bank of Spanish creek, about 3 miles above the mouth of Black Bear creek. An account of them will be found in the Annual Report for 1929 on page 204. Hopeful indications were found on this ground last year, pointing to the possible existence of a gold-bearing channel in the left bank of Spanish creek. A great deal of painstaking work has been accomplished this year by A. Anderson single-handed, but without obtaining any positive proof of the existence of such a channel. Immediately below the upper workings described in the 1929 Annual Report, A. Anderson drove another tunnel a distance of 150 feet into the left bank of the creek at a short distance above creek-level and made several open-cuts farther down-stream.

Lease of J. W. Davis.—This is situated somewhat below Summit lake on the Spanish Creek slope. Various shallow shafts and open-cuts are said to have yielded some coarse gold, and hopeful indications generally, especially in the vicinity of a small creek flowing into Spanish creek.

Lease of J. Lyne.—A description of this ground will be found in the 1928 Annual Report. The owner works away single-handed each year and recovers a not inconsiderable amount of coarse gold.

Keithley Section.

Four-mile Creek.

Four-mile creek flows south-westerly into Keithley creek, about 4 miles above the mouth of the latter. At its point of emergence into Keithley Creek valley its modern aspect and surrounding topography strongly suggest the possibility of the existence of a pre-Glacial channel on the south side of the present creek. This possibility was recognized many years ago by the owners of the *Onward* claim. Interest in this creek revived quite recently, and is reflected in the painstaking prospecting carried out by Messrs. Chester and Thomas, of Keithley Creek, and in the commencement of hydraulic operations by Placer Engineers, Limited, during the present year. The former hold one creek lease on Keithley creek, at the mouth of 4-Mile creek, and two bench leases on the latter extending from the mouth upwards on the south side. Placer Engineers, Limited, hold leases covering the ground immediately adjoining that of Chester and Thomas on the west and north.

Placer Engineers, Ltd.—This company, having acquired the *Kitchener* mine water rights and water system, commenced to pipe out the bed of the creek, starting just above the point of emergence of the latter into Keithley Creek valley. It is not known just what results were gained.

Leases of Chester and Thomas.—Messrs. Chester and Thomas, two old-time prospectors of Keithley Creek, have done a considerable amount of painstaking prospecting on their leases, the position of which is above described and which seems to be of obvious potential promise.

Among other operators in this section may be mentioned F. L. DeLong on Weaver creek, and Major Woodward on Snowshoe creek, whose respective properties it was not possible to visit during the year.

Yanks Peak.

Lode-mining activity in this section centres on Yanks peak and the surrounding area, which it was not possible to visit during the year, but an account of which will be found in the Annual Report for 1929.

Midas. A description of this property will be found in the Annual Report for 1929, pages 193 and 194. The quartz vein therein described, exposed on the surface by open-cut over a length of 90 feet, was sampled in considerable detail by an examining engineer during the year, with the following results:—

Width sampled.	Gold. Oz. to Ton.
31 inches	0.78
63 inches	3.84
35 inches	0.75
48 inches	0.83
47 inches	0.36
42 inches	0.50
72 inches	0.30

These samples were obtained from the surface open-cut and represent a length of about 90 feet.

This vein is being probed at a vertical depth of 130 feet by a crosscut tunnel, which had, it is stated, reached a distance of 410 feet on January 9th, 1931. It is estimated by the owners that the vein should be reached within the next 50 feet. Surface values are distinctly gratifying and clearly justify the development now being undertaken.

Horsefly Section.

Beaver Valley.

Leases of C. R. Carfrae.—These leases, owned by C. R. Carfrae, of Horsefly, are situated at the upper end of Beaver Creek valley, and a description of former work will be found on page 203 of the 1928 Annual Report.

C. R. Carfrae and O. Sandberg, with commendable enterprise, purchased a Keystone drill during the year and commenced a systematic cross-sectioning of the ground by drilling. Two holes drilled at the extreme head of the valley, about three-quarters of a mile above "China" cabin, reached bed-rock at a depth of 33 feet, and another hole drilled about 1 mile above the workings described in the 1928 Annual Report reached bed-rock at a depth of 44 feet. At the time of inspection on October 23rd a cross-section of holes was in progress in the vicinity of workings described in the 1928 Annual Report.

Antoine (Sucker) Creek.

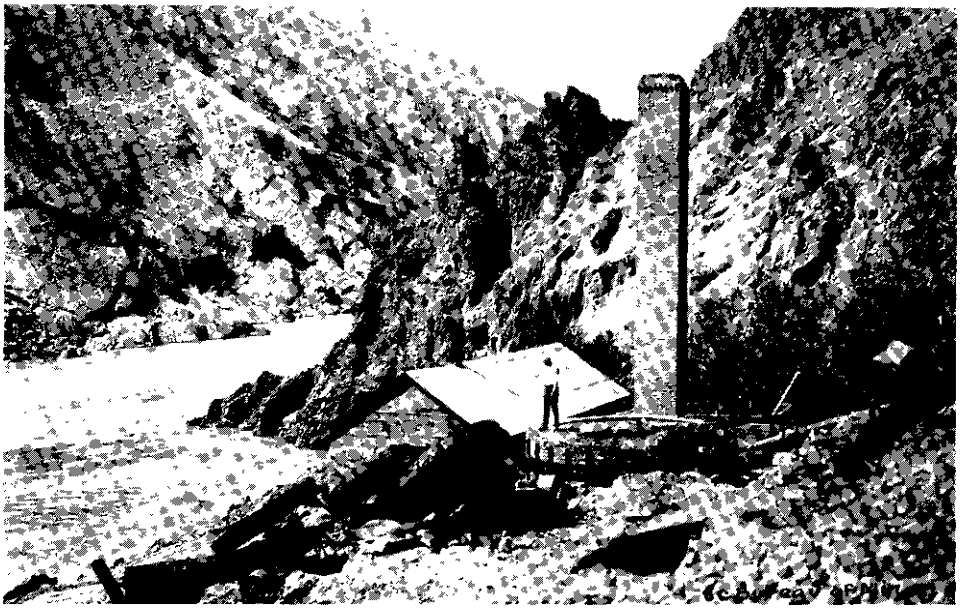
Antoine creek has its source in Antoine lake, from which it flows south-westerly into Robert (Anderson) lake, one of a chain of lakes on Beaver creek. The total length of Antoine creek is about 3 miles. For the greater portion of its length the creek occupies a wide flat-bottomed valley with gently sloping rims, but for about half a mile above its mouth the creek cuts through a rocky canyon-like gorge. It is in this latter portion of the creek that the oil-shale exposures occur, which are described on pages 181 and 182 of the 1927 Annual Report. A discovery of placer gold, accompanied by a certain amount of metals of the platinum group, was made last year by R. N. and J. Campbell, of Horsefly, immediately above the last-mentioned portion of the creek, which reflects much credit on the discoverers. This discovery, curiously enough, was made in the immediate vicinity of the hole drilled some years ago to a depth, it is understood, of some hundreds of feet, to probe the oil possibilities, and where the drilling-rig still stands.

As to the mode of placer occurrence exhibited: Exposures are as yet somewhat meagre. Some small hydraulic pits have been opened up on the right bank of the creek. One of these shows a total height of about 15 feet of glacial gravels overlying a false bed-rock of red clay at the creek-level. Masses of the red clay are also included in the gravels. The pay-streak is about 3 feet in thickness immediately overlying the red clay. The red clay is not glacial, but appears to be the weathered kaolinized detritus originating from the country-rock of the immediate vicinity. This is exposed on the opposite bank of the creek and is seen to be a green-coloured volcanic flow-rock, evidently containing a large proportion of ferro-magnesian silicates.

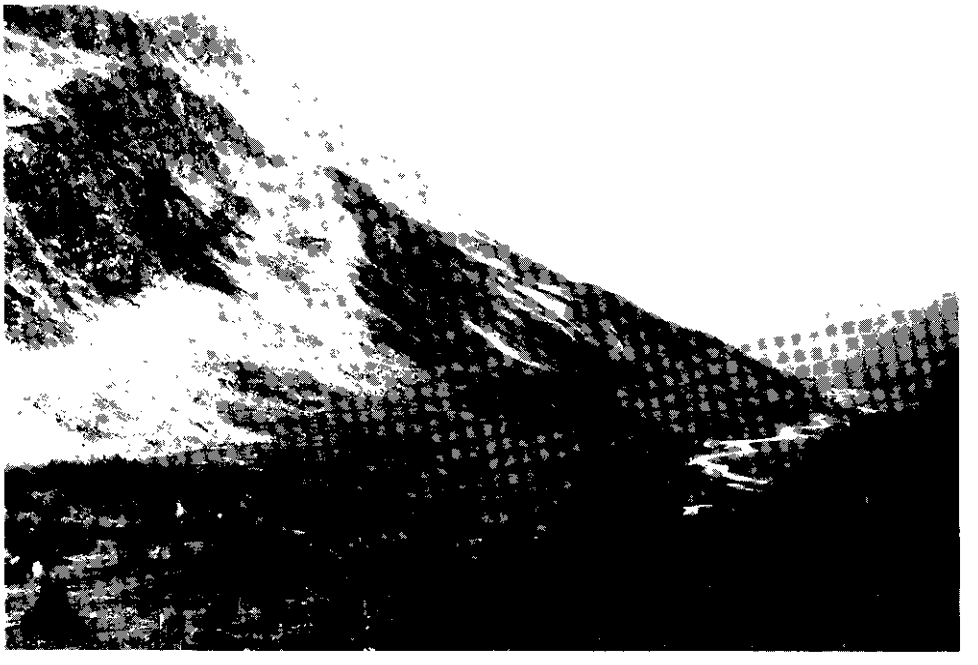
The modern character of the lower portion of the creek is in striking contrast to the upper 2½ miles, where the maturity of relief indicates prolonged pre-Glacial stream-erosion. Over-deepening of the main Beaver valley by ice-erosion has produced the rejuvenation of Antoine creek now in progress. It seems very likely, however, that there is a buried pre-Glacial outlet of Antoine creek, but there is no very striking topographic feature suggestive of the particular

New Power Plant—Cariboo Gold Quartz Mining Co., Ltd.

Diatomite on Fraser River, West of Quesnel.



Big Slide Mine, Lillooet M.D.



Griswold Claims, Bridge River, Lillooet M.D.

side of the creek on which this may exist. On the right bank of the creek, considerably above water-level, several pits have been sunk, the gravels in which are said to show promising values in the vicinity of the hydraulic pits, and pits a mile or more up-stream from this point are also said to be encouraging.

It is understood that last year the property was under option to B. F. Lundy and associates, by whom a limited amount of Keystone-drilling was carried out, the results of which are not known to the writer. Construction of a ditch-line to bring water from Antoine lake was also started but was only partially completed, when, for reasons not known, the option was relinquished. When the latter took place R. N. and J. Campbell and associates constructed a small dam in the creek, installed a pipe-line and small monitor, and with the limited head and water thus available have carried on hydraulic operations during the year.

As determined by aneroid barometer, the elevation of Antoine lake is somewhat below Horsefly (2,550 feet) and is 270 feet vertically above Robert lake. Storage facilities in Antoine lake are excellent, but it is not known what amount of water would be available from this source alone.

Conditions generally are good for hydraulicking up to a certain point, but from what has been said of the grade of the upper portion of the creek, it will be understood that the latter would be below sluice-flume grade.

The pay-gravels on false bed-rock show very encouraging values, but the question naturally arises as to whether there is in addition a true bed-rock run. The former seem due to the effect of glacial stream concentration. In view of the fact that the false bed-rock appears to be of local origin, the effects of ice-erosion of bed-rock would not seem likely to be pronounced.

The property clearly warrants careful investigation to determine several factors, knowledge of which is essential before any large-scale operations can be planned, such, for example, as yardage and values, the possible existence of a buried channel in the lower portion of the creek, and also the water-supply. Except as to the last mentioned, the obvious advisability of Keystone-drilling is indicated as the mode of investigation. Refer also to the Annual Report for 1929, page 202.

Black Creek.

Rountree Mines, Ltd.

This company has an option on the leases of G. Mackeracher and has certain of its own above the latter. Hydraulic operations were carried on during the year under the direction of James Armes, manager, and the sluice-flume has been advanced on sluice-grade to a point about 250 feet above the canyon, but above bed-rock. On the west side of the creek, at the head of the flume, two rock-exposures may be the rims of the old channel of the creek, but this remains to be proved. The management states that, inasmuch as the main objective is to reach the old channel which crosses Black creek above this point, the matter of getting bed-rock in the lower portion of the creek is subordinate to the main issue.

Field evidence of the existence of the old channel mentioned is afforded by a depression on the surface crossing Black creek more or less at right angles, at a point several hundred feet above the head of the sluice-flume, which can be traced on the surface for a considerable distance in both directions. It is stated that certain shafts were formerly sunk in this channel on the East fork of Black creek, and also that satisfactory results were obtained as the result of a cross-section of Keystone-drill holes put down in 1918 in the channel on the east bank of Black creek by P. Fraser. (Refer to the 1918 Annual Report.) The management has also formed the opinion that at a point about 700 feet above the present sluice-flume head a tributary of Black creek, now drift-filled and in which a tunnel was formerly driven on the right bank of the latter, has cut down through this old channel; accordingly, present plans focus on advancing the sluice-flume up Black creek, piping out this tributary, which it is hoped will enable access to the main channel to be gained.

The view is held that the investigation of this old channel is warranted, but that further more positive evidence should be obtained than now seems available before contemplating hydraulicking. Apart altogether from the question of yardage and values, from the standpoint of practical mining possibilities, the bed-rock gradient of the old channel, likewise the level of this in relation to Black creek, are highly critical factors and one cross-section of drill-holes seems insufficient.

It is understood that the management contemplates securing additional water from the East fork of Black creek and from Club creek. An adequate water-supply is also of obvious importance to this undertaking. An 18-horse-power Novo gasoline-engine and a small Gardner air-compressor have been installed at this property to expedite drilling, and removal by blasting, of large boulders. Refer also to "Placer-mining in British Columbia," pages 42 and 43.

Horsefly River.

Hobson's Horsefly.

This old hydraulic mine was one of the enterprises of the late J. B. Hobson and is described in the Annual Report for 1902. In the years which have passed since the cessation of operations the tailings have been undergoing in part a process of reconcentration, aided by disintegration of the cemented gravels, by the Horsefly river; so much so that surprisingly good gold values occur in the upper stratum over which the modern river passes. George Kuchan, F. Kroupa, T. Kroupa, and E. Oman, taking advantage of low water in the fall, staked a lease and commenced ground-sluicing, and seem likely to reap the reward of their powers of observation. In view of the disintegration which has taken place since these gravels were first mined, it is possible that some portions which have not actually been washed by the river may yet pay to rework, and it is the intention of the present operators to experiment in that direction next year.

Rat Lake.

Lease of G. Kuchan.—Rat lake is a small lake situated a short distance south of Hobson's Horsefly mine. On the lease of George Kuchan, of Horsefly, on the north shore of the lake, is exposed a deposit of residual gravel precisely similar to the gravels of what has been called in these reports the pre-Glacial Horsefly river, and mention of which will be found on page 50 of "Placer-mining in British Columbia." This ancient river is also apparently becoming known as the "White Channel." Its gravels, being composed almost wholly of white quartz, are strikingly different from those of any other channel in the Cariboo district.

The existence of the Rat Lake deposit, which is said to extend for 1 mile at this point, was unknown at the time the argument was advanced in these reports that both Ward's Horsefly mine and Hobson's Horsefly mine possibly exemplified reconcentration of the gold from this ancient stream, the exact course of which is yet unknown. The occurrence of the gravels of this ancient channel as shown in the *Miocene* mine and the Rat Lake deposit in such close proximity respectively to the mines above mentioned would seem to lend additional support to the argument as to the advisability of investigating the "White Channel." The only practical way to obtain any idea of the value of the gravels of this ancient river is by means of Keystone-drilling.

CENTRAL MINERAL SURVEY DISTRICT (No. 3).

By H. G. Nichols, Resident Mining Engineer (Headquarters, Kamloops).

INTRODUCTION.

General.

The Central Mineral Survey District covers the greater part of the southern interior of British Columbia. It comprises the seven Mining Divisions of Kamloops, Clinton, Lillooet, Ashcroft, Yale, Nicola, and Vernon, and includes the Chilcotin plateau; the entire valley of the Thompson river, with the Shuswap and Clearwater Lake areas; the Nicola plateau; the Fraser Valley watershed, below Williams Lake, as far south as Hope, with the Bridge River and Chilcotin River areas; the Okanagan valley down to Penticton, and that of the Skagit river as far south as the International boundary-line.

The district may be subdivided, on topographical and geological grounds, into three sections, or belts of territory, each possessing entirely different characteristics. On the west there is the Coast Range belt, which stretches in a north-westerly direction from the Coquihalla area to the southern end of Chilko lake. This belt is identified with the eastern flank of the Coast range with its characteristic features of mineralization closely associated with batholithic intrusion. On the east there is the belt related to the Cariboo range of mountains, which reaches from Cherry Creek, in the Vernon Division, to the Clearwater Lake area in the north. This area is largely occupied by ancient sediments with relatively few exposures of igneous rocks. Mineralization is represented generally by the lower-temperature type of lead-silver-zinc metals.

Intermediate between these two belts there is the dry belt of the Interior plateau with an average width of from 80 to 100 miles. The northern part of this area, occupied largely by the Chilcotin plateau, is covered by recent lava-flows, with few opportunities in prospecting for metallic minerals. The lower half includes many stocks of intrusive rock and a generally fractured condition of the intruded volcanic and sedimentary formations.

With the exception of the western belt, the district does not present equal facilities for mineral discoveries with those that are characteristic of other sections of the Province, in which surface exposures are the result of active erosion.

Almost the first steps in the mining history of British Columbia were taken within the Central District in 1857, when placer gold was discovered on the lower reaches of the Thompson and Fraser rivers, but few discoveries of lode-mineral had been made up to the year 1880. At that time there were less than a dozen of such occurrences known.

In the early days the principal items of mining activities were naturally in connection with placer-mining on the Fraser river and its tributaries; there were also some gold-quartz operations on a small scale in the Lillooet district; some intermittent attempts to exploit resources of non-metallics in the Clinton Division and copper came to be recognized as a possible resource with the operation of the *Iron Mask* mine near Kamloops, from which a considerable production of copper-silver ore was obtained.

Subsequently, attention was directed towards the investigation of widespread occurrences of copper ores in the Kamloops, Nicola, Yale, Ashcroft, and Clinton Mining Divisions. A number of prospects of the lead-zinc-silver type in the Shuswap Lake area was discovered and a variety of interesting gold-deposits were brought to notice, upon which a considerable amount of prospecting-work was done.

In the course of the years following these early days of mining a large number of mineral prospects were brought to notice, embracing a wide variety of types, but in no case had a scale of production of any note been reached. In the year 1929 there were over 200 known areas of mineral occurrences of possible economic importance, and in the beginning of the year under review the situation was briefly as follows: Chief interest attached to the gold-quartz veins in the Bridge River area, where the *Pioneer* mine was producing gold bullion steadily and was in the course of development; to the opening-up of a silver-lead vein with associated values in gold in the Stump Lake area, in the Nicola Mining Division; to the prospecting and development that was being carried out on the nickel-bearing bodies of pyrrhotite at Emory creek, in the

Yale Mining Division; and to the gypsum-quarries at Falkland, in the Kamloops Mining Division, where a largely increased production has been achieved by Gypsum, Lime, and Alabastine, Canada, Limited, for the purposes of manufacture at its plant in New Westminster. In addition to these few instances of outstanding attraction, from the point of view of the possibilities of production, there was widespread activity in prospecting, and a greater amount of attention was paid by operating companies and investors to the mineral resources of the southern interior than had been the case at any previous period.

Despite this general interest, it is to be borne in mind that at the commencement of 1930 the mining situation in the Central District was still in a state of evolution, and there was no one outstanding mine within its boundaries to aid in offsetting the generally unfavourable outlook with which the year started.

In view of these conditions the achievements during the year are of particular significance and may be pointed to as placing this district in a position, unique in its history, inasmuch as it affords some of the most encouraging features, both in regard to development and discovery, in the mining situation of the Province to-day; and in regard to the latter-named aspect, it is pertinent to remark that new discoveries are of the essence of mining progress.

Many factors have contributed to the above result; foremost among these are, undoubtedly, the dogged perseverance of prospectors and operators in the face of the very real handicap and discouragement attaching to this period of industrial depression, and the realization of the opportunity for preparedness, which is inherent to such times, that has been evidenced by the exploration policy of operating companies.

A summary of the known mineral occurrences was presented in the Annual Report for 1929. Additions to this summary, to which reference may be made, are as follows:—

Gold associated with arsenopyrite in contact deposits of iron ore on North Thompson river.

Chalcopyrite in quartzite in Skagit River area.

It may be said, in general, that in spite of conditions under which it might reasonably have been expected that the best to be done was to mark time, the district has responded to the efforts that have been made in its development to a degree which is entirely encouraging, and high tribute is paid to the work of all those prospectors and others who have contributed to this end. Invaluable aid has also been given by the Geological Survey of Canada in connection with the mapping of new areas and the supply of geological information, and marked evidence of appreciation of the necessity for encouraging and stimulating activity under existing conditions has been afforded by the attitude of the Department of Mines in making unusually large grants of money to assist in the construction of roads and trails leading to mining areas and properties.

Prospecting.

Considerable activity has centred around the area embracing the Adams plateau, north of the Shuswap lakes, and reaching north-westerly beyond the valley of the North Thompson river. Prospecting in the Adams Plateau area is likely to be benefited materially as a result of the aerial photographic work of the Topographical Survey, Canada. Work has also been carried on in the Highland Valley area, especially on Forge mountain, where G. Novak, of Rossland, has been developing the *Transvaal* group, and it is hoped that, with the completion of a road which is being constructed, developments in this area will follow. A certain amount of work has been done in the Coquihalla and Skagit River sections, but, on the whole, activity in this field has fallen off; however, as previous efforts in this direction were not, in the main, guided by a spirit of intelligent search, so much as by promotion interests, it is possible that better results may be obtained by the more careful system that is being employed at present.

A number of titles have been allowed to lapse, but in general the amount of activity that has been maintained under existing conditions is praiseworthy. In particular, mention may be made of the work of C. Howlett on the *Gold Coin* and *Grandview* groups in the Skagit valley, and of the prospectors who have scoured the difficult hills flanking the Coquihalla valley and the divide between the Skagit and Tulameen rivers.

A limited number of prospectors have been active in the field in the Okanagan section. This is a difficult country for the individual prospector and presents geological problems that are apt to confuse him. In this connection it is fitting to observe that considerable harm may attach to statements of irresponsible operators. An instance of such pernicious influence is the unwar-

rantable publicity that has been given to a project of oil exploration in this area. It cannot be stated too definitely that there is no justification in the known facts for the statements that have been made in certain quarters with regard to the possibility of finding oil in the country around Kelowna.

The Taseko Valley (Whitewater) area has been quiet, following suspension of operations by the Consolidated Mining and Smelting Company of Canada on the *Mohawk* and *Spokane* groups, but E. J. Taylor reports further discoveries of gold ore on the *Buzzer* group, adjoining the *Windfall*.

J. Russell, of Lillooet, and Grant White, of Bridge River, have done assessment-work on properties north of Bridge river between Gun creek and the Shulap range, where occurrences of ores of gold, copper, and mercury are found, but no new discoveries are reported from this section.

W. Davidson has been carrying on work on the *Alpha* group on the Bridge River road and there has been the usual amount of placer-work on Marshall creek and Hurley river.

The old *Maggie* on the Cariboo road was unwatered, and some prospecting was carried out in the area south-west of Kamloops and in the North and South Thompson River valleys, including work by G. K. Rogers, of Knutsford, on properties near the *Ajax* copper claims; by W. Graham, of Cherry Creek, on the *Copper King;* and by Meadow Creek Mines, headed by C. E. Scanlan, of Kamloops, on properties near Dupont lake. Further exploitation-work has been done by Comstock of B.C., Limited, on the lead-silver and iron deposits on Iron mountain near Merritt, and J. L. Brown, acting for Primary Ore Mining Company, of Vancouver, has been continuing work on the *Mary Reynolds* group near Stump lake. H. J. Blurton, of Vernon, has opened up some more gold-bearing quartz veins near Vernon and there has been some activity in the country west of Okanagan lake and in the valley of Cherry creek, in the Vernon Mining Division.

Discoveries.

An interesting discovery of gold associated with arsenopyrite has been made near Mount Olie, in the Kamloops Mining Division. The discovery is of particular significance, the values being found to be associated with arsenopyrite in a high-temperature iron-ore deposit under conditions that lend encouragement to the search for similar occurrences in the surrounding country, and a considerable amount of activity has been stimulated. The mineralization appears to be related to the intrusive classified by W. L. Uglow as the Darlington hornblende diorite, of which there are numerous exposures in the vicinity. The property has been optioned by the Premier Gold Mining Company, Limited, and this company is now actively interested in the district for the first time.

Discoveries of silver-lead-zinc ore have been made on Adams plateau by F. A. McLeod, of Salmon Arm. These bodies of sulphide ore, which outcrop on the level surface, lie in the same mineralized zone east of Adams lake on which diamond-drilling work was carried out previously by Granby Consolidated Mining, Smelting, and Power Company. A similar occurrence has been opened up by Bischoff Bros., of Celista, at a few miles to the east, and hopes for this area are enhanced considerably by the growing amount of proof of the extent of the mineralization and by knowledge of geological features having a bearing upon it.

Development.

The principal item of development is that at the *Pioneer* mine, in the Bridge River district, which mine may now be referred to as in a leading position among the primarily gold-producing mines of the Province. Development of the *Enterprise* vein on the *Planet* property, in the Nicola Mining Division, has resulted in the production of lead-silver-gold concentrate to the gross value of about $100,000 and has demonstrated the economic value of this member of the series of veins in this area. Work on the nickel-deposits on Emory creek, in the Yale Mining Division, has yielded encouraging results, a second ore-body having been outlined by open-cutting and diamond-drilling work. This property may now be looked upon as a possible producer of nickel on an important scale. In the Clinton Mining Division Consolidated Mining and Smelting Company of Canada, Limited, has been developing the chrome iron-ore deposits on Scottie creek, and it is understood that the results are sufficiently encouraging to warrant further work.

Production.

The following table shows the lode-mineral production of No. 3 District:—

Mine.	Ore.	Gold.	Silver.	Copper.	Lead.
Kamloops Mining Division—	Tons.	Oz.	Oz.	Lb.	Lb.
Ford	21	.....	5	1,200	.....
Lillooet Mining Division—					
Pioneer	36,540	18,067*	.....	.....	.....
Nicola Mining Division—					
Planet	17,000	3,295	73,724	29,825	576,667
Green, L. F.	1	.....	19	210	.....
Yale Mining Division—					
Aurum	65	385	89	.....	.....
Dawson	10	13	27	.....	.....
Totals	53,637	21,760	73,864	31,235	576,667

* Includes 4,226 oz. gold produced in 1929 but not credited in that year.

Bibliography.

The following additions are to be made to the list of references that was published in the Annual Report for 1929:—

Ref. No.	Publication.	Author.
32	G.S.C.: Summary Report, 1929, Part A	C. E. Cairnes.
33	G.S.C.: Summary Report, 1929, Part A	N. F. G. Davis.

Statistics.

In the table of comparison between the statistical figures for the years 1929 and 1930, which follows, it will be noted that a general reduction of 33 per cent. in the volume of prospecting activity is recorded.

Mining Division.	Claims and Leases recorded.		Certificates of Work.	
	1929.	1930.	1929.	1930.
Kamloops	334	213	388	369
Clinton	94	57	129	113
Lillooet	468	192	402	371
Ashcroft	106	87	79	76
Yale	878	276	636	500
Nicola	117	108	167	210
Vernon	171	77	126	93
Totals	2,168	1,010	1,927	1,732

KAMLOOPS MINING DIVISION.

Shuswap Lake Section.

Cotton Belt. No further work has been done upon this property, situated on a plateau at an elevation of about 6,000 feet above sea-level and lying at a distance of about 14 miles north-east of the head of Seymour arm, one of the branches of Shuswap lake. The mineralization on this property is represented by pyrrhotite, magnetite, galena, and blende in a persistent lead lying conformly with the flat-dipping schist formation, and associated with a belt of crystalline limestone. The occurrence has properties in common with a number of examples of mineralization in this formation, which is generally considered to be of Cambrian or pre-Cambrian age, and occupies a wide belt of territory on the northern

and eastern boundaries of the district. Thus there is a certain relation between the mineral occurrence on this property and the silver-lead-zinc deposits around the Shuswap lakes; the very similar occurrences on the Adams plateau; the silver-lead veins associated with barite at Agate (Squaam) bay on Adams lake, and, in lesser degree, the mineralized horizons in the chlorite-schists of the Barriere River area, as well as the base-metal veins in quartzite in the Clearwater area at the head of the North Thompson river. In most of these cases exposures are found at high altitudes and development has been retarded by difficulties of access. This matter of transportation has been a serious factor in connection with the *Cotton Belt* property, which requires for its development an amount of work that can only be accomplished by means of power-drills operated by more or less heavy machinery, and the grade of the ore is not such as to encourage operations carried on on any lesser scale.

Copper Chief. Prospecting-work on this property, owned by J. T. Lauthers and associates, on a ridge between White lake and Blind bay, did not result in the discovery of ore of economic grade, although there is a considerable amount of copper mineralization disseminated throughout a wide zone in a schist formation. It is possible that development at a greater depth would encounter better results.

Copper Cup. Surface workings have uncovered several exposures of copper ore, chiefly chalcopyrite, associated with quartz, along the same general direction of shearing in which the seams on the *Copper Chief* are found. The same observation applies in regard to the need for deeper development.

Bonnie Brae. This group of four claims, owned by Daggett & Cox, of Salmon Arm, is situated on the northern slopes of Mount Ida, at an elevation of about 1,500 feet above the valley of the Salmon river. Some further work has been carried out by the owners, as a result of which some better evidence of the character of the mineralization is afforded. The mineral occurrences on this group are represented by extensive bodies of quartz, containing pyrite and some blende and galena carrying silver values and a little gold. This quartz occurs in zones of shearing and fracturing in impure quartzites and schists, traversed by dykes of feldspar porphyry. A number of open-cuts strung out in a general direction of N. 60° E. (mag.) exposes a series of these quartz-bodies varying up to 6 feet in width, which appear to lie within a dominant zone of fracturing. The most north-easterly of these open-cut exposures lies at a vertical distance of about 250 feet above the bed of Hobs creek (locally known as Hobson creek), which follows an oblique course down the slope of the mountain in a north-westerly direction. From a point on the steep bank of this creek, lying almost due north from the outcrop above mentioned, a tunnel has been driven for a distance of about 70 feet in a general southerly direction, following the course of a porphyry dyke which lies on the western side of a zone of shearing, having a dip of about 50° to the north-east. The ground in the neighbourhood of the dyke is much disturbed and the width of the zone cannot be stated definitely; a characteristic feature is the inclusion of bodies of quartz, one of which is also exposed in the bed of the creek about 50 feet farther to the east, indicating a width of about 50 or 60 feet for the zone. The new work above referred to was done on the *Foothill* in a canyon of the same creek at a distance of approximately three-quarters of a mile to the north-west of the upper workings of the *Bonnie Brae* group, and about 1,200 feet below them. A zone of shearing in the same schist and quartzite formation is exposed in open-cut workings at a sharp bend of the creek. This zone has a north-westerly strike and a dip of about 50° to the north-east, and the inclusion of quartz associated with a considerable amount of pyrite is in all respects similar to that found in the upper workings. It is indicated that the two sets of workings are on the same zone of shearing, which is in all probability responsible for the direction taken by the creek in its oblique course across the hillside occupied by a hard quartzite formation.

In these lower workings there is also a considerable amount of massive pyrrhotite on the foot-wall side of the zone, and this is not without significance, occurring as it does at the lowest point at which this apparently persistent shear has been exposed. The upper line of outcrops above referred to, following a north-easterly direction, appear to occupy fractures in a greatly disturbed section of the formation intersected by the porphyry dykes, and all these occurrences are to be referred probably to a main source of mineralization along the shear-zone. The whole base of Mount Ida is underlain by granite, and it is in this connection that the occurrence of heavy sulphide mineralization in the lower workings is held to afford some encouragement for

further development along the line of shearing in the overlying quartzite. The following samples were taken:—

A picked sample of quartz from the face of the 70-foot tunnel: Gold, trace; silver, 12 oz. to the ton. Quartz from *Foothill:* Gold, trace; silver, trace. Quartz on hanging-wall of shear in 70-foot tunnel: Gold, trace; silver, 0.6 oz. to the ton. Quartz from upper open-cuts in cross-fractures: Gold, trace; silver, 6 oz. to the ton. Pyrrhotite from *Foothill:* Gold, trace; silver, trace; zinc, trace.

Sunset. This group of eight claims is situated on Mount Ida, near Salmon Arm. Two main veins occur on the property; the lower vein was developed to some extent several years ago and carried values in silver and lead. The upper vein has been reported to carry values in gold and platinum, but no further information is available in regard to this occurrence than was furnished in the account given by W. F. Ferrier and published in the Final Report of the Munition Resources Commission in the year 1920.

The property is now owned by Sunset Mines, Limited, with head office in Salmon Arm, and it is understood that further work is to be commenced during the coming year.

Sugar Loaf. This property is situated at a distance of about a mile to the south-east of the *Grandview* and is owned by Edwin Smith and associates, of Grindrod. Some open-cutting work has been done to prospect the continuation of a well-defined quartz vein in the quartzite formation in which some gold values, associated with pyrite, were found. The general direction of this vein is in a line with the mineral occurrence on the *Grandview* property. The hardness of the rock has made it difficult for the individual prospectors, working by hand, who have not been able to do sufficient work to enable a definite opinion of the value of this property to be given.

Grandview. This property, situated in the broken country west of Grindrod and about 18 miles east of Salmon Arm, covers a portion of the mineralized area in which scattered gold values are found in quartzose segregations in a quartzite formation, together with some base-metal mineralization in quartz veins, cutting a black argillite, lying in contact with the quartzite. At the present time no continuous lead has been discovered. The property is owned by E. R. Sutton and associates, of Grindrod.

Lucky Coon, Lucky Strike. These properties, owned by H. McGillivray and associates, of Shuswap, were referred to in former Annual Reports as the *Elsie* group. This claim constitutes one of the group which includes the *Lucky Coon, Golden Eagle, White Swan, Elsie,* and *Billie,* adjoining one another in a general north-east and south-west direction, with additional claims lying alongside them to cover the downward continuation of the mineralized zones on their flat dip.

At the north-east end of these claims the strike of the lead is found to be continuous for a distance of about 2,000 feet; a gap of about 1,000 feet follows in which no exposures have been found; there is then an occurrence on the *White Swan* where a similar body of mineral is found having the same strike and dip, but lying at a distance of 320 feet to the west. At a distance of about 300 feet south-west of this showing another lead of high-grade mineral is found on the same line of strike as the first-named (*Lucky Coon*) lead, and at a distance of 1,500 feet farther to the south-west, on the banks of Spillman creek, an attractive vein is exposed on the *Elsie*, lying at a further distance of 300 feet to the west from that on the *White Swan.* The continuation of this ore-body is found in a series of open-cuts extending over the *Billie* towards the south-west for a distance of 1,500 feet.

The greater number of the open-cuts on this property were made by Granby Mining, Smelting, and Power Company, which held the property under option some two years ago and also carried out a limited programme of diamond-drilling. Starting from the north-east end of the *Lucky Coon*, two diamond-drill holes were put down at an angle of 60° to intersect the *Lucky Coon* ore-body below the outcrop exposed in a big open-cut. At a distance of some 300 feet to the south-west another diamond-drill hole was placed below an outcrop exposed in an open-cut at about 100 feet higher up the hill. At a further distance of about 700 feet indications on the surface point to splitting and divergence of the ore-bodies. Two distinct occurrences, having strikes respectively of N. 20° E. and N. 50° E. (mag.), are exposed in open-cuts. The appearance of this section of the ground supports the view of a wide mineralized zone in which individual leads at the surface might be expected to indicate bodies of greater importance at some depth. Below this point two diamond-drill holes were put down.

Louis Creek Placers, Kamloops M.D.

Homestake Mine, Kamloops M.D.

Mosquito King, Kamloops M.D.

Lakeview Claim, Kamloops M.D.

A considerable amount of work was done on the *White Swan* creek showing. The ground here is very broken in proximity to a dyke intrusion. On the *Elsie* showing on Spillman creek a tunnel was driven in on the north bank, following a strong vein of solid mineral, and a diamond-drill hole is said to have cut about 7 feet of vein-matter. In the tunnel the vein is seen to be 2 feet wide at the face. Open-cuts in the nature of shallow surface trenches were made both to the north and the south of this exposure, but failed to prove continuity at the surface; but this work was inconclusive owing to insufficient depth being attained.

At a point about 450 feet south-west of Spillman creek a similar indication of divergence to that noted in connection with the *Golden Eagle* is found on the *Billie*. No diamond-drilling was done here. In general it may be said that the results of this exploratory work were inconclusive, as too great reliance appears to have been placed upon the appearance of the oxidized outcrops. The work, in fact, reveals a persistent zone of mineralization, heavily oxidized at surface, with occasional occurrence of sulphide mineral.

The view is submitted that the whole of this mineralization is related to an underlying intrusive of which evidence at surface is found at a short distance towards the north-east, and at many other points on the plateau, and that the whole series of these flat-dipping leads may represent surface aspects of a mineralization more closely associated with the contact of this intrusive rock, pointing to the possibility of a change in the type of the mineralization as depth is obtained. In this case the presence of solid sulphide at surface would be of secondary importance in relation to the evidence of the extent and persistence of the mineralization in general. It is true that up to the present time the values obtained from these seams are not particularly encouraging to their extensive development, as is evidenced by the fact that Granby Mining, Smelting, and Power Company did not consider the occurrence of sufficient importance to warrant continuance of its operations at the time, and it is also true that there is a lack of association of gold values. On the other hand, it appears that the intrusive rock heretofore referred to is probably related to the similar stocks of hornblende diorite in contact with which arsenopyrite carrying gold values has been found in deposits of iron ore. The following samples of the several occurrences on this property were taken:—

Golden Eagle.—Sample across solid sulphide 6 inches wide: Gold, trace; silver, 62 oz. to the ton; lead, 44.4 per cent.; zinc, 4 per cent. Sample across 12 inches solid sulphide: Gold, 0.02 oz. to the ton; silver, 15 oz. to the ton; lead, 12 per cent.; zinc, 10 per cent. Composite sample from two intersecting seams: Gold, 0.04 oz. to the ton; silver, 47.5 oz. to the ton; lead, 40 per cent.; zinc, 8 per cent. Sample from across 20 inches: Gold, trace; silver, 15.3 oz. to the ton; lead, 10 per cent.; zinc, 8 per cent. Sample across 36 inches: Gold, 0.06 oz. to the ton; silver, 26 oz. to the ton; lead, 18 per cent.; zinc, 5 per cent. Sample across 12 inches: Gold, 0.04 oz. to the ton; silver, 12.6 oz. to the ton; lead, 15.2 per cent.; zinc, 9.5 per cent. Sample across 30 inches: Gold, 0.2 oz. to the ton; silver, 1.6 oz. to the ton; lead, 1 per cent.; zinc, 6 per cent.

White Swan.—Across 3-foot seam in creek: Gold, trace; silver, 10.5 oz. to the ton; lead, 6 per cent.; zinc, 24 per cent.

Elsie.—Sample across 30 inches in tunnel: Gold, trace; silver, 10.4 oz. to the ton; lead, 26 per cent.; zinc, 10.2 per cent. Sample of oxidized outcrop: Gold, trace; silver, 4.2 oz. to the ton; lead, trace; zinc, 2 per cent.

King Tut. This group of eight claims, owned by F. A. McLeod, of Salmon Arm, adjoins the *Lucky Coon* group towards the north and east. Prospecting-work that was carried on in former years failed to disclose the continuity of the *Lucky Coon* ore-bodies along the normal line of strike, but work conducted during 1930 towards the eastern limit of the mineral claims in this group resulted in the discovery of an attractive body of lead-silver-zinc ore, having a different strike. This body of ore was exposed in a series of open-cuts over a distance of about three-quarters of a mile, in which solid sulphide is exposed at surface. The lead varies from 18 inches to 4 feeet in width and has a strike of N. 55° E., lying at an angle of about 35° to the normal direction of the *Lucky Coon* occurrence. Towards the south-west, outcrops of a similar character occur over a further distance of 500 or 600 feet, but no definite information had been obtained as to whether these occurrences were in place.

A sample taken across 2 feet in the open-cuts at the south-west end of the newly prospected ground assayed: Gold, trace; silver, 8.6 oz. to the ton; lead, 7.6 per cent.; zinc, 21.5 per cent. A sample taken from the next open-cut at a distance of about 75 feet towards the north-east

assayed: Gold, trace; silver, 6 oz. to the ton; lead, 4.6 per cent.; zinc, 6.8 per cent. A sample taken from the deepest cut towards the north-east end, in which the seam is fully 3 feet in width, assayed: Gold, 0.08 oz. to the ton; silver, 32.6 oz. to the ton; lead, 28.8 per cent.; zinc, 8.4 per cent.

All these exposures lie on a level stretch of ground where depth can only be obtained by sinking; there is, however, an opportunity for a tunnel-site where about 100 feet in depth could be obtained for initial prospecting purposes at a point about 600 feet to the south-west, where some work carried on previously had exposed some mineral that was thought to lie in the normal direction of the *Lucky Coon* occurrence. There is little doubt, however, that these exposures represent continuity along the more easterly line of strike, and it is probable that it will be found that these ore occurrences follow this direction in going north towards the contact with a body of intrusive rock which is referred to hereafter in describing the *Speedwell* group. This body of mineral represents the strongest individual occurrence yet discovered on the plateau and its further development will be a matter of considerable interest, more particularly in regard to the possibility outlined elsewhere of a change in the type of mineralization on approaching the contact with the intrusive.

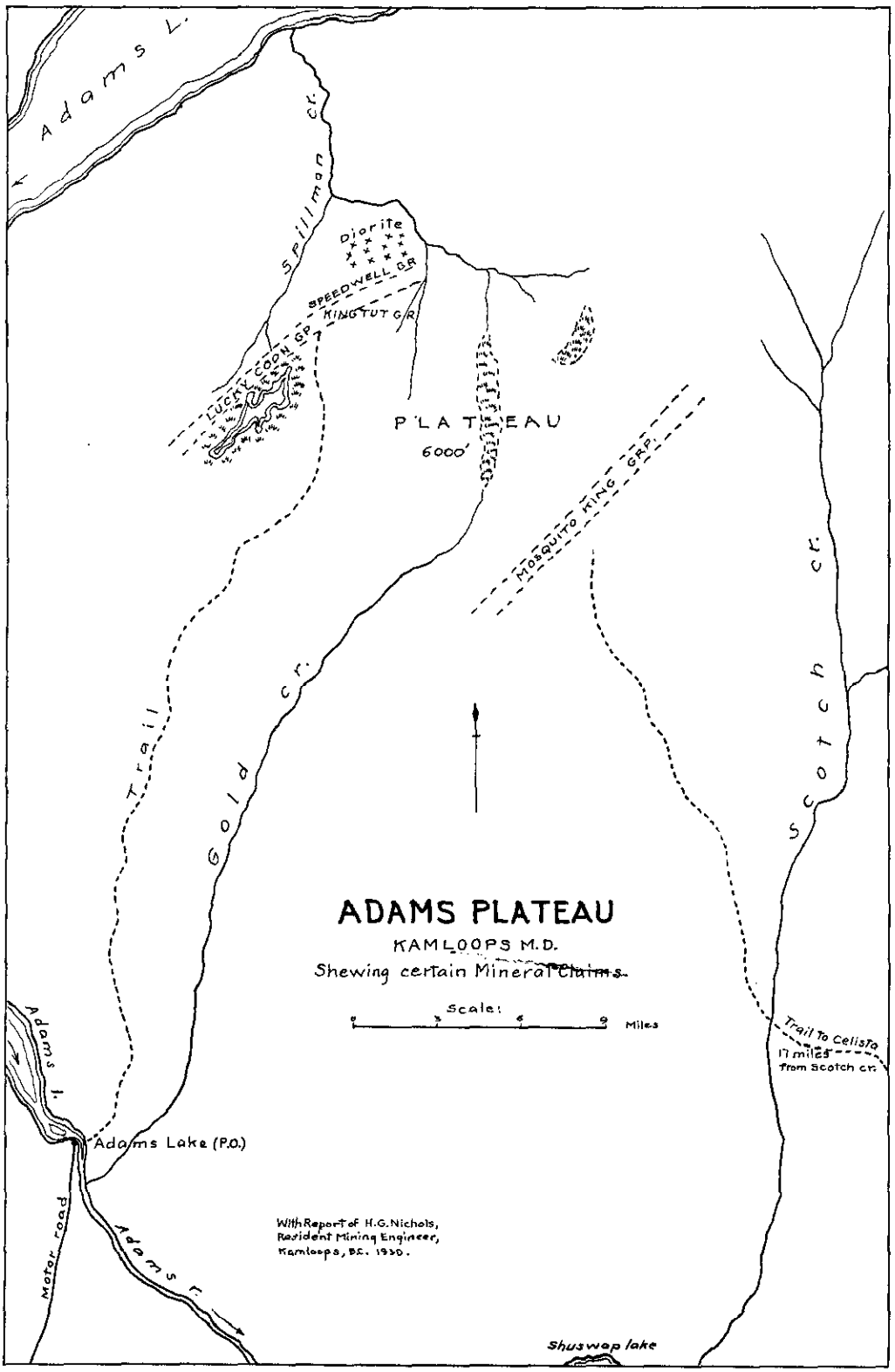
Speedwell. These groups of sixteen claims are owned by a Salmon Arm syndicate and were located by J. Thornton, who is in charge of the operations. They are staked in continuation of the *King Tut* group, reaching for a distance of about a mile to a precipitous bluff flanking a creek which flows into Adams lake from the east, close to the mouth of Spillman creek, coming in from the south-east. Certain of the claims also cover ground lying to the east of the *King Tut* and were so located in recognition of the easterly swing of the mineralized zone above alluded to.

At the point where the *King Tut* ore-body occurs, close to the side-line between the two groups of claims, the ground is considerably disturbed and it is not yet apparent whether the same line of strike continues. Around this point there are large bodies of quartz with scattered inclusions of lead-zinc minerals, and in a series of open-cuts some narrow veins of sulphide ore are exposed. At a distance of three claim-lengths from these workings, towards the north-east, the location-line, following the more northerly direction of the two lines of strike, reaches the contact between a body of hornblende diorite, intrusive into the prevailing schist formation on the summit of a precipitous bluff, down the side of which the contact may be followed, having a direction of N. 70° E., with a dip to the south. It appears probable that this intrusion is responsible for the several easterly divergencies of the leads along this mineralized zone, and that it will be found that on approaching this contact towards the north-east the dominant line of strike will lie in a more easterly direction than it does farther to the south-west. In this case the ravine of the creek above referred to would afford an attractive opportunity for prospecting and might provide a site from which the ultimate development of this ground at depth could be attacked.

Mosquito King. This group of seven claims is owned by Bischoff Bros., of Celista. It is situated on Adams plateau, at an elevation of about 6,000 feet, on a ridge between Scotch creek on the east and Gold creek, flowing into the Adams river, on the west. The property is reached by a rough trail from Sturdy's ranch, 5 miles north of Celista, climbing a steep hillside for a distance of about 12 miles in a north-west direction.

The mineral-zone upon which these claims are located has a strike which varies from N. 70° E. at the south end to a little north of north-east, being roughly parallel to the zone on which the *King Tut*, *Lucky Coon*, and *Speedwell* groups are located, some 3½ miles to the west. A number of open-cuts have exposed a lead which appears to have a maximum width of 18 feet over a distance of 1,200 feet, while the result of further surface-stripping work indicates that the mineralization continues without a break for another 300 or 400 feet. Beyond this point towards the north-east the formation is intersected by a tongue of intrusive rock, but the lead is picked up again in several shallow cuts over a further distance of three-quarters of a mile; the ore-bodies vary between 8 inches and 5 feet of almost solid sulphide. Towards the south end of the property a lead is indicated at a distance of 700 feet south-east of the main occurrence, but this has only been exposed in two shallow cuts. Eight samples were taken from workings at different points over a distance of 1 mile.

A sample from a surface cut exposing a width of 18 feet of mineralized ground assayed: Gold, trace; silver, 1.4 oz. to the ton; lead, 5.2 per cent.; zinc, 7.2 per cent. This was towards


Adams L.
Spillman cr.
Diorite
SPEEDWELL GR
KINGTUT G/R
LUCKY COON GP
PLATEAU
6000'
MOSQUITO KING GRP.
Trail
Gold cr.
Scotch cr.
ADAMS PLATEAU
KAMLOOPS M.D.
Shewing certain Mineral Claims.
Scale:
Miles
Trail To Celista
17 miles
from Scotch cr.
Adams L.
Adams Lake (P.O.)
Motor road
Adams r.
With Report of H.G. Nichols,
Resident Mining Engineer,
Kamloops, B.C. 1930.
Shuswap lake

the southern end of the zone. A sample from a shallow shaft and open-cut, in which a width of 8 feet is indicated, across the upper 4 feet, assayed: Gold, trace; silver, 1 oz. to the ton; lead, 3.4 per cent.; zinc, 12.2 per cent. A sample across the lower 4 feet from the same workings assayed: Gold, trace; silver, 7.6 oz. to the ton; lead, 12.2 per cent.; zinc, 10.4 per cent. A sample from an outcrop lying north-east of the tongue of intrusive rock above referred to, and at a distance of about 1 mile from the south-west extremity of the zone, assayed: Gold, trace; silver, 1.2 oz. to the ton; lead, 4.4 per cent.; zinc, 11.2 per cent. A sample across 2 feet assayed: Gold, trace; silver, 2.8 oz. to the ton; lead, 8.6 per cent.; zinc, 7.6 per cent. At a further distance of about 100 feet towards the north-east a sample taken across 7 inches assayed: Gold, trace; silver, 2.8 oz. to the ton; lead, 7.4 per cent.; zinc, 21.6 per cent. A sample taken from the extreme north-east end of the property, across 8 inches, assayed: Gold, trace; silver, 4.4 oz. to the ton; lead, 13.6 per cent.; zinc, 7.2 per cent.

It will thus be seen that, while there is a general uniformity of mineral content, the values are low; but the attraction of the property is held to be in connection with the possibility of underlying bodies of considerable extent and different type of mineralization in which these surface occurrences are little more than indications in a country underlain at, probably, no considerable depth by intrusive rock, which is widely exposed at surface in the vicinity.

Venus and Evelyn.

This group of four mineral claims, standing in the name of C. F. Johnson, of Magna Bay, and associates, is situated on Crowfoot mountain, at a distance of approximately 10 miles north of Magna Bay, on Shuswap lake, at an elevation of approximately 6,000 feet above sea-level. Silver-lead mineralization is found as replacements along erratic seams in a belt of limestone which traverses the plateau in a direction approximately N. 60° W. The particular band of limestone in which this mineralization occurs is approximately 100 feet wide and constitutes one member of an interbedded formation of limestone and schist which is several hundred feet in width.

The original workings on this property were confined to an open-cut working from which a pit had been dug to a depth of about 12 feet. In these workings some fairly high-grade silver-lead-zinc ore was found in seams cutting the formation in a north-east and south-west direction; these seams did not prove to be continuous. The work comprises a number of trenches and open-cuts extending along the length of the band of limestone for a distance of approximately 300 feet and practically covering its entire width; there are about twenty of these cuts. The general result of these workings is to show an extremely broken condition of the ground at surface, with a weathering and erosion of the limestone resulting in disjointed blocks. Mineralized seams are found running in every direction and scattered mineralization throughout the decomposed limestone is general. In one open-cut, at a distance of about 120 feet north-west of the original working-place, some high-grade mineral has been found lying along the hanging-wall of the limestone-band and apparently conforming to the general strike and dip of the formation. A picked sample from this point assayed: Gold, trace; silver, 50.1 oz. to the ton; lead, 41.2 per cent.; zinc, 7.8 per cent. All these outcrops lie on a plateau-like area and accumulation of water in the open-cuts renders prospecting difficult.

The occurrence, at many points over the whole area of the plateau, of exposures of a porphyritic igneous rock supports the view of an underlying intrusive at no great depth below the surface as being responsible for the condition of mineralization as well as for the broken and disjointed character of the formation. Under the conditions it is not likely that bodies of economic importance, with any degree of continuity, are to be found at surface, and prospects in connection with the property will depend upon exploration at some depth. The search for such ore-bodies in plateau-like areas such as this one is beyond the scope of the ordinary prospector, and appears to call for some reliable method of geophysical prospecting, in the first place, as a guide to further development. Such methods are to be recommended in this case on account of the heavy sulphide character of the ore where it does occur.

Iron Pot.

This claim, opened by W. Henstridge, of Celista, covers a mineral-exposure on the bank of a small creek flowing into Scotch creek from the west at a distance of about 6 miles north of Shuswap lake and at an elevation of about 2,000 feet. A number of quartz-seams and mineralized leads are exposed in the bed of the creek, with an east-west strike and dip to the south. The mineralization is represented chiefly by pyrrhotite, but there is some lead and zinc associated with the quartz. These bodies of mineral lie within a zone about 400 feet wide and the best showing is at the highest point on the side

of the hill on the foot-wall side of the zone. Two short tunnels have been driven at this point on a lead which has a width of about 2 feet, but no values were obtained on sampling. It is reported that some fair gold values have been obtained from the lower seams and that nickel is also found with the pyrrhotite.

The country-rock is schist, the formation having a flat dip towards the south; it is intersected by several dykes and is considerably disturbed. The prospect, so far as it has been developed, does not appear to offer much promise, but it might be worth while to attempt to open up the foot-wall occurrence at some little depth by driving a crosscut tunnel from a point lower down the creek which would intersect it at a depth of about 70 feet and would also serve the purpose of prospecting the greater part of the width of the whole zone.

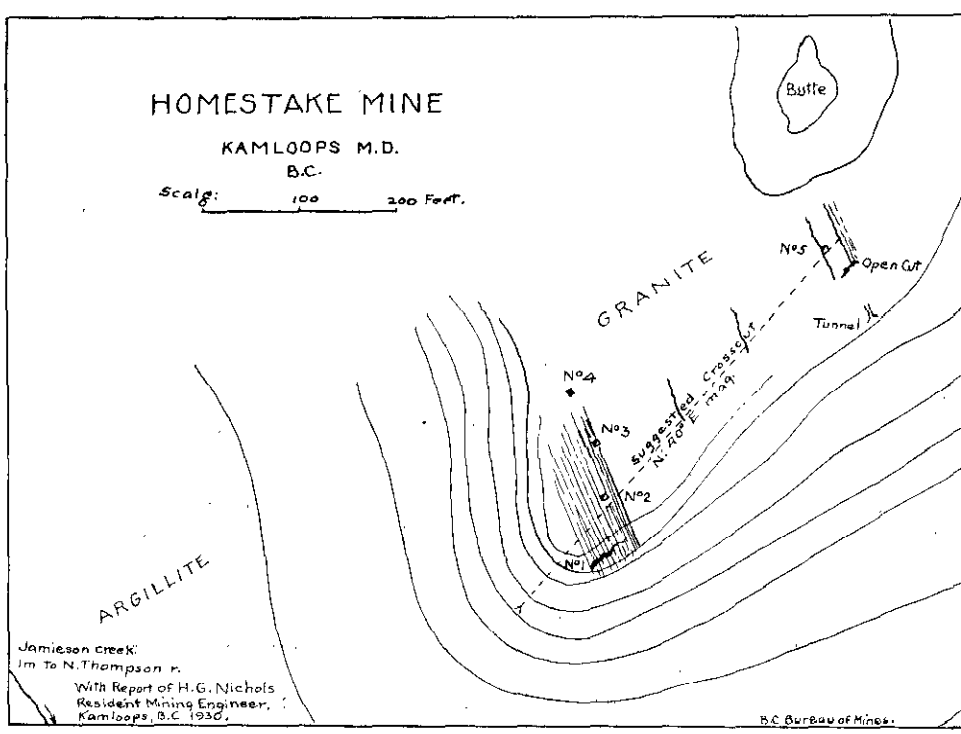
Douglas and Lower Six.

These groups of claims are located on Agate (Squaam) bay, east of the *Homestake*, and were located by G. H. Brock, of Soda Creek. Outcrops of silver-lead ore occur in association with barite and in quartz veins under conditions that have some features of similarity with those in the *Homestake*. More particularly towards the eastern end of the ground, and on adjoining properties located on the shore of Adams lake at a lower elevation, chalcopyrite is also found, and the opinion is held that at some depth the type of mineralization may be found to change. The property is under option to Paymore Mines, Limited.

North Thompson River Section.

Homestake.

This is one of the oldest known gold-quartz properties in the Province, having been reported upon by G. M. Dawson in the year 1888. It is situated on the north side of Jamieson creek, a tributary of the North Thompson river, at a distance of 18 miles above Kamloops. The property is reached by a winding



trail 2½ miles long following an old wagon-road around the steep side of a hill, terminating in a prominent butte at an elevation of about 1,800 feet above the valley. At the time of Dawson's examination only a small amount of work had been done in the nature of shallow pits and costeaning-ditches, and although his description of the occurrence is naturally vague, the opinion was expressed that the property deserved further examination and that large quantities

of ore of medium grade might be obtained. The opinion is expressed in this old report that "the date of the origin of the veins is contemporaneous or equally so with that of the intrusion of the granite-mass, and that its silicification and decomposition happened concurrently with the segregation of the vein quartz, which often forms irregular stringers, characterizing certain zones of the rock." As may be gathered from this description, the occurrence is represented by gold-bearing quartz veins in a granite formation which is here exposed, intrusive into argillites.

The property was bonded in the year 1920 to a local Kamloops syndicate by the present owners, O. Redpath, T. Bulman, and associates, of Kamloops, and a small amount of sinking-work was done by the bonding company, and in addition some sinking, tunnelling, and open-cutting has been carried out on other occasions. As a result of this work further facts are observable than was possible at the time of Dawson's examination, and a feature of significance is a well-defined zone of shearing in the granite with which the gold-quartz occurrences are identified.

The claim is 1,500 by 1,500 feet, the location-line running approximately north-west, south-east (mag.), and covers a series of quartz veins traversing the apex of the butte in a belt approximately 300 feet wide. These veins are more or less parallel to one another, having a steep dip towards the south-west. The zone of shearing in the granite is exposed by open-cuts in a steep bluff on the south-west or hanging-wall side of the mineralized belt. These open-cuts indicate a width of 30 feet for this shear, of which about 40 per cent. is occupied by quartz in definite vein-like form, while three other open-cuts on the flat grassy summit of the bluff, extending over a distance of about 300 feet in a general north-westerly direction, indicate a width of about 50 feet for the shear-zone. Towards the north-east, at a distance of 250 feet from this shear-zone on this foot-wall side, another vein is exposed in a tunnel, open-cut, and shaft-workings, extending over a distance of about 150 feet in the same general north-west and south-east direction. The maximum width exposed of this foot-wall vein is about 18 feet. The shaft has been carried down to a depth of 75 feet on the hanging-wall side of this vein, which is regarded as occupying a zone of fracturing in the granite, sympathetic to the main zone of shearing above referred to, and it is probably the occurrence referred to by Dawson.

The economic aspect in regard to these veins may be influenced considerably if they are regarded, as appears reasonable, as being related essentially to persistent shear-zones in the granite rather than as "irregular stringers characterizing certain zones of the rock." It is to be remembered that at the time of Dawson's inspection a very limited amount of work had been done, and while that accomplished up to the present time falls far short of what is required for a thorough understanding in correlation of the several occurrences, it is possible that in the light of these exposures his views might have been modified. It is evident that there is a large deposit of vein quartz in this mineral-belt, and while it appears that a considerable portion is without valuable content, there are certain sections, especially in the zone of shearing, that give promise of response to development.

In the hanging-wall section—that is, in the shear-zone proper—a considerable amount of pyrite and arsenopyrite is found, while the wide vein on the foot-wall side of the belt appears to be characterized, more especially on its foot-wall side, by galena. The following samples were taken:—

(1.) From the shaft on the hanging-wall side of the foot-wall vein, across 5 feet at a depth of 45 feet below the surface: Gold, 0.04 oz. to the ton; silver, 0.2 oz. to the ton.

(2.) Sample from the dump at open-cut on foot-wall side of foot-wall vein: Gold, 0.40 oz. to the ton; silver, 9 oz. to the ton.

(3.) Sample from dump at head of a shaft sunk on a 20-inch seam on the foot-wall side of the shear-zone: Gold, 0.16 oz. to the ton; silver, 3 oz. to the ton.

(4.) General sample of quartz representing 40 per cent. of the width of shear-zone exposed in open-cuts on the side bluff: Gold, trace; silver, trace.

(5.) Sample from 9-inch seam on hanging-wall of shear-zone: Gold, 0.05 oz. to the ton; silver, 0.8 oz. to the ton.

(6.) Sample from pit above open-cut in centre of shear-zone, across 5 feet: Gold, trace; silver, trace.

Samples from the open-cut on the foot-wall side of the foot-wall vein are reported to have yielded good values, and Dawson quotes an assay from one specimen which yielded: Gold, 1.1 oz. to the ton; silver, 34 oz. to the ton. He also quotes three other assays taken from exposures

in the same vicinity, as follows: (1.) Gold, 0.58 oz. to the ton; silver, 2.52 oz. to the ton. (2.) Gold, 0.76 oz. to the ton; silver, 29 oz. to the ton. (3.) Gold, 0.70 oz. to the ton; silver, 25 oz. to the ton.

Assuming that these reports of occasional values are correct and in view of the indications of possible continuity, as afforded by the structural conditions of shearing, it is considered that this property is deserving of more attention than it has received and offers an opportunity for legitimate expenditure of capital in its exploitation.

In the past this occurrence has been regarded as being represented by a series of irregular veins with spotty values, and such work as has been done has been guided by the hope of happening upon a rich pocket or ore-shoot. The property is to be regarded, however, as presenting a possibility of developing a considerable tonnage of low-grade ore. The number and extent of the occurrences of quartz are held to point to a general silicification of a zone of shearing and a comprehensive system of development is required. The steeply dipping hillside flanking Jamieson creek on the south-west side of the bluff affords a good chance for a tunnel-site, and a crosscut could be driven from a point on this hillside to intersect the shear-zone at a depth of about 250 feet below the surface and, passing through it, could be continued to intersect the foot-wall vein in a total distance of about 500 feet. Drifting from this level could be carried out, and in this way the initial stages of development could be completed at a moderate expense. There is not a great deal of timber on the hill in the immediate vicinity of the property, but there is an abundant supply at a distance of about 1 mile. Water flows in Jamieson creek all the year round and electric power can be obtained from the hydro-electric power station on the Barriere river.

Gold Hill.—H. Skonig continued development-work upon this property, situated near Chu Chua, on which occasional high values in gold have been found. This property was described in the Annual Report for 1929.

King Pin.—Some further encouraging values in silver-lead-zinc ore were found in continuing a short surface tunnel on this property, but no definite lead has been discovered.

White Rock.—There have been no recent developments upon this property, situated on the south side of the Barriere river.

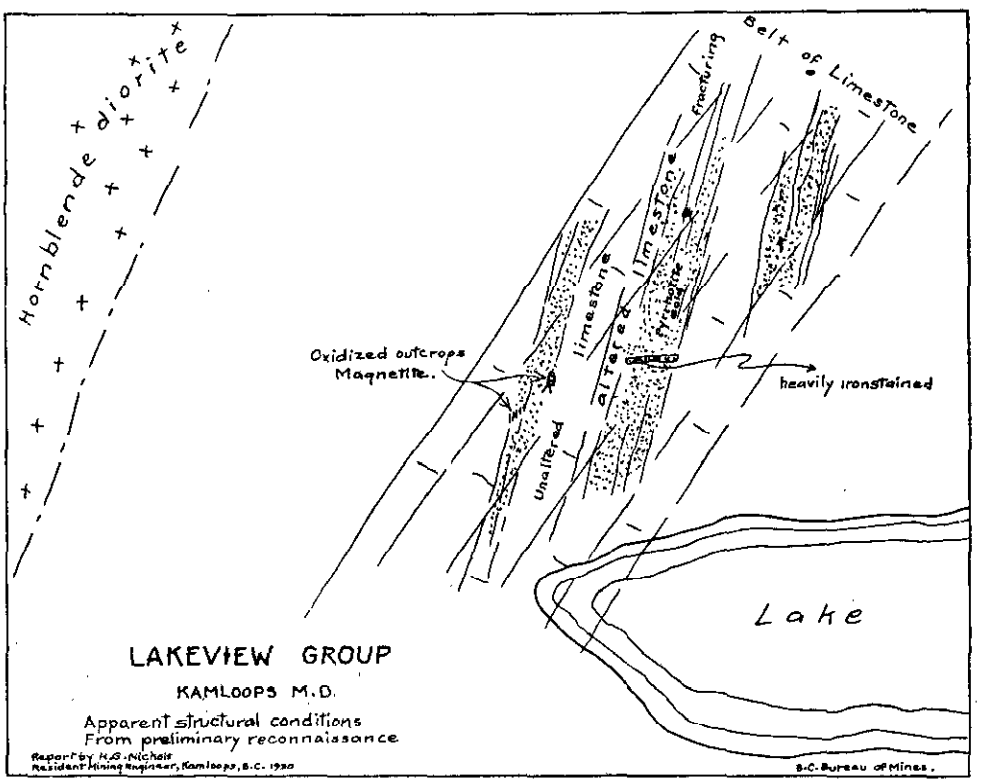
Silver Lake. Work was continued on this property, situated at a distance of about 15 miles from Mount Olie, during the early part of the year by F. Lawrence and P. Johnson. This group of claims, on which the mineralization is represented chiefly by copper and zinc, possesses features of attraction, but requires deeper development.

Lakeview. The discovery of this property was made during the latter part of the year under unusual circumstances. The group consists of fourteen claims, situated at a distance of about 9 miles due west of Mount Olie, on the Canadian National Railway, at a distance of about 60 miles from Kamloops up the North Thompson river. The discovery was made late in the year by P. Johnson and F. Lawrence, who for the past five or six years have been opening up a prospect some 2½ miles north of the *Lakeview*. The property is located around the shores of a small lake lying in a rolling upland at an elevation of approximately 4,000 feet above sea-level.

Outcrops of oxidized iron ore, chiefly magnetite, were known to occur in the limestone formation crossing the southern end of the lake, and some surface-stripping work on one of the strongest of these outcrops resulted almost immediately in the discovery of a body of solid pyrrhotite carrying some arsenopyrite. Encouraging samples were obtained from this surface showing and stripping-work was continued, exposing a width of about 40 feet of heavily iron-stained oxidized material, in the centre of which a band of sulphide 6 feet wide came right up to the surface. The southern half of this 40-foot stripping-work was then carried down to a depth of 6 feet, cutting through the body of pyrrhotite, in which arsenopyrite was found to be freely distributed. A high-grade content was found in this mineral and an examination was made immediately by representatives of the Premier Gold Mining Company, Limited, by whom negotiations were thereupon concluded for the acquisition of the property and commencement of development-work.

The group of claims is reached by following the old Hudson's Bay Company's trail up the north side of the valley of Eakin (3-Mile) creek, a tributary of Lemieux creek, which flows into the North Thompson river at Mount Olie, for a distance of about 8 miles, reaching the summit of the upland, which is thickly wooded with jack-pine and fir, and across which the winding trail

continues for a further distance of about 6½ miles in a general north-westerly direction. The mineralization is of the ordinary high-temperature iron-ore type, near the contact of an intrusive rock. The replacement appears to have occurred along a zone or zones of fracturing cutting obliquely across a wide belt of limestone and lying in a direction more or less parallel with the intrusive contact. This intrusive rock is a hornblende diorite which is tentatively referred to as being a stock of the Darlington batholith of the late W. L. Uglow. The unusual feature of the occurrence is the extent of the gold content associated with the arsenopyrite. Several samples of the solid sulphide have been taken, and it is understood that the sampling, carried out by the Premier Gold Mining Company, substantiated practically the results obtained by the owners. Two samples, taken respectively on the east and west side of the cut, through the 6-foot width of sulphide, yielded a content of 2½ oz. of gold to the ton on assay, and a sample of a narrow streak of solid arsenopyrite assayed 12.3 oz. gold to the ton.



The discovery was made in September and snow was already on the ground when a camp for winter operations was being established in the first week of October; there was, accordingly, very little opportunity for prospecting, and more detailed knowledge of the occurrence can hardly be expected before the snow is off the ground. A further occurrence of pyrrhotite was, however, exposed in a shallow pit at a distance of about 300 feet west of the main occurrence and in a direction which conforms approximately to the estimated line of strike of the zone of alteration in the limestone. Development operations during the winter are restricted to shallow workings looking to a preliminary estimation of the extent of the mineralization and of the association of arsenopyrite.

Smuggler. This property is situated on the northern slope of a hill rising to an elevation of about 2,000 feet above the valley, on the south side of the North Thompson river, at Birch Island. The property is controlled by Smuggler Hill Development Company, of Kamloops, and was operated formerly in connection with a number of bodies of silver-lead ore that are found, associated with quartz veins, in the sediments occupying the lower, gentle slopes of the hill.

More recently, attention has been given to superficial deposits of managanese ore which cover a considerable area of the ground. A number of test-pits were dug, which resulted in proving that the manganese-deposit was the result of the action of surface waters, and search was made for the original deposit from which the mineral had been leached.

In the progress of this work a zone of altered rock was located around the base of a ridge forming the apex of the hill, in which notable amounts of fluorite and celestite were discovered. Geological-survey work carried on during the past year* resulted in the mapping of a body of granite, intrusive into the sedimentary formation and being identified with the prominent ridge of the hill. In the vicinity of this granite intense alteration of the formation has occurred, the belt of metamorphosed rocks in which the fluorine and strontium minerals are found occurring around the contact of the granite. The extent of this zone of alteration has not yet been determined and it is probable that the occurrence of the minerals above referred to will vary considerably in extent. Samples are reported to have been taken over considerable widths and to have yielded assays in strontium as high as 30 per cent., but until a better definition of the contact-zone has been obtained such results cannot be taken as being representative. The presence of a certain amount of manganese in this marginal zone of alteration points to it as being the source of the surface deposit above referred to.

Minnesota Girl. Prospecting was continued upon this claim, situated on Foghorn creek, which flows into the North Thompson river from the east at Birch Island, by the owner, J. Schlichter, of Birch Island. The tunnel which is being driven as a crosscut to explore the downward continuation of ore-bodies of silver-lead occurring in a fractured quartzite on surface, about 200 feet above the tunnel-level, was continued to a total distance of 322 feet. Some low-grade mineralization was encountered in the last 27 feet of this distance, and for the last 5 feet the tunnel penetrated broken ground with considerable oxidation. It is proposed to drift north and south from this tunnel along seams which appear to bound the mineralized zone, having a width of about 40 feet, which is identified with a granite-contact. No ore of economic importance has yet been opened up.

Grizzley. A. P. Horne, of Blue River, continued prospecting-work on this property, situated in the Clearwater district. A considerable expenditure has been made in the construction of a trail to facilitate the opening-up of the mineral properties in this area, the geology of which was described by N. F. G. Davis and published in the Summary Report, 1929, Part A, of the Geological Survey of Canada.

Summit.—No new developments are to be recorded on this property, which has been described in previous Annual Reports.

Blue Ice.—It is anticipated that further work will be done upon this group, situated at the head of Hobson creek, upon the completion of trail-construction which is now being undertaken.

South Thompson River Section.

Ajax. G. J. Rogers, of Knutsford, suspended further work on this copper property, lying to the west of Kamloops, in favour of prospecting adjoining areas in which similar wide zones of shearing, with a persistent copper mineralization, are found. It will be remembered that the *Ajax* property was investigated by Consolidated Mining and Smelting Company of Canada, Limited, in a limited programme of diamond-drilling work.

Tenderfoot. This property, owned by a local (Kamloops) company, is a Crown-granted claim that was staked in the year 1889 under the old "apex law," being 1,500 feet long in a general east-and-west direction and 600 feet wide. It is situated on an arid ridge at an elevation of about 500 feet above the level of Kamloops lake and at a distance of approximately half a mile north of the Canadian National Railway track on the east side of Copper creek.

The mineral occurrence is represented by seams of bornite and oxidized copper in a zone of fracturing in the prevailing flow-rocks. This zone is about 30 feet wide and the mineralization has been traced for a distance of about 150 feet by a series of open-cuts. At the west end a seam was exposed that was referred to by the late G. M. Dawson in his report on the Kamloops area, published in the year 1894. Subsequent to the date of his examination the open-cut

* J. F. Walker, personal communication.

workings were extended, and the entire deposit of high-grade mineral was extracted in a distance of about 10 feet, extending to a depth of 6 feet; the continuance of the seam is represented by *sparse mineralization only.*

In an open-cut lying some 15 feet farther to the east two other seams of oxidized copper mineral are exposed, and at a further distance of about 30 feet more evidence of similar mineralization is encountered. An incline shaft was sunk upon this last-named occurrence, and at a depth of approximately 50 feet below the surface a tunnel was driven to intersect the mineral-zone and drifts run out in both directions over a total length of about 70 feet. Some stoping-work was carried out, a winze was sunk, two crosscuts were run towards the north, and a raise was put up to meet with the incline shaft above referred to. Altogether, about 250 feet of workings were carried out on this level, irrespective of the winze, which was under water at the time of examination, but which is stated to be about 35 feet in depth, with a crosscut to the south 35 feet long.

An amount, variously reported as being a car-load and as 100 tons, was extracted from these workings, including some high-grade bornite from a 2-inch seam in the raise. This ore is said to have been shipped to the Ladysmith smelter in the year 1918 by an Edmonton syndicate that acquired a temporary option upon the property. There is no definite vein; the character of the mineralization, as evidenced by the material lying scattered on the dumps and by the appearance of the several seams in the underground and surface workings, is to be described as sporadic in a zone of fracturing.

Copper King. Some exploratory work was carried out by W. R. Graham upon this property, owned by Baroness Sartorio, of Kamloops, which is situated at Cherry creek, on the Kamloops–Savona road, at a distance of 16 miles from Kamloops. Chalcopyrite, bornite, and magnetite are found at several points on the upper levels of a hill rising to a height of about 500 feet above the road, in a fractured diorite formation. In one open-cut the fissuring was found to be particularly intense, and the copper mineralization evident on the surface gave the impression of a definite fissure-vein. A shaft was sunk many years ago on this outcrop to a depth of 30 feet and a drift was run for a distance of 150 feet. From these workings an amount of approximately 1,000 tons of ore was mined, which is reported to have had an average content of 4 per cent. copper and $6 in gold.

The ore appears to have occurred in a shoot or pocket having a maximum width of about 15 feet over a length of 75 feet; the remaining 75 feet of the tunnel-workings towards the north was in barren ground, although the fissuring continued. Near the face of this north drift a crosscut was run out to the east for 20 feet, but failed to pick up any further ore.

There are a number of open-cuts on the surface in which small seams of ore are found, and in all of these the mineralization occurs along joint-planes. A tunnel was driven at a depth of about 75 feet below the upper workings in an attempt to locate the downward continuation of this ore-body.

The workings on this lower level, amounting in all to about 700 feet, comprise 150 feet of a crosscut to the east and 300 feet of drifting in a general north-easterly direction along the line of strike of the mineralized fissure that was followed in the workings above. From the end of this north-east drift an almost vertical raise connects with the level above. A further 250 to 300 feet of work was done on the lower level in groping around to find the extension of the seam towards the north. The result of this lower working is to show that the occurrence is not to be considered in the light of a fissure-vein, but as scattered mineralization which happens to have been concentrated near the surface in one section of a north-and-south fissure system.

During 1930 four car-loads of ore was extracted from the stope from the upper workings and it is possible that still further amounts might be cleaned up. It would appear that there was not much promise of any large supply from this source, as more recent work was devoted to picking out ore from the old dump; this ore was passed down through the raise and brought out through the lower workings. It is understood that a shipment of this material that was sent to Trail did not pay for treatment. There is no reserve of ore developed, and while it is *possible that the shoot extends below the 30-foot level, it does not appear to reach down to the* lower level, on which horizon there would not appear to be encouragement for further exploration. There might be an opportunity, however, for underhand stoping from the 30-foot level, with a prospect of extracting and sorting out some shipping-ore, and further ore-shoots might be developed at surface as a result of systematic open-cutting.

Bertha and Molly. These claims are situated in the Meadow Creek area, at a distance of 3½ miles due south of a point on the road from Kamloops to Mamit lake, at a distance of 35 miles from Kamloops. The property, on which copper mineralization is found, is situated in an area of hummocky upland, about 300 feet above the valley, which is heavily timbered with pine and willow.

The country-rock in this area is a diabase porphyry which is greatly fractured with scattered mineralization in seams and joint-planes. There appears to be a dominant zone of fracturing traversing the claims in a general east-and-west direction, with a steep dip towards the south. At the western end of the claims a shaft was sunk many years ago to a depth stated to be 75 feet at a point where some patches of high-grade cuprite occur in fractures. A Kamloops syndicate entitled "Meadow Creek Mines" was formed for the avowed purpose of continuing the development at this point, but operations carried out during the early part of the year were devoted to gouging out some ore for shipping purposes from around the collar of this shaft and to a depth of about 12 feet below the surface. In the course of this work, in which a great deal of sorting was done, the shaft had been filled up with discarded material to within a few feet of the top. About 120 sacks of sorted material was stacked for shipment, of which it is possible that not more than about 5 tons would stand the cost of treatment. This material was obtained from sorting the old dump as well as from the recent excavations.

At a distance of about 1,500 feet to the west a series of open-cuts has been made on the side of a westerly dipping hill at a depth of about 75 feet below its summit; the same indications of fracturing with sparse mineralization are found. At this point there would be an opportunity to strip across the full width of the zone of fracturing in order to ascertain whether there might be some higher concentration that would warrant development. As at present exposed there is no body of ore opened up or indicated, and there is very little to distinguish these occurrences from the many evidences of scattered mineralization along joint-planes of the diabase which is characteristic of this whole area. It is relevant to remark that recent operations, by filling up the shaft and thus obscuring evidence that might have been available as a result of past work, have tended to decrease rather than improve the attraction of this prospect.

Transvaal. This group of claims is situated on Forge mountain, in that section of the Highland Valley area east of Spatsum which lies within the Kamloops Mining Division. A great number of low-grade copper-deposits are known in this area and from time to time efforts have been made to develop them. In years gone by considerable expenditure was incurred, both in diamond-drilling and underground workings, in this endeavour, but owing to certain difficulties of transportation and to lack of detailed knowledge of the geology of the country, none of these properties have been brought to the stage of profitable production.

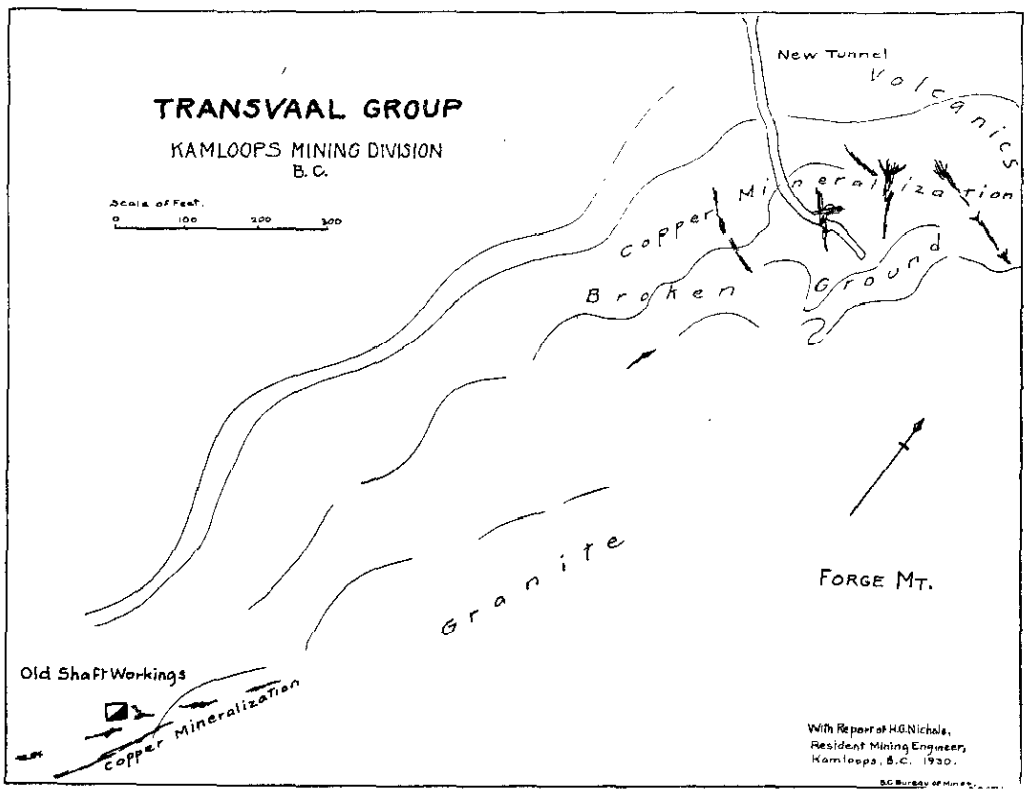
Prior to the collapse in metal prices the development of this group was recommenced by the owner, George Novak, of Rossland, who undertook to explore some promising showings upon which a considerable amount of work had been done in open-cutting, shaft-sinking, and crosscutting from a point on a gentle hillside below two of the most promising outcrops.

The property is situated close to the contact between the granite in which the greater number of the mineral occurrences of the area are found, with the Kamloops volcanics, and along this marginal zone the rocks are greatly shattered, dislocated, and altered. It is possible that the greater part of the mineralization lies within the fractured volcanics and is related to tongues of granite and dyke-rock in which sulphides are found.

The mineralized area on this property lies in broken country with much scattered debris, and the less disturbed formation lying to the south and west is covered with heavy overburden as a result of which very little surface prospecting has been carried out in this direction, and so far as the present evidence goes the mineralization is identified with the highly fractured formation of the marginal zone.

There appear to be two main systems of fracturing which are exposed in the old shaft-workings, some 1,500 feet to the west of the present site, and in the series of open-cuts in which are exposed the ore-bodies that are the objects of the present work.

About 200 feet of developing and crosscutting work has been done and some good values have been encountered; the work, however, has not yet been carried far enough to determine



whether the quite attractive ore-body exposed in the surface cuts represents more or less continuous mineralization along a dominant zone of fracturing, or whether this is a sporadic occurrence at the intersection of the two fracture systems.

During the year progress has been made in the construction of a wagon-road to eliminate the almost insuperable difficulties of access by which the development of this property has been retarded.

Non-metallic Minerals.

Sodium Carbonate and Sodium Sulphate.—Some encouraging results have been obtained in exploratory work carried out by C. W. Austin upon dry lake deposits, situated at a distance of about 12 miles west of Kamloops, near the main line of the Canadian Pacific Railway and the highway to Vancouver.

The sodium-carbonate deposit covers an area of about 3 acres, surrounded by volcanic rocks, and appears to extend to a considerable depth. It is overlain by a few feet of mud, below which the crystal, containing about 63 per cent. water and from 1 to 5 per cent. mud, has been exposed in one pit about 16 feet wide by 80 feet long and in holes drilled with the aid of a steam-jet, which have penetrated the deposit to depths ranging from 18 to 36 feet without reaching bottom. Analyses of this soda crystal are stated to have given results of about 92 per cent. sodium carbonate and 8 per cent. sulphate.

The sodium-sulphate deposit covers an area of about 7 acres, at a distance of 1½ miles east of the sodium-carbonate area and at about three-quarters of a mile south of the Canadian Pacific Railway tracks at Cherry Creek, on Kamloops lake.

Two pits have been dug to depths of 4 and 9 feet respectively, and two holes were drilled—to depths of 7 feet near the edge of the depression and of 19 feet near the centre—without reaching the bottom of the deposit of crystal, which is overlain by only a few inches of mud and shows about 97 per cent. sodium sulphate on analysis.

A boiler and pumping equipment have been installed, and production of washing-soda is anticipated in the coming year, when further development will be carried on.

Gypsum, Lime, and Alabastine, Canada, Ltd.—This company has continued operations at the gypsum-quarries at Falkland, on the Kamloops–Vernon road, with greatly increased production. During 1930 an amount of 41,000 tons was produced, of which 11,000 tons was shipped to the company's plant in Calgary, 8,000 tons was sold as raw crushed gypsum, and 22,000 tons was used at the New Westminster plant. The gypsum is used for the manufacturing of wall-board, lath, tiles, and plaster.

PLACER GOLD.

Hobson Creek.—Work was continued on this property, situated at a distance of 2½ miles above the northern extremity of Hobson lake. A tunnel has been driven and connected with the old workings, in which good values were reported to have been found, some years ago. No definite evidence of what might be termed an old channel was found and it would appear that the bench is composed, of the greater part, of poorly assorted glacial debris in which some local concentrations may be found.

Tenquille Creek.—There was a little renewed activity by individual prospectors on these old placer-gravels and some coarse gold was recovered.

Eakin (3-Mile) Creek.—On this creek, which flows into Lemieux creek at Mount Ollie, on the North Thompson river, some interesting placer operations have been conducted. Occurrences of gold in the bed of Lemieux creek and in the lower section of Eakin creek have been known for some time, and previous operations carried on some years ago had led to the suggestion that the gold was derived from a conglomerate formation which is cut through by the creek.

During 1930 placer gold was discovered above this formation and some coarse nuggets were obtained from a section of the creek-valley in which boulder-strewn flats extend for a distance of about 1 mile over widths varying from 50 to 150 feet. Some good work was done by J. R. Lockwood, an old-time placer-miner, in the constructing of a small dam with a boomer-gate and in sluicing operations, with a view to testing out this ground as thoroughly as possible. Some encouraging results were obtained, but the difficulties in connection with the handling of the boulders prevented any definite estimation of value being obtained. The work is being continued by a local syndicate under J. R. Lockwood's direction. It is understood that the location was made originally by E. Myers, whose interest has been acquired.

Louis Creek.—The original plans for the operations on these placer claims, located on Louis creek, which flows into the North Thompson river from the south-east at a distance of about 37 miles north of Kamloops, as proposed originally by Noble Creek Prospecting and Development Company, underwent several changes owing to lack of agreement of parties interested. The original purpose was to bring water down by a flume 6,000 feet in length for the operation of monitors near the mouth of Louis creek, where good values had been found by preliminary testing work. At this point some two years ago an amount of about 200 yards of gravel out of the bed of the stream was washed, with the recovery of approximately 11½ oz. of gold.

Coincident with the change of management, this plan was changed in favour of treating a section of the creek at a distance of a quarter of a mile above its mouth, to which point the construction of the flume had already been completed. Two 6-inch monitors were used in preparatory work and a drag-line scraper was also employed to excavate for a bed-rock sluice. Numerous difficulties were encountered in this work, largely by reason of the uneven bed-rock; and after considerable expenditure in the handling of about 30,000 yards of gravel the finances of the company were exhausted and this work was suspended. A new company was then formed on the initiative of R. M. Reid and some of his associates in the old company, and complete control of the property was obtained by Paymore Mining Company, with head office in Winnipeg, having a capital of 5,000,000 shares, no par value, the purchase consideration being 500,000 shares in the new company. This company is now registered in British Columbia.

In view of the amount of preliminary work that had been done, it was decided to continue the project of working the upper section of the creek in the first instance, and heavier machinery was installed for this purpose. Repeated difficulties in connection with the uneven character of the channel have militated against the achievement of satisfactory results, but a small yardage has been washed, after removing a depth of about 20 feet of overburden from a 330-foot section of the creek-bed, with some encouraging recovery.

Operations have also been carried on by the company on Dixon creek, a tributary of Louis creek, where a 4-inch monitor was used under a 320-foot head of water delivered by a flume 1,200 feet long. Some coarse gold is found in the bed of this stream. Keystone-drilling carried

out on the flats around the mouth of Louis creek failed to yield satisfactory results and the project that had been entertained previously for dredging this ground was abandoned.

CLINTON MINING DIVISION.

Buzzer. E. J. Taylor and J. Cuthbert recorded assessment-work on this and adjoining groups, situated in the upper Taseko valley. The work consisted of tunnelling and open-cutting, and some encouraging gold values were found in the zones of alteration in granodiorite, throughout which there is a general impregnation with copper minerals carrying values in gold.

Mother Lode. Some further tunnelling-work on this property, situated on the hillside above the *Buzzer*, was done by N. E. Holbrook. This property was formerly under operation by Consolidated Mining and Smelting Company of Canada, Limited, and development of a wide mineralized zone was commenced by means of a crosscut tunnel.

Spokane Group. N. E. Holbrook continued prospecting in the mineralized area of this group, situated at a high elevation, at a distance of about 2 miles down the Taseko valley from the *Mother Lode*. This property was also previously under operation by Consolidated Mining and Smelting Company of Canada, Limited. The mineral occurrence is in many respects similar to those on the *Mother Lode* and *Buzzer* groups.

Timothy Mountain.—The mineral claims, on which molybdenite and complex veins with associated gold and silver values occur in this area at the extreme north-eastern limit of the Clinton Mining Division, have been bonded by Consolidated Mining and Smelting Company of Canada, Limited, and a considerable expenditure has been made upon trail-construction to facilitate operations that are to be undertaken in the coming year.

Ruby.—This gold-quartz claim is situated on the North fork of Watson Bar creek. Open-cut work was done by M. Munroe on what is reported as a wide ledge.

Confidence.—This claim, together with the *Astonisher* and *Independence*, is also located on the North fork of Watson Bar creek. Prospecting-work was carried out by W. Trimble on gold-quartz showings.

Big Slide. Some trenching-work, shaft-sinking, and tunnelling was carried out by Big Slide Mining and Development Company, Limited, of Vancouver, on this gold-quartz property, situated below the mouth of Kelly creek, on the east bank of the Fraser river. Some of the old workings were also cleaned out.

Flint. This chrome-iron property is situated on Scottie creek, 4 miles from the Bonaparte valley, and is reached from a point on the Cariboo road 20 miles north of Ashcroft by a narrow auto-road. The property has been under option to Consolidated Mining and Smelting Company and a camp is established close to the workings.

The chrome ore occurs in a belt of altered serpentine which traverses a hill on the right bank of Scottie creek, rising to a height of about 200 feet above the valley. The property was opened up originally by Henry Cargyle, of Ashcroft, and some sorted ore was taken out and shipped from a number of open-cuts reaching over the brow of the hill for a distance of about 400 feet. The occurrences appear to lie on a zone having a north-westerly strike and an easterly dip into the hill. On the foot-wall side of this zone the serpentine is less altered and there is a variable width of more or less disintegrated rock of the Cache Creek series adjoining it, with narrow veinlets of a jasperoid material running through it, in which chromite is disseminated; this rock alternates with a darker material in which the chrome is found in nodules or kidneys.

Following the shipment, in 1929, of about 150 tons of ore taken from around the open-cuts, Consolidated Mining and Smelting Company proceeded to develop the ground by means of crosscut tunnels penetrating the zone, with some lateral drifting. An upper tunnel was driven at a depth of a few feet below the lowest open-cut for a distance of about 20 feet and was then turned northward, following the disintegrated rock, in which some nodules of chromite of good grade were found.

The continuance of this crosscut tunnel was suspended in favour of driving a lower tunnel at a depth of some 60 feet below the upper workings, and this lower tunnel has been driven into the hill for a distance of over 200 feet and a certain amount of drifting has been carried out from it. The same conditions of disseminated chromite in the disintegrated rock, and of kidneys of variable size of more solid mineral, were found in these workings, but no evidence of direct

continuity has been established. Work is being continued by the company in the hope of developing a sufficient number of these more or less disjointed occurrences within the mineralized zone to warrant economic extraction, but the question of tonnage is of less importance at the present time than of the proportion in the chrome-iron content. Some of the heavier mineral would appear to carry too high a proportion of magnetite to permit of successful concentration. The operations are still in the prospect stage and their continuance will depend upon the results obtained by the work now in progress.

Bear.—A 50-foot tunnel has also been driven on a chrome-iron occurrence situated some 4 miles west of the Scottie Creek property. This property is also under control of Consolidated Mining and Smelting Company.

Maggie. Situated on the Cariboo road at a distance of 24 miles north of Ashcroft, this old property was developed many years ago and has lain idle until the workings were unwatered, during the year under review, by W. R. Hocking, of Seattle. The area in which this property is situated is occupied by fragmental volcanics and argillites of the Cache Creek series, and in the immediate neighbourhood of the *Maggie* workings there is an exposure of serpentine, representing an alteration of an intrusive peridotite. The formation is intersected by a series of albite dykes. Zones of fracturing, having a general north-and-south direction, constitute a noticeable feature owing to the extensive oxidation of an original pyrite content in the disintegrated and broken rocks; the mineral occurrence, however, that has been developed on the *Maggie* lies in a shear-zone, having a north-east and south-west strike, which is exposed in a cutting on the highway where it is approximately 80 feet wide.

The property was located originally and developed in the nineties by the father of the present owner. A tunnel was driven for a distance of about 600 feet from the level of the road, following the direction of the shear-zone towards the south-west, and a shaft was sunk from the outcrop at a distance of about 100 feet from the portal of the tunnel and 100 feet vertically above it. The tunnel is connected with the shaft by a crosscut towards the north or foot-wall side of the zone, and at a further distance of 100 feet from the portal a second crosscut was driven for 65 feet to the foot-wall of the shear. At a depth of 100 feet vertically below the adit-level a second tunnel was driven for a distance of about 150 feet, and the shaft was continued for a further 100 feet in depth on the foot-wall of the zone. These workings were abandoned in the year 1905 and were inaccessible until they were opened up and unwatered during 1930. Pyrite and chalcopyrite are found in narrow seams throughout the first few hundred feet of the tunnel, and in the 65-foot crosscut a body of solid mineral 2 feet wide was encountered in a width of 6 feet of well-mineralized ground. Iron and copper sulphides are disseminated throughout the decomposed rock over a greater width. On the 200-foot level a 3-foot vein, carrying considerable amounts of bornite, tetrahedrite, and chalcopyrite, associated with pyrite in a quartz gangue, was followed for about 100 feet. A sample taken across this vein assayed: Gold, trace; silver, 2.4 oz. to the ton; copper, 2.4 per cent.; lead, 0.6 per cent.; zinc, 3.4 per cent. Samples taken from the mineral exposed in the adit-tunnel workings yielded negative results.

The shear-zone may be traced on surface following the course of a dry ravine for a distance of about 2,000 feet, and at a distance of 1,500 feet west of the shaft-workings a considerable amount of quartz with a pyrite content is found in a zone of cross-fracturing that appears to lie in the general direction of one of the prominent fracture-zones above referred to. This fracture-zone was prospected by means of two crosscut tunnels at a distance of about 4,500 feet to the south. The prospect has certain features of attraction and there would appear to be encouragement for continuing the adit-crosscut to reach the intersection with the fracture-zone above referred to.

Non-metallic Minerals.

Dominion Soda Producers.—An amount of about 336 tons of soda was shipped to Vancouver by this company from the *Anita* group, situated 3 miles west of the 70-Mile House.

Soda Mining Products Co., Ltd.—This company shipped an amount of about 84 tons of soda from the *Rose*, *Blue*, and *White Elephant* groups at Coulson's Spur, Pacific Great Eastern Railway.

B.C. Chemical Co. No further operations were carried on at the works of this company, situated at the Last Chance lake deposit, about 11 miles west of the 59-Mile House. A considerable expenditure was incurred in the construction of a plant,

described in the Annual Report for 1929, but it is reported that the results obtained were not satisfactory.

Coal.

Hat Creek.—There has been some renewed activity in regard to the exploitation of the lignite-deposit on this creek, preparations being made for shipment of the coal to Vancouver. This property was fully reported on in the Annual Report for 1925.

Placer Gold.

Clinton Placer Exploration Co., Ltd.—This company, with headquarters in Vancouver, holds a group of nine bench leases on the east bank of the Fraser river, at a distance of 1 mile south of Kelly creek. Some machinery was installed and test-pits were put down to explore the gravels of an old channel. Considerable difficulty was experienced on account of water-trouble.

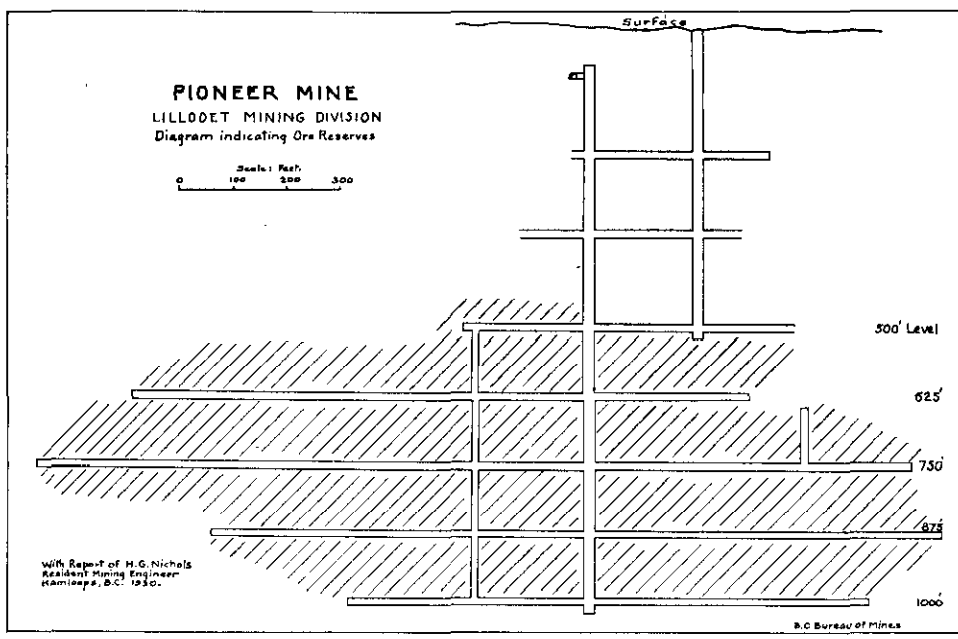
French Bar Creek.—Some prospecting-work was carried out on this creek by W. L. Pedlow, of Vancouver, and associates.

Watson Bar Creek.—Assessment-work was recorded on the *Homestake* and *Borin* benches and sluicing operations were carried out by M. Munroe on the *Ruby* and *Red Boy* claims. An amount of gold valued at about $1,500 was taken out from this area during the year. Operations were restricted owing to shortage of water.

LILLOOET MINING DIVISION.

Pioneer.

Important developments have been carried out on this property during the year, as a result of which a considerable life is now assured for this mine. The property was originally located in the year 1897, and following the suspension of the initial operations, in which partial development was carried down to a depth of about 230 feet below the surface by means of a vertical shaft, very little was accomplished until the



year 1923, when an effort was made by David Sloan (for the original owners) to interest New York capital in it. The shaft was unwatered at that time to permit of an examination, but the proposition was declined by the examining engineer. In July of the following year arrangements were completed between David Sloan and the owners, whereby a policy of development was commenced and financed entirely, with the exception of a small initial outlay, by returns derived from ore extracted from the old stopes. In these operations the old equipment of the property was used, although it was then in a bad state of repair. The shaft was continued to

a further depth of 142 feet, at which level a crosscut was driven to the vein, with encouraging results.

By the exercise of strict economy the same policy of development was carried on successfully during the two succeeding years, and by the end of 1926 the mine had been partially developed to a depth of 500 feet and with a favourable outlook with regard to lateral extension.

During the ensuing three years the property was acquired by Pioneer Gold Mines of B.C., Limited, with a capitalization of $2,400,000. A new vertical shaft was put down and development carried on with establishment of ore reserves sufficient to warrant the erection of a new cyanide-treatment plant. This plant was operated for more than a year upon a mixture of ore from the mine and tailing from the previous operations, in which the latter predominated, and it was not until the year 1930 that the mill was run entirely on ore directly supplied from the mine-workings.

At the beginning of the year 1930 the situation was as described in the 1929 Annual Report, with available ore reserves above the 500-foot level practically exhausted, with the shaft down to the 1,000-foot level, and with drifting commenced on the lower levels. By the end of the year four levels had been driven, as follows:—

On the 625-foot level: East drift, 300 feet; west drift, 850 feet; total, 1,150 feet.

On the 750-foot level: East drift, 603 feet; west drift, 1,030 feet; total, 1,633 feet.

On the 875-foot level: East drift, 654 feet; west drift, 704 feet; total, 1,358 feet.

On the 1,000-foot level: East drift, 520 feet; west drift, 450 feet; total, 970 feet.

Total development on all levels below the 500-foot level, 5,111 feet, of which approximately 4,100 feet was driven during the year. In addition to this drifting footage, 1,000 feet of development-work was done in raising and crosscutting. The mill was kept running steadily during the year on the entire material extracted without sorting from the above-mentioned development-work, exclusive, of course, of crosscutting, estimated to amount to 25,000 tons, in addition to about 4,000 tons from stopes both east and west on the 725-foot level and east on the 875-foot level.

The production for the year was $285,961, of which approximately $62,000 was from ore stoped and the remainder from rock and ore extracted in development. It would appear that the mineral recovery left something to be desired, due probably in large measure to the fact that the design of the plant and the method of treatment employed required adjustments to meet the change from tailing to mine ore.

The average value of heads to the mill for the period under review was calculated as from $14 to $15 to the ton. The average width of the vein on all levels is 3 feet and the average width of excavation in the development-work was 5½ feet; the average grade of the vein in these development-workings below the 500-foot level would therefore be over $26 to the ton. In this connection it may be said that samples taken on the 800-foot level, over 3 feet, of a beautiful ribbon-quartz, showing some free gold, assayed 5 oz. gold to the ton, and on the 725-foot level east, over a distance of 300 feet, samples taken across the vein, varying in width from 3 to 5 feet, averaged over $50 to the ton. Again, on the 725-foot level west, over a distance of 130 feet, samples across a width of 3 feet averaged over $80 to the ton. Other sections assay $30 to the ton over a width of 5 feet. On this particular level, where lateral development has been carried for 1,622 feet, the average width of vein is estimated at 4 feet, with values in excess of $22 to the ton.

In general it may be said that all development-headings are in ore, although there are certain gaps on the 600-foot level. In the east drift on this level a barren zone was entered at a short distance from the shaft, but as the ore on both the 500-foot and 700-foot levels extends well beyond this point, assurance was felt that the vein would be picked up again. A raise put up from the 725-foot level has shown that the vein lies in the foot-wall of the present workings as was expected. On the 600-foot level west, at a distance of 825 feet from the shaft, the vein appears to be split in the neighbourhood of a body of serpentine which comes in on the foot-wall side, but as the 700-foot level extends for about 200 feet farther beyond this point in good ore, there appears to be little doubt that this interruption is merely local. The conditions of faulting which have been encountered throughout the mine-workings are not serious, the vein being always picked up again after passing through a disturbed section in the course of a few feet, and their chief disadvantage lies in the fact that the ore cannot be broken down as cleanly where they occur. Faulted conditions appear to be less prevalent on the lower levels than they

are above, and the walls of the vein-fissure are strongly defined. The present plans of the company are to provide a new 3-compartment vertical shaft by raising from the 1,000-foot level and sinking below it. This shaft will be equipped with an electric hoist capable of hoisting from a depth of 3,000 feet. It is also planned to increase the daily capacity of the mill to 300 tons by the addition of crushing and grinding machinery. During the past year certain alterations have been made, including the installation of a Dorr bowl classifier, in closed circuit with the tube-mill, and additional settling capacity. In order to cope with the water-shortage problem, which is always felt in the winter months, a new hydro-electric plant has been installed on the South fork of Bridge river at a distance of 3½ miles from the *Pioneer*. This plant is capable of developing 750 horse-power. An average number of sixty men has been employed throughout the year and camp equipment provides for several families as well as the maintenance of a school.

Paymaster. This group was located on a creek flowing into Cadwallader creek at a distance of about 2½ miles above the *Pioneer*. Bodies of quartz were located on the precipitous sides of this creek, from which very occasional gold values were obtained. These quartz-bodies were considered to be analogous to the Cadwallader Creek veins and a wide area of a similar augite-diorite stock was reported to occur in this area. Examination served to substantiate the reports of the geology as previously published, in which it appears that the augite diorite is confined to a narrow tongue, and for the greater part the quartz occurs in members of the Bridge River and Cadwallader series of rocks.

Lorne. No further work has been done upon this property, which is situated below the *Pioneer*, on Cadwallader creek, since the suspension of operations in 1929. The mine was examined by representatives of the Premier Gold Mining Company, Limited, during the summer. This property is possessed of considerable attractions and its effective development has been retarded by the disproportionate liabilities incurred by the ambitious scheme of operations carried out by Lorne Gold Mines, Limited.

Griswold. Work on this property, which is under option to the Consolidated Mining and Smelting Company of Canada, Limited, and is situated at a high elevation some 40 miles above the forks of the Bridge river on the main branch, was suspended during the month of September pending the completion of further plans for its development. Promising bodies of chalcopyrite, occurring in a granite formation, have been discovered, but values in the precious metals are almost negligible. The property is considered as a possible reserve of copper ore under more favourable market conditions than exist at the present time.

Wayside. It is understood that negotiations are pending to provide for the further development of this gold-quartz property, situated near the forks of the Bridge river. The veins occur in zones of sheeting in an augite-diorite stock, otherwise similar to that in which the Cadwallader Creek mines lie.

Golden Cache. The anticipated reopening of this property, to assist which the wagon-road from Seton lake was repaired, did not mature during 1930. It is understood that the projected plans had to be postponed owing to the prevailing depression.

Alpha. Situated on Bridge River road at a distance of 1 mile below the mouth of Gun creek and owned by W. Davidson, this property is under option to Consolidated Mining and Smelting Company of Canada, which has been financing work carried out by the owner during the past eighteen months. A mineralized zone, in which gold and silver values are associated with pyrrhotite, lead, and zinc, occurs in a shear in the Bridge River series, identified with a porphyry dyke and bodies of serpentine.

A second lead, and possibly a second individual shear, occurs at a distance of about 200 feet west, the direction of both occurrences being approximately north and south. Outcrops indicating a continuance of the same thing are found over the hill towards Gun lake. A tunnel has been driven on the eastern shear for a distance of about 400 feet and varying values have been found over the whole distance. In certain places, over a width of about 1 foot, samples have yielded around 0.5 oz. of gold to the ton, but these values are spotty, and the average content over widths ranging between 2 and 4 feet is low—namely, from a trace to $2 in gold and a few ounces in silver.

A crosscut is being driven to intersect the western shear from the face of the tunnel. Samples taken from outcrops on this latter occurrence yielded better results.

The property is in a prospect stage, but the persistent indication of gold values is evidently held to be justification for the thorough prospecting that is being done.

The same occurrence is found on the other side of the river, where zinc and antimony predominate. Antimony is also found in the tunnel-workings, especially in seams bordering the dyke.

Cinnabar King.—Grant White, of Bridge River, did some more work on this property, situated on the high ground east of the headwaters of Tyaughton creek, and reports the discovery of a greater extent of the cinnabar impregnation in this area.

Marion.—No further work was done on this group, lying some 8 miles west of the *Cinnabar King*. Exploratory work was done by Lillooet Mercury Mines, Limited, in 1929, and a good trail was made to the property with a view to the installation of a retorting plant.

Copper Mound. This property, at the head of Wolverine creek, which flows from Tenquille basin westward into Lillooet river, owned by J. Jacks, of Pemberton, was bonded by interests identified with E. W. Hamber, of Vancouver. The negotiations were the result of reported discovery of bodies of copper ore with associated gold values of commercial importance in the massive pyrrhotite and magnetite bodies that occur in this area. Some camp-construction work was initiated and a considerable amount of new open-cut work was done. With the exception of some minor concentrations of copper mineral, the general result of this work was not held to be encouraging; the area, however, which is very heavily mineralized, is worthy of more careful prospecting-work.

Gold King. C. Barbour, of Agerton, continued the sinking of a shallow shaft on the heavily iron-capped shear from which encouraging values in gold have been obtained from previous sampling at a few feet below the surface. The property lies at a high elevation in the Tenquille basin. A sample taken from the bottom of the shaft at a depth of about 26 feet assayed: Gold, 0.56 oz. to the ton; silver, 9 oz. to the ton; lead, 0.8 per cent.; zinc, 6.8 per cent. This property represents a decidedly attractive prospect in view of the persistence of proven width and mineralization of the shear-zone; of the possibilities for cheap development by diamond-drilling; and of the repeated evidence that is obtained of the possibility of values in gold being discovered at some depth. Several tentative negotiations have been entered upon, but in every case the shortness of the season has militated against a successful issue.

Placer Gold.

McGillivray Creek.—This property was not visited during the year, but it is understood that no development of particular importance was carried out and that operations are to be resumed in the coming year.

ASHCROFT MINING DIVISION.

O.K. This property, of which a report was given in the Annual Report for the year 1922, is situated in the Highland Valley area. No further work has been done and the old camp and mill are in a dilapidated condition. The copper mineralization occurs in a well-defined shear in the granodiorite and the structural conditions would appear to favour persistence in depth. This property represents possibly one of the best opportunities for development of the low-grade copper-deposits in this area.

Empire. This property, situated at a distance of about 2½ miles from the *O.K.*, possesses more or less the same characteristics, but, so far as can be seen from the limited workings, the shearing in the granodiorite is not so strongly developed. The ore on the dumps from vertical and incline shafts indicates mineralization along fracture-zones rather than along shears. Bornite occurs as scattered impregnations in a blocky granite.

Coal.

Botanie Creek.—Some tunnelling-work was done by a local (Lytton) syndicate for the purpose of investigating some seams of lignite exposed on the north bank of Botanie creek at a distance of approximately 2½ miles from Lytton. These coal-measures occur in close proximity

to the contact of an intrusive rock with the sedimentaries and the formation is greatly disturbed. Some free-burning lignite is obtained from beds extending over a width of about 25 feet, but the coal is not clean.

Placer Gold.

Gravel-bars in the lower reaches of the Thompson river and on the Fraser river below Lytton have received some attention, notably below Spences Bridge, where a Vancouver organization is employing suction methods of operation.

YALE MINING DIVISION.

B.C. Nickel Mines, Ltd.

This company, with headquarters in Vancouver, has been developing properties at the head of Emory creek, in the Yale Mining Division, on which extensive bodies of a nickel-bearing pyrrhotite occur in a wide basic dyke intrusive into granite. During the past year a programme of diamond-drilling, guided by a system of electrical prospecting, has been continued with the object of delimiting the ore-bodies preparatory to underground development. The property may be reached up the valleys of Emory and Stulkawhits creeks, which flow into the Fraser river from the west, near Choate Lodge, on the Cariboo highway. The distance by either route is approximately 8½ miles. A good trail has been constructed up the former valley and plans are under consideration for the construction of a wagon-road to provide for the transportation of the necessary machinery for development.

The pyrrhotite is found outcropping in massive form on prominent bluffs on the steep hillside at elevations of between 2,800 and 4,000 feet above sea-level. Diamond-drilling which was commenced in 1929 was devoted initially to the investigation at moderate depth of one of the principal outcrops on which an open-cut had exposed a width of over 75 feet of solid mineral. Samples taken along the length of this open-cut had indicated an average content of between 2 and 3 per cent. nickel, while higher values were obtained in several of the diamond-drill cores.

The work was continued during 1930 following a preliminary investigation by electrical prospecting, which indicated a further body of sulphide lower down the hill at a distance of approximately 800 feet from the main showing, and in addition three more holes were put down below this outcrop, in one of which it is stated that mineral continued for 170 feet. On the lower showing an open-cut exposed a width of 30 feet of sulphide at surface, from which samples yielded around 1 per cent. nickel, and a diamond-drill hole that was put down at an angle of 25° at a distance of about 300 feet from the open-cut penetrated solid mineral with slightly higher values in nickel for a distance of over 70 feet.

At the present stage of the development it is not possible to state definitely whether these two ore-bodies are directly related to one another, but it appears probable that they represent units in a series of similar occurrences within the basic dyke and they are held to be examples of magmatic segregation therein. The nickel content appears to be in direct relation to the density of the sulphide. While an estimation of economic importance can be obtained only as a result of extensive underground development, the work which has been accomplished has been sufficient to show that there are extensive bodies of nickel-bearing mineral representing a large reserve of the metal. The property has therefore emerged from the stage in which it was to be referred to as an interesting prospect to one in which it may be considered as a possible source of supply of nickel on a large scale, and the work of development necessary to ensure its economic value is warranted fully.

Emancipation.—Some further exploratory work was carried out on this gold-quartz property near Jessica, which is controlled by the Dawson Gold Mines, Limited. Ten tons of ore was shipped that yielded a net return of approximately $10 a ton.

Aurum Mines, Ltd.

Prospecting-work conducted previously on the lower levels of this mine has been abandoned, and, following a change of management and under the direction of W. G. Norrie as consulting engineer, efforts have been devoted to following the occurrence of high-grade gold ore from the point it was encountered in the upper levels and to a systematic prospecting of the surface, particularly in regard to the bodies of gold-bearing quartz which occur at other points on the property. A car-load of ore, which yielded net returns of about $100 a ton, taken from above the upper level was shipped, and in the course of this excavation a narrow seam of very high-grade ore was encountered in which the gold appears to be associated with arsenopyrite.

Brett Gold Mines, Ltd.—This syndicate, with headquarters in Chilliwack, acquired the property originally held by Hope Gold Mines on 15-Mile creek, near Jessica, and some further prospecting-work has been carried on.

Rambler and Master Ace Groups.—Thirteen claims under these group names have been located by E. C. Rice, of Tulameen, and associates, near the head of Peers creek. The property was examined by representatives of the Granby Mining, Smelting, and Power Company. There is stated to be a promising showing of gold-copper ore.

Silent Friend. Prospecting-work on this property, situated in the Skagit valley close to the International boundary-line, has been continued by Alex. Robinson. A crosscut tunnel has been driven for a distance of approximately 300 feet to intersect the continuation of the attractive natural exposure of primary copper-silver ore on the side of a gulch about 150 feet above. Up to the present time the results of the work have been negative, but it is understood that operations will be continued next year. A good trail has been constructed to the property.

A.M. This group of seventeen claims was located at the head of the South fork of Cedar creek, a tributary of the Skagit river, by G. Allison, of Hope. The property has been bonded by Consolidated Mining and Smelting Company of Canada, Limited, and it is understood that development-work is to be commenced as soon as weather conditions permit. Mineralization is represented by chalcopyrite as replacement in quartzite.

Placer Gold.

Pierre River Syndicate. This company, with headquarters in Vancouver, acquired some placer properties on Peers creek, which flows into the Coquihalla river from the east at a point just below Jessica, on the Kettle Valley Railway. These properties were originally owned by J. Fulbrook, of Jessica. The area, which is situated at a distance of about 6 miles up from the mouth of the creek, is identified with the eastern and western contacts of the serpentine belt of the Coquihalla area. The gold content in the gravels appears to be related to these contacts. The valley of the creek is approximately 600 feet wide for a distance of about a mile and is flanked by a series of flats and benches. The sinking of a shaft was commenced close to the bed of the creek and was carried down to a depth of 60 feet without encountering bed-rock. In previous years some good results were obtained from ground-sluicing, but, so far as is known, there is no evidence available in regard to the existence of pay-gravel on bed-rock. The proposition can only be looked upon as affording an opportunity for individual prospectors working on a small scale, or as involving a heavy expenditure in the hydraulicking of a very large amount of overburden on a problematic quest. At the moment this course is not to be thought of.

Fraser River.—Eight placer claims were recorded near Chapman's and one claim at the mouth of the Nahatlatch river. It is understood that plans are being made by W. H. Mills for hydraulic mining at Boston Bar.

Siwash Creek.—Prospecting on this creek, flowing into the Fraser river above Yale, has been continued.

NICOLA MINING DIVISION.

Planet Mines and Reduction Co. of Nicola, Ltd. The property of this company is situated on Stump lake, midway between Kamloops and Merritt. It comprises a group of claims covering certain veins of a series that occur in the prevailing diabase porphyry of this district. The late G. M. Dawson called attention to these veins many years ago as providing promise of the establishment of a mining camp. The veins cover a wide area on a rolling treeless hill bordering the lake on its east side, and a considerable amount of development-work was done several years ago on members of the series, on the flat summit of the hill, lying at a distance of a few hundred feet from the vein that has been opened up by the company.

The *Enterprise* vein, which has been developed by the company, outcrops on the slope of the hill at an elevation of approximately 400 feet above the level of the lake. It has a strike approximately north and south, dipping into the hill at an angle of about 45°. This vein was originally opened up by means of an incline shaft, but recent developments have been carried out from a crosscut tunnel which reached it at a depth of 320 feet on its dip below the surface.

At this level drifts have been run both north and south and stoping operations have been carried over a distance of approximately 600 feet, the principal workings being south of the crosscut. The vein pinches and swells, the fissure being characterized by gentle folding. The width sometimes reached 6 or 7 feet, but the average for the distance stoped is not much over 2 feet. The mineral content is represented by galena, sphalerite, and pyrite, with associated gold and silver values. A mill with an estimated capacity of from 60 to 80 tons a day was erected and put into operation in the year 1929, in which the ore is concentrated by flotation, and estimates based upon certain gold values that were encountered in sections of the vein anticipated a gold content of around $12 a ton in the heads to this mill.

Early in 1930 it was ascertained that considerable values in gold were being lost in the tailing, and drastic alterations, following changes in the technical direction, were made in the milling equipment and methods. These changes consisted of the substitution of a standard Dorr classifier for the rotary-type machine that had been installed previously, and of the elimination of the Peterson flotation-cells for roughing treatment, and provision of a Forrester cell with a 90-ton capacity for this purpose. A Wilfley table was also introduced for treating the tailings from the Forrester cell and the middlings from the two cleaner-cells. Considerable saving in power and water was effected by the changes in the flow-sheet and it is claimed that a considerably higher recovery of the gold content was obtained. During the year an amount of approximately 17,000 tons of ore was treated in the mill, and concentrate having an average value of about $175 a ton was shipped to the Trail smelter, representing a total gross value of about $100,000. It will be seen from these figures that, even allowing for a considerable continued loss of gold in the tailing, the average grade of ore from the vein during the year's operation was very much lower than estimated. During the latter part of the year it is probable that there was a falling-off in grade, due to the necessity for extracting ore from the upper levels of the mine, where more than ordinarily low-grade sections of the vein had been developed. Conditions in general at this property since the erection of the mill have been, as might be anticipated, subject to the disadvantage attaching to a mine which is being operated for the purpose of keeping a mill running before it has been developed adequately, and it is to be remarked that this mill was out of proportion to the capacity for ore-supply represented in the vein upon which the operations of the company have been concentrated. At no time during the year has there been more than four months' reserve of ore. The inevitable result was reached late in the year, when it was found impracticable to continue stoping operations in the upper levels and the available ore reserve was exhausted. A shaft has been sunk below the 320-foot level to a depth of 160 feet on the vein and a new level is being driven at a depth of 115 feet with the object of opening up a further ore-supply. It does not seem probable that continuous operations can be assured profitably in this way. On the other hand, the work which has been done and the results that have been obtained in establishing value of this vein as an individual member of the series above referred to are encouraging to a policy of intense development, by which the ultimate mineral resources of the hill might be rendered available for ore-supply. As has been mentioned above, a considerable amount of development was done upon some of these veins many years ago. The principal workings were carried out from a shaft on the *Joshua*, which was sunk to a depth of about 400 feet and from which several hundred feet of drifting-work was carried out. These workings have been under water for some years, but might be approached by means of continuing the *Enterprise* crosscut, and this work is warranted.

Viewed in this light, of a comprehensive holding, the area might be looked upon as representing one of the best prospects in the district.

Primary Ore Mining Co.

This Vancouver syndicate acquired the *Mary Reynolds* group, situated near Stump lake. A narrow vein of high-grade silver mineral was prospected on this property some years ago, but it was not found to be continuous. The occurrence lies in a zone of alteration in the prevailing greenstone formation in which a considerable amount of quartz is developed in veins and lenses of variable extent. Recent work by the company has been devoted to diamond-drilling along this zone towards the south and a continuance of the underground workings towards the north that were abandoned by the previous operators. In particular a drift towards the north, from an incline shaft at a depth of 36 feet below the surface, was advanced for a further distance of about 20 feet, and a continuation of the high-grade mineral was found in seams along both walls of a fissure about

4 feet wide. It is stated that the whole width of this fissure would represent ore of milling grade. A sample taken across this 4 feet assayed: Gold, 0.10 oz. to the ton; silver, 26.6 oz. to the ton. The same fissure can be traced on the surface, where some well-mineralized quartz occurs at a distance of some 80 feet ahead of the underground workings. No further work has been done on the northern extension, but towards the south, at a distance of 550 feet from the shaft, a diamond-drill hole was put down to a depth of 111 feet. It is stated that three quartz veins were cut in this bore-hole, but it would appear that the continuation of the main zone had not been reached.

Prospecting-work on adjoining claims was carried out and several old open-cuts were resampled. For the greater part, quartz occurrences that are found in the fractured greenstone are of low value and no particularly encouraging results were obtained from this work.

Thelma. Operations upon this property, situated 9 miles north of Nicola, were carried on for a short time during the early part of the season, but have since been abandoned owing to financial difficulties and failure to develop ore-bodies of any importance. The crosscut from the bottom of the *Thelma* shaft was driven into the hanging-wall for 90 feet, a short drift was carried from the bottom of the shaft for a distance of about 80 feet, and a small amount of crosscutting was done from it. The ore-body that was found in the upper level was not encountered in these workings. Some work was then done in the *Bernice* shaft, where a small seam of high-grade ore was encountered. It is clear that more systematic development would be required on this property; up to the present time no more than occasional shoots of silver-lead ore in the belt of limestone have been found.

Comstock of B.C. Ltd. This company owns the *Leadville* group, situated around the summit of Iron mountain near Merritt. The workings are reached by a good road. As described in previous Annual Reports, the lead-zinc-silver ore-body, occurring in a barite gangue, was followed down to a depth of 100 feet, with a shaft in which a width of 5 feet of a good-grade lead mineral was exposed. At this depth some faulting had occurred and further sinking was abandoned, following which, operations were suspended until arrangements could be made for less expensive development-work. A portable compressor for power-drills has been taken in, and it is understood that a crosscut tunnel is to be driven to intersect the vein below the shaft-workings, from which lateral development-work will be carried out.

Coal.

Middlesboro Collieries, Ltd.—Development-work was limited to the actual demands of consumption and the market for domestic coal was affected unfavourably by conditions of unemployment to the extent that more firewood was cut and sold by men out of work.

VERNON MINING DIVISION.

Pre-Cambrian Mines, Ltd. This company, with headquarters in Seattle, Wash., has been continuing development upon the *White Elephant*, situated near Ewings Landing, on the North arm of Okanagan lake. This property was brought into prominence some years ago by the discovery of high-grade bismuth-telluride ore, associated with a large body of quartz in granite. Subsequent work, including the sinking of a vertical shaft with crosscutting at a depth of about 100 feet, proved this quartz-body to be of considerable extent, and also outlined a band of pyrrhotite which was uncovered in open-cut workings and intersected by the shaft.

Pre-Cambrian Mines, Limited, was incorporated two years ago with the object of establishing average values for this occurrence, from which spectacular assays were obtained from chance occurrences of the telluride, the greater part of the body of quartz being either valueless or of low grade. For this purpose a small pilot-mill was erected and attention was paid in the first place to attempting a concentration by flotation of the sulphide mineral in close proximity to which the telluride was found. The result of this work was not satisfactory, the concentrate having a very low value.

During the year in review a new double-compartment incline shaft on the foot-wall of the occurrence has been put down to a depth of 70 feet, and it is planned to continue to a depth of 400 feet, running drifts and crosscuts at least every 100 feet, in order to thoroughly prospect the body of quartz with less attention to the pyrrhotite. This quartz, which is assumed to have

a strike slightly east of north, with a dip of about 60°, is said to carry some gold values, and it is stated that a bulk sample representing the total amount of the ground excavated in the open-cut workings, including some portion of the pyrrhotite band, together with the seam carrying the high-grade gold telluride, showed fair average values.

The work is being carried out under the direction of P. H. Holdsworth, consulting engineer, of Seattle, and it is understood that every effort will be made to establish the economic value of this prospect, and that development will be carried on systematically and is not now guided by the results of geophysical prospecting as referred to in the 1929 Annual Report.

Payroll. H. J. Blurton, of Vernon, did assessment-work on this group, situated on Deep creek, on the west side of the North arm of Okanagan lake, which was described in the Annual Report for 1929. The quartz vein, carrying values in silver and lead, was exposed at surface over a distance of about 900 feet, and prospecting at a distance of approximately 2½ miles higher up the valley resulted in the discovery of quartz veins with an antimony content, from which samples are reported to have yielded high values in gold.

Jumbo. Some further work was done on this property, situated 2½ miles north of Vernon, on the Kamloops road, on which quartz veins carrying free gold occur in a contact-zone between argillites and a greatly altered and fractured igneous rock. Previous attempts to prove continuity have not met with good results, but some promising samples were obtained from a tunnel slightly below the recent open-cut workings, of quartz with a heavy content of pyrite.

Goodenough. This copper property was examined by representatives of both Consolidated Mining and Smelting Company of Canada, Limited, and of Granby Mining, Smelting, and Power Company, but although preliminary negotiations were entered upon, no working arrangement was completed and no further developments are to be recorded.

Wandering Jew. This claim is situated about 15 miles below Westbank, on the west side of Okanagan lake, and about 1 mile from the Vernon–Penticton road; it is owned by Clement Aitkens, of Kelowna. The area is covered by a hornblende-diorite intrusive in which occur zones of shattering with a general north-south direction. Alteration within the zones has resulted in the development of much hornblende and ferro-magnesian minerals. There are also wide dykes of a pegmatite rock, one of which, near the principal open-cut workings, appears to border the shatter-zone of altered rock. Traces of mineralization are found, notably pyrite and copper-stains, and there is some quartz, but no ore-bodies of economic importance have yet been located.

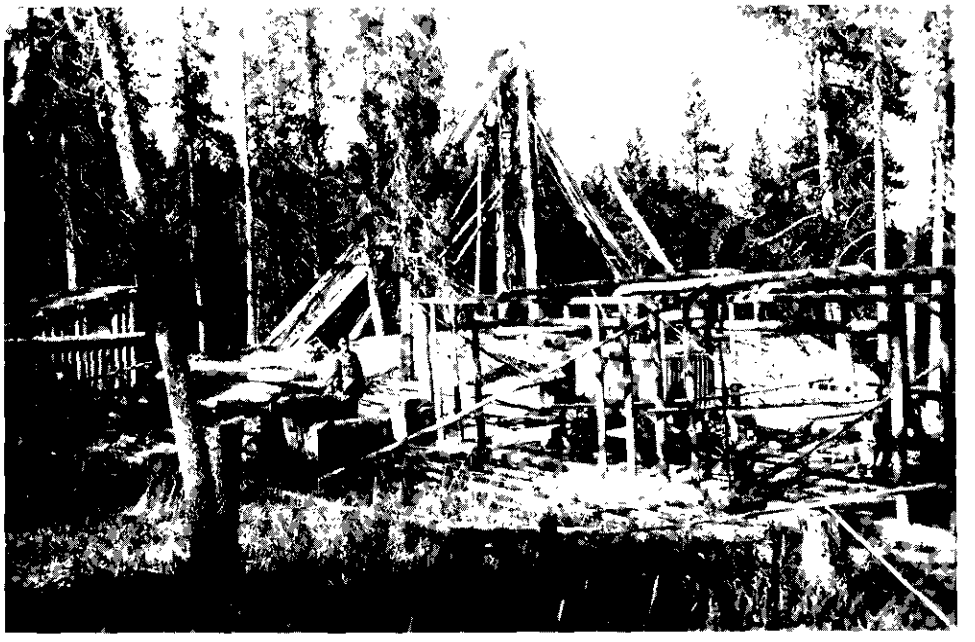
St. Paul. Work was continued on this property on Monashee mountain by the Saint Paul Mines, Limited, with headquarters in New Westminster. Some high-grade silver-lead ore has been obtained from this property, on which the ore occurrence presents some geological problems that have not yet been worked out fully. The mine was visited during the year by C. E. Cairnes, of the Geological Survey of Canada. It appears that the deposit is in the nature of a stockwork, related to a marginal phase of an intrusive rock in which there is a high development of hornblende. At a distance of a few hundred feet from the occurrence of this sulphide ore, from which some fine specimens of jamesonite were obtained, there is a quartz vein carrying considerable pyrite with low gold values in spots. Further development is required on this property.

Coal.

Shorts Creek.—Some preliminary arrangements were made to open up the coal occurrence on this creek near Fintry, on the west side of the Okanagan lake; work, however, was suspended temporarily.

Placer Gold.

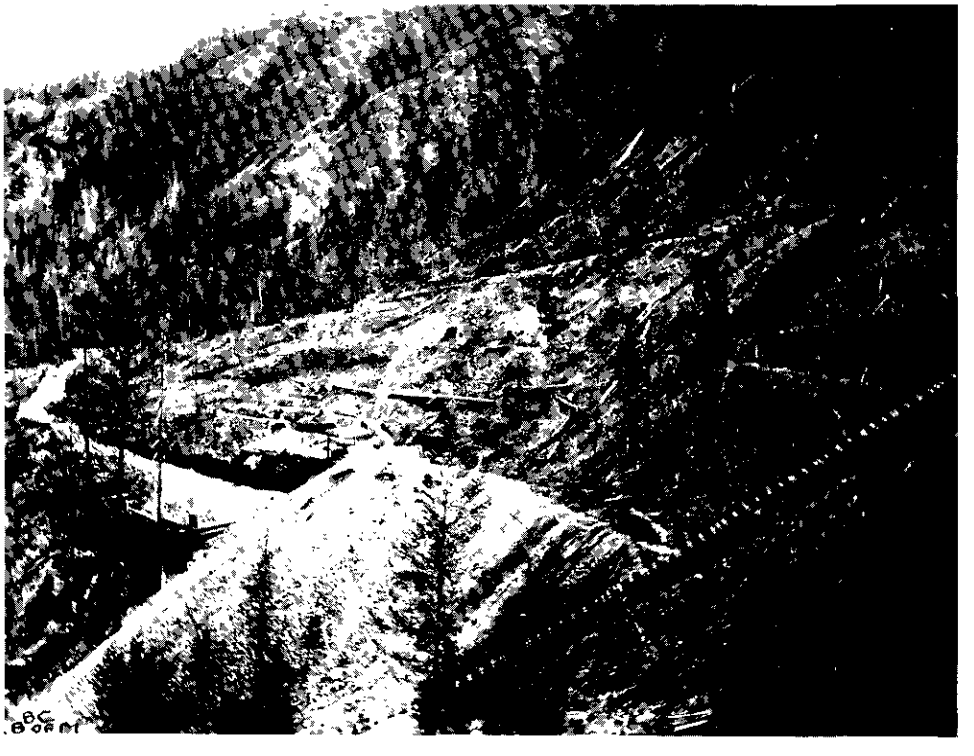
There has been little activity in placer-mining. Some work was done on Siwash and Cherry creeks; G. W. Bilbrough reporting a production of nearly $300 in gold.



Comstock of B.C., Nicola M.D.

Mineral Hill, Stump Lake, Nicola M.D.

Sally Mine, Greenwood.



Highland Lass Mine, Greenwood M.D.

SOUTHERN MINERAL SURVEY DISTRICT (No. 4).

By Philip B. Freeland, Resident Mining Engineer (Headquarters, Grand Forks).

INTRODUCTION.

The Southern Mineral Survey District (No. 4), including 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 of mountains.

The general depression and consequent drop in metal values naturally reacted unfavourably, with the result that production decreased. Copper-output, which was responsible for a large part of the district's tonnage, seriously declined when the Granby Consolidated Mining, Smelting, and Power Company curtailed and finally closed down its operation at Copper mountain on November 15th. This was considered necessary owing to the fact that the ore is low grade in copper, with only a small percentage of gold and silver, and the capacity of the mill approximately 3,000 tons a day. A larger reduction plant and consequently larger tonnage might have offset the low price of metals for a longer period.

Gold production increased due to the operation of the *Union*, in Grand Forks Mining Division, and may be enhanced in the future if some of the preliminary investigations and exploration continue to be satisfactory. The Hedley Gold Mining Company's production of gold has decreased in the past few years, due to lower-grade ore found at depth and increased difficulty in finding ore-bodies sufficiently large to warrant development.

The price of silver, at 28½ cents an ounce at the end of the year, was responsible for the discontinuance of the smaller silver-lead-zinc operations and worked a hardship on the high-grade silver-lead producers, especially at Beaverdell.

The lower price of platinum, at between $35 and $60 an ounce, did not abate the interest taken in certain placer-mining operations on the Tulameen. It is well known that the platinum in this area contains a good percentage of iridium, which has been selling at about $160 to $190 an ounce and which increases the amount of revenue received.

The coal industry at Princeton has been placed on a much sounder basis financially, so that it is in a position to take advantage of any markets that may accrue. The mildness of the 1930 winter curtailed production to some extent, and at Blakeburn the mine disaster had the same effect.

In the non-metallic section of the industry there was a reduction of output. No fluorspar was produced from the *Rock Candy* mine on account of the fact that sufficient tonnage was mined and shipped in 1929 to meet all requirements at the Trail smelter. It is probable, however, that the mine will be opened again in 1931. Several inquiries have been received regarding possible tonnage of chromite, which occurs in association with the serpentine rocks at Cascade and Rock Creek, and also for magnesium sulphate found and mined in 1918 in Spotted lake, near Richter pass, in the Osoyoos Mining Division. Arsenic was produced as a by-product of the *Nickel Plate* gold ore, limestone from the Fife quarries at Christina lake, and brick from the Doukhobor kilns at Grand Forks.

Many thanks are due to all mine operators and prospectors whose claims were visited, for their kindness and hospitality.

Transportation Features.

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 West Kootenay Power and Light Company's line passes through the district from Cascade to Princeton and affords cheap power for mine operation.

The district is well provided with roads and trails. 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 84 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 Skaha 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, 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 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 over Lamont creek. 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.

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.

Important assistance by the Department of Mines was given on the Lightning Peak road, Tulameen–Summit Camp road, and Princeton–Allenby road. The trunk trail commenced in 1929 from Copper mountain to the Ashnola river was continued. Up to the present 23 miles has been built from Copper mountain to Princeton mountain, with a branch 15 miles long connecting it by a bridge across the river with the old Similkameen (Roche) River trail, and a further 3 miles towards the Ashnola river east. Roughly, 5 miles still remain to be built down Lightning creek to join with the old Ashnola trail, as well as cleaning out and reconditioning of the latter for several miles beyond. When this is finished it will be possible to take a pack-horse outfit from Copper mountain to the mouth of the Ashnola river, where it joins the Similkameen river about 8 miles above Keremeos.

The Trans-Provincial road, being constructed from Princeton to Hope, has reached the vicinity of Copper creek. This road will be a great assistance to mine development in that area.

A narrow motor-road has been built from the "Crossing" on the Edgewood–Vernon road up 6 miles towards Lightning peak, and it is possible to drive a car over it. Beyond this point a tractor-road has been constructed and corduroy placed over the swamps.

The Forestry Branch has cut out the old 12-Mile trail leading from the Hope trail and built a new connection with another trail cut down from Covall and Cascade creeks, the latter flowing into Granite creek. The Granite Creek trail and Newton and Badger Creek trails have all been cut out, so that this area is well provided with rough transportation facilities. The bridge across Lawless creek on the road leading to Laws camp has been rebuilt.

Bibliography.

A list of 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, 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.

Prospecting was confined in the eastern part of the district—namely, to the country lying adjacent to transportation—and this action may be thoroughly recommended. The work naturally loses some of the incentive created when prospecting in a new territory; but there is

compensation in the knowledge that low-grade mineral found on or near existing transportation routes may be of commercial value, whereas the same material cannot be considered if found a long distance away. Therefore it seems advisable, especially when metal prices are low, to be sure that no minable ore-bodies have been overlooked in the prospecting scramble of former years.

In this regard the following areas and suggestions may be of use: It has been definitely ascertained that a tremendous amount of copper mineralization was deposited in different locations in the Boundary country. At Phoenix and Deadwood camps several million tons of copper ore were mined. Smaller tonnages were produced from the *B.C.* and *Emma* near Eholt, also from the *Copper Mine* and *Enterprise* in Copper camp and the *Bruce* and *Sappho* near Midway. Other prospects occur interspersed between these locations. The geology of the belt was roughly surveyed by R. W. Brock in 1901, and the map issued is a splendid guide to the general formations of rocks to be found. The serpentines are especially interesting owing to the fact that platinum is often found associated with the copper ores, and chromite as a constituent of the original rock. More than a cursory inspection is required, and possibly a considerable amount of surface-stripping to ascertain strikes or continuance of mineral-zones in favourable locations. These suggestions are made because it is evident that where mines are found there have been mineralizing solutions in circulation, in this case over a very much larger area than that which has been mined, and therefore intensive study is warranted. Replacement of the limestone was the type of ore-deposit generally found and these were often discovered to be buried under more recent lavas.

In the Paulson district there are silver-lead-zinc and copper deposits in limestone to be found in the Burnt basin, also gold-copper in the same formation. Platinum has been discovered associated with pyrite in quartz.

At Cascade chromite-deposits occur in the serpentine-belt close to electric power and railway transportation.

Besides the *Rock Candy* fluorspar-mine, there are other lower-grade deposits of this mineral farther north on the Granby river. Along the edge of the valley of the Granby river numerous limestone-beds contain copper and gold-bearing pyrrhotite and pyrite.

The belt of schistose rocks occurring at Camp McKinney and from Osoyoos lake north, including Fairview, contains many gold-bearing quartz veins which are attractive.

The arsenopyrite ores of the Hedley region occurring in the contact of the limestone, gabbro, and diorite are widespread and have not been prospected at any great depth except in the *Nickel Plate*. In the Apex basin the limestone and brecciated volcanics contain arsenopyrite, pyrite, chalcopyrite, and gold.

New developments at Lightning peak on the quartz veins have been encouraging, inasmuch that the gold values, which were small on the surface, have shown a decided increase in depth, especially on the *A.U.* claim. There is a large area in this vicinity of granite and schistose rocks containing quartz veins which have not been developed beyond 30 feet in depth. More work is justified.

The headwaters of the Kettle river and streams flowing into the river for about 15 miles south produced some placer gold in the early days of mining in the country. Many quartz veins which are gold-bearing, generally in small quantities, are formed adjacent to these streams and comparatively little development-work has been done upon them. The topography of the streams is worth studying with the idea of ascertaining any divergence of the present waters due to glacial or other obstruction and panning possible old channels.

The Tulameen placers have been discussed in former Annual Reports and have received a good deal of publicity owing to numerous failures. The river-gravels contain gold and platinum, but whether mining can be made to pay is a matter still to be proven or disproven. The failures have been due to lack of information regarding the course of the old channels and the installation of plants before thorough prospecting. When this is realized some advance may be made toward obtaining possible monetary returns for capital expended. In the meantime the river-gravels still remain favourable prospecting-ground.

The following return for gold and platinum recovered from a lease on the Tualmeen river below Coalmont may be of interest:—

Johnson, Matthey & Co., Ltd., 73–82 Hatton Garden, London, E.C. 1, July 30th, 1930.

Particulars of Assay of Platinum Mineral: 13.43 oz.

Percentage of Contents—	Per Cent.
Gold	0.58
Palladium	0.31
Platinum	68.74
Iridium	2.22
Rhodium	0.48
Insoluble platinum metals (osmiridium, etc.)	8.1
	Value.
0.078 oz. gold at $19.40	$1.51
0.041 oz. palladium at $16.97	.68
9.231 oz. platinum at $35.16	324.58
0.298 oz. iridium at $194	57.81
0.064 oz. rhodium at $43.65	2.79
1.088 oz. insoluble platinum metals at $97	105.53
	$492.90

The presence of iridium in the platinum group is one of the satisfactory features of placer-mining and makes up to a great extent for the lower price of platinum.

Owing to the fact that placer gold and platinum is traded at local stores for supplies and sent away through private sources, some difficulty is experienced in obtaining correct production. The local banks report receipts of about 32 oz. of gold and 3 oz. and 13 dwt. of platinum. John Guest shipped 13.43 oz. of platinum minerals to London. Other small shipments are known to have been made, but figures are not forthcoming.

The value of brick sold by the Doukhobor Community at Grand Forks was $16,862.

PRODUCTION.

The following table shows the mineral production of District No. 4 for 1930:—

Division.	Ore.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.
Grand Forks	36,916	9,488	356,291	.....	42,701	.....
Greenwood	3,338	79	650,261	.....	276,193	.....
Osoyoos	39,714	11,136	203	3,773	664	.....
Similkameen	703,652	4,276	115,941	15,489,798	79,400	.....
Totals, 1930	783,620	24,979	1,122,696	15,493,571	398,958	.....
Totals, 1929	1,002,051	20,282	611,695	22,539,798	240,130	128,910

Division.	Arsenic.	Coal.	Limestone.	Brick.	Fluorspar.	Platinum.
	Tons.	Tons.	Tons.	$	Tons.	$
Grand Forks	.....	.....	20,064	16,862	.....	.....
Greenwood	.....	.....	.....	.....	.....	.....
Osoyoos	887	.....	571	.....	.....	.....
Similkameen	.....	171,738	.....	.....	.....	771
Totals, 1930	887	171,738	20,635	16,862	.....	771
Totals, 1929	743	198,478	22,097	15,000	17,800	1,699

SIMILKAMEEN MINING DIVISION.

Granby Consolidated Co.

The operation of the Granby Consolidated Mining, Smelting, and Power Company's mine on Copper mountain, near Princeton, was seriously handicapped by the falling price of copper. In February curtailment of output commenced and was continued generally until the mine closed down on November 15th. On this account the tonnage milled fell short of the 1929 total by about 200,000 tons. After closing the mine and mill the majority of the staff were employed at the company's mine at Anyox. No work has been done since November 15th at Copper mountain or Allenby.

At the Mine.—A new central steam-heating plant consisting of three slack-coal-burning boilers, one of which is used as a stand-by, was completed. This plant supplies heat to all office and machinery buildings, bunk-houses, and some of the dwelling-houses. Six new staff-houses were finished and all company buildings painted. New quarters for waitresses were built, consisting of six bedrooms, sitting-room, and two baths. Recreation-grounds were improved and six curling-rinks built. The company collaborated with the West Kootenay Power Company in building a new sub-station to house a new 2,000-kw. condenser for voltage regulation. Complete new switching equipment, protection devices, and meters on various circuits were installed, making eight metered circuits instead of three. On the Similkameen river, below the mine, a new stand-by 100-gallons-a-minute motor-driven high-pressure pump was installed for water-supply and fire-protection. A new double-drum hoist with two 4-ton skips attached was installed on the fifth level. New 8-foot bicycle-type sheaf-wheels and Lilly safety-control devices were added to the surface and No. 5 level hoists. The 3-compartment, two 6- by 6-foot and one 3½-foot manway shaft was completed between No. 5 and No. 8 level and continued for 200 feet below No. 8, making 750 feet of shaft below No. 5 level and 325 feet below the level of the Similkameen river. Nearly 800 feet of crosscutting and drifting was done on No. 8 and development commenced on No. 7 level, 175 feet above No. 8. Two 1,000-ton loading-pockets below No. 8 and between No. 5 and No. 6 levels were completed. The management hopes, by installing larger skips which will handle larger pieces of rock, that a considerable amount of bulldozing will be eliminated in certain areas. In parts of the mine, chiefly in the glory-holes, the porphyry dykes are being mined before the ore. With the elimination of a large part of the porphyry when mining, and further sorting on a belt, 100 per cent. rejection of waste rock is hoped for. Hitherto the dyke apophyses, intruded into the ore, especially in the glory-holes, where they are disintegrated to a large extent, were responsible for a considerable dilution of values. The overburden around the surface ore-bodies has been removed to a great extent by a road-ripper and two 7-foot automatic dumping rotary scrapers attached to tractors.

The 7-foot Symons crusher at the mine plant continued to give some trouble, due to the fact that the ore often breaks into flat slabs, which slip through the opening before being crushed. To offset this, new elongated parts have been attached, so that more blows a minute are struck. This has not entirely eliminated the trouble, so that some coarse grinding has still to be done in the mill. The average number of men employed at the mine was 425.

At the Mill.—Two new ball-mills and two classifiers (Dorr) were added to the mill. Several thousand feet of new water-line piping was installed to replace the old wooden-pipe system, with the addition of 700 feet of 8-inch steel pipe. A complete dry-valve air-pressure type sprinkler system for fire-protection was also constructed. In the old tailings-pond below the mill three classifiers were used to build dams from the heavier sands which were diverted for the purpose from the main flume. A large area for future tailings-disposal has been constructed in this way. A 500-gallon centrifugal pump has been added to the pumping plant on the Similkameen river below the mill. All concentrates were shipped to the Tacoma smelter. An average number of 125 men was employed at the mill.

Copper Reef. This group of Crown-granted claims, adjoining to the north and west the Granby Company's holdings on Copper mountain, has been developed by the Consolidated Mining and Smelting Company during the year. Numerous open-cuts, tunnels, and trenches along the contact of the gabbro stock uncovered several well-mineralized zones containing pyrite, chalcopyrite, and bornite in a feldspathic gangue. Diamond-drilling was done towards the end of the year and, it is understood, further mineralization discovered. Owing to a heavy mantle of gravel on the lower part of the claims near the Similkameen river, prospecting is difficult.

Voights Camp.

No work was done on the groups of claims, originally owned by Emil Voight, in this camp.

Olympic. This claim, Lot 3262, situated near Voights camp and Crown-granted in the name of J. Wright and L. G. Barron in 1912, has not been worked for many years. Stripping, open-cuts, and a shaft probably 40 feet deep have been excavated over an area 200 feet long and 25 feet wide. On the dump near the shaft and open-cut about 30 tons of ore containing magnetite, pyrite, chalcopyrite, and azurite has been piled. A grab sample of this ore assayed a trace in gold and silver and 0.40 per cent. copper. Owing

to the caved condition of the open-cuts and shaft it was impossible to examine the workings below the surface. The ore appeared to be typical of that found in Voights camp.

WHIPSAW CREEK SECTION.

S. & M. and Marion. These claims, situated about 13 miles up Whipsaw creek from the 9-Mile bridge, had the assessment-work done upon them by Sam Spencer, of Princeton, the owner. Further galena and sphalerite mineralization was discovered, but insufficient work done to prove the existence of commercial ore-bodies.

Copper Basin Mines. Under the management of P. H. Fraser, of Vancouver, development-work was done on a group of claims adjoining the *S. & M.*, chiefly near Whipsaw creek, where several narrow veins containing pyrite, galena, and sphalerite had been uncovered. Owing to heavy overburden and displacement due to faulting some difficulty was experienced in following the vein system. The country-rocks and the mineralization generally are similar to those found on the *S. & M.* group; i.e., highly altered schistose and sedimentary rocks cut by narrow quartz veins of pyrite, galena, and sphalerite; the latter predominating. A narrow road follows the Hope trail to the property.

SUMMIT CAMP, TULAMEEN.

Silver King Mining Co. This company's holdings on Treasure mountain were operated under special agreement by Wm. B. Dornberg and associates, of Vancouver. A small mill was built, consisting of one 10-inch jaw-crusher, two sets of rolls, 12 by 30 and 14 by 30 inches, jigs, and two Wilfley tables. A 50-horse-power Fairbanks-Morse oil-engine operates the plant. Water is supplied by gravity through a flume from Amberty creek.

Shipments of concentrates to the Trail smelter, according to the management, are as follows:—

No. 1. Dry tons, 25.7; silver, 78.4 oz. to the ton, and 46.9 per cent. lead.

No. 2. Dry tons, 25.7; silver, 104 oz. to the ton, and 58.8 per cent. lead.

No. 3. Dry tons, 27.9; silver, 96.2 oz. to the ton, and 55.8 per cent. lead.

The zinc contents in the concentrates averaged about 5 per cent. Another 10 tons are at Tulameen Station awaiting shipment.

The pilot plant was built with the idea of eliminating the zinc contents in the ore and was successful to a large extent. Adjustments and additions will probably be necessary from time to time. The galena carries most of the silver in the form of argentite. The ore is conveyed from the mine to the bunkers at the mill by buckets attached to a 1½-inch cable which is operated by an air-driven hoist installed at the mine.

Practically all the ore mined was stoped from above No. 2 level, both from the east and west side of the main crosscut. The ore on the east side did not materialize to any great extent until an upraise was driven about 15 feet and two veins of galena were discovered varying from 4 to 18 inches in width. On the west side the stopes have been extended on the vein wherever a sufficiently high percentage of galena was found. The veins are not persistent in width, but vary from 1 to 18 inches and average between 6 and 8 inches. The percentage of galena also varies considerably and the high-grade mine ore will often completely change to sphalerite within a few feet vertically or horizontally. This condition necessitated very careful mining and holes were drilled to a 3-foot depth limit and shot with a minimum charge of dynamite. A good deal of waste rock was transported with the ore to the mill, and to eliminate this the management hopes to install a picking-belt at the mine, where the larger pieces of waste will be discarded. Open-cuts below the No. 1 tunnel have uncovered the continuance of the vein for 125 feet in a south-westerly direction. A large percentage of this ore is galena.

Owing to financial trouble the operation closed down late in the autumn, but the management hopes to acquire more capital in order to resume work in the spring. If the prices of metals improve, the success of this operation will mean much to Summit camp, where there are several attractive small veins containing silver, lead, and zinc which could be concentrated at some profit to the miner.

Sunbeam. This claim, situated near the headwaters of the South branch of Sutter creek, is owned by John Thynne and associates, of Tulameen. Development consisting of stripping and open-cuts for several hundred feet, chiefly along the creek-bottom, has uncovered a quartz vein containing galena, pyrite, and sphalerite, striking north and

south (mag.) and varying in width from 2 to 14 inches. This is a similar type of vein to those found elsewhere in the neighbourhood, but it has a different strike where discovered, which is due possibly to displacement caused by the invasion of igneous rocks a short distance to the west of the showing. A sample taken across 8 inches of the vein assayed: Gold, 0.08 oz. to the ton; silver, 38 oz. to the ton; lead, 27 per cent.; zinc, 14.8 per cent. A sample of dark-grey mineral taken from an open-cut higher up the hill and farther south was found to be stibnite containing neither gold nor silver. By diverting the water in the creek this vein can be easily developed by drifting.

Other Claims.

The *Eureka* group, owned by Andy Jensen, of Tulameen, and associates; the Summit Camp Mines, Limited, including the *Queen Bess* claim and several others, have been mentioned in former Annual Reports and may be classed as having the same type of ore as the *Silver King* and the *Sunbeam*.

Lucky Todd-Crown, etc.

The owner, Dan Vuich, of Tulameen, has done a considerable amount of development-work on these claims, situated on Railroad creek, a tributary of the Tulameen river. Recent developments comprise 160 feet of tunnel driven on the contact of the schists and granite on the north side of the creek at an elevation of about 800 feet above the motor-road. In the tunnel occasional lenses of ore were found containing pyrite, bornite, chalcopyrite, azurite, malachite, and tetrahedrite. Ore also occurred in the fracture-zones, caused by faulting. Open-cuts for several hundred feet along the strike of the contact uncovered oxidized iron and copper carbonates in the fracture-zones. A general sample of the dump assayed: Gold, 0.02 oz. to the ton; silver, 3.6 oz. to the ton; copper, 1.8 per cent. Further development has been commenced at a lower elevation and possibly more ore may be found in place. The schistose rocks are similar to those found farther north-east and have been described by Camsell under the Tulameen series. Deposits of copper in these rocks are worth prospecting.

LAWLESS CREEK-OTTER LAKE SECTION.

In former Annual Reports attention has been drawn to the stretch of country, roughly 10 miles long and from 5 to 7 miles wide, stretching between the Tulameen river and Thynne creek and Otter valley and Lawless creek respectively. The Tulameen series, comprised of greenstones, limestone, and schists, forms the main central mass of rocks. On the east and west flank and also in small central areas two invasions of granite, granodiorite, and granite porphyry have taken place. In certain areas, for several miles along this contact and also where the smaller central invasions occur, oxidized pyrite, malachite, and chalcopyrite have been found. The most important mineralization has been uncovered on the Hope Range Copper Company's ground near Lawless (Bear) creek, the *Spokane-Motherlode* group, and the Federation Copper Mines property on Rabbitt mountain. Owing to the flat dip of the veins into the mountain and consequent necessity of sinking on the ore, no deep development has been done at present, so that very little is known regarding the size of the bodies. If sufficient capital could be accumulated for diamond-drilling the commercial value of the area could be demonstrated in a comparatively short time.

Coalmont Gold Mines.—This company's development with holdings on Arrastre creek, a tributary of Granite creek, was reported upon in the Annual Report for 1929. The claims were not examined in 1930, but, according to the management, work was continued in a small way on the *Dora*.

PLACERS.

Slate Creek Consolidated Placers.—This company, under the management of Norman McCormick, of Tulameen, continued driving the tunnel, commenced in 1925, under the bed of Slate creek, a tributary of the Tulameen river. The total distance driven up to December 30th, exclusive of offsets and a short distance formerly driven by Laws, was 2,200 feet. This development was not carried on continuously during that time. According to recent advice from the management, the old creek-bed gravels have been encountered mixed with local slide-rock. Colours of gold, platinum, and palladium have been panned from this material. The exact depth to bed-rock has not been ascertained. A considerable amount of work has yet to be done in the

rock near the mouth of the tunnel before installing permanent sluice-boxes and undercurrent. One shift is being worked.

John Guest Leases.—Numerous leases were held by John Guest, with headquarters at the Prudential Trust Company, Vancouver, including areas between Slate creek and Tulameen village, on the Tulameen river; between Coalmont and Princeton on the same river and below Princeton on the Similkameen river. No work was done on any of these leases, except below Slate creek, where a substantial log bridge was built across the Tulameen river, scaffolding to carry grizzly and sluice-boxes, and excavations for machinery necessary to operate a plant. Money promised by French capitalists was not forthcoming, so that no further work was done. The manager, John F. Guest, hopes to interest others, and install a drag-line scraper, pumps, and all necessary plant. The benches covered by these leases are likely ground for finding platinum and gold, but the area must be drilled if satisfactory results are to be obtained.

Granite Creek Mining and Development Co.—This company operated its steam-driven shovel, constructed on a barge, for a short time during the year on their leases at Granite creek. No particulars regarding the amount of gold and platinum recovered are at hand.

Coal.

The development of the coal-mines at Princeton has proceeded satisfactorily. The Pleasant Valley Mining Company, Tulameen Coal Mines, Limited, and the Blue Flame Coal Company have all operated during the year. A large percentage of the output is shipped to Vancouver for consumption.

OSOYOOS MINING DIVISION.

Hedley Gold Mining Co.

This company operated its mine and mill at Hedley from April to November, inclusive, and produced about 39,670 tons of arsenical gold ore. Most of the ore was mined from the deeper levels and the remainder from some of the old stopes close to the surface. The diamond-drilling campaign was continued and some minable, though small, bodies of ore discovered. A geological survey report upon the mine by H. S. Bostock, of the Geological Survey of Canada, appears in the Summary Report, 1929, Part A. This report is one of many others made in recent years with the idea that further minable ore-bodies might be found. Up to the present this has proven abortive and it seems probable that, unless something unforeseen occurs, the operation will not be able to continue much longer.

Golden Zone.

This group, consisting of four Crown-granted claims—the *Silver Bell, Golden Zone, B.C.*, and *Irish Boy*—and situated about 8½ miles north of Hedley, has been bonded by a syndicate of local men under the management of S. M. Nechiefman, of Hedley. The claims were located in 1900 on the headwaters of Hedley creek at an elevation of 6,000 feet (barometric). Two roads lead to the property—one, now in disuse, from Hedley, and the other a branch from near the summit of the *Nickel Plate*–Penticton road, 6 miles in length, which is rough but passable.

* Camsell describes the geology in part as follows:—

"The oldest rocks are of sedimentary origin and are probably of Carboniferous age, similar to the Hedley sediments. No fossils, however, have been found in them. They consist of limestones, quartzites, and tuffs, all of which have been considerably metamorphosed by later igneous intrusions. They dip at an angle of 30° to the south-west. These contain interbedded sheets of diorite and some gabbro, showing a strong similarity to the rocks of the Hedley district.

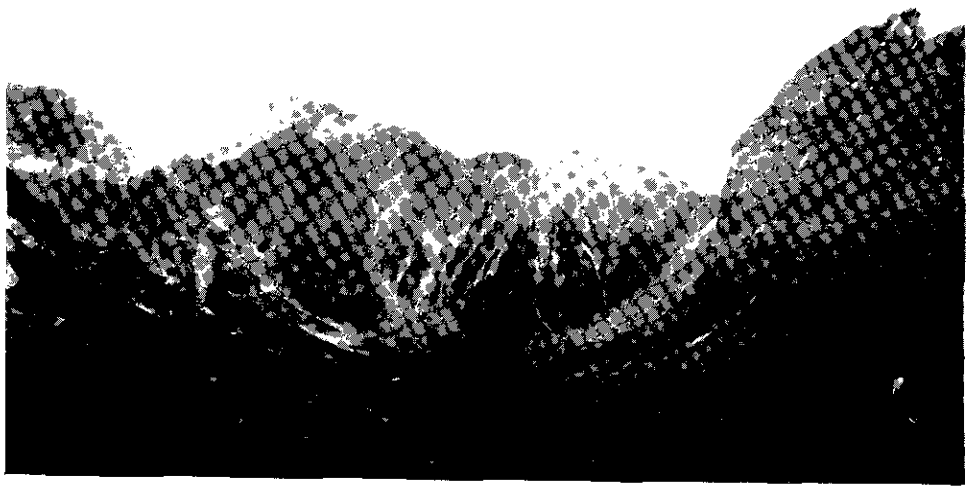
"Intrusive into these sedimentary rocks, and found only on the two western claims, is a body of fine-grained micaceous granite. This weathers very readily, so that a fresh sample is difficult to obtain. It consists of feldspar, quartz, and hornblende, and much biotite. It has undergone some metamorphism, probably from organic disturbances, so that a gneissic structure is frequently developed in it. On its contact with the sediments it becomes finer in grain and more acid in composition.

"*Character of the Deposit.*—The claims have been staked on a well-defined and persistent quartz vein, which can be traced in an east-and-west direction for over 1,200 feet. This vein

* Memoir No. 2, 1910, Hedley Mining District, B.C.

Hedley Gold Mining Co. Mine Camp, Similkameen M.D.

Waterloo Gold Mines, Ltd., Greenwood M.D.



Moose Creek, Golden M.D.

Ruth-Vermont Mine, Golden M.D.

cuts both the fine-grained granite and the sediments. In the former it occupies a strong fissure, varying in width from 2 to 4 feet, but on passing into the sediments it appears to split up into four or five smaller veins.

"The lead is a true fissure and frequently shows a well-marked ribbon-structure, due probably to the filling of an open space. The walls are clean and smooth and often show slickensiding. The dip of the vein is about 90°.

"The gangue is a hard white quartz and the ore-minerals occurring in this are pyrite, arsenopyrite, blende, and chalcopyrite. On the surface the quartz is generally honeycombed on account of the weathering-out of the sulphides. Below the zone of oxidation it is seen that the sulphides appear in well-crystallized individuals in the gangue, as well as filling minute fractures of a later date than the crystallized individuals. The sulphides filling the fracture-planes are, as a rule, arsenopyrite and pyrite.

"The age of the quartz veins is rather problematical, but they are probably later than the intrusion of the quartz porphyry, and may be genetically connected with it as an after-effect. Undoubtedly orogenic movements have taken place both before and after the formation of the quartz vein, for the vein is slightly displaced by a fracture to the west, so recent that it still preserves its topographic expression.

"The values are in gold as well as some silver, and are said to be higher in the sedimentary rocks than in the granite. On panning some of the decomposed ore on the surface, a number of very fine colours of gold are obtained among the arsenopyrite concentrates in the bottom of the pan. No samples were taken for assay, though the results obtained by the owners and others are said to be very satisfactory indeed."

Work done in the past consisted of a shaft sunk 115 feet deep, a second shaft 250 feet to the west and 47 feet deep, and numerous shallow pits and open-cuts for several hundred feet along the vein. A 5-stamp mill hauled in by sleighs was installed in 1908, but no serious attempt was made at milling owing to water-shortage.

The present operators reconditioned the old *Nickel Plate* road, are cleaning out the main shaft, have reconstructed the camp, and are at present driving a tunnel about 100 feet in elevation below the collar and 600 feet distant from the main shaft. This tunnel will probably intersect the main quartz vein within a distance of 100 feet, when the lead will be followed on the strike towards the shaft. A sample from the vein 4 feet wide near the present tunnel assayed: Gold, 0.02 oz. to the ton; silver, 10.8 oz. to the ton; zinc, 3.9 per cent. A sample of dump ore taken from the 47-foot shaft assayed: Gold, 0.12 oz. to the ton; silver, 0.80 oz. to the ton. An ore-dump sample from the main shaft assayed: Gold, 0.76 oz. to the ton; silver, 4.30 oz. to the ton. The last two samples carried pyrite, arsenopyrite, and sphalerite, but were not assayed for the last-named mineral. Judging by reports of ore developed, the mill was prematurely built. Water was very scarce in the neighbourhood at the time of examination (September 16th), but sufficient for a small operation might be impounded in some of the meadows adjacent to the property. At the elevation of about 6,000 feet there is a heavy snowfall in that locality, which will assist in the preservation of moisture. A hoist, boiler, and Cameron pump were left on the property. Six men are employed at the present time.

Nelson.—This group, situated in the Apex basin and owned by James McNulty, now deceased, of Hedley, was not developed this year.

Whirlwind-Cyclone. This group, owned by Dan McKinnon, Ed. Baxter, *et al.*, of Hedley, and mentioned in former Annual Reports, is situated on Hedley creek, close to the town of Hedley. Most of the year's work was done near the *Whirlwind* "red tunnel" on the extension of the oxidized ore. A tunnel 50 feet long with a 12-foot offset was driven a short distance below and to the west of the main tunnel. About 3 feet of oxidized matter was struck near the mouth of this tunnel. Two open-cuts, 25 and 50 feet respectively to the west of the main tunnel, exposed 3½ and 2 feet of the same material. A sample from the cut farthest west assayed: Gold, 0.07 oz. to the ton; silver, 0.60 oz. to the ton. A sample from the next cut assayed: Gold, 0.06 oz. to the ton; silver, 0.40 oz. to the ton. A general sample, taken from the main "red tunnel" over an oxidized vein varying from 3 to 6 feet in width, assayed: Gold, 0.43 oz. to the ton; silver, 1.3 oz. to the ton. The main tunnel has been driven 68 feet on the vein, with a branch tunnel on the vein 20 feet long commencing 18 feet from the face. About 50 feet of this tunnel has been driven in oxidized

pyrite and arsenopyrite. The remainder is mostly sulphides. A 100-lb. sample taken by the owners from various parts of the vein was leached with cyanide without grinding, and the recovery was 0.42 oz. in gold and the tailings 0.21 oz. in gold.

It is the intention of the owners, providing a small amount of capital can be secured, to pipe water from a spring 6,000 feet distant to the mine, where a set of wood or small metal tanks can be erected and the oxidized ore leached by cyanide without grinding. The money derived from the operation will, it is hoped, provide sufficient funds to continue development. Insufficient work has been done to prove the full extent of this oxidized zone, but a rough calculation, including the dumps, gives about 2,000 tons.

Golconda. This claim, owned by Dan McEachern, of Keremeos, and situated near Olalla, has been mentioned in former Annual Reports. Development this year comprised extending the lower tunnel 50 feet in ore and putting in three upraises, 12, 25, and 30 feet in height respectively and 60 and 75 feet apart. The shear-zones vary from 1 to 6 feet in width and contain pyrite, chalcopyrite, and molybdenite. Sorted ore assayed from 7 to 18 per cent. copper and sorted molybdenite ore assayed 17 per cent. MoS_2. About 1 mile of narrow road leads to the property from Olalla, where the main Penticton–Keremeos road passes. The Great Northern Railway at Keremeos is 4 miles distant.

Oro Fino-Independence. These Crown-granted claims, situated about 4 miles east of Olalla, were bonded by E. A. Somerville, of Vancouver. Many years ago several shafts, tunnels, and open-cuts were excavated on these claims and a 2-stamp mill erected on Oro Fino creek, which flows into Meyers flats. Particulars of this operation are not forthcoming, but it is understood that a very small amount of ore was milled. Development done exposed a quartz vein from 1 to 6 feet wide containing pyrite, most of which was oxidized. Spectacular pockets and stringers containing free gold were found, which apparently were not persistent enough to be commercial. This year a new tunnel was commenced below a series of open-cuts on the *Independence* and driven about 40 feet on the vein. A very spectacular vein from 1 to 2 inches wide was struck near the tunnel-mouth, containing free gold in the quartz. At the time of examination, October 25th, the face of the tunnel was mostly barren quartz without any trace of gold. Later, according to the owner, more free gold was struck. About 20 tons of quartz was piled outside the tunnel. A grab sample of this ore assayed: Gold, 0.88 oz. to the ton; silver, 0.50 oz. to the ton. The veins are persistent in the schist and further development is warranted in hopes of finding an average grade of tonnage that can be milled. The claims can be reached by following an old road up from Meyers flats or by a branch from the White Lake–Keremeos road, which follows the creek up to Noad's ranch; thence by trail about 1¼ miles. Water is scarce, but there is plenty of timber.

B. & E. Mining Co. This company, with headquarters at Leavenworth, Wash., operated a group of claims adjoining the *Oro Fino* group for a short period during the early part of the year. Developments in the shaft tunnel proved unsatisfactory and owing to lack of capital to continue exploration the mine closed down. The veins and values are similar to those found on the *Oro Fino*, and some very high-grade gold ore has been found on the property.

B. & E. Mining Co., near Oliver.—(*a.*) Sample across 14-inch quartz at bottom of shaft on the level of tunnel-back: Au, 0.02 oz.; Ag, 1.6 oz. (*b.*) Grab sample in open-cut 100 feet west of shaft assayed: Au, 0.02 oz.; Ag, 1.3 oz. (*c.*) Grab sample of mill-feed from ore-bins: Au, 1.96 oz.; Ag, 0.5 oz.; Cu, trace. (*d.*) Sample of mill concentrates, produced about 200 lb. from 5 tons of mill-feed: Au, 17.26 oz.; Ag, 6.1 oz.; Cu, 0.11 per cent. (*e.*) Sample of mill tailings from dump: Au, 0.36 oz.; Ag, 1.4 oz.; Cu, trace.

Lakeview-Dividend-Gipsy Fraction. This group of old Crown-granted claims, situated near the International boundary at Osoyoos lake and reported on in 1927, was leased for seven years from the Dividend-Lakeview Consolidated Mining Company by W. B. Reilly, Chas. Antonson, and Dave Lonie, of Oroville, Wash. An old 10-stamp mill was dismantled at Fairview, hauled down to the mine, and five of the ten stamps erected below the dump of the main tunnel on the *Dividend*. The old compressor was reconditioned and the remainder of the plant overhauled preparatory to operation. It was the intention of the lessees to crush and amalgamate part of the old dump, in which a good deal of discarded quartz, containing copper and gold, was in evidence. The latest report is that two car-loads of ore have been shipped to the Tacoma smelter.

Tiger Gold Syndicate.

This group of claims, situated a few miles north of the *Horn Silver* group, near Similkameen Station on the Great Northern Railway, was not visited this year. According to reports, developments were carried on by a small crew of men under the management of A. T. Miller. The property was reported upon in the Annual Reports for 1927 and 1928.

No work was done on the *Horn Silver* group this year.

Morning Star-Silver Crown-Black Diamond.

These claims, owned by Steve Mangott and Dan McEachern, of Oliver and Keremeos, and situated in the Fairview camp, were the cause of much interest to examining engineers, owing to the fact that a series of strong gold-bearing quartz veins traceable for several thousand feet have been exposed in different locations along the strike. This is an old camp that has produced some very spectacular gold ore near the surface. Deeper shaft developments down to 300 feet have proven the vein system to be continuous, but the grade of ore to be lower. The lower elevations have not been examined owing to water and caved conditions, but reliable authority states that in some instances the values across 8 feet assay from $6 to $10 a ton in gold and silver. On the *Morning Star* two parallel vein systems 200 feet apart have been uncovered for several hundred feet and developed by a shaft of unknown depth, two shallow shafts about 20 feet deep, and numerous open-cuts. On the west vein an open-cut 80 feet long and 12 feet deep produced, according to reliable reports, spectacular values in gold. This ore was crushed and amalgamated in a small stamp-mill below the property. Rough general sampling across widths varying from 15 inches to 5 feet assayed from 0.08 oz. in gold and 1.28 oz. in silver to the ton to 0.70 oz. in gold and 4.48 oz. in silver to the ton. An average of these samples is: Gold, 0.31 oz. to the ton; silver, 2.78 oz. to the ton.

GREENWOOD MINING DIVISION.

Wallace Mountain.

Bell Mine, Ltd., and Highland Lass.

The *Bell* mine, which has been operated steadily since 1916 under varied ownership, including Duncan McIntosh, Oliver, Crane, and latterly Henry Lee, changed hands early in the year, and the McIntosh-Lee interest was purchased under agreement by Staples and associates, of Vancouver and Creston. The latter, having obtained a bond on the *Highland Lass* claim, adjoining the *Bell* on the north, combined the two properties under one management. The ore mined from the two properties is kept and shipped separately owing to the fact that there are different owners, and this policy will be continued until the purchases are completed.

The shear-zones being mined on the *Highland Lass* are probably the top of the *Bell* zone extension and a good deal of trouble has been experienced in mining this ore, due to the fact that large blocks of the overlying Wallace rocks have been absorbed by the quartz diorite. The shear-zones in the Wallace either disappear or feather out and become too low grade to mine and ship directly. At the present time a winze is being sunk along the ore to prospect its value at depth. Should this prove attractive, the lower level will probably be driven ahead under the present workings and the ore mined from there. Three men have been working continuously and the ore shipped to the Trail smelter.

On the *Bell*, ore is still being mined at different elevations in the south-east corner of the claim. There appears to be very little change in the percentage of silver found in the shear-zones, and due chiefly to the ability of Henry Lee, who acts as consulting engineer from time to time, no trouble has been experienced in following the much-faulted ore-bodies. About 1,865 tons of silver-lead ore was shipped during the year, which creates a record for this mine.

Sally Mines, Ltd.

This group was operated throughout the year by a small crew of men under the superintendence of J. Hanna and several car-loads of silver-lead ore shipped.

The continuance of the shear-zone being mined in the *Wellington* was found on the *Sally* by crosscutting south-east from an old tunnel close to the boundary of the claims. The grade of the ore where struck was not high enough to permit shipping, but drifting commenced with the hope of finding a higher silver content. Should this ore prove profitable, it is probable that mining will be done through No. 2 tunnel on the *Wellington* ground.

Wellington Syndicate, Ltd.

The *Wellington* mine was operated until July 31st and again from September 23rd to the end of the year with a small crew of men. The lowest tunnel was driven ahead and the lower section of the ore discovered. Most of the work done since September was in the form of development and getting the mine ready so that it may respond more quickly to any advance made in the price of silver. To finance the development a few car-loads of ore were shipped to Trail. At the present time the mine has more ore blocked out than at any time during the life of the operation. In some of the recent shipments more gold has been found.

A minor amount of work was done on the *Revenge*, *Bounty*, *Tiger*, *Duncan*, and *Nepanee*. No work was done on the property of the Beaver Silver Mines, Limited.

Carmi-Cranberry Ridge Section.

Butcher Boy.

This mine, situated within a mile south-west of Carmi and owned by P. B. S. Stanhope and R. Kerr *et al.*, of Midway, was partly developed many years ago by a shaft about 80 feet deep, short drifts from the shaft, and numerous open-cuts on the strike of the vein. This year J. Carlson and associates, of Carmi, leased the property from the owners, cleaned out and deepened the shaft, installed a hoist, and commenced drifting on the 80-foot level on the vein in an easterly direction and towards the *Carmi* mine. The old drift, 12 feet long on the 40-foot level, uncovered a quartz vein 8 inches wide containing pyrite and galena. On the 80-foot level a similar character of ore was found in two veins 6 and 8 inches wide respectively. Judging by the highly metamorphosed and disturbed condition between the foot and hanging wall, it seems probable that the vein has split and that farther ahead it will unite again. A general sample of unsorted ore on the dump assayed: Gold, 0.34 oz. to the ton; silver, 2.50 oz. to the ton; lead, 1.6 per cent. Assays of $80 to the ton in gold are reported to have been taken from this property.

The ore occurs in shear-zones in a fine-grained quartz diorite. Reinecke considers that the ore occurrence near Carmi is similar to that found on Wallace mountain, only at a lower elevation. Lower silver values suggest a closer proximity to the monzonite batholith. The shear-zones have been traced with minor faulting for 1,500 feet. Further development appears to be warranted. The Canadian Pacific Railway runs within half a mile of the property and a motor-road leads to the mine.

Inyo-Ackworth.

(Braemar Mining Company, 305 Dominion Building, Vancouver.) These claims, situated on Cranberry ridge and owned by H. Fry, 411 Pender Street West, Vancouver, have been mentioned in the 1925 and 1928 Annual Reports. This year two or three men were employed driving the lower tunnel ahead and putting in an upraise about 150 feet from the mouth. The objective of the lower tunnel is the ore-zone developed in the upper tunnel and open-cut which lies approximately 200 feet ahead. Patches of low-grade ore have been found from time to time in the lower tunnel containing pyrite, sphalerite, and galena. The difference in elevation between the two tunnels is 130 feet.

Main Kettle River Section.

Colonel.

This group, consisting of the *Colonel*, *View*, *Eselmont*, *Lookout*, *Export*, *One Professor*, *Golden*, and *Leaf* claims, and situated on the headwaters of the Kettle river near Keefer lake, about 12 miles north of the Edgewood–Vernon Road crossing, is owned by Colonel Victor Harington, Robt. Fullmore, and associates, of Edgewood. The claims can be reached by an old very crooked horse-trail commencing a quarter of a mile west of the river crossing and following the banks of the river for about 6 miles on the west side, where it crosses and traverses the higher benches until it reaches the upper Keefer lake, where a small log-cabin camp has been built. Some of the above claims are located over the divide in the Arrow Lake Mining Division. These were not examined, but the owner states that the continuation of the mineral-zone extends for some distance in that direction. Open-cuts, short tunnels, and trenches have uncovered a much-disturbed zone about 30 feet wide, containing oxidized iron, pyrite, and marcasite in a gangue of quartz, on the east side of the lake above the cabin. The country-rock in the immediate vicinity of the workings is greenstone. Samples of quartz and greenstone impregnated with pyrite assayed a trace in gold and 3 oz. in silver to the ton. Gravel from the small stream flowing below the workings panned a few colours of gold. The work done up to the present is mostly exploratory with the view of locating the

whereabouts of the gold-bearing quartz found in the stream. Ore in place had not been discovered at the time of examination, August 30th. The presence of gold has been known for many years in this district, and on that account further prospecting appears to be justified.

Ina and Red Rose.

These claims, owned by Geo. Thompson, of Vernon, are situated about 1½ miles up the Kettle river from the Vernon–Edgewood road, on the west side.

The *Ina* was formerly known as the *Shamrock*, on which spectacular specimens of gold-bearing antimony were found. Most of the old workings, consisting of tunnels, shafts, and open-cuts, are caved in, or impossible to examine thoroughly on account of partial caving. Stringers of jamesonite (antimony ore) in quartz, varying from 1 to 6 inches in width, were seen in an open-cut and small segregations in a tunnel below the cut. The vein occurs in a badly disturbed area of argillite and no continuity in any one direction could be found. The strike of the ore where seen was N. 60° E. (mag.). It seems probable that the development has been done on the displaced top part of a vein, the roots of which lie farther up and in the hill to the west. A picked sample of ore assayed: Gold, 0.44 oz. to the ton; silver, 6 oz. to the ton; lead, 10.8 per cent.; antimony, 5.3 per cent.

Mogul Mining Co.—During the year no work was done upon this company's property, which is described in the 1929 Annual Report.

Camp McKinney.

Pacific Copper Mines.

This company, with headquarters at 104 Motor Transport Building, Vancouver, explored a group of seventeen claims in the vicinity of the *Old England* and *Victoria* claims, about 2½ miles in a westerly direction from the old main camp. Some of the old *Victoria* log cabins were reconditioned for camping purposes and water was flumed from a small stream originating in a beaver-dam for domestic use as well as sluicing operations. Several quartz veins traverse the schist in the neighbourhood, varying in width from 1 inch to 6 feet. Slightly mineralized impregnations of pyrite and occasionally galena occur chiefly along the fracture-joints of the quartz where it has been faulted. At the camp several block-faults have displaced the vein in sections for about 200 feet down the creek. Along this faulted zone several short tunnels and open-cuts have been driven. Occasionally free gold is said to have been found, but generally the quartz where developed is low grade. A new tunnel was commenced in the middle segment of the fault-zone, the results of which are not to hand. The old creek tunnel driven near the *Old England* claim developed a partly oxidized quartz vein averaging about 6 inches in width for a length of 20 feet. Beyond this the vein pinched to a fracture and the work was abandoned. Samples of this ore contained from $10 to $12 a ton in gold. Across the creek another tunnel was driven for over 100 feet on a highly sheared zone of faulting containing pyrite and a considerable amount of graphite along the fracture-planes. The country-rock here is a fine volcanic tuff. On the *Old England* claim the old workings, consisting of open-cuts and short tunnels, most of which were cleaned out, had been driven on a highly siliceous zone containing pyrite varying in width from 2 to 12 feet and containing pyrite. Some high-grade gold ore is said to have been mined from some of these workings, but this could not be substantiated. Possibly the workings from which the ore was taken had not been cleaned out.

Le Roi and War Eagle.

These claims, owned by James Copeland *et al.*, of Rock Creek, were the subject of litigation owing to a lien being placed on the property. A year ago a lease and bond was taken on the property by A. F. Thomas and associates, of Greenwood and Victoria, and a contract let for shaft-sinking. Apparently the work was accomplished, but full remuneration was not forthcoming, so that the contractors placed a lien on the property. It is understood that an agreement was arrived at whereby payment will be made to the lien-holders, either by royalty when the mine is worked or when a sale is consummated. The ore discovered by shaft-sinking and open-cuts is pyrite and chalcopyrite containing gold and silver. Oxidation extends over an area about 200 by 200 feet. A picked sample of ore taken from near the collar of the newest shaft assayed: Gold, 0.02 oz. to the ton; silver, 4.6 oz. to the ton; copper, 4 per cent.

A good deal of interest has been taken recently in the gold-bearing quartz veins which were found and mined many years ago in Camp McKinney. No reliable data of geological conditions found in the underground workings are obtainable, but miners who have worked underground state that the ore was formed along the faults, most of which had only a short displacement.

It is also understood that the surface ore was chiefly pyrite and free gold, whereas at a depth of between 300 and 400 feet the free gold was absent and replaced by heavier sulphides containing gold. The plant was built especially to treat the type of ore found on the surface, and, according to reports, did not satisfactorily save the values in the sulphides.

Frank Wilson Lease.

This lease, owned by Frank Wilson, of Rock Creek, is situated close to the *Old England* claim on a branch of the North fork of Rock creek. Work done consists of two large open-pits, about 500 feet long and 200 feet wide in the widest part, which had been ground-sluiced when water was available in the spring. Rim-rock outcrops on the east and west side of the lower pit and forms a barrier between it and the present creek. Bed-rock has not been found except at the lip of the lower pit. The ground worked is evidently partly assorted glacial material which possibly overlies an old creek-channel, and it will be necessary to find bed-rock before the value of the lease can be ascertained. Fine colours of gold have been panned from certain parts of this gravel-mass, but no continuous payable strata were found. Attempts have been made in former years to drift into this ground from the present creek side and end of the old channel and some gratifying results obtained, according to the operators. Owing to fine running sand being struck the work was discontinued. A large volume of water is necessary to remove the entire mass of overlying gravel, and it seems advisable first to prospect bed-rock at the lower end of the pit by tunnelling. The depth to bed-rock can be found by sinking in the upper pit. There is not sufficient ground-water late in the year to hinder such an operation. In former years gold was mined in the creek below this lease, and, with the known gold-bearing quartz veins in the region of Camp McKinney above and in the direction from which the creek flows, more work may be recommended.

Vendella.

This claim, situated near Greenwood, is mentioned in former Annual Reports. It has been leased by J. Wichser, of Greenwood, who was developing by extending the lower tunnel. The usual stringers of quartz, containing pyrite, galena, and sphalerite carrying low values in silver and lead, were found, but no minable ore-bodies.

Jewel-Enterprise.

These adjoining claims, situated on Jewel lake, have been optioned by a syndicate of men in Calgary, Alberta. The *Jewel* prior to 1916 was operated by the Jewel-Denero Mines Company, of Edinburgh, under the management of Chas. Banks, Vancouver. The *Enterprise* claim, originally belonging to Mackenzie & Mann, is now owned by the Duhamel Estate at Greenwood. Several small payments have already been made on the option. The old syndicate mined and milled for several years prior to 1916. Since that time nothing has been done in the *Jewel* and the cyanide-mill has been dismantled. The *Enterprise* was developed by shafts and open-cuts and the extension of the vein system can be traced for some distance on the surface.

Owing to water the workings on the *Jewel* and *Enterprise* have never been examined by the writer. It is probable that underground maps are obtainable from the original syndicate, which will give some idea of the extent of work done and what ore is left in the mine. The ore is pyrite and smaller amounts of galena in a gangue of quartz, containing gold and silver. Water can be obtained for milling purposes in Jewel lake, which lies about a quarter of a mile from the main shaft on the *Jewel* claim. The veins occur in a highly altered chloritic and hornblendic schist a short distance away from the granodiorite contact.

The following is an excerpt from the report on this property by John D. Galloway in the 1913 Annual Report:—

"The property is situated on the contact between a grey granodiorite and a series of highly altered metamorphic rocks, which are probably partly of sedimentary and partly of igneous origin. This older series consists largely of green schists, together with greenstones, quartzites, and argillites. Some of the rock looks like fine-grained diabase, but is considerably altered. The district is heavily cut by granite-porphyry and black lamphrophyre dykes, which are of age generally subsequent to the vein formation. The vein does not follow the contact, but cuts the granite and also the schistose rocks. In the granite the fissure appears to have been well defined, and here the vein generally consists of a quartz-filling, with very slight alteration of the wall-rock. In the schists the action which produced a clean-cut fissure in the granite seems to have only had the effect of producing a shattered zone or series of minute parallel cracks. Throughout the schists the 'vein' consists of small stringers, together with large 'blebs' of quartz scattered

here and there in an irregular manner. It is probable that in this portion of the vein the principal action was one of replacement of wall-rock by mineralizing solutions flowing along the minute cracks. The result is that, on account of the unsuitability of the wall-rock for replacement, this portion of the vein has practically no ore-shoots of commercial size. The black lamphrophyric dykes, which vary from a few inches to 20 or 30 feet in width, have in some instances faulted the vein a few feet to the east; i.e., a normal fault. Another series of faults, later than the dykes, has also affected the ore-body. These faults, to some extent, parallel the vein, and that they are later than the black dykes is evidenced by the latter being faulted. Taken in all, the relation of dykes, faults, and mineralization is quite complicated, especially where the vein is entirely in the schistose rocks, and it would take some time to work out in detail the exact relation.

"The contact of the granite with the schists is not very regular, as long tongues of granite extend some distance into the other formation. It may be that the shattering of the vein in proximity to the contact is only local, and that at some distance away, and wholly within the schists, the vein again becomes normal.

"In this connection it should be noted that a supposed extension of the *Jewel* vein occurs on the *Enterprise* and *Ethiopa* claims lying to the north. These claims were not visited, but from reliable sources it is learned that the vein on both properties corresponds very closely with the *Jewel* vein in appearance, size, strike, dip, and other particulars, while the formation in which they occur is described as being analogous with the schistose rocks of the *Jewel* vein. These claims were developed to some extent ten years ago, but, as the ore is low grade and refractory, work was discontinued. The successful treatment of the *Jewel* ore may result in their being reopened.

"The main shaft, 320 feet deep, is situated on the *Jewel* within 50 feet of the *Denero Grande* line; at this point the vein is wholly in granite. Drifts have been run from three levels to the north and to the south, into the *Denero Grande* property, for a short distance. From 100 to 300 feet north of the shaft the vein enters the schists, where, as before stated, it rapidly splits up. On the No. 2 level a great deal of drifting has been done following various stringers in the schists. One drift, going 1,000 feet north of the shaft, has a crosscut at its end running east and west—i.e., at right angles to the supposed course of the vein—for 300 feet without encountering any ore-shoots. In the granite the vein runs from 2 to 12 feet in width, with an average of about 4 feet. Values are from $8 to $9 to the ton. Inasmuch as the company has been unable to secure the other one-half interest in the *Denero Grande*, practically no work has been done on this property, except running the south drifts from the main shaft a short distance beyond the line. The surface of the *Denero Grande* is covered with a heavy mantle of wash, which makes surface prospecting difficult.

"About 1,000 feet north of the main shaft is the Rowe shaft, 150 feet deep; at this point the vein is in the schists. This shaft was full of water at the time of visiting the property, but Mr. Rowe says that the vein, although small, is well defined at the bottom. Two other shallow shafts, between the two former ones, were also full of water and could not be examined.

"It is to be hoped that exploratory work will be pushed forward on the *Denero Grande*, as in that direction conditions seem very favourable for a good shoot of ore."

Gold Drop. This claim, owned by Louis Bosshart, of Greenwood, and mentioned in the 1925–1928 Annual Reports, was prospected further by the owner by extending the lower tunnel. This is an interesting occurrence of high-grade telluride ore which requires development.

Stemwinder. This claim, mentioned in several recent Annual Reports and owned by Robt. Forshaw, of Greenwood, was developed by extending the lower gulch tunnel about 20 feet. According to reliable reports, the ore discovered and stripped on the surface beside the road, about 30 feet in elevation above, extends downwards and the upper face of the tunnel is in ore of a similar character; i.e., pyrite and chalcopyrite in a brecciated volcanic tuff and highly siliceous limestone. Further work which is being carried on at present will demonstrate the value and size of this ore-body, which has been stripped for 100 feet in length on the surface. Whether this strike is the extension of the *Brooklyn-Stemwinder* ore or a separate lens remains to be proven. In any case it is an interesting development that warrants exploration in an area where much copper ore has been produced in the past.

Greenwood Section.

Mining generally near Greenwood was quiet this year owing chiefly to the low price of copper and silver. The *Providence* was not operated, but there was a continued search for the vein extension to the north. Other copper properties, including the *Anaconda*, *Ah There*, *Greyhound*, and *Copper Mine* (*Big Copper*), were the subject of inquiry from outside interests, and there is a strong likelihood that, when the price of copper increases, serious exploration of these different areas will commence. Nothing further was done by the Southwest Mining and Milling Company on the group of claims bonded near Denoro. Developments at Lightning peak, some of which are in the Greenwood Mining Division, will be dealt with under the Grand Forks Mining Division.

GRAND FORKS MINING DIVISION.

Lightning Peak Camp (partly in Greenwood Mining Division).

Waterloo Consolidated Mines, Ltd.

This company, reported on in the 1929 Annual Report, with headquarters at Penticton, continued development in a small way under the management of R. L. Clothier during the year. Shipments of sorted silver-lead-zinc ore were made to the Trail smelter as shown on the accompanying plan. Development continued on the *Waterloo* No. 2 tunnel and a lean zone was struck on each side of a narrow tongue of diorite which intruded into the limestone about 30 feet from the face at the time of examination. Continued development is said to have encountered a more highly mineralized zone. Some stoping on a high-grade ore-shoot was done about 70 feet from the face. A new tunnel, No. 3, about 90 feet lower in elevation than No. 2, was commenced and driven about 50 feet. According to the management, this tunnel struck about 3 feet 6 inches of ore from the commencement, containing some tetrahedrite as well as galena and sphalerite. The presence of tetrahedrite has not been noticed in the mine ore hitherto and probably represents a lower horizon of the ore-deposition.

On the *A.U.* claim a small hoist, head-frame, cable, and bucket were installed and a shaft sunk about 25 feet on one of the series of north and south quartz veins. The vein on the surface measured about 10 inches in width, with about 6 inches of ore on the foot-wall. A 10-inch sample of this taken 14 feet down the shaft assayed: Gold, 0.36 oz. to the ton; silver, 16.6 oz. to the ton; lead, 8.2 per cent.; zinc, trace. According to the management, the vein widened to 2 feet at 25 feet and continued from 14 to 18 inches in width of sulphides, which assayed over an ounce in gold, 11 oz. in silver to the ton, and a considerable amount of lead. There are probably four parallel quartz veins striking in a northerly and southerly direction and on one of these the shaft was sunk. Whether sufficient tonnage, in one or a combination of all of these veins, can be found containing values that will warrant building a small reduction plant depends upon the results of further development. Up to the present the ore found is attractive enough to warrant the prospecting at depth of all these veins. The company may be well advised to discontinue development on the *Waterloo*, where silver is the chief mineral found, and concentrate its efforts upon exploring the north and south quartz veins, which contain higher gold and lead values.

Machinery installed at the *Waterloo* comprises one Canadian Ingersoll-Rand drill-sharpener, one 10 by 10 Ingersoll-Rand compressor, and a 55-horse-power Clayton semi-Diesel engine. A blacksmith-shop, sorting-shed, and water-tank have also been built.

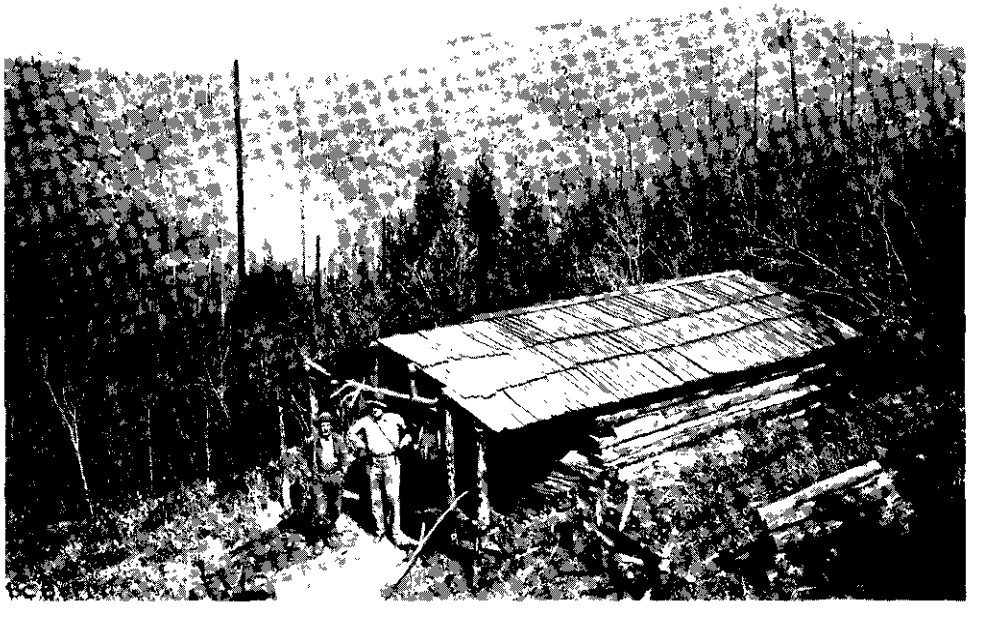
This company purchased a tractor and grader and built several miles of narrow road, so that it is possible to drive a car for 6 miles and take the tractor into camp the remaining 12 miles.

A preliminary geological survey was made of the area by C. E. Cairnes, of the Geological Survey of Canada, and without doubt the results will be beneficial in helping the operators in the district to plan future development and exploration.

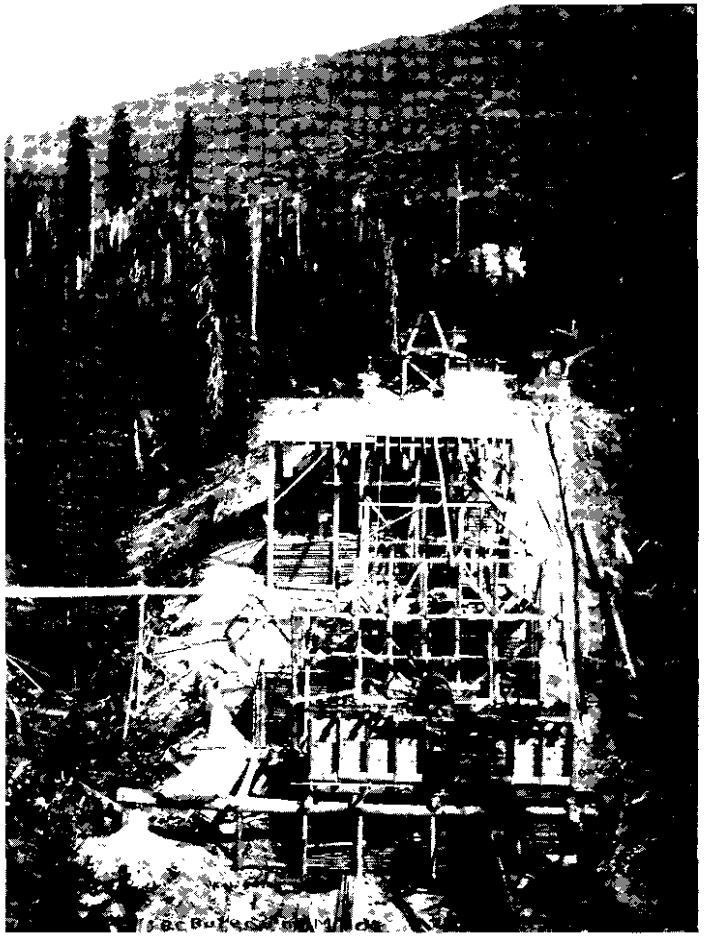
Victoria.

This claim, owned by Adam Scaia, of Edgewood, is located on the north-west side of the *Rampalo*. Three quartz veins varying from 3 to 10 inches in width, and containing pyrite with occasional segregations of galena and sphalerite, have been uncovered in two open-cuts, 25 feet and 30 feet long respectively. The veins occur in granite porphyry, 15 feet apart, close to its contact with the schist, and strike S. 65° E. (mag.). A sample from the three veins assayed: Gold, 0.05 oz. to the ton; silver, 9.5 oz. to the ton. The lead and zinc, being in small amounts, were not assayed.

Halifax Mine, Grand Forks M.D.

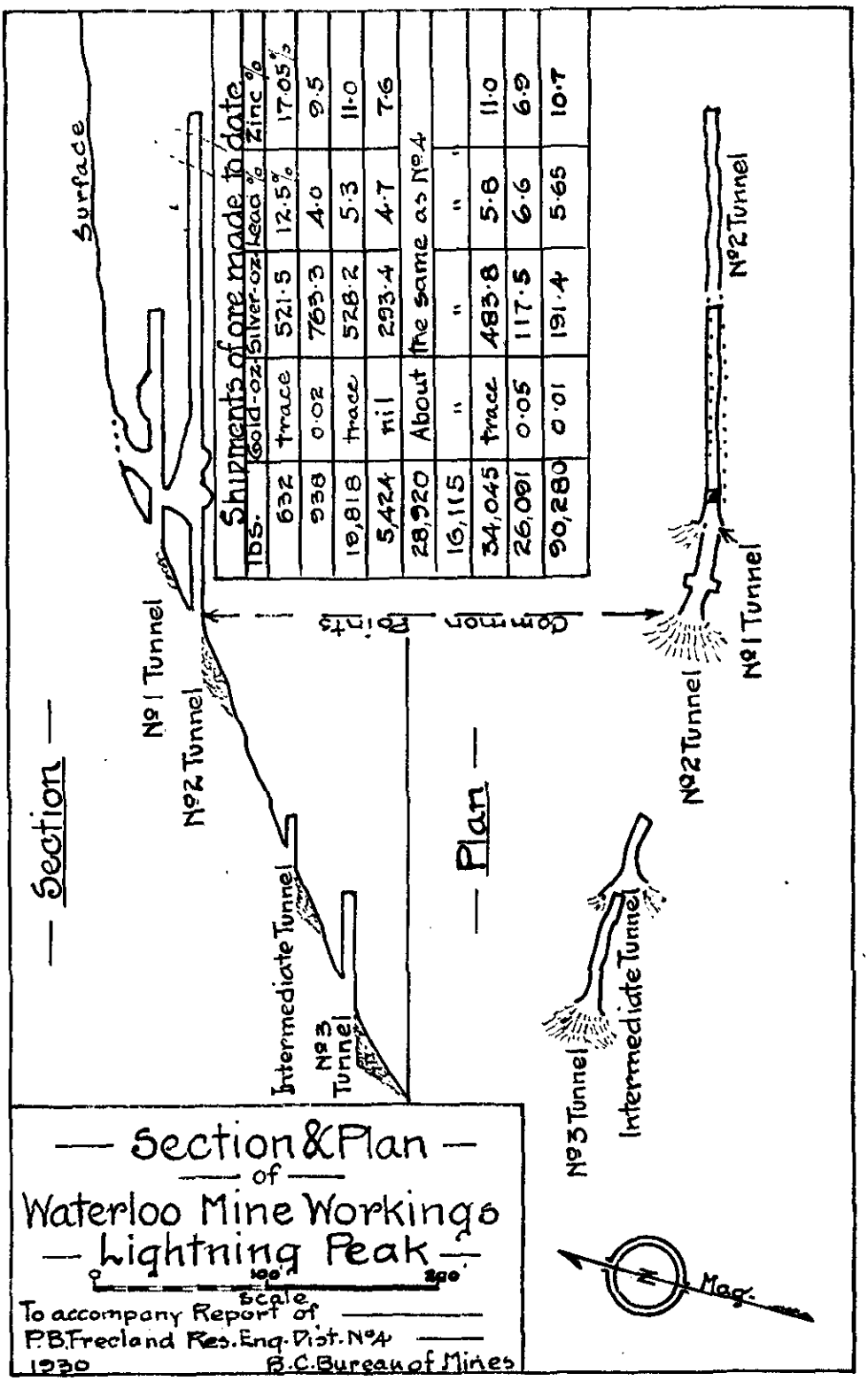


Molly Gibson, Grand Forks M.D.



Dornberg Mill, Tulameen River.

Union Mine, Grand Forks M.D.



Shipments of ore made to date				
Tons.	Gold-oz.	Silver-oz.	Lead %	Zinc %
632	trace	521·5	12·5%	17·05%
938	0·02	763·3	4·0	9·5
19,818	trace	528·2	5·3	11·0
5,424	nil	293·4	4·7	7·6
28,920	About	the same as No 4		
16,115	"	"	"	"
34,045	trace	483·8	5·8	11·0
26,091	0·05	117·5	6·6	6·9
90,280	0·01	191·4	5·65	10·7

Killarney. This claim, mentioned in former Annual Reports and owned by W. J. Banting, of Edgewood, was developed by extending the upper open-cut into a 6-foot tunnel on the vein. The ore, a silver-bearing galena and sphalerite, split and follows the foot and hanging wall, with disintegrated country-rock and quartz gangue in between. The size of the vein varies from 6 to 8 inches on each wall. In the middle tunnel the drift was extended westerly and siliceous ore containing galena, pyrite, and sphalerite was followed for about 40 feet. A displacement at the face has evidently thrown the vein to the north. Further development in this direction may be recommended.

West Fork. This claim, one of the *Lightning Peak* group and situated across the headwaters of the Granby river in a north-easterly direction from the *Killarney*, was developed by the lessee, W. A. Calder, of Edgewood. The lowest tunnel was extended 65 feet in a north-easterly direction and higher-grade silver-lead ore found where the vein had been faulted.

Pay Day. This group, situated about a mile north of the *West Fork* and owned by Walter Johnstone, of Silverton, and A. Williams *et al.*, of Edgewood, was reported upon in 1929. The claims were not visited this year, but it is understood assessment-work was done. This is an interesting mineral occurrence that is large enough to warrant further development.

Potosi-Potosi Nos. 1, 2, 3. This group of claims, situated on what is locally named the Baby range lying to the south of the *Waterloo* claim, is owned by James Graham, of Edgewood. Numerous quartz veins varying from a few inches to 6 feet occur in the schist and limestone on or near the granite and porphyry contacts. Mineralization seen was mostly iron oxides, pyrite, and manganese. Some gold values have been obtained from picked samples taken from the narrower veins, but in general the larger ones are very low grade. Work done consists of merely tracing the vein system by open-cuts and shallow pits, and when this has been satisfactorily accomplished development will be done to ascertain the value of this mineralization at depth. A new log cabin was built on the *Potosi* claim.

Union. This group, consisting of the *Union*, *Union Fraction*, *Paper Dollar*, *Idaho*, *Silver Dollar*, and *Burke*, is situated in Franklin camp, about 45 miles north of Grand Forks, near the Granby river. The claims are registered in the name of J. F. McCarthy and financed, it is understood, by the Hecla Mining Company, of Wallace, Idaho. The first four claims of the group are old Crown grants and the latter two more recent stakings. The mine operated continuously during 1930, except for time lost occasioned by plant breakages and a few days during the Christmas holidays. New construction for the year comprised a 16- by 24-foot addition to the engine-room and a 28- by 40-foot addition to the mill. Machinery installed is one 240-horse-power Fairbanks-Morse Diesel engine at the mine and one 6- by 6-foot ball-mill at the mill. Compressor capacity from one machine is 420 cubic feet and from the other 300 cubic feet. The capacity of the mine ore-bin is 300 tons. Most of the development was done during the year on the No. 1 tunnel, which is located near the top of the old glory-hole and on No. 2 tunnel. The total length of the tunnels to date is: No. 1, 500 feet; No. 2, 480 feet; No. 3, 1,050 feet; and No. 4, 1,220 feet. The vertical distance between No. 2 and No. 1 tunnels is 92 feet; between No. 3 and No. 2 tunnels, 135 feet; and between No. 4 and No. 3 tunnels, 197 feet. As well as the above, some crosscutting has been done in No. 4 tunnel. Most of the ore milled was taken from Nos. 1, 2, and 3 tunnel stopes and headings. All the ore is passed through the mine to No. 4 level, where it is trammed out to the 300-ton mill-bin by a mule and six dump-cars. A total of 36,886 tons of ore was milled during the year, producing 1,104 tons of concentrates shipped to the Trail smelter. The ratio of gold to silver in the concentrates is 1 to 36. The average number of men employed was sixty. At the latter end of the year Paul Schultz, who was mine superintendent since operation commenced, left for California, chiefly on account of health, and he was replaced by Byron Wilson.

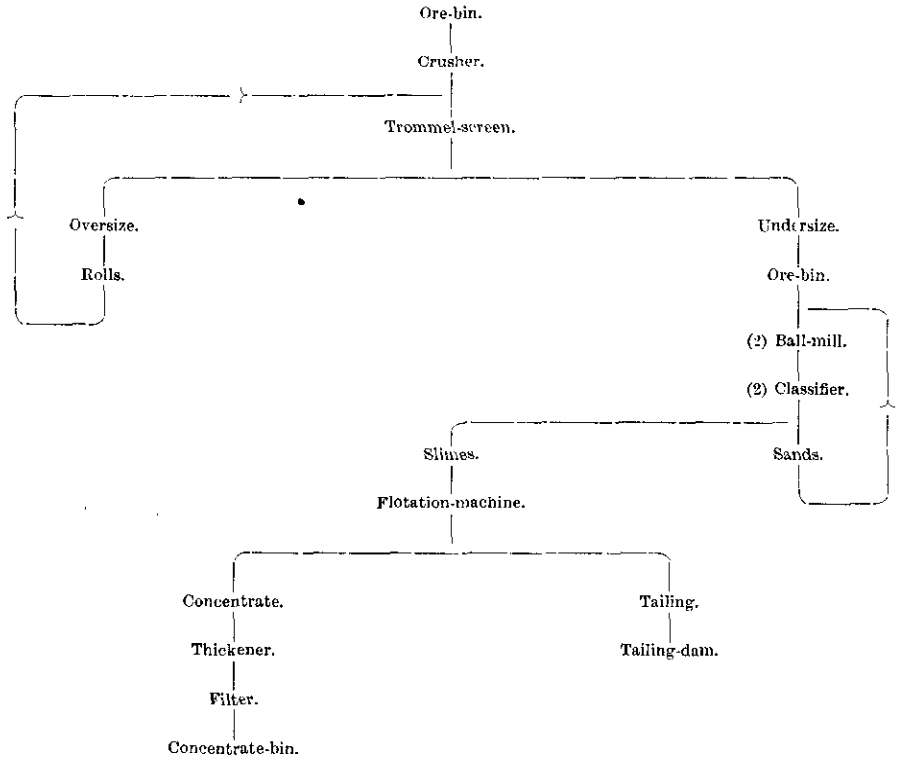
Developments in No. 4 tunnel have up to the present proved very disappointing and only fragmentary pieces of ore found. As far as development has gone, the ore has been proven to exist in place for about 40 feet below the No. 3 tunnel, and until this is mined out or prospected further the lower section of the ore, if any, may be difficult to find. There are possibilities of a flat fault having thrown the ore to the south of No. 4 tunnel. Crosscuts to the north have proven that it does not descend on the company's ground in that direction. In No. 3 tunnel stopes a dacite-porphyry dyke was struck, which is believed, though not absolutely proven, to be

responsible to some extent for the higher gold values found in the ore near its contact. The original ore in the mine that assayed between $9 and $10 a ton in gold and silver (chiefly silver) has now been enhanced by larger quantities of gold. Some of the richer zones have been spectacular and assayed up to $200 a ton. The average mine-run is much below this figure, but it is doubtful if the operation could have survived the low price of silver if higher gold values had not been found. The ore that contains the gold does not appear to be different to other mineralization found in the mine—namely, pyrite, with lesser amounts of galena, sphalerite, and hæmatite, in a gangue of quartz and calcite. No native gold is visible in a thin section under the microscope, according to W. E. Cockfield, of the Geological Survey of Canada, Vancouver, who kindly examined specimens of the ore. The dacite-porphyry dyke, also examined, contained similar secondary veins of calcite which suggested some connection in the history of the ore and the dyke.

The widths of ore mined are from 5 to 25 feet, and as there are no commercial walls visible it is found necessary to take in the neighbourhood of 100 samples a day from drift headings and stopes. Two assayers are continuously employed.

The flow-sheet of the mill is embodied in this report, and about 160 tons of ore a day treated on mine-run that gives a ratio of about 30 tons of rock to 1 of concentrates. After drying, the concentrates are sacked and hauled by two motor-trucks a distance of 29 miles to Lynch Creek Station on the Canadian Pacific Railway, and from thence by freight to the Trail smelter.

Union Mill Flow-sheet.



Copper Cliff. This claim, owned by Elmer Rice, Klaus Scheer, and associates, of Grand Forks, and situated about 38 miles north of the town on the west side of the Granby river, was developed by continuing the lower crosscut tunnel. A total distance of 400 feet has been driven, which places the tunnel-face almost vertically under the cabin, near which some mineralization was uncovered. The country-rock in the face of the tunnel in granodiorite.

Assessment-work was done upon the *Copper No. 2*, owned by Pete Santure, Grand Forks; *Bluejoint Nos. 1* to *4*, owned by Ab. Fee, A. and F. Scott, Grand Forks; and *Exchange* group,

owned by R. Simpson, of Grand Forks. These claims are situated along the Granby river as described in the Annual Report of 1928. The *Rock Candy* fluorspar-mine, owned by the Consolidated Mining and Smelting Company, was not operated, but a survey of the condition of the mine, plant, and tramway was made by Dan Matheson, former superintendent, with a view of commencing operations during 1931.

Yankee Girl & Boy.

These claims, owned by James Hutchinson, of Montreal, and managed by W. Lanskail, of Republic, Wash., were developed during the year by sinking a 50-foot winze in the upper tunnel on the vein and driving a branch crosscut towards the probable downward extension of the vein from the lower tunnel. The ore, which is chiefly pyrite with lesser amounts of galena and chalcopyrite in a gangue of quartz, contains gold. The vein varies from 3 inches to 2 feet in the widest part and averages about 8 inches. In the new winze, mineralization occurred in segregations and narrow streaks in the quartz and required close sorting. A shipment of 21 tons was made to the smelter at Trail. Before the lower crosscut reached its objective the mine closed down. Three men were employed.

Fife Quarries.—This property, situated near Christina lake and owned by the Consolidated Mining and Smelting Company, was operated and the limestone-output shipped to Trail for fluxing purposes.

PAULSON SECTION.

Halifax.

This group, mentioned in the 1927 and 1928 Annual Reports, was bonded by Jos. Grafton, of Rossland, and a considerable amount of work done which uncovered continued copper, lead-zinc mineralization in the limestone-beds. This area is an interesting one geologically and warrants further exploration.

Molly Gibson.

This group, owned by the Molly Gibson (Burnt Basin) Mining Company, Rossland, and mentioned in the 1928 Annual Report, was explored by open-cuts and trenches chiefly on the mineral-croppings on the McRae Creek slope. Owing to the extreme hardness of the rock, development proceeds very slowly. The ore, which is pyrite and pyrrhotite, containing gold, occurs as a siliceous replacement in the limestone-beds on the contact of the alkali-syenite dykes.

EASTERN MINERAL SURVEY DISTRICT (No. 5).

By B. T. O'Grady, Resident Mining Engineer, and A. M. Richmond, Assistant Engineer (Headquarters, Nelson).

(Reports marked * are by A. M. Richmond.)

INTRODUCTION.

The Eastern Mineral Survey District (No. 5) comprises the following twelve Mining Divisions: Revelstoke, Lardeau, Trout Lake, Slocan, Slocan City, Ainsworth, Nelson, Trail Creek, Arrow Lake, Golden, Windermere, and Fort Steele.

The effect of the abnormally low metal prices has been very severely felt in District No. 5, from which metal production is now mainly silver, lead, and zinc. The Slocan and Ainsworth Divisions, which for many years have contributed substantial amounts of ores and concentrates, have been especially hard hit, and production from this area during 1930 has been almost entirely confined to occasional small shipments by leasers. Throughout the district independent shippers are marking time and many development operations have been suspended pending an improvement in conditions. The suspension of activity at many small properties has had little effect, however, on the production of the district, which is largely derived from the *Sullivan*. Production was well maintained by this great mine, which had an increased output for the year. Another factor which contributed to increased production was the substantial output of concentrates from the *Monarch* during the first nine months of the year. Unfortunately, the mill was shut down in October, due to the slump in metal prices.

In spite of the depressed condition of industry generally, development, exploration, and prospecting have been continued at a fair rate. Activity in varying degree occurred at some sixty-eight properties, which represents a decrease in the number of operations of, roughly, 50 per cent. as compared with the year 1929. The sustained demand for and investigation of promising prospects by old-established mining companies indicates their confidence in the ultimate recovery of the metal market. Especially this seems to be the case in regard to lead.

Several interesting new discoveries have been made, indicating potentialities for increased production of silver, lead, and zinc under more normal conditions. In this connection the more important factors are the success attained in development at the *Monarch* near Field and the extensive showings opened up by the Consolidated Mining and Smelting Company on the *Comfort* and *Kootenay Chief* claims, adjoining the old *Bluebell* mine on Kootenay lake. Of considerable interest are the recent discovery of good-grade silver-lead-zinc ore on Salmo river north of the *Reeves-McDonald* and the accidental discovery of large surface showings of zinc-lead ore on the *Albion* group near Vermilion Crossing in Kootenay National Park.

Recent discoveries tend to show that, as pointed out before, systematic and scientific exploration of certain promising mineral-belts, and favourable formations within them, offers decided possibilities for the discovery of new mines.

There has been a marked revival of interest in gold properties. The *Reno* has been in production throughout the period under review and small-scale activities have occurred at the following gold prospects: *Second Relief, Queen, Ymir-Wilcox, Goodenough, Bayonne, Euphrates, Humming Bird,* and *California,* all in the Nelson Mining Division; *I.X.L., O.K., Midnight, Snowdrop, Golden Drip,* and *Camden,* near Rossland; *Homestake* and *Running Wolf,* near Cranbrook. Some production was made by the *Second Relief* (gold bullion and concentrates), *Ymir-Wilcox* (gold bullion), and *Goodenough* (gold-silver-lead ore). Hydraulic placer-mining operation by the French Creek Development Company at its property north of Revelstoke is beginning to show results and about $2,700 in coarse gold was recovered towards the end of the season.

The tremendous activity by the Consolidated Mining and Smelting Company in connection with the construction of the chemical-fertilizer plant at Trail has provided much employment at a critical time and will eventually be an important addition to the industrial activity of the Province. In connection with this undertaking, two phosphate-deposits are being explored in East Kootenay, one near Crowsnest and the other south of McGillivray.

At the Trail smelter the great new slag-fuming plant has been brought into operation and notable improvements made in current practice.

Hydro-electric Development.

Largely in connection with the fertilizer undertaking, additional power facilities are being provided by the West Kootenay Power and Light Company, the subsidiary company of the Consolidated Mining and Smelting Company. A large force of men is at work in connection with construction of a fourth plant on the Kootenay river at Corra Linn falls, where three 19,000-horse-power units are to be installed. This new plant will bring this company's capacity on the Kootenay river to well over 200,000 horse-power. The same company proposes to construct a huge dam on the Pend d'Oreille river which ultimately will result in the additional development of over 200,000 horse-power. This will constitute the largest single power-development in the Province. The site of the big dam is on the Pend d'Oreille river, about 1 mile above its confluence with the Columbia river. Borings have demonstrated that a suitable footing can be obtained for the dam, which will be some 365 feet or more in height above the bed of the river.

Geological Survey Work.

Recent publications of the Geological Survey of Canada include: Memoir 161, "Lardeau Map-area," with General Geology by J. F. Walker and M. F. Bancroft and Mineral Deposits by H. C. Gunning; "Mineral Developments in Salmo Map-area," by J. F. Walker, Summary Report, 1929, Part A. During the past field season B. R. MacKay made a study of the Corbin coal area in the East Kootenay. This lies about 12 miles south of Crowsnest pass and within 2 miles of the British Columbia-Alberta boundary.

Production.

Mine or Group.	Tonnage.	Character of Ore.
Ainsworth Mining Division—		
Banker	56	Silver, lead.
Whitewater	47	Silver, lead, zinc.
Fort Steele Mining Division—		
Sullivan	1,923,767	Silver, lead, zinc.
Golden Mining Division—		
Monarch	75,054	Silver, lead, zinc.
Ruth-Vermont	63	Silver, gold, lead, zinc.
Lardeau Mining Division—		
Lead Star	13	Silver, gold, lead.
Nelson Mining Division—		
California	18	Silver, gold, lead.
Goodenough	1,086	Gold, silver, lead.
Reno	9,670	Gold, silver, lead.
Second Relief	1,479	Gold, silver.
Revelstoke Mining Division—		
Regal	24	Silver, lead.
Slocan Mining Division—		
Black Colt and Palmita	358	Silver, lead, zinc.
Bosun	203	Silver, lead, zinc.
Canadian Group	40	Silver, lead.
Elkhorn	47	Silver, lead, zinc.
Galena Farm	2,830	Silver, lead, zinc.
Great Western	64	Silver, lead, zinc.
Lucky Thought	80	Silver, lead, zinc.
Mary Ryan	10	Silver, lead, zinc.
Noble Five	1,736	Silver, lead, zinc.
Ruth-Hope	2,080	Silver, gold, lead, zinc.
Silversmith	150	Silver, gold, lead.
Slocan King	11	Silver, lead.
Slocan Rambler	77	Silver, lead, zinc.
Sovereign	50	Silver, lead, zinc.
Standard	164	Silver, lead, zinc.
Slocan City Mining Division—		
Treasure Chest	2	Silver, lead.
Trail Creek Mining Division—		
Gold Drip	20	Gold, silver.
I.X.L.	35	Gold, silver.
Midnight	33	Gold, silver.
Total tonnage	2,019,267	

GOLDEN MINING DIVISION.

This Division embraces a large area of mountainous country to the east and west of the Columbia river. Prospecting in the early days, mostly in the nineties, resulted in a large number of mineral claims being located in the westerly section, occupying the northern part of the Purcell range. A very useful prospector's map compiled by F. C. Lang, of Golden, and published in 1897, shows the approximate position of these old claims, the character of the ore, and the locations of the old trails. Most of the exploration accomplished in connection with these claims, of a very superficial character, was done in those early days, development-work of recent years having been confined to a few widely separated properties, such as the *Ruth-Vermont*, *Giant*, and *Crown Point* group of the Witwatersrand Syndicate, references to which follow in the body of this report. No detailed information covering this portion of the Purcell range has yet been published by the Geological Survey of Canada, the nearest available data being contained in the Summary Report for 1925, Part A, "Reconnaissance in the Purcell Range West of Brisco, Kootenay District, B.C.," by J. F. Walker. The sketch-map accompanying this publication shows the north-westerly extension of the rocks mapped in the Windermere sheet (Geological Survey, Memoir 148) to Bobbie Burns creek. As the Toby conglomerate, an important horizon-marker, can be traced for many miles farther north, it is apparent that the district west of the Columbia is largely underlain by rocks of the Upper Purcell and Windermere series of late pre-Cambrian age. Granitic intrusives are also known to be exposed which are probably equivalent to the granite stocks tentatively referred to the Jurassic period on the Windermere sheet. Other publications of the Geological Survey of Canada relating to the Golden Mining Division include: "Placer Gold and Lead-zinc Deposits, Dogtooth Range, Kootenay District, B.C.," by C. S. Evans, in the Summary Report for 1926, Part A; Memoir 68, "A Geological Reconnaissance between Golden and Kamloops, B.C., along the Canadian Pacific Railway," by R. A. Daly; Memoir 55, "Geology of Field Map-area, B.C. and Alberta," by J. A. Allan; Summary Report, 1925, Part A, "Knopite and Magnetite Occurrence, Moose Creek, South-eastern British Columbia," by H. V. Ellsworth and J. F. Walker.

Comparatively little attention was paid by prospectors to the rugged section of the Rocky mountains lying east of the Columbia river. It is now becoming apparent that the belt of Middle Cambrian rocks, including the Cathedral formation in which the *Monarch* and *Kicking Horse* deposits are located, merits more attention, although the situation is a little complicated by the restrictions imposed at present on mining in Yoho and Kootenay National Parks. Discoveries of lead-zinc float-ore several miles south-easterly from the *Monarch* mine and large surface showings of similar ore at the *Albion* group, some 27 miles south-east of the *Monarch*, near the northern boundary of the Windermere Mining Division, are of considerable interest as indicating the possibilities awaiting careful investigation of the mineral-belt containing these occurrences. The rugged character of the area, formerly very difficult of access, probably accounts for the lack of mineral discoveries by the old-timers who thoroughly covered most areas.

Monarch. The most important operation in this Division was that at the property of the Base Metals Mining Corporation, Limited, on the main line of the Canadian Pacific Railway east of Field. As a comprehensive description of the *Monarch* and *Kicking Horse* deposits, together with plan and sections of the *Monarch* ore-bodies, is contained in the Annual Report for 1929, only a brief summary of recent progress will now be submitted.

The following information was obtained in a letter from the management:—

"In the West Monarch mine development has continued southward on the ore-body to a total distance of 1,525 feet from the outcrop. Of this distance, 815 feet was driven in 1930, and from it 220 feet of crosscutting and 60 feet of raising has been done. All but a small part of the work has been on ore, and there is ore in the face of the south workings, although several short sections of waste were passed through.

"For cheaper handling of the ore an incline drift has been driven in waste under the ore-body, nearly parallel to it, and will be connected with the ore-body by ore-passes at intervals. A gravity-tram will be operated in this incline.

"The ore developed by the year's work is slightly thicker and narrower than that in the older northern part of the ore-body. A somewhat greater tonnage of ore has been developed during the year than has been mined, and it is of a somewhat higher grade, averaging about 40 per cent. combined metals.

"In the East Monarch mine drifting and stoping has been carried southward 290 feet during the year. A drift has also been driven southward 570 feet in waste underneath the ore-body to facilitate handling of the ore and for exploring the extension of the ore-body through raises.

"Approximately 1,300 feet of diamond-drilling has been done on and near the two ore-bodies.

"During the year 70,000 tons of ore was milled, largely from the northern and lower grade part of the ore-body, which averaged 1.3 oz. silver, 9.1 per cent. lead, and 10.4 per cent. zinc. From this 7,751 tons of lead concentrates were produced, averaging 76.8 per cent. lead and 4.3 per cent. zinc; and 10,847 tons of zinc concentrates averaging 59.6 per cent. zinc and 1.2 per cent. lead. Net recoveries were 94.4 per cent. of the lead and 86.2 per cent. of the zinc. Lead concentrates were smelted at the Selby smelter in San Francisco. Zinc concentrates were shipped in part to Japan and in part to Europe.

"The mill was shut down on October 15th on account of low metal prices, but development-work in the mine was continued to the end of the year."

Giant.

This property, which has been under development by the A. B. Trites interests, of Vancouver, since 1926, is situated at an elevation of about 3,000 feet on the north-west slope of Spillimacheen mountain and is about 6½ miles by road from Spillimacheen, on the Kootenay Central Railway. References to the property are contained in past Annual Reports and in Geological Survey Summary Reports for 1925, Part A, and 1926, Part A. The deposit consists of fine-grained galena occurring in lenses in a wide vein of barytes. Exploration by diamond-drilling was carried on throughout the summer and fall under the direction of J. L. Parker, to whom the writer is indebted for the following notes:—

"Nineteen holes were drilled aggregating 4,101.5 feet. These were drilled from stations underground and from the 600-foot level, which is 600 feet below the outcrop. Information learned shows that the low-grade ore exists below the 600-foot level and that it occurs in lenses striking diagonally across an ore-channel, which latter has an easterly strike. Between the 700- and 800-foot levels 32 feet of ore at right angles to the dip of the lens gives assays of 1.15 oz. silver, 8.1 per cent. lead, and just below the 900-foot level a lens of ore 10 feet in width was drilled across, giving 3.24 oz. silver, 23.6 per cent. lead. This was as low as we could drill owing to the limitations of the power."

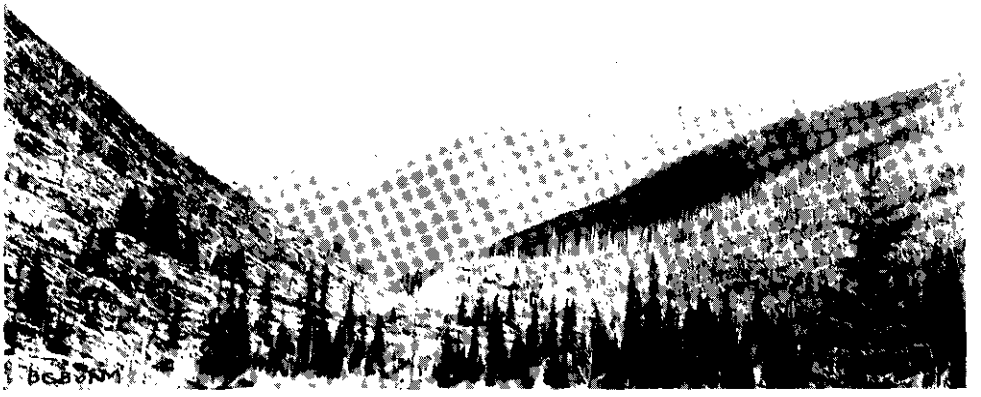
Accompanying these notes are details of the directions and angles of each hole. Resumption of activity at the *Giant* is anticipated during the coming season and there is a possibility that some production of baryte will be made, this being dependent on the economic factors involved, including freight rates.

Witwatersrand Syndicate, Ltd.*

Work at this company's property on the North fork of McMurdo creek, a tributary of the Spillimacheen river, has been continued steadily throughout 1930 under the direction of G. W. Edwards. The property was described briefly in the 1929 Annual Report and the following notes will summarize the more recent work. For sake of clarity it might be mentioned that a series of mineralized outcrops along a general north-south line and over a length of 2,000 to 3,000 feet have been explored during the past few seasons' work. The showings are not necessarily readily connected, several of them being at widely separated altitudes. The mineralization in general is of two types—small mineralized quartz stringers striking normal to the schistosity of the country-rock, a chlorite-schist, and, secondly, interbedded slates and limestones in which the limestone is sometimes replaced by galena, sphalerite, and associated silver values, the latter type being the more important.

Three main showings, called "A," "B," and "C," extend from the south to north, the principal one being the first mentioned. Recent work in 1930 disclosed two new showings presently described.

The "A" showing at 7,080 feet elevation consists of a mass of galena, sphalerite, carbonates, etc., in limestone and banded schist, with a width of 30 to 35 feet. This outcrop, of undetermined length (due to slides, etc.), strikes S. 25° E. and dips 50° to the north-east, and is the best showing so far exposed. At 6,860 feet elevation and 250 feet to the north-east, a crosscut tunnel 430 feet long at S. 45° W. was driven to intersect this deposit at 200 feet depth. No intersection was made, however, and work in 1930 has been mostly devoted to the driving of a second crosscut tunnel from a point 175 feet in from the portal of this, the "A" tunnel, in a S. 30° E. direction. When the property was visited in August the crosscut had been advanced 390 feet without



Trojan Mine, Windermere M.D.

True Fissure Mill, Trout Lake M.D.

O.K. Mountain, Trail Creek M.D.

Mountain Con, Slocan M.D.

reaching the projected downward continuation of the ore. The management estimated that a further 50 to 60 feet of tunnelling would be required before reaching their objective. This second crosscut driven in grey to black schist encountered several quartz stringers, with a general strike normal to the schistosity (N. 70° W.), but no traces of mineralization were found. Above the "A" tunnel at 7,080 feet elevation and approximately north from the "A" showing, a 90-foot crosscut tunnel at S. 45° W. connects with a 60-foot winze from the surface. Two short crosscuts have been driven from this intersection in a north-west and south-easterly direction. Banded lime and schist conforming to the strike and dip of the winze contains small amounts of galena and zinc-blende. Small mineralized quartz stringers are found in a section of the winze.

The "B" showing was not examined this year, but consists of galena in quartz-filled fissures, and has been partially developed by two tunnels at 6,100 and 6,030 feet elevation respectively and approximately 1,800 feet north-westerly from the "A" showings.

About 1,000 feet north-west of "A" showing at 6,970 feet elevation a 15-foot tunnel has been driven as a crosscut to cut lime-schist banded mineralization. The formation here strikes N. 60° W. and dips 25° to the south-west. Small stringers of ore have been exposed in this work as well as in an open-cut 20 feet to the north of this tunnel. This outcrop of galena and zinc is approximately 500 feet above the old "C" showings.

At 6,300 feet elevation and 1,100 to 1,200 feet north-west of "A" showing, mineralized lime and schist were recently discovered and a short tunnel driven into the hill to prospect them.

A crew of fourteen to sixteen men has been employed until recently, when the crew was reduced to six or eight men for the winter months. Machinery consists of hand-tools, an Ingersoll-Rand portable compressor, and mounted jack-hammer drills at the "A" tunnel. No reports as to the success of the extension of "A" tunnel have been received since the property was last visited.

The following information is contained in a letter from G. W. Edwards:—

"Since your visit the development-work on the *Witwatersrand* properties has been confined to the main or easterly workings at 'A' and 'A 1.' The outlying prospecting operations were suspended for the season shortly after your visit; consequently there is nothing further to advise you thereon.

"In the fall material and supplies were transported to the mine camp and a crew of twelve men provided for the present winter and coming spring. After the gasoline on hand had been consumed the compressor was closed down until the spring. The work has been continued three shifts, one face driving on the ore-body at Intermediate level 'A.'

"Up to date 200 feet have been driven on the mineralized zone and a good grade of milling-ore of galena maintained. Crosscutting at 100 feet from point of commencing to drive has exposed a mineralized width of 25 feet. A winze is now being commenced at this point to sink on ore.

"The present face of level at 200 feet is about 100 feet beyond the eastern or largest surface working, which is satisfactory as proving that the mineralization continues at depth beyond this point at surface; as you doubtless recollect, the surface easterly of this point is covered with heavy rock-slide, rendering surface data impossible. Furthermore, the zone is bearing to the right and level swinging south-easterly; consequently, if the trend of direction continues, increased depth will be attained more rapidly and should reach a maximum depth of about 1,000 feet.

"A small tonnage of the ore has been sacked with the intention of shipping same at first opportunity to Trail for a reduction test.

"The main crosscut level at 'A' tunnel, driven to intersect the ore exposed above in 'A 1' workings, has been driven 428 feet. Assuming that the dip of strata as seen in upper workings is maintained at the depth of this cross-cut, an additional footage of at least 250 feet must be completed before intersection of ore can be expected.

"*Footage at 'A' and 'A 1.*'—A total footage at the Main 'A' tunnel with machine-drills, consisting of 521 feet of crosscutting and 525 feet of driving, has been accomplished. By hand-drilling a further 200 feet and 35 feet of crosscutting has been completed and is still progressing, with sinking also about to start. The aforementioned footage does not include the surface or

outcrop workings as regards crosscutting, driving, and sinking at these two points, which represents an additional footage of 400 feet."

Ruth-Vermont.

This group is situated on Vermont creek, tributary of Vowell creek, which flows into Bobbie Burns creek, about 38 miles by rough road from Spillimacheen, on the Kootenay Central Railway. No development-work was done in the area during 1930, but the property was examined in June in connection with an application for assistance towards improving transportation. The property, consisting of some ten claims, of which the *Ruth*, *Charlotte*, and *Minnie* Crown-granted claims form the nucleus, is held by the Galena Syndicate, Limited, a private company incorporated in England and registered in British Columbia. The company's interests also include some five or six claims in the adjacent area and a group of five claims on McMurdo creek, but no appreciable activity has yet occurred in connection with them. H. G. Lockwood, barrister and solicitor, of Golden, is the local representative of the company.

Previous references to the *Ruth-Vermont* are contained in the Annual Reports for 1926, 1927, and 1929. The geology of the area, which lies some 28 miles north of the Windermere Map-area (Geological Survey of Canada, Memoir 148, by J. F. Walker), has not yet been mapped, but the north-westerly extension of the same rocks has been traced by Walker to Bobbie Burns creek (*see* Summary Report of the Geological Survey of Canada for 1925, Part A, "Reconnaissance in the Purcell Range West of Brisco, Kootenay District, B.C."). The presence of pebble conglomerates, presumably the Toby conglomerate, at no great distance from the *Ruth-Vermont* holdings, would indicate that the deposits occur in rocks of the Mount Nelson formation, a subdivision of the Upper Purcell series of late pre-Cambrian age. The country-rocks of the deposits are limestones, calcareous schists and shales, the beds being contorted, fractured, and considerably metamorphosed. No igneous intrusives were noted in the immediate vicinity, but granite, probably Jurassic, is reported to be exposed north of Vermont creek. The general strike of the formation is north-westerly, with varying dips to the south-west. The workings are situated on the precipitous mountain-slope, formed of rock bluffs and talus, on the southern side of Vermont creek, the camp being situated at an elevation of 5,500 feet above sea-level on a bench near the creek-level.

Exploration has been done on two distinct types of deposits, fissure-veins cutting the formation, and replacement mineralization. In regard to the first mentioned a considerable amount of preliminary development and prospecting work has been done on the series of small fissure-veins which, in general, parallel the strike of the formation, but dip to the south-west at steeper angles. These veins, varying in width from 3 to 30 inches, are mineralized with pyrite, galena, and sphalerite in a siliceous gangue. This ore in some cases contains low gold values and generally a small percentage of copper. No copper mineral was noted, but the comparatively high silver values may be due to the presence of a grey-copper mineral. Ore-shoots so far developed are short and their continuity in vertical extent has not yet been tested to any appreciable extent. Of this type are the Blacksmith and Pine Tree, on which most of the work has been done, the Mountain, Slide, West, and other similar small veins. The general strike of these fissures is from S. 50° to 60° E. (into the hill), with steep dips, up to 75°, to the south-west.

The Blacksmith vein, at the north-eastern extremity of the area examined, has been explored by three tunnels driven in from the abrupt mountain-side at elevations (aneroid) of approximately 6,185, 6,335, and 6,385 feet. These workings are known respectively as the Lower, Intermediate, and Upper Blacksmith tunnels. This last working, said to be 90 feet long, was blocked by snow at the time of the writer's examination in June. A grab sample from a pile of ore, roughly estimated at 30 tons, assayed: Gold, 0.12 oz. to the ton; silver, 23.1 oz. to the ton; lead, 21.6 per cent.; zinc, 10.4 per cent.

In the Intermediate tunnel, which has only been driven a short distance, the vein, varying in width from a streak to 5 inches, consists of oxidized quartz containing some grey copper associated with the iron, lead, and zinc sulphides. The Lower Blacksmith tunnel, about 140 feet long, has been driven along a narrow and somewhat indefinite vein for a length of 60 feet to where a cross-vein is encountered and a small stope has been opened up from a 45-foot raise. In the stope, which is about 20 feet long, the ore varied in width from 24 to 30 inches. In the back some oxidized decomposed material, containing a little galena, has been left, and at the south-eastern end of this working the ore apparently peters out. Going south-easterly along

the tunnel, beyond the raise, an unimportant stringer is followed to the face. Selected ore from the stope assayed: Gold, 0.07 oz. to the ton; silver, 65 oz. to the ton; lead, 27 per cent.; zinc, 13 per cent.

Below the Lower Blacksmith tunnel and at about 6,000 feet elevation the Old Timers tunnel has been driven to explore the downward continuation of the fissure-zone. This tunnel, driven many years ago, is chiefly a crosscut which for the first 150 feet goes south-easterly to where a sharp turn is made, and then south-westerly for some 235 feet. At the inner extremity of the crosscut a vein is cut and drifted on to the south-east for a short distance. In the stope, which extends above this drift for a length of about 30 feet and a height up to 20 feet above the level, the vein is well mineralized with galena and sphalerite over a width of from 4 to 12 inches. The strike here is N. 55° W. and dip 75° to the south-west. A grab sample from four sacks of ore from this stope assayed: Gold, 0.10 oz. to the ton; silver, 40.3 oz. to the ton; lead, 21.4 per cent.; zinc, 25.2 per cent. Going back 30 feet along the crosscut from this drift, a zone about 16 feet wide is cut which contains several north-westerly-striking quartz stringers mineralized chiefly with sphalerite. The stringers, up to 12 inches wide, dip at about 65° to the south-west and in strike parallel the last previously described vein in the stope. An 18-foot drift, run south-easterly to explore the stringer-zone, does not show any appreciable continuity in that direction. At other points on the Old Timers tunnel-level prospect-tunnels have been driven without making any further mineral discoveries.

A few hundred feet south-westerly from the portal of the Lower Blacksmith tunnel, and at approximately the same elevation, the Pine Tree vein has been explored by a drift 74 feet long. The dip and strike here are similar to the previously described veins. This quartz vein is well mineralized over short lengths and across widths up to 2 feet. A little stoping has been done on two ore-shoots, 10 and 20 feet long respectively. The two shoots are separated by a 20-foot section of vein which is mostly quartz. A grab sample of broken ore from the 20-foot shoot at the inner end of the tunnel assayed: Gold, 0.05 oz. to the ton; silver, 43.5 oz. to the ton; lead, 23.2 per cent.; zinc, 14.2 per cent. One or two other short tunnels are understood to have been driven to explore the same vein in the precipitous bluffs, but these were not seen.

Below the Upper Pine Tree tunnel are the workings on the "Nelson ore-body," which is a different type of deposit to those previously described. Two short tunnels, at elevations of 6,005 and 6,085 feet respectively, are connected by an inclined raise. The upper tunnel contains a short raise to a stope which connects with the surface. Together these workings develop a wide zone of mineralization, known as the replacement ore-body, which occurs in highly metamorphosed, pyritized, and silicified calcareous rocks. Fracturing and folding of the strata is much in evidence in the vicinity of the workings. The mineralization consists of the disseminated sulphides of iron, zinc, and lead, the iron and zinc apparently being the most abundant, though there are nice showings of galena in places. Owing to the precipitous character of the ground along the outcrop considerable time would be necessary to investigate the possible extent of the mineralization, and a large amount of sampling would be necessary to arrive at a fair average of the grade of the material. From the cursory examination made of the Nelson workings it seemed that the strongest mineralization occurs over widths up to 13 feet on and above the upper tunnel-level, where a little stoping has been done for a length of 25 feet. Assays of samples quoted in a mining engineer's report, made available to the writer, show good milling values starting at 15 feet from the portal to the face over widths of 12 feet in the stoped area and 6½ feet in the tunnel beyond. In the raise below the working just described the mineralization seems scattered and indefinite. The lower tunnel, about 80 feet long, is mostly in argillaceous rocks in the foot-wall country, which, however, contain some quartz stringers mineralized with pyrite and sphalerite.

A shipment of sorted ore was made early in 1930 by C. W. Riley, of Golden, then in charge of the property. Several hundred sacks of similar ore remain at the mine, a grab sample from which assayed: Gold, 0.10 oz. to the ton; silver, 51.6 oz. to the ton; lead, 30.2 per cent.; zinc, 17 per cent.

The high cost of mining and sorting such ore from small, widely separated shoots in the fissure-vein workings and the long expensive haul to the railway would preclude the possibility of shipping at a profit even with much better metal prices and transportation conditions. The future of the property would seem to depend on the possibility of developing a large tonnage warranting milling and other equipment for production.

The writer was accompanied by S. D. H. Pope, Assistant District Engineer of Public Works at Golden, who subsequently made a comprehensive report on transportation conditions to his Department. This will be available for reference in the event of resumption of exploratory activity in the area. The report is of interest in connection with the whole area embracing the Spillimacheen river, Bobbie Burns creek, and their tributaries, now reached by three routes starting respectively from Parsons, Carbonate Landing, and Spillimacheen, on the Columbia river.

Quartz Creek.* This property, owned by N. T. Edwards, Sam Indebrigsten, T. Edwards, *et al.*, of Revelstoke, consists of the *Fata Morgana*, *Dominion*, *Manitoba*, and *Amanada* claims. They are located at the head of Porcupine creek, the left tributary of Quartz creek, and are served by a 16½-mile trail from Beavermouth, a small station on the main line of the Canadian Pacific Railway. An interesting sight near the junction of Quartz and Porcupine creeks is the now abandoned and desolate placer-mining camp, established presumably about the year 1865 by men on their way into the Big Bend placer mines.

The *Fata Morgana* group is located on an outcrop of quartz which contains disseminated through it small quantities of malachite, chalcopyrite, and pyrite. The work to date consists of a few open-cuts at elevation of 7,050 feet, and exposes a large ledge of quartz occurring in quartzites.

In the uppermost open-cut the mineralized quartz would appear to strike N. 70° W., with a dip 55° to the north, and has about 10 to 12 feet of its width definitely exposed. A sample of selected ore from this open-cut assayed 1.41 per cent. copper. In a second open-cut, about 50 feet to the east and at 40 feet lower altitude, a channel sample across a width of 100 inches of copper-stained quartz assayed: Gold, 0.02 oz. to the ton; silver, 0.4 oz. to the ton; copper, 0.57 per cent. The outcrops are loose-looking and indefinite in character, though it is understood that a limited amount of trenching since the property was examined has proved them solid bed-rock and not slide material as might have been thought.

Zinc Mountain.* During 1930 the Zinc Mountain Mining Company, Limited, of Calgary, Alta., under F. Henderson, president, spent considerable time and money in prospecting claims located on the north-west side of Moose creek in the vicinity of Zinc mountain. When the property was visited late in August four men were employed, with D. McLeod as foreman.

This property, consisting of twenty-three claims held by location and assessment-work, is 10½ miles in an easterly direction from Leanchoil, a small station on the Canadian Pacific Railway west of Field. However, the route taken to the property is about 27 miles in length, the first 12 miles from Leanchoil to Ice River Cabin being over a rough wagon-road, and the remaining distance following the old Kootenay trail up the Beaverfoot river to Moose creek and thence northward to the tent camp on Moose creek at 5,900 feet elevation, directly east of Mount Helmet and the Washmawapta snow-field.

The development-work has been done on a small showing of blende, pyrrhotite, chalcopyrite, and galena, which occurs in limestone and calcareous shales in close proximity to a series of basic dykes, the area being located close to the contact of the limestone with rocks classified by J. A. Allan, in Memoir No. 55, Geological Survey of Canada, as transition members of the igneous complex outcropping in the Ice River and Moose Creek area.

Two short tunnels and several open-cuts at 7,000 feet elevation constitute the development-work to date. The No. 1 tunnel at 6,950 feet elevation is 30 feet long and runs N. 70° W. At the present portal and on the left wall a lens of pyrrhotite, blende, and galena averaging possibly 1.8 to 2 feet in width, conforming with the strike (N. 50° to 80° W.) and dip (35° to S.W.) of the limestone and shale, has been uncovered. The lens is about 15 feet long, its northern end terminating on a fault-slip (N. 75° E.), the ore apparently following along this slip to the upper right-hand wall of the tunnel portal, where minor amounts of galena were noted in association with a basic biotite-porphyry dyke. The ore from this level, amounting to 20 tons in all, was piled at the portal of the tunnel and a careful sample representing the dump assayed: Gold, 0.06 oz. to the ton; silver, 7.2 oz. to the ton; lead, 12.3 per cent.; zinc, 15.7 per cent.; copper, 3.26 per cent.

The No. 2 or lower tunnel at 6,900 feet elevation is 126 feet long, and starting at a point 50 feet below and 55 feet S. 23° E. from the No. 1 tunnel portal it runs N. 36° W. for 35 feet and thence west 63 feet to the face. From a point 40 feet from this face a 28-foot crosscut has

been driven north. A small bunchy occurrence of ore on the left wall 20 feet from the face of the main tunnel is the only mineralization on this level. A basic dyke similar to the one developed on No. 1 level appears along the right wall of the main tunnel near the face.

At the time of examination the crew was engaged in stripping the 15-foot lens in the upper tunnel. More recent reports from the property, however, indicate that development-work has been suspended indefinitely.

Minor activity has been reported from the vicinity of Donald, where Metro Chotobar has continued prospecting his placer claims located a short distance west of the Columbia river.

WINDERMERE MINING DIVISION.

Mining in general has declined in this Division and the cessation of work at the *Paradise*, operated continuously for many years, has been a severe blow to the camp. The Windermere Mining Division comprises a large area to the west and east of the Columbia river, of which the only portions covered by geological publications are the "Windermere Map-area," Geological Survey of Canada, Memoir 148, and the area northerly from the Windermere sheet contained in Summary Report of the Geological Survey for 1925, Part A, under the title of "Reconnaissance in the Purcell Range West of Brisco, Kootenay District, B.C." However, these two publications cover the economic geology of most of the known mineral-deposits and are the basis from which the general geology of the northerly section of the Purcell range can be deduced.

The *Albion* group, where interesting new discoveries of zinc-lead ore have been made, described hereunder in the body of the report, and situated on Hawk creek, in Kootenay National Park, is located in a geologically unmapped area near the north-eastern boundary of the Division. The limestone country-rock to the deposits has been assumed to be a member of the belt of Middle Cambrian rocks which are shown on Map No. 142A, issued with Geological Survey of Canada, Memoir 55, "Geology of Field Map-area," as extending south-easterly from the *Monarch* deposits. Although the two occurrences are very widely separated, interesting prospecting possibilities are indicated for the mineral-belt containing them and in which, at other points, float-ore of similar character is reported to have been found in the past. This is also alluded to under Golden Mining Division.

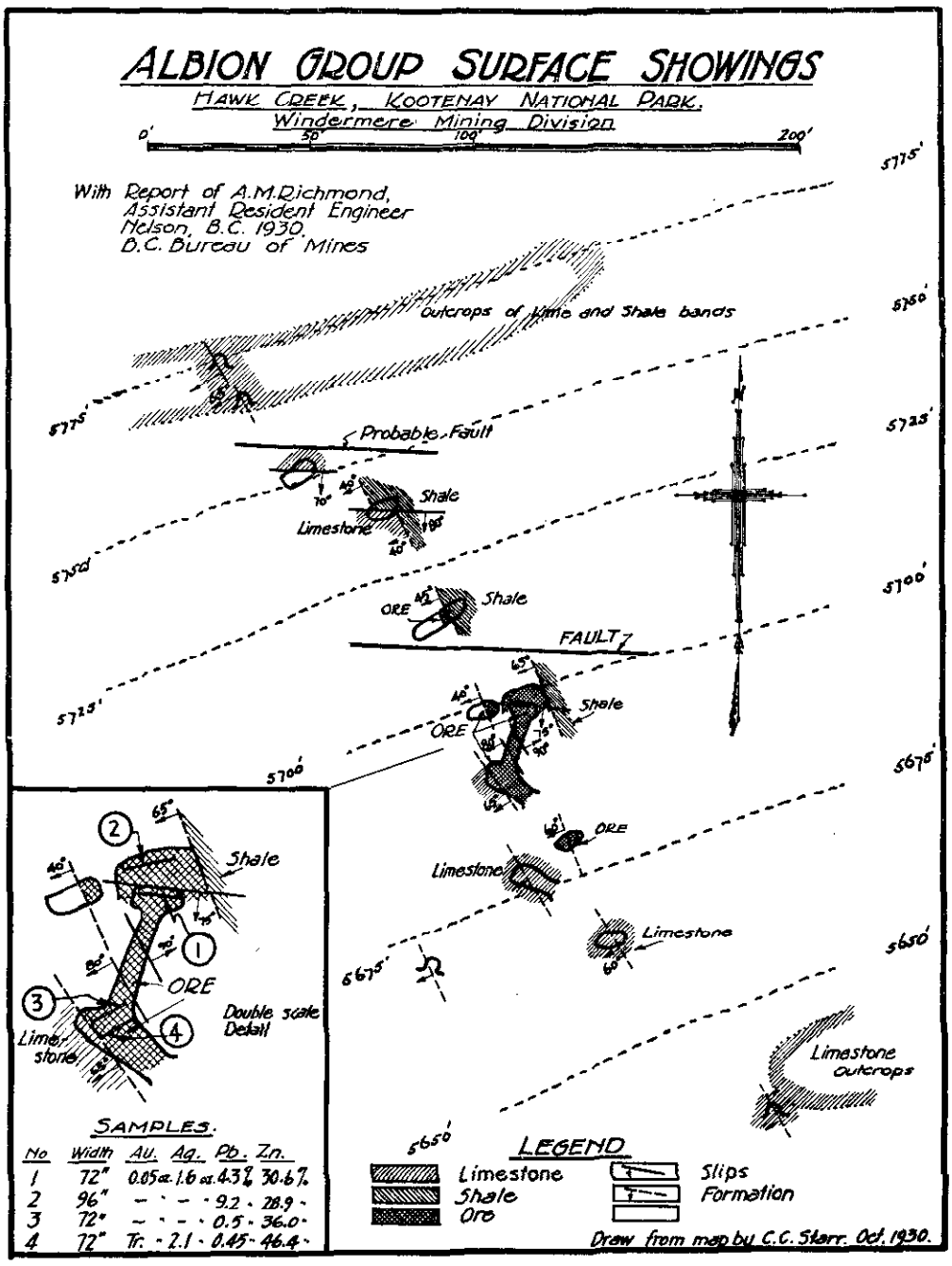
Mineral King. This silver-lead-zinc prospect is situated at 5,700 feet elevation on the Toby slope of the ridge between Toby and Jumbo creeks and is reached by trail from the end of the Toby Creek road, 24 miles from the Kootenay Central Railway. A small crew of men was employed during the summer months in driving a crosscut tunnel to test the westerly extension of the vein at depth. This work was financed by interests represented by F. R. Eichelberger, of Field. References to the property are contained in the Annual Reports for 1920, 1921, and 1922, and in Geological Survey of Canada, Memoir 148.

Outlook. This silver-lead-zinc prospect, situated on the southern side of Delphine creek, about 1 mile by trail from the 25-Mile camp, is owned by the Kootenay Metals Corporation, of Bellingham, Wash., of which W. J. Dols is secretary. A brief description of the property is contained in the Annual Report for 1924 under *Outcrop* and *Outlet*. Prospecting-work has been carried on at intervals since 1928, when the *Outlook* group was acquired by the above company. During the past season exploratory work done included the driving of some 50 feet of tunnel and considerable surface work.

Minor prospecting activities have been reported from the *White Cat* on Slade creek, owned by J. C. Pitts, of Invermere; from the *Bald Eagle* on Slade creek, owned by J. Burman, of Athalmer; and the *Silver Spray* on Coppercrown creek, owned by M. McLeod, of Invermere.

Albion.* During the construction of a trail in Kootenay National Park, one of the men, F. W. Jowett by name, discovered a boulder of lead-zinc float. This discovery he buried and on completion of the trail returned with his partner, Ed. Morigeau, of Athalmer, and after a short search the two men discovered lead-zinc mineralization in place about 600 feet up the hill from the place where the float had first been found. Six full claims, *Albion No. 1* to *Albion No. 6*, inclusive, were staked and recorded at Wilmer, subject to the approval of the Federal Parks Board. The claims, located 1½ miles east of the Banff–Windermere highway on the north side of Hawk creek, are best reached by 24 miles of motoring south over the highway from Castle Mountain, a small station on the main line of the Canadian Pacific Railway, near the Alberta-British Columbia boundary.

When the showings were examined in August, 1930, but a limited amount of surface-trenching had indicated a width of 12 to 14 feet of zinc-lead replacement mineralization in grey limestone. The general strike of the limestone and banded shale country-rock formation is N. 25° to 30° W. and with a dip of 40° to 60° to the south-west. Two open-cuts which are indicated in the detailed sketch with this report had disclosed neither wall of the mineralization, but gave the impression rather that a width of 20 to 25 feet of good zinc ore might readily be disclosed by a trench joining the two cuts. Subsequently this work was accomplished and the continuity of width in the ore demonstrated. This latter work, which is all shown in the



sketch-map, has also indicated the probable presence of faulting to the north of the main showings. The early heavy fall of snow in October prevented necessary trenching to the south-east of the best open-cuts and due to this cause the small crew of men was withdrawn for the winter months.

A few samples were taken and are given here to indicate the grade of mineralization and widths. Channel sample No. 1, over a width of 72 inches in the upper open-cut, assayed as follows: Gold, 0.05 oz. to the ton; silver, 1.6 oz. to the ton; lead, 4.3 per cent.; zinc, 30.3 per cent. A check sample over a width of 96 inches in the same open-cut taken by an independent and reliable engineer assayed: Lead, 9.2 per cent.; zinc, 28.9 per cent. Sample No. 3, taken across 72 inches in the lower and adjacent open-cut, assayed: Lead, 0.5 per cent.; zinc, 36 per cent. Sample No. 4, taken by Resident Engineer B. T. O'Grady across a width of 72 inches in the same open-cut, assayed: Gold, trace; silver, 2.1 oz. to the ton; lead, 0.45 per cent.; zinc, 46.4 per cent. The subsequent trenching between the two open-cuts mentioned has disclosed ore of equally good grade.

The predominant mineral, zinc-blende, has a resinous lustre, varies from dark brown to amber in colour, and occurs in almost cryptocrystalline form in the limestone. The galena is found in small aggregates scattered through the zinc.

In its present state the showings are of considerable merit (with an increased market value for zinc) and would warrant the expenditure of an appreciable amount of money for further surface-trenching, diamond-drilling, etc., if permission for this work can be obtained from the Dominion Parks Board. This discovery is also extremely interesting from a wider view-point, in that the area between Hawk creek and the *Monarch* at Field is at once brought into mind as a possible area for the finding of further mineralization of this type. The rocks of the two camps are of somewhat similar characteristics and a glance at Map 142A, which accompanies the Geological Survey of Canada report on the "Field Map-area," Memoir No. 55, by J. A. Allan, would indicate a zone of interesting prospecting possibilities.

Following the examination in August several parties became interested and the property was finally secured under option and bond by an Eastern Canadian mining company which is already interested in this section of British Columbia. A small crew of men was employed and the results of the work accomplished before snowfall are shown in full on the accompanying map, kindly furnished by the operators' geologist.

FORT STEELE MINING DIVISION.

Located in the south-eastern corner of No. 5 District, this Division is chiefly noted for its great production of silver-lead-zinc ores from the *Sullivan* mine and for the coalfields adjacent to the Crowsnest Pass branch of the Canadian Pacific Railway. Information relating to the latter deposits is contained in the reports of the Inspectors of Mines. Data published by the Geological Survey of Canada covering portions of the Fort Steele Division include: Memoir 76, "Geology of the Cranbrook Map-area," by Stuart J. Schofield; Memoir 69, "Coal Fields of British Columbia," compiled by D. B. Dowling; Memoir 87, "Geology of a Portion of the Flathead Coal Area," by J. D. McKenzie; "Relationship of the Pre-Cambrian (Beltian) Terrain to the Lower Cambrian Strata of South-eastern British Columbia," by S. J. Schofield; Memoir 38, "North American Cordillera, Forty-ninth Parallel," by R. A. Daly.

Memoir 76, referred to above and published in 1915, covered the economic geology of a large number of metallic deposits in the area tributary to Cranbrook, including the principal silver-lead-zinc mines. With the exception of the great new developments since made at the *Sullivan* mine, the situation is not materially changed and no very important new discoveries have been made. However, the limited prospecting activity which has since occurred in this section has mostly been confined to existing prospects and no comprehensive systematic exploration of the promising mineral-belts has been undertaken. The following remarks under "Future of the Silver-lead Deposits" (Memoir 76) would therefore still apply: "The mineralized silver-lead zones are generally associated with the Aldridge argillaceous quartzites, as if these quartzites were favourable for the deposition of silver-lead ores. If this be true, the Cranbrook area, being underlain for most part by the Aldridge formation, offers a wide field for prospecting-work." On page 113 of the same publication the author contributes an interesting comparison of the silver-lead-zinc deposits of East Kootenay with those of the Coeur d'Alenes in Idaho.

Sullivan. This well-known mine of the Consolidated Mining and Smelting Company of Canada, Limited, at Kimberley is the source of the bulk of District No. 5 production of silver, lead, and zinc. As the character and geology of this unique deposit, the history of the property, mining conditions, and the 6,000-ton concentrator have been exhaustively dealt with in the technical press and in past Annual Reports, only a few notes relating to new developments will now be submitted.

In the mine new sections of the ore-body have been opened up and measurable ore reserves have been proportionately increased. Development-work done during 1930 includes 12,340 feet of diamond-drilling and 9,466 feet of drifting, raising, and crosscutting. Preparations for putting down a winze below the main haulage (or 3,900-foot) level are well advanced and at the time of writing an early start on sinking operations is expected. The winze, to be driven on the foot-wall plane of the ore-body on its average dip as proved by previous diamond-drilling, will probably eventually be connected to a vertical shaft of large dimensions, out of which all the ore mined in the workings opened up below the 3,900-foot level could be hoisted. A possible site in view for such a shaft is favourably located some distance south-easterly from the adit-level workings in a marked depression, where the elevation of the collar of the shaft would approximate that of the present main haulage-level. With regard to the problem of eventually withdrawing the ore left in huge pillars, recent progress is described by H. E. Miard in the section of this publication devoted to the reports of the Inspectors of Mines.

In connection with the coarse-crushing plant at the mine, additional sorting equipment was installed and a dust-collecting system placed in operation. The enlargement of the concentrator to treat 6,000 tons a day, comprising extensions to the entire plant as described in the Annual Report for 1929, was finally completed early in the year. Operation of the concentrator was carried on practically continuously throughout the year and a total amount of 1,910,949 tons was milled. This represents an increase of 151,073 tons over 1929. Shipments were maintained as usual, with an increase in lead and a slight decrease in zinc production. There was also a slight improvement in the grade of both products. The installation in the grinding-circuit of two Genter thickeners enables the plant not only to grind and classify at an optimum density, but also to float at an optimum density, resulting in an improvement in classification and subsequent metallurgy.

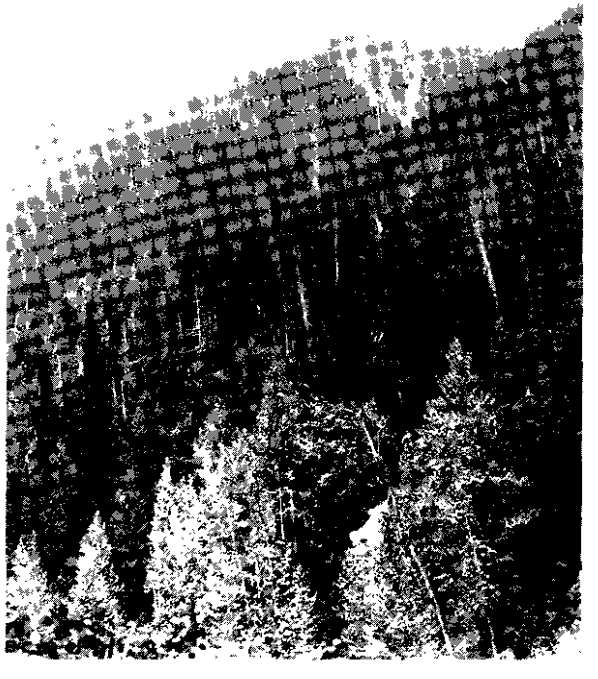
The remarkably low working-costs which have been achieved in mining and milling and the increased lead production recorded have helped materially to offset the abnormally low metal prices. As the Consolidated Mining and Smelting Company conducts all operations, from extracting the ore to producing the refined metals, and makes most of its own machinery, it benefits by all profits of its operation and is able to work the *Sullivan* under the best possible conditions. E. G. Montgomery is general superintendent; W. Lindsay, mine superintendent; C. T. Oughtred, superintendent of concentration.

Aurora.* No further development-work has been reported during 1930 from this property, situated west of the *St. Eugene*, on the opposite shore of Moyie lake. Plans formed in 1929 for the unwatering of the *St. Eugene* shaft have been abandoned for the time at least. Past references to the *Aurora* may be found in the Annual Reports for 1923 and 1926.

Kootenay King.* No further development or exploration work was done in 1930 by the Kootenay King Mining Company on its Wild Horse Creek property, formerly under option to the Britannia Mining and Smelting Company, Limited. Past detailed references to this property are contained in the Annual Reports for 1925, 1928, and 1929.

Kootenay Selkirk.* Development-work at this property, situated at 7,000 feet elevation in Grundy basin, 8 miles north-east of Fort Steele, was discontinued early in the year, and though it was intended to proceed with development trenching and tunnelling in the summer months, no activity has been reported. It has been intimated by the interested parties in Cranbrook that market conditions did not justify further work at the present time on their narrow quartz vein in quartzite close to a diorite-contact. Mineralization occurs as small lenses of galena in the quartz. A description of the property appears in the Annual Report for 1929. P. A. McGrath, of Cranbrook, is manager of the company, the **Kootenay Selkirk Mining Company.**

Utica Mine, Ainsworth M.D.



Snowflake Mine, Revelstoke M.D.

Kicking Horse Mine, Golden M.D.

Monarch Mine Tram, Golden M.D.

*Moyie River Mining and Development Co.**—No activity in 1930 has been reported from this property, situated at the forks of Moyie river and Ridgway creek, about 12 miles south-west of Lumberton. A report on the property is contained in the 1929 Annual Report.

Coronado.* This group, comprising the *Coronado*, *Reno*, and *Reno Fraction* claims, is situated near the headwaters of the East fork of Wild Horse creek, some 16 miles by road and trail from Fort Steele. A car can be driven 10 miles north-east from the latter place to the old *Dardanelles* arrastra on Wild Horse creek, from which place the main North Fork trail is taken for 2 miles up-stream. Crossing the creek, a steep trail 4 miles long is traversed to the *Coronado* camp at 7,000 feet elevation. J. C. Reynolds and Emil Banks are the owners of the property.

The formation in the vicinity of the workings consists chiefly of bedded limestone underlain by comparatively thin beds of quartzites and shale. Above the limestone and along the inaccessible bluffs which rise to the south-east of the showings igneous intrusives outcrop, judging by the large amount of float on the talus-slopes of these bluffs.

The ore-minerals consist principally of malachite, chalcopyrite, chalcocite, and pyrite, with small amounts of associated gold and silver in a gangue of limestone. The workings consist of three or four outcrop trenches and a 50-foot crosscut tunnel.

The 50-foot tunnel at 7,000 feet elevation is driven in a S. 30° W. direction across flat-dipping limestone-beds. The lime formation strikes N. 45° to 50° E. and dips to the south-east at 15° to 20°. On the left wall of the tunnel portal, and principally in a small open-cut a few feet from the portal, mineralization of the limestone with copper carbonates has been exposed. A channel sample at the portal of this tunnel across a width of 72 inches normal to the dip of the limestone-bands assayed: Gold, 0.03 oz. to the ton; silver, 0.3 oz. to the ton; copper, 0.13 per cent.

Approximately 200 feet south-east from the tunnel portal and at 7,150 feet elevation a large irregular L-shaped open-cut has exposed the best surface showing on the property. The upright section of the L varies from 10 feet wide at the top to 6 feet wide at its junction with the horizontal branch of the cut, which has an average width of 4 to 5 feet. Both arms of the L-shaped cut are about 15 to 17 feet long. Over this irregular area, which would represent a thickness of 12 to 13 feet on the dip of the limestone-beds, copper carbonate (malachite) is well developed, in association with small amounts of tetrahedrite and pyrite. A large sample obtained by chipping the entire exposure assayed: Gold, 0.03 oz. to the ton; silver, 2.3 oz. to the ton; lead, 0.2 per cent.; zinc, trace; copper, 1.34 per cent. At the north end of the horizontal limb of this cut the copper mineralization terminates against a strong outcrop of pyrite.

Two other prospect-trenches approximately 100 and 250 feet to the north-east of this L-shaped trench, containing small amounts of copper mineralization, have been opened up, but give little additional information.

The owners have built a substantial log cabin on the opposite side of the valley from the showings and have spent a considerable amount of their time in improving the trail from Wild Horse creek to the property.

Boy Scout. This group, consisting of nine claims, of which four are Crown-granted, is situated on Hellroaring creek, some 5 miles by trail from the wagon-road at St. Mary lake, the mine camp being about 2,000 feet in elevation above the lake. The property is largely owned by A. H. Mayland, of Calgary, who has financed the work done in recent years. The workings are situated on the steep wooded hillside on the eastern side of the valley. According to Map 147A, accompanying Geological Survey of Canada, Memoir 76, the rocks of the area belong to the Aldridge formation. The ore, consisting of finely crystalline lead, zinc, and iron sulphides, occurs in a wide zone of shearing, in quartzite and argillaceous rocks, which strikes south-easterly (into the hill) and dips from 50° to 60° to the south-west.

The principal workings developing the shear-zone are three tunnels at approximate elevations (aneroid) of 5,410, 5,300, and 5,100 feet above sea-level. The upper or No. 1 tunnel, about 160 feet long, is driven along the general direction of the lead from where the original discovery was made. At the portal a wide exposure of rusty-weathering, argillaceous quartzite contains narrow bands of silicified rock and quartz mineralized with lead and iron sulphides. The greater part of the tunnel lies on the hanging-wall side of the lead, where no definite mineralization is in evidence, but towards the inner end a turn is made towards the foot-wall side exposing a

3-foot width of ore which assayed: Gold, 0.02 oz. to the ton; silver, 1.40 oz. to the ton; lead, 10.8 per cent.; zinc, 4.4 per cent. This showing, the full width of which is not yet exposed, is of a more definite character than the mineralization at the portal and gives promise of more continuity, the sulphides being uniformly distributed throughout a quartzite gangue. In this inner showing the mineralization apparently conforms with the bedding of the country-rock, which strikes about S. 50° E. and dips at 58° to the south-west. The face of this tunnel is estimated to be about 100 feet below the surface. The No. 2 tunnel, in a little over 300 feet, is also driven in a general south-easterly direction, but lies for the most part in the softer argillaceous rocks on the foot-wall side of the lead. From this tunnel three short crosscuts have been made to the south-west, or hanging-wall side. The first two crosscuts cut widths of from 4 to 5 feet of quartz interbanded with country-rock, with which some disseminated sulphides and streaks of oxidized material are associated. The third crosscut, about 75 feet back from the face of the main tunnel, exposes a width of 6 feet of strong mineralization in which galena is uniformly distributed. The lower or No. 3 tunnel has been driven for a length of over 700 feet. At about 400 feet in from the portal a wide zone of scattered galena and pyrite mineralization, associated with quartzose phases of the country-rock, was encountered. Some crosscutting at this point shows the mineralized zone is from 20 to 25 feet wide. At about 700 feet in from the portal crosscuts have been driven on both sides of the main tunnel to further explore the extent and character of the mineralization. The crosscut to the north-east had been driven 70 feet and the crosscut to the south-west was in 50 feet when the property was visited in June. A careful examination of the lower level was difficult at that time owing to the very wet condition of these workings. Selected ore derived from the lower tunnel assayed: Gold, 0.32 oz. to the ton; silver, 4.90 oz. to the ton; lead, 8 per cent.; zinc, 4.8 per cent. The general impression gained was that the strongest and most uniform mineralization seen was that already referred to at or near the inner extremities of the two upper tunnels, which appear to be entering a favourable zone of deposition.

Work done during the 1930 season included some 250 feet of tunnelling on the lower level, a 2-drill Ingersoll-Rand gas-driven compressor being in use. Mining was discontinued in September.

In January, 1930, the Cranberra Mines, Limited (N.P.L.), a private company, was incorporated to take over the *Boy Scout* group. A. H. Mayland, of Calgary, is president and Harold Bennett, of Cranbrook, is his agent.

Homestake. Situated on the north-western side of Perry creek, about 17 miles by road and trail from the Cranbrook–Kimberley highway, this property is owned by the Cranbrook Gold Mining Company. A brief inspection was made late in the season, but snow prevented any examination of the surface workings. Numerous references to the *Homestake* are contained in past Annual Reports, the most comprehensive descriptions of the Perry Creek quartz veins being contained in the Annual Report for 1898 and Geological Survey of Canada, Memoir 76. These publications also contain information regarding past placer-mining operations in the same area.

A series of parallel quartz veins, very persistent in length, and in some cases very wide, strike parallel with the enclosing argillaceous quartzites and schists of the Creston formation. In the vicinity of the *Homestake* the strike of these rocks is north-easterly and south-westerly. The deposits have been described as true fissure-veins, the associated minerals being free gold, pyrite, and quartz. For many years differences of opinion have existed concerning the average gold content of these quartz veins, and in this connection the situation is still much the same as suggested in the Annual Report for 1898, in which certain inconclusive mill tests are described. If any large-scale systematic sampling has ever been undertaken, which is doubtful, no information concerning the results have ever been published. Such sampling as is known to have been done has been very limited in scope. An analysis of the available data shows a very unequal distribution of gold, the best values having been obtained over narrow widths in the superficial zone, where local concentration of gold may have occurred from oxidation of pyrite. Future exploration might well be directed to prospecting the outcrop of the veins with a view to locating, if possible, favourable geological areas where mineralization has been sufficiently concentrated to form ore-bodies of workable size and grade. Work done during 1930 includes retimbering of the old tunnel and about 40 feet of drifting in the Scorgie tunnel.

South-westerly from the *Homestake* and farther up the creek, a little work was done on the McIntosh prospect.

Bird Prospect. Bird Bros., of Cranbrook, put in several months prospecting their gold-quartz property adjoining the Perry Creek wagon-road, about 8 miles north-easterly from the *Homestake*. The workings are believed to be located on the extension of the same vein system.

Running Wolf. Late in the fall some activity developed in connection with this property on French creek, a tributary of Perry creek from the south. Considerable work was done in past years on some wide quartz veins. This prospect is mentioned by Schofield in Geological Survey of Canada, Memoir 76. Malcolm Horie and associates, of Cranbrook, have been reconditioning the old tunnels and sampling the gold-quartz veins.

B. and V. This prospect, situated south-westerly from Cranbrook and reached by road some 6 miles in length, is owned by A. Van Arsdalen and B. Frisinia, of Cranbrook. Since the reference to the property made in the Annual Report for 1929 a short adit-tunnel has been driven to connect with the bottom of the shaft. Summarizing conditions, the area covers a low rounded ridge and is underlain by quartzites of the Aldridge formation, containing sills of igneous rock, probably related to the Purcell sills. The whole series strikes northerly to north-westerly and dips flatly to the east. Cutting the formation in an easterly-westerly direction are numerous narrow quartz veins which, in places, carry irregular bunches of galena, and occasionally sphalerite, associated with pyrite and pyrrhotite. These veins dip steeply to the south, approximating the vertical in some cases. The other type of deposit consists of indefinite scattered mineralization with galena and pyrite in the sill-rocks and adjoining quartzites where they are cut by the quartz veins. The principal working is a 30-foot shaft, at the bottom of which an 84-foot tunnel connects with the surface. The tunnel, driven easterly along a quartz vein, crosscuts a quartzite-sill contact. The quartz vein, up to 30 inches wide at the portal, where it is well mineralized with pyrrhotite and some galena, splits into stringers in the face of the tunnel just beyond the shaft. The quartzite and sill-rocks are irregularly mineralized with scattered disseminations of galena.

Over the area of thirteen claims comprising the property a considerable amount of prospecting has been accomplished by open-cuts and shallow shafts. No definite results had been obtained at the time of the writer's visit in the late fall. The widespread, irregular mineralization would suggest that commercial concentrations of ore may be found in the quartzites of the adjacent area.

Empire and Strathcona. This copper prospect is situated on Sand creek, about 4 miles by road from Galloway Siding on the Canadian Pacific Railway, 26 miles west of Fernie. These two Crown-granted claims, owned by the S. Steele Estate, have been under lease and bond to P. V. Parkes, of Lethbridge, who is understood to have formed the Park City Mining Company under a Dominion charter. The company is not registered in British Columbia. A small crew of men was employed on development-work during the early part of the year. The workings are situated on the steep side-hill above the camp at the end of the road. On account of the overburden it is difficult to form any definite idea of the geological structure of the formation, which in the vicinity of the workings consists of dark schists and shales, striking north-westerly and dipping steeply to the south-west. Apparently conforming in dip and strike with these rocks a wide iron-stained ledge has been explored by five prospect-tunnels and a number of open-cuts.

The deposits consist of chalcopyrite, associated with pyrrhotite and arsenopyrite, occurring as scattered stringers and disseminations in a gangue largely composed of siderite and some quartz. An analysis of a composite sample of selected material was as follows: Gold, 0.02 oz. to the ton; silver, 1.3 oz. to the ton; copper, 1.21 per cent.; iron, 36.91 per cent.; alumina, 6.57 per cent.; lime, 1.62 per cent.; magnesia, 4.71 per cent.; silica, 8.90 per cent.; sulphur, 6.81 per cent.; arsenic, 2.93 per cent.; antimony, 2.21 per cent.; manganese, 1.57 per cent.; loss on ignition, 20.89 per cent.

The principal working, No. 4 tunnel, is located at about 4,100 feet elevation or about 1,000 feet above the camp. This has been driven as a crosscut 200 feet to where a winze has been sunk 37 feet on the lead, which here is very wide and contains a large amount of massive siderite with some quartz. In this matrix chalcopyrite and its oxidation products are sparsely dissemi-

nated. A sample across 6 feet near the bottom of the winze assayed: Gold and silver, *nil;* copper, trace. A similar assay was obtained from a sample across 7 feet in a small stope above the level. These were disappointing as the lead is quite impressive-looking, and although the distribution of the copper sulphide is very irregular it was hoped that there might be some gold or silver present. Above this working short tunnels have been driven into the lead at approximate elevations of 4,300, 4,450, 4,600, and 4,800 feet. The 42-foot tunnel at 4,300 feet elevation has just struck the lead in the face. Going up the hill, the next two tunnels, apparently quite short, are temporarily inaccessible for caving at the portal. The No. 1 tunnel, at 4,800 feet elevation, is a curving drift in the lead which in places contains stringers and disseminations of chalcopyrite, with copper-carbonate stains. The gangue is similar to the showings in No. 4 tunnel, massive siderite predominating. A sample across 5 feet in the face gave: Gold and silver, traces; copper, 0.4 per cent.

The lower or No. 4 tunnel is connected with ore-bins at the camp by a surface tram 1,900 feet long, rising on a 35° pitch. It is built of 4- by 4-inch wooden rails, has three rails with a passing in the centre, and is a gravity-tram controlled by a drum at the top. J. D. Simmons, of Elko, has been in charge of the work.

Peacock Copper.* This property, comprising thirty-two mineral claims in all, is situated 1.5 miles in a north-easterly direction by road from Galloway, a small station 26 miles west of Fernie, on the Crowsnest branch of the Canadian Pacific Railway. The ground was acquired in May, 1930, from Joseph D. Simmons, of Elko, James H. Walker, *et al.*, by the Peacock Copper Company, Limited, by terms of an agreement whereby the vendors received 220,000 shares of the company stock for their holdings. The company, incorporated in February, 1930, is capitalized for $200,000, divided into 400,000 shares of 50 cents par value stock.

The limited amount of development-work at this property has been done on the *Mona No. 1*, situated close to the high-tension power-line of the East Kootenay Power Company, and consists of two shafts 18 and 105 feet deep respectively, a small horizontal stope connecting the bottom of the short shaft with the second shaft and several shallow open-cuts along the strike of the vein (N. 40° W.). The 18-foot shaft was sunk at an angle of 56° to the south-west on a narrow vein of quartz containing copper carbonates, principally malachite, and minor amounts of chalcopyrite, pyrite, etc. The vein, which varies from 1 or 2 to 10 inches in width in the depth of the 105-foot shaft, occurs in blue and greyish limestone. At a depth of 15 feet a small replacement ore-body of chalcopyrite containing small gold and silver values was found in the hanging-wall side of the vein. With this discovery a second shaft was started 20 feet to the south-east and sunk 105 feet on the vein at an average dip of 55° to the south-west. The small flat-lying replacement ore-body of chalcopyrite at 15 feet depth was mined from this shaft, the resultant stope covering an area of approximately 20 by 10 feet, with an average excavated thickness of 1.8 to 2 feet. Approximately 35 to 40 tons might have been mined from the existing stoped area, the small ore-lens pinching out as it receded from the main vein feeding it.

No further discoveries were made in the 105-foot shaft. The bottom of this shaft, which is filled with water, could not be examined, but the writer was informed that the vein, which is persistent down to the water, had widened out to about 10 to 12 inches at the bottom of the shaft, though not with any perceptible increase in mineralization, which at this depth consists of minor amounts of chalcopyrite and pyrite in the quartz gangue.

A substantial log-cabin camp has been erected at the property by the owner.

Phosphate.

Exploratory work by the Consolidated Mining and Smelting Company of Canada to prove the phosphate-deposits in the eastern section of the Fort Steele Mining Division has been aggressively continued. Considerable prospecting-work has been done at numerous points covering a large area along the trend of the phosphoria-beds from near the International boundary to the head of the Elk river. Mining operations have chiefly been concentrated at the *Lizard*, *Crow*, and *Marten* properties.

Lizard.—Work was suspended at this Lizard Creek property, near Fernie, early in the spring when sufficient information had been obtained in this locality. The compressor equipment was moved to the *Crow* mine and the camp was closed.

Crow. This mine is situated about three-quarters of a mile northerly from the railway at a point some 2 miles north-west of Crowsnest Station. At 4,600 feet elevation a crosscut 250 feet in length has been driven to cut the phosphate-beds, on which 2,800 feet of drifting was done. A raise on an average slope of about 20° has been driven 800 feet to explore a thick section of phosphate which has a length of about 400 feet along the main drift. Similar thick sections are developed in other portions of the drift. Towards the end of the year a ventilating-raise 400 feet long was put through to the surface from the drift-workings. The mining equipment includes two 9- by 8-inch Ingersoll-Rand portable gas-driven compressors. The camp buildings afford comfortable accommodation for the men and an office building has been provided for the staff. C. White is engineer in immediate charge of this operation and R. Rowe is mine foreman.

Marten. At this mine, which adjoins the Eastern British Columbia Railway at a point about 5½ miles south of McGillivray Station, operations were started in the fall and exploration was in an early stage when the property was visited early in November. Rapid progress is reported to have been made since then. At 4,400 feet elevation No. 1 tunnel, the principal working, is a crosscut 20 feet long to the phosphate-bed, along which a drift was extended 200 feet at the end of the year. Two shallow incline shafts and two short prospect-tunnels were also driven to explore the outcrop of the bed in the vicinity. Mining equipment includes a 6- by 8-inch Ingersoll-Rand compressor. Temporary living-quarters, consisting of tents with board floors and walls, have been provided. L. J. Doyle is mine foreman.

In addition to the above-described mining operations, parties were at work throughout the summer on Line creek and at the head of Alexander creek, systematically prospecting the phosphoria-beds. The work done included numerous open-cuts, five short tunnels, and thirteen shallow shafts. With regard to exploration in general, the work in progress 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 superphosphate at the chemical-fertilizer plant under construction at Trail. As far as exploration has proceeded the important beds of oolitic phosphate have in general proved to be narrow, but persistent, with a fairly regular content of phosphoric acid. In the case of the *Crow* deposit, however, large widths have been found where there has been folding and overlapping of beds in certain sections. Leo Telfer is in charge of all phosphate operations and exploration, some seventy-five men being employed altogether.

Gypsum.

No gypsum was mined in 1930 by the Canada Cement Company on its property near Mayook, 15 miles easterly from Cranbrook. The gypsum-deposits of the Fort Steele Mining Division, including those at Mayook, are described by L. Heber Cole in "The Gypsum Industry of Canada," published by the Department of Mines (Canada), Mines Branch.

Petroleum.

An interesting summary of past drilling operations carried out in the Flathead Valley oilfield by G. H. Kirkpatrick, of Vancouver, is contained in the June and July issues of the *British Columbia Miner*, published in Vancouver. The article also contains considerable information regarding the geological work done in the area. Owing to various circumstances drilling operations have been handicapped, but evidently exploration is to be pushed to full conclusions. With regard to recent progress in this field, the writer is indebted to the author of the above-mentioned article for the following notes:—

"There are several oil-showings in that district, both in the Flathead valley itself and in the valleys of its tributary creeks. The present development-work is being carried on in Sage Creek valley at a distance of approximately 5 miles to the east of the Flathead river and 8 miles north of the International boundary. Two companies have been carrying on work in this locality; one, the B.C. Oil and Coal Company, Limited, has been developing its own property, but closed down towards the end of the summer. This company is reported as having reached a depth of approximately 1,100 feet.

"The Crow's Nest Glacier Oil Company, Limited, operating on land leased from the Amalgamated Oil Company, Limited, has carried on work continuously throughout the season since May, 1930. This company is engaged in cleaning out its well, which in July, 1927, reached a depth of 3,265 feet and was then heavily shot with nitro-glycerine. This shot resulted in a

heavy flow of gas for a short time, after which the well bridged with debris from the shot. It was not until September of 1929 that the well was again cleared, but the result was that it immediately bridged again. During the present year operations have been towards clearing this bridge. Due to the fact that the well is an old one and that many old tools have at various times been lost and have to be side-tracked, this task has proved very difficult and slow, but in spite of all the difficulties steady progress has been made. At the close of the year this company was engaged in fishing out tools lost through the breaking of the cable. It was expected that this operation, while probably slow, would not present any insuperable difficulties, and that following the recovery of the lost tools the task of clearing out the rest of the bridge will be comparatively easy and short. It is understood that it is the company's intention to continue drilling operations throughout the winter and that it is hopeful of achieving results either in the winter or early spring.

"During the operation of clearing this well in 1930 several very interesting and encouraging shows of oil and gas were encountered, as a result of which those in charge of the well are very hopeful that when cleared the well will prove a commercial producer."

Pacific Petrol Products, Ltd.

Near Dorr, south of Elko, a new undertaking was recently initiated when drilling operations were begun by this newly incorporated company, which is capitalized for 2,000,000 shares of no par value. A. J. Daniels is president and H. W. Barker is secretary-treasurer, the registered office being in Victoria. This is the first attempt to explore for oil in this district and little is known about the detailed geology of the immediate area which lies just east of Geological Survey Map 147A, accompanying Memoir 76, and some 6 or 7 miles north of Map 76A, issued with Memoir 38 (Forty-ninth Parallel). The rocks forming the greater part of the district adjoining the valley of the Kootenay river near the International boundary (Gateway, Purcell lava, Siyeh formations), placed in the Middle Cambrian period by R. A. Daly, were later assigned to the pre-Cambrian by S. J. Schofield. Devonian-Carboniferous limestones, where shown on both map-areas, are either resting unconformably upon the Gateway (Memoir 76, page 100) or faulted with relation to the pre-Cambrian formations as shown by Daly at the International boundary. Drilling operations are reported to have been suspended towards the end of the year.

Superior Oils, Ltd.

A company of this name was recently incorporated in connection with a new oil-prospecting venture. The company's office is at Nelson, R. W. Dawson being secretary. J. W. Mulholland, also of Nelson, sponsored the undertaking in connection with eight sections staked by him in the area along the Great Northern Railway north of Dorr and at points adjacent to the Canadian Pacific Railway from Wardner to Morrissey. At the time of writing, applications for oil-prospecting licences are being advertised in the British Columbia Gazette.

Granite.

Huchcroft Granite Quarry.

Members of a small syndicate of Cranbrook men, headed by J. F. Huchcroft, are at present opening up a granite-quarry which adjoins the Canadian Pacific Railway 3½ miles south-west of Cranbrook. The rocks here are part of a considerable area of Purcell sills which, according to S. J. Schofield, vary in composition from a hypersthene gabbro to a very acid granite or granophyre, with intermediate members between these two extreme types. (Refer to Geological Survey of Canada, Memoir 76, page 56 *et seq.*). A car-load of rough blocks was shipped during the summer. Of the various grades of granitic rock present in the deposit, the greenish-black variety, which takes a fine polish, is reported to be the most in demand. The granite shipped is reported to have been highly satisfactory for monumental work and for building purposes, and several car-loads have been ordered. J. F. Huchcroft explains, however, that his new venture is purely in the experimental stage and that the local product has to compete with importations from old, well-established concerns. He is also investigating the Purcell sills in the vicinity in connection with copper-gold deposits of the differentiate type such as are described by Schofield in the previously mentioned Memoir on the Cranbrook Map-area.

Placer.

Palmer Bar Placers, Ltd.—This private company, capitalized for $100,000, was incorporated in July to operate gold-placer leases on Palmer Bar creek south-west of Cranbrook. No activity has yet been reported. The company's office is at 105 Royal Financial Building, Vancouver.

On Wild Horse creek placer-mining exploration, continued by W. A. Drayton, of Fort Steele, has included the driving of a tunnel on bed-rock.

SLOCAN MINING OPERATIONS.*

The year 1930 was one of the quietest ever witnessed in the Slocan mining centres. Early in the year practically all the shipping and developing properties were forced, largely on account of the drastic decrease in market prices obtainable for lead, zinc, and silver (the main minerals produced in this camp), to curtail mining and milling operations, and shortly afterwards were compelled to halt for an indefinite period all underground development and exploration work. The *Cork-Province*, *Whitewater*, and *Lucky Jim* properties were placed in charge of watchmen at the end of January, 1930, and the *Noble Five*, *Ruth-Hope*, and *Galena Farm* assumed the same status shortly after.

While cessation of activities at these and other properties in the Slocan was mainly dictated by metal prices, another contributing factor to the present situation was the failure or necessary retrenchment of the various interested brokerage-houses who in many instances had advanced large amounts of money to the mining companies in anticipation of a good market for the stock certificates held by themselves. As a result of this condition several of the companies find that they have large debts for moneys advanced, while others find they have money receivable from the brokerage-houses which the latter are unable or unwilling to pay out. The resumption of mining will depend on the stabilization of metal prices at figures much higher than the present prices quoted on the London markets.

Conditions at the majority of the camps in the Slocan area are as given in the 1929 Annual Report, and only brief notes are given this year summarizing the present status of all the more prominent properties, noting the development-work which has been done during the year and indicating the general depression felt throughout the camp.

Zincton.

Lucky Jim.* Conditions at this property, situated at Zincton, on the Kaslo & Nakusp Railway, and owned by the Lucky Jim Lead and Zinc Company, Limited (H. H. Yuill, president and general manager), have not changed since the information contained in the 1929 Annual Report was written. Following the termination of exploration-work in January and the withdrawal of the crew, the property has been in charge of a watchman.

Sandon Camp.

Ruth-Hope.* At this well-known property, situated a short distance above Sandon and owned by the Ruth-Hope Mining Company, Limited (R. H. Stewart, president), only a small amount of development-work has been done since February, 1930. Mining and milling operations to the end of February were carried out under adverse conditions of low metal prices and a very severe winter. A total of 2,038 tons of ore was mined and milled, from which 198.7 tons of lead concentrates, 223.5 tons of zinc concentrates, and 41.5 tons of crude ore were shipped to the Trail smelter.

In May a small crew of leasers were given a year's lease in the Stewart workings of the mine and to the end of the year had shipped 41.3 tons of sorted crude lead ore.

The company started operations on a small scale in October and since then have employed five men in the mine. This activity became necessary as the enforced idleness underground caused deterioration of the mine-timbers, had allowed portions of the lower workings to fill with water, and increased the danger of losing some of the pillars in the worked areas due to premature caving. The small crew of men has been employed in timbering, pumping, and generally reconditioning the mine until recently, when they started to mine some of the sill pillars in the New Ruth section of the mine. H. A. Rose is superintendent in charge of the property.

Silversmith.* This property, which adjoins the *Ruth-Hope* to the south, is owned by the Silversmith Mines, Limited (John B. White, of Spokane, president), and has been idle for the greater part of 1930. Late in the fall, A. K. Olsen, former mine superintendent at the *Silversmith*, obtained a working lease on the property on a 25-per-cent. royalty basis. Employing a crew of fourteen to sixteen men, he reconditioned the jig and table

sections of the *Silversmith* concentrator and the aerial tramway connecting the mill with the No. 10 level of the mine. A crew of nine men was retained for the underground work, and from September 15th to October 31st milling-ore containing 5 per cent. lead and 10 oz. silver to the ton was mined from various stopes above the No. 10 *Silversmith* level. From this tonnage one car of jig and table lead concentrates and one car of clean ore were shipped to the smelter, but the returns obtained precluded any possibility of operating the mill on a paying basis with existing metal prices and consequently the crew was laid off.

Four sub-leases were then given to two-men parties, and these eight men, together with the man operating the power plant and A. K. Olsen with partner, are at present mining and sorting ore for shipment from stopes between the 900- and 1,000-foot levels and the 1,100- and 1,200-foot levels. The mill-feed obtained by the men in mining operations is being stored for future treatment.

Canadian-Brandon.*

This property, owned by J. Brandon, of New Denver, is under four-fifths interest option to the Ruth-Hope Mining Company. It is situated adjacent to the *Ivanhoe* property on Silver ridge, a short distance south-west of Sandon by steep trail. During the summer months the trail serving this property was extensively repaired, and following the shipment of 40 tons of sorted ore from the No. 1 level of the mine early in 1930 a small crew of men was employed in August under the direction of H. A. Rose. The No. 2 level of the property, at 6,856 feet elevation and 105 feet vertically below No. 1 level, was extended for 210 feet to the end of 1930, and recent reports from the property indicate that this work is being continued and the men are hand-drifting on the vein.

Noble Five.*

Work at this property, situated 1½ miles east of Sandon and owned by the Noble Five Mines, Limited (N.P.L.) (Paul Lincoln, president and general manager), was stopped early in the year and conditions are essentially as reported in the 1929 Annual Report.

Carnation.*

This property, owned by A. R. Mann and associates, is situated on Silver ridge, a short distance west of Sandon, and is connected thereto by an excellent caterpillar-tractor road 4 miles long. Following an enforced shut-down in the early months of the year due to water-shortage, the company resumed development-tunnelling on the No. 3 level and continued exploration-work for a short time in the summer months. At the present time this property, which was not visited in 1930, is closed pending a decision by the owners as to future plans.

Wonderful.*

The option held on this property by the Standard Silver Lead Company was dropped in October, 1930, after 700 to 800 feet of drifts and raises had been driven. The *Wonderful* is situated a short distance north-west of Sandon, on the west side of Carpenter creek. Recently Clarence Cunningham, of the Cunningham Mines, Limited, to whom the property reverted, has had a crew of two men at work underground in this property doing some prospecting.

It is planned to carefully study the surface in the spring by means of trenching and, if possible, ground-sluicing in an endeavour to throw some light on the future possibilities of this once well-known shipping property.

Black Colt and Queen Bess.*

These two well-known Slocan properties are located on the ridge between Carpenter and Howson creeks, a few miles north and west of Sandon. Development-work during the major portion of 1930 was financed by the Paulsen interests of Spokane, but due to continued depressed market and financial conditions this backing was withdrawn on December 15th, 1930, since which time C. Cunningham, of Alamo, has employed a crew of approximately ten men at the *Black Colt* side of the ridge. The crew of ten men employed at the *Queen Bess* section of the property has been discharged for the time being.

On Carpenter Creek side of the ridge at the *Black Colt*, development-work in 1930 was confined to one major and three or four minor objectives. The lowest or No. 3 level on this property was extended for 200 feet to a point under a fair showing of ore exposed on the No. 2 level. The connecting raise subsequently driven encountered ore as it approached the No. 2 level. Several minor drifts and raises were driven for prospecting purposes with fair results, and a new adit-drift above the No. 1 level was started to connect with a sub-level above this No. 1 tunnel. The major piece of development-work started during the year was the extension

of the No. 3 tunnel in a westerly direction towards a point 420 feet below a very fair showing of ore in the lowest or No. 10 level of the *Queen Bess* property. At the end of the year this tunnel was 750 feet from its objective point. Recently a small tonnage of sorting-ore has been mined from the upper levels of the *Black Colt*, part of which it is intended to ship to the smelter.

At the *Queen Bess* the development-work financed by the Paulsen interests included reconditioning and timbering several of the old drifts and tunnels on the No. 5 level. From a point at one end of the stoped area from which the *Queen Bess* derived fame, a new crosscut tunnel was to intersect two possible parallel veins distant 300 and 600 feet respectively from the main vein. This crosscut, now in 600 feet, has encountered several narrow streaks of carbonates near the face, the "B" vein at 300 feet distance not showing in this new work. It is planned to continue development-work in this level when the snow has melted in the coming spring. At the present time this section of the company's holdings is closed.

Bluebird.* This property, owned by the Bluebird Mines, Limited (W. H. Burgess, managing director), is situated above the *Noble Five*, on the divide between Carpenter creek and Jackson basin. Exploratory drifting and crosscutting in the *Stranger* tunnel on the Jackson Basin side of the ridge was discontinued early in 1930 after a long and unsuccessful attempt to locate the downward extension of ore from the old and now caved workings of the *Bluebird* vein. Upon suspension of work in this tunnel a 2-mile connecting trail from the *Noble Five* property to the *Idaho* No. 2 tunnel was constructed. A development contract was then let by the company to D. McLellan *et al.*, of Sandon, for the extension of the *Idaho* No. 2 tunnel, at that time in approximately 500 feet, to explore possible ore-bearing zones along the vein.

Machinery installed at the property during 1930 includes a Holman compressor of 165-cubic-foot displacement and a small ventilation-fan, both of which are driven off a 25-horse-power Crossley gasoline-engine. A mounted jack-hammer drill of the S 49 type, as supplied by the Canadian Ingersoll Rand Company, is used in the tunnel-driving. Buildings erected during this same period include a blacksmith-shop and a compressor building, both located near the portal of the *Idaho* No. 2 tunnel, as well as minor improvements and additions to the living-quarters.

Since this third phase of exploratory tunnelling was started (the first two being the unsuccessful work on *Idaho* No. 2 and the *Stranger* tunnels) the contractors have driven approximately 510 feet of drifts and crosscuts. The main tunnel was extended along the vein for 450 feet and is stated to have encountered a narrow showing of mill-feed ore at 967 feet from the portal. Three short crosscuts aggregating 60 feet in length have been driven into the foot-wall side of the vein, and the No. 1 and No. 2 crosscuts, respectively 300 and 360 feet from the portal, are reported by D. McLellan, the contractor, as having encountered a narrow stringer of ore, the mineralization being principally galena with some silver values. The No. 3 crosscut is also reported to have struck a narrow shoot of ore, but this, like the other showings mentioned, was found after the property was visited in the summer, and detailed knowledge respecting the commercial significance, grades, widths, and possible importance cannot be given at this time. In the old workings the galena, blende, and silver mineralization apparently occurred in a quartz and spathic iron-filled fissure in slates and shales of the Slocan series.

Altoona.* This property is owned by the Altoona Mines, Limited, and A. J. Murphy, of Sandon, is in charge of operations for the company. The claims are situated 1½ miles north of Sandon on the Sandon–Three Forks road. During 1930 a small crew of men has been employed at various times in trail-construction and further exploration-work. Detailed information on this property was contained in the 1929 Annual Report and developments in the past season are given here briefly. While surface-trenching during the summer a large outcrop of zinc mineralization was uncovered by stripping to the north-east of the No. 1 level portal. Two separate occurrences, approximately 10½ and 11½ feet in width on either side of a 4-foot quartz-porphyry dyke, were channel-sampled with disappointing results. The average assay of two samples over the 10½-foot width was: Gold, 0.025 oz. to the ton; silver, 2.1 oz. to the ton; lead, *nil;* zinc, 4 per cent. The average assay of two samples over the 11½-foot width was: Gold, 0.02 oz. to the ton; silver, 1.9 oz. to the ton; lead, 0.05 per cent.; zinc, 3.75 per cent. When the new showing was examined in August two men were employed in driving (by hand-mining methods) a short crosscut tunnel from near the portal of the No. 1 level adit to a point below the dyke and open-cuts which would explore the downward continuation of the mineralization at a depth of 20 to 25 feet below the surface cuts.

Mary Ryan.* A small amount of underground work was done at this property, situated in McGuigan basin, early in 1930 by the Mary Ryan Mines, Limited, under the direction of R. Wolthausen. A geological survey of the property was made during the summer by E. C. Annes, of Vancouver.

Mountain Con.* This property, which was well described by the late W. F. Robertson in the 1904 Annual Report, has witnessed further prospecting-work during the past season. The claims are situated 9 miles south-east of Sandon, near the head-waters of Carpenter creek, and are easily reached by a very good trail from Cody.

The upper portion of the vein, a fissure of quartz which strikes N. 50° E. and dips to the north-west at 78° in the granite country-rock of this vicinity, has yielded a small tonnage of very rich silver ore in the earlier days of the Slocan camp. This year one of the original locators, C. A. McLeod, of Edmonton, Alberta, determined to give the property another trial, and accordingly engaged a crew of two or three men and with the necessary supplies started work on the No. 4 level of the property.

This level, which starts approximately 300 feet below and 650 feet to the south-east of where ore occurred on the No. 3 level, was advanced a distance of 100 feet along the strike of the vein (here N. 45° to 50° E.). At a point 175 feet from the face of the No. 4 level a raise was driven along the vein for 105 feet, with disappointing results. From a study of a small map made of the property it would appear that, should the past ore-lens found on No. 3 level continue to rake to the north-east at 45° as shown by a sketch-map of the upper workings made by the late W. F. Robertson, the present face of the tunnel is about 500 feet from its objective. As the upper workings, which were stated to be caved, were not examined, information as to the ore occurrence here is not available. It would seem that this season's work was undertaken as a prospecting venture, looking for possible high-grade ore-shoots which might occur *en eschelon* along the vein, but which unfortunately were not discovered.

Other minor activities which occurred during 1930 in the area contingent to Sandon included the following: The driving by George Gormley and sons of a short prospecting-tunnel at a low level on the *Western* claim, situated near Three Forks; small leasing operations at the *Helenita* (*Rio*) property in Jackson basin by S. Marzoli and associates, of Sandon; continued mining operations on a small scale at the *Victor* property by the late George Petty, of Sandon and Three Forks; surface prospecting by George Clark on claims above the *Leadsmith* property, situated near the head of Cody creek.

Silverton Area.

Galena Farm.* The property of the Galena Farm Consolidated Mines, Limited, is situated 1½ miles south of Silverton and extends east from Slocan lake to the *Van Roi* property, a distance of approximately 3 miles along a strong shear-zone at and close to the contact of the Slocan sediments and the Nelson granite batholith.

During the early portion of 1930, following the completion of the extensive programme of mill and tram construction outlined in the 1929 Annual Report, the mill was operated on development ore from the mine and also on material obtained from a dump of the former mill's jig tailings, the resultant lead-zinc bulk concentrate being shipped to Trail smelter. Low metal prices forced a shut-down of company operations, but a group of eight experienced Slocan miners and millmen obtained a development lease on the *Galena Farm* unit of the company's holdings and operated for about two months' time before closing out their lease, which gradually lost any attractiveness it may have had as the metal prices dropped lower and lower.

Following the close-down by the leasers in the summer, the property has been idle and future plans of the company have not been indicated. During the summer and fall some of the extra milling equipment owned by the company was used in the equipment of a concentrator for the *True Fissure* mine near Ferguson, and this provided work for a few of the company's men from Silverton.

Van Roi.* This property, comprising fourteen claims adjacent to and east of the *Hewitt*, is situated 4 miles east of Silverton, on the south side of Silverton (4-Mile) creek. The exploration-work undertaken by the Van Roi Mines, Limited, and energetically carried on in the fall and winter of 1929, was halted temporarily in January, 1930, on account of a fire which destroyed the cook-house and "dry" buildings. Necessary repairs were made and a small crew of men kept at work around the mine until June 15th, when financial difficulties forced a shut-down on the development-work.

The results of the development-work on the South vein, where practically all this recent work was done, are much the same as given in the 1929 Report, and are viewed by the management as quite satisfactory with fair market prices for lead, silver, and zinc.

The camp since June 15th has been in charge of the foreman and a timberman, who, instead of being merely watchmen, have reconstructed the flume serving the property and are now engaged in rebuilding the boarding-house which was burned to the ground early in the year. Clarence Cunningham, of Alamo, has been in charge of the recent exploration-work, with W. Nelson, of Silverton, as his foreman.

Mammoth.* This property, owned by the Western Exploration Company (R. A. Grimes, of Silverton, manager), is situated on the north side of Silverton (4-Mile) creek, approximately 5 miles by road from Silverton. Detailed descriptions of the mine and the present modern milling plant are contained in the Annual Reports for 1926, 1928, and 1929.

Following the completion of the 16,000-foot heavy-duty aerial tramway which connects the mine with the new mill in Silverton, and a short try-out of the new equipment both at the mine and in the mill, the management adopted a policy of watchful waiting until such time as market conditions will warrant production at the rate of 100 tons a day. During the year a small amount of development-work was done in the mine, the most important piece being the completion of a 400-foot crosscut driven in a northerly direction from No. 4 level of the *Mammoth*. This crosscut was driven to prospect the foot-wall of the vein and in a search for water.

At the *Standard* property, which is part of the ground held by the Western Exploration Company, a small party of leasers has mined a few cars of clean ore.

All work at the mine and mill is now stopped and the reopening will depend on a marked improvement in the metal market, especially lead and silver markets.

New Denver.*

Several parties of lessees have been active on the old surface dumps and in portions of the underground stopes of the *Bosun* property. This property is situated on the shores of Slocan lake, 1½ miles south of New Denver, and S. Ellis, of Silverton, has charge of the property for the owner, J. C. Campbell, of New Denver. Several cars of lead jig-concentrates were recovered by the leasers and shipped to Trail smelter.

Reports recently received from New Denver indicate that the *Mountain Chief* property, situated 1½ miles east of New Denver on the New Denver–Three Forks road, was worked during the major part of 1930 by three leasers, J. Cechelero, M. Latoni, and L. Vingneaux by name.

SLOCAN CITY MINING DIVISION.*

There has been little activity in this Division during the past year. The *Enterprise* property on Enterprise creek has been closed since the failure of the Stobie-Forlong interests early in the year and future plans are still undetermined. A slightly increased interest in prospecting, due no doubt to the slack time at former shipping properties, resulted in a new discovery on Chapleau creek, a tributary to Lemon creek, by George Stoll, of Nelson. The new location, which has not been visited yet, is situated a short distance below the old *King Jack* property, approximately 5 miles due east of Slocan. Good gold values in quartz gangue have been obtained across narrow widths, one sample taken by the owner returning him $140 in gold to the ton.

Rex.* This property, owned by D. McCuaig, of Slocan, is situated close to the *Republic* road and about 2 miles from Slocan. Development-work on the property consists of 120 feet of tunnel, mostly in granite, and one short open-cut in 6 feet in a bank of sand and gravel. The main tunnel at 2,730 feet elevation has developed some small lenses of galena-grey-copper ore in narrow quartz stringers, and a sample taken from a few hundred pounds of ore piled at the tunnel portal assayed: Gold, 0.16 oz. to the ton; silver, 114 oz. to the ton; lead, 8 per cent.

Coronation.* This property, situated 2 miles back from the Slocan–Silverton highway on Memphis (12-Mile) creek, is owned by interests represented by H. Parker, of Slocan. The group contains the *Coronation* and *Memphis* claims. Development-work consists of a 144-foot tunnel at 3,725 feet elevation and a 70-foot tunnel at 3,775 feet elevation, both tunnels being driven in an easterly direction from the bank of the creek. The 70-foot tunnel is caved and could not be examined.

The 144-foot tunnel was driven in granite and followed along narrow quartz stringers for portions of its length. At 90 feet from the portal two slips striking N. 8° E. and dipping to west at 80° offset the course of the tunnel to the north by 6 feet. It was at this intersection of slips and quartz stringers that small bunches of high-grade dry ore were found. A sample taken from a small pile of grey-copper ore at the tunnel portal assayed: Gold, 0.06 oz. to the ton; silver, 175 oz. to the ton.

Lost Lode.* This group of six claims, owned by R. D. Kennedy, of Lemon Creek, is situated on the south-eastern extension of the *Hope No. 2* ground, owned by the Piedmont Mines, Limited. The owner has driven a 60-foot tunnel along a narrow oxidized slip in granite at one point on his property, situated half a mile south-east of the *Hope No. 2* boundary on the imaginary extension of the *Hope No. 2* ore-zone. When this tunnel was examined there were no evidences of mineralization exposed and the owner was advised against attempting any underground hand-development scheme before at least thoroughly prospecting the surface of his ground for traces of ore-deposition.

AINSWORTH MINING DIVISION.

Publications of the Geological Survey of Canada covering portions of the Ainsworth Mining Division include: Memoir 117, "Geology and Ore Deposits of the Ainsworth Mining Camp"; "Slocan Area, Ainsworth and Slocan Mining Divisions," Summary Report for 1916; "Kootenay Lake District," Summary Report for 1928; Memoir 161, "Lardeau Map-area." The revised geology, by C. E. Cairnes, of the Slocan camp, which includes portion of the Ainsworth Mining Division, is awaiting publication.

Properties Tributary to the Kaslo–Nakusp Railway.

Whitewater.* This property, which is situated at Retallack, on the Kaslo–Nakusp Railway, has been idle since February 1st, 1930. The past history and a large amount of detail relative to the mine and surface plant is contained in the Annual Reports for 1927, 1928, and 1929. Following the closing of the mill in July, 1929, and a subsequent surveying and examination under the direction of H. H. Yuill and P. Price, which took until the end of February, 1930, to complete, the underground development crew was discharged and the property placed in charge of a watchman. The results of this detailed examination were disappointing when compared to the large tonnage estimates of good-grade ore that had previously been made, as only a relatively small tonnage of spathic iron and low-grade zinc-blende mineralization is indicated in the mine between the 1,100- and 1,400-foot levels. This small available tonnage is largely made up of stope remnants, unstoped pillars, and small blocks of low-grade material, the grade of which is considerably lower than the ore mined from this area by the company in 1928 and 1929. The future plans for the property have not been disclosed by the company.

Wellington.* This property, owned by the Wellington Mines, Limited, is situated to the west of the *Whitewater*, on the Kaslo–Nakusp Railway. Past references to it are contained in the Geological Survey of Canada Report for 1895 and in the Annual Reports for 1896, 1928, and 1929. The company started an intensive development scheme in December, 1927, and to the end of the spring of 1930, when operations were stopped, had accomplished over 4,000 feet of tunnelling and several hundred feet of diamond-drilling with unsatisfactory results.

The work done this year on the *Ivanhoe* tunnel, situated 600 feet to the west of the old upper workings and at 100 feet lower elevation, ended disappointingly and the small crew employed by the company was dispensed with. The property is idle at the present time and future plans for the property are unknown.

Bear Lake.* This property, which consists of the *Bear Lake*, is owned by Albert Sandeman, of Zincton. The claim is situated across the Zincton–Kaslo road at the north-eastern end of Bear lake, the short trail from the road to the workings starting at Watson creek. The formation in the vicinity comprises banded slates and shales of the Slocan series, which are traversed by quartz-porphyry dykes common to the area.

The only work done on the property consists of an adit-tunnel at 3,750 feet elevation, the portal being located 200 feet north of and 50 feet above the road. The face of the drift was

in 40 feet from the portal when examined in the summer and a sample taken across 12 inches of calcite, quartz in crushed slate, at the face assayed: Gold, trace; silver, 0.4 oz. to the ton; lead, *nil;* zinc, 1 per cent. This small amount of mineralization occurs on the foot-wall side of a narrow quartz-porphyry dyke which strikes N. 5° W. and dips to the west at 45°, practically the same strike and dip as that of the slate country-rocks, which here strike N. 15° W. and dip to the south-west at 40°.

Sure Thing.* This property, owned by A. G. Pearson, of Kaslo, consists of one small claim (600 by 1,200 feet) called the *Sure Thing* and adjoins the *Charleston*, of the *Keystone Charleston* group, to the north. Both claims are reached by 1½ miles of trail from the old upper workings of the *Whitewater*. The *Sure Thing* was staked to cover a contact of slates, calcareous shales, and interbedded limestone-bands of the Slocan series. This contact, which strikes N. 60° W. and dips to the south-west at 80°, is well defined along the trail leading to the camp at 5,600 feet elevation.

The workings, examined in the summer of 1930, included two adit-tunnels and an intermediate level. Other workings, now caved, include a small area of stoped ground and several connecting raises. The upper adit-tunnel at 5,700 feet elevation is in 70 feet on a N. 60° W. line and exposes small amounts of low-grade mineralization at varying intervals along its length. Approximately 20 feet from the portal of this upper level a raise connecting the intermediate level breaks through in the drift bottom. The intermediate level is 40 feet long and is connected to the lowest level by two short raises now caved. The lowest level at 5,600 feet elevation is 285 feet long and runs in a N. 60° W. direction along a narrow spathic iron and quartz-filled fissure for most of its length. A raise connecting this level with both the intermediate level and the upper adit-tunnel level bottoms at 111 feet from the portal. At 36 feet farther in from the portal the second raise connecting the intermediate level is bottomed. Between these two raises the spathic, quartz-filled fissure swells to a width of 8 or 12 inches, and for a length of 18 to 20 feet contains some galena and associated silver values. A similar-sized lens of spathic and galena was also exposed along the back of the drift at 165 to 175 feet from the portal.

Other activities in the area contingent to the Kaslo-Nakusp Railway included: Further prospecting at the *Keystone Charleston* group by A. J. Harris; prospecting and minor development operations at the *Sunset* by Dave Anderson and Con Stewart under terms of a lease and bond; and a new discovery of low-grade lead-zinc mineralization near 14-Mile by A. J. Curle and Charlie Lynn, of Kaslo. At this latter place C. Lynn opened up three open-cuts close to Kaslo creek, showing a cross-fracture in limestone containing carbonates, galena, small amounts of sphalerite, and associated silver values. Approximately 1,000 feet to the south of this discovery A. J. Curle has opened a trench 24 feet long across limestone which contains galena, carbonates, and sphalerite in varying amounts along the length of the trench. The ore is low grade, but further trenching at short intervals to the east and west of this cut should be done and the whole area so exposed systematically and thoroughly channel-sampled. These new discoveries are located about 2,000 feet to the east of A. J. Curle's *Manganese* claims at the 14-Mile post of the Kaslo–Nakusp Railway.

No further activity occurred at the property of the Utica Mines, Limited, since operations were suspended in December of 1929. This was one of the properties in which the Stobie-Forlong Company were interested in before the financial crash of early 1930.

Keen Creek Area.

Cork Province.* There has been no activity at this property, situated 4 miles west of Zwicky, on Keen creek, since development and exploration work was stopped in January, 1930. For detailed references to the property the reader is referred to past Annual Reports, the one for 1929 containing a brief summary of recent operations.

The Keen Creek section of the Ainsworth Mining Division was practically idle throughout 1930, the following notes summarizing briefly the small amount of work accomplished: F. Helme continued work on the *Silver Bear*, the year's work being reported as very encouraging; the property of the Sturgis Creek Mines, Limited, on Sturgis creek was examined in June, but no mining activity resulted; J. A. Carter continued prospecting and development work on the *Flint* group on Dago creek, a tributary of Keen creek.

Deer and Doorway.*

This group of two claims, *Deer* and *Doorway*, is owned by John Kuz and John Horck, of Kaslo. The property is located 4 miles by road and 2 miles by trail north of Kaslo above what is locally known as Shenty bench, at an elevation of 4,700 feet above sea-level. The ground was staked in 1929 and the owners since that time have completed a considerable amount of trenching and approximately 150 feet of underground tunnelling. The formation in the vicinity is limestone and slate, and in the main tunnel these rocks are cut by a quartz-porphyry dyke close to their contact with sericite-schist. The underground work consists of two short tunnels at 4,750 and 4,665 feet elevations, the mineralization consisting of minor amounts of zinc-blende in quartz veins cutting the limestone and slates. A sample of a small pile of selected ore at the portal of the upper tunnel cut assayed: Gold, 0.01 oz. to the ton; silver, 1.20 oz. to the ton; lead, 0.6 per cent.; zinc, 32.8 per cent. The owners continued prospecting during 1930 and considerably improved their steep trail to the log-cabin camp they have erected a short distance below the workings.

KOOTENAY LAKE AND AINSWORTH.

Comfort and Kootenay Chief.

The leading operation in this area was that by the Consolidated Mining and Smelting Company on the *Comfort* and *Kootenay Chief*, which adjoin the *Blue Bell*, on which the old mine-workings are situated, to the north and south respectively. The *Blue Bell* mine holdings have largely been acquired by the above-mentioned company, a small interest being retained by S. S. Fowler and B. L. Eastman. The new work, initiated in 1929, has been confined to the *Comfort* and *Kootenay Chief*. The character of the deposits is described in Geological Summary Report, 1928, Part A, "Kootenay Lake District," by J. F. Walker, in which the accompanying plan shows the general layout.

On the *Comfort*, at a point about 1,400 feet north from the extreme northerly limit of the *Blue Bell* workings, a 2-compartment shaft has been sunk 420 feet on a slope of about 38° just south and on the foot-wall side of a surface showing previously discovered. From 155 to 285 feet down from the collar, ore shows along the shaft. At 195 feet down, drifting has been done northerly and southerly. The south drift winds about in the limestone and cuts good widths of ore, in which lead seems to predominate appreciably over the zinc. This ore-shoot has an indicated length of 140 feet. In the north drift similar ore is developed near the shaft. At 390 feet down from the collar a drift to the south develops ore for a length of about 140 feet over an average width of at least 5 feet, the ore being exposed up to 10 or 12 feet wide in places. Impressive masses of clean galena occur here with the mixed ore. Sampling of these showings averaged 13.1 per cent. lead and 8 per cent. zinc (silver assay not available). The showings on this level are apparently part of the ore-body partially opened up in the south drift at the 195-foot level above. The total development done on the *Comfort* amounts to 1,253 feet of sinking, crosscutting, and drifting. Work was discontinued on October 1st, as exploration had reached the stage where further equipment was necessary to reduce development and pumping costs. On the *Kootenay Chief*, near the extreme south end of the property, 1,063 feet of underground work was done, mostly during the first six months of the year. This was chiefly crosscutting and drifting, but includes a winze 110 feet deep. These workings develop a very wide mineralized zone in limestone in a zone of cross-fissuring. The better values are concentrated over a width of about 27 feet. Smelter returns from four car-load lots of this material averaged: Silver, 2.8 oz. to the ton; lead, 8.6 per cent.; zinc, 9.1 per cent. The results of the development-work done on the *Comfort* and *Kootenay Chief*, considered in conjunction with J. F. Walker's geological study of the *Blue Bell* deposits, suggests very interesting potentialities for the whole area embracing all three properties.

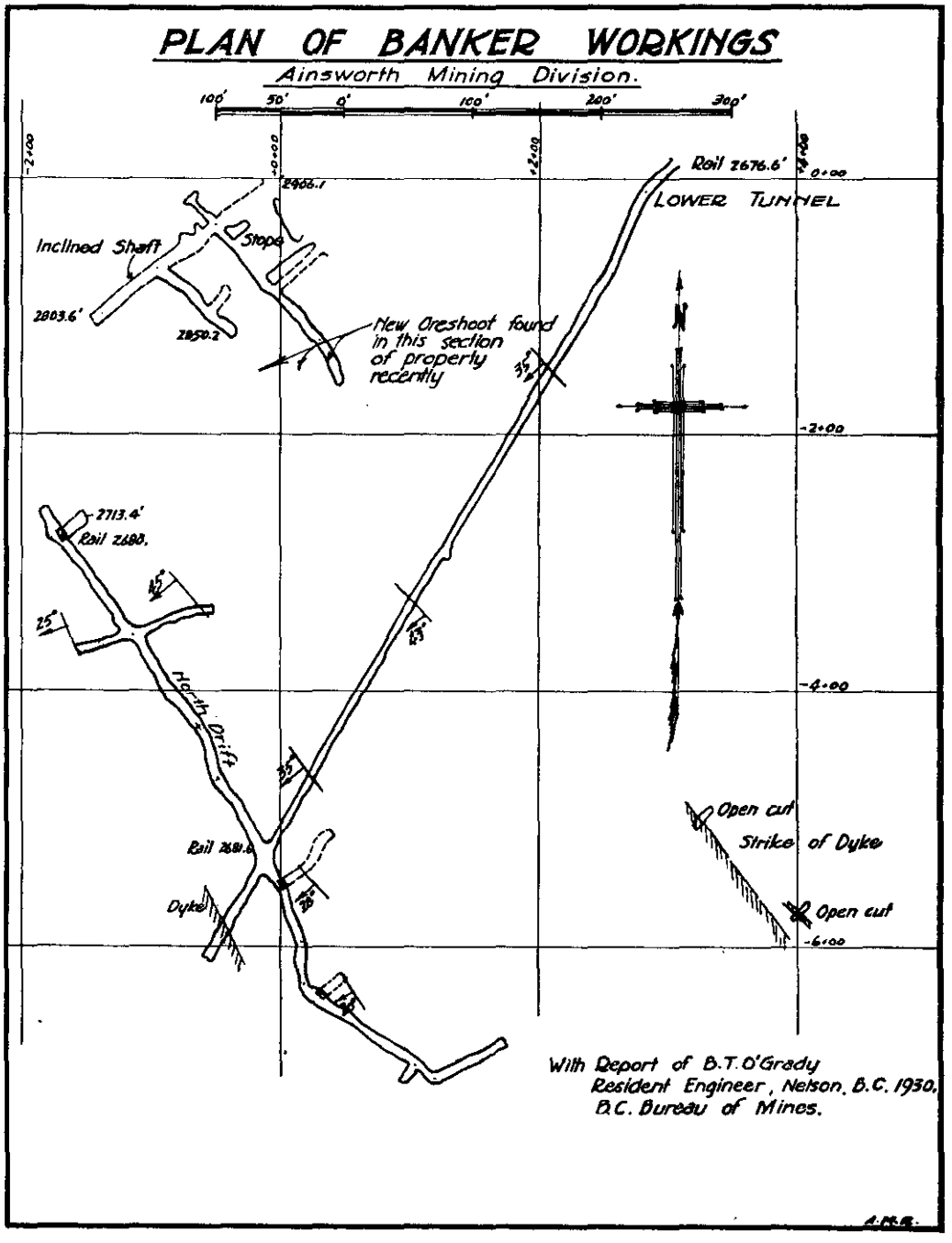
Mineral Dyke.

Exploration of this prospect, south-east of Walker Landing on Kootenay lake, has been discontinued by the Consolidated Mining and Smelting Company. The surface showing contained pyrite and chalcopyrite, small amounts of platinum and palladium being associated with this mineralization, which occurs in a decomposed dyke or sill. The work done included 254 feet of tunnelling by hand to test the deposit below the superficial zone. Results were indefinite and the company's option was dropped. C. Rossiter, of Kaslo, is the owner.

R.F.G.

Exploration was carried out during the past season by the Princess Creek Mining Company on its *R.F.G.* group. Crosscutting was done by hand, the work being done under the direction of E. J. Edwards, of Spokane. The ore is silver-lead-zinc.

Banker. At this property, situated on the Ainsworth–*No. 1* Mine road, exceptionally good showings of silver-lead-zinc ore were opened up during leasing operations by Andy Garrett, Ray Hughes, and associates, of Kaslo, who shipped some 56 tons of ore. Further shipments were suspended pending better metal prices. The character of the deposits is described in Geological Survey of Canada, Memoir 117, "Geology and Ore Deposits of Ainsworth Mining Camp," by S. J. Schofield.



The *Banker* vein, 6 to 8 feet wide, has been traced through several claims. It is a fissure-vein paralleling the bedding-planes of the enclosing quartzites and schists, which strike approximately north and south, with a dip of from 20° to 45° to the west. Galena, which predominates in the ore, is associated with zinc-blende and pyrite in a gangue of quartz, calcite, and crushed country-rock. The massive character of the galena lends itself to hand-sorting and the zinc-blende appears to be relatively small in amount. The ore-shoots seem to have been localized in zones where the vein and strata dip flatly. The upper workings on the *Banker* claim consist principally of an inclined shaft at an elevation of 2,906 feet (collar) above sea-level. From the shaft, which is about 200 feet deep, two drifts extend southerly along the vein at elevations of 2,876 and 2,847 feet respectively. Throughout this portion of the shaft the dip of the vein averages about 27° and below the 2,847-foot level the dip of the shaft and vein steepens to about 34°. The 2,876-foot level drift, about 160 feet long, develops a well-mineralized section of the vein, which, towards the shaft, has been largely stoped to the surface. At the inner end recent work by the leasers opened up a nice shoot of ore containing impressive masses of galena associated with mixed galena and zinc-blende over a width up to 8 feet. When the property was visited in the summer this shoot had a length of about 65 feet, with ore in the south face of the drift, and stoping had been started above the level. The 2,847-foot drift has been driven some 73 feet to explore the ground below the stoped portion at the northern end of the 2,876-foot level above. In this lower working no appreciable amount of ore had been developed, but some ore was visible in the floor at the inner end of the drift. This tunnel, which may be too far into the hanging-wall, has only to be extended a short distance to enter the ground below the good ore-showings at the inner end of the tunnel above. In addition to this group of shaft-workings, the outcrop of the vein has been explored by open-cuts and a shallow shaft, from which a small amount of stoping was done and some ore shipped. Strong galena mineralization remains in this last-mentioned working and is visible in some open-cuts. Judging from these superficial showings and those in the shaft-workings, it seems probable that a favourable zone of deposition occurs in the flat-dipping portion of the vein, which, in the shaft, extends 120 feet to the lower drift.

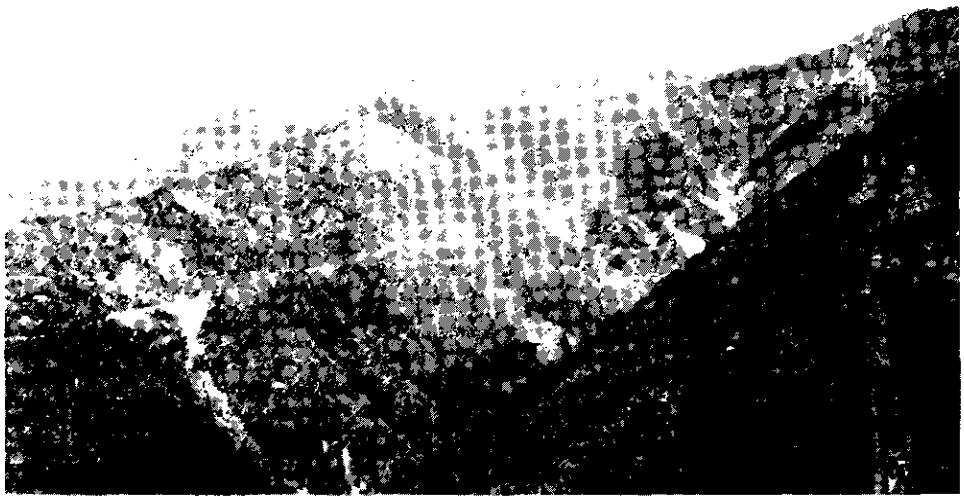
The work done by the Consolidated Mining and Smelting Company in 1928 consisted of a crosscut tunnel, at an elevation of 2,676 feet, which explored the vein at a depth of about 380 feet, measured on its average dip, below the outcrop. This crosscut tunnel, 715 feet long, is located south-easterly from the shaft-workings. At 625 feet in from the portal, drifts were run northerly and southerly, but bad air in these workings prevented an examination. The northerly drift extends some 315 feet to a point just short of developing the ground below the shaft-workings. Some crosscutting was done and short raises were put up from near the inner end of this drift. In the southerly drift some raising and crosscutting was done. In this section, where some ore is reported to have been developed, the dips are from 20° to 28°. The *Banker* mine and adjacent property, which takes in part of the Ainsworth townsite, were acquired in the fall by H. S. Fry, representing Portland capitalists. Since then a limited amount of development-work has been done in the shaft-workings, but it is not expected that any extensive work will be undertaken until there is an improvement in metal prices, particularly in regard to lead.

Pontiac, Scranton, and Sunrise.

These and adjoining claims at the head of Woodbury creek, which flows into Kootenay lake from the west, were examined last summer by a mining engineer for American interests, who are represented by Carl J. Bailer, of Portland, Oregon. Development-work is expected to be started during the coming season. The properties, largely owned by C. F. Caldwell, of Salt Lake City, are described in the Annual Reports for 1899 and 1904, since when no appreciable mining activity is reported to have occurred. The ores in this section contain silver, lead, and zinc, gold values being associated with pyrite in some cases.

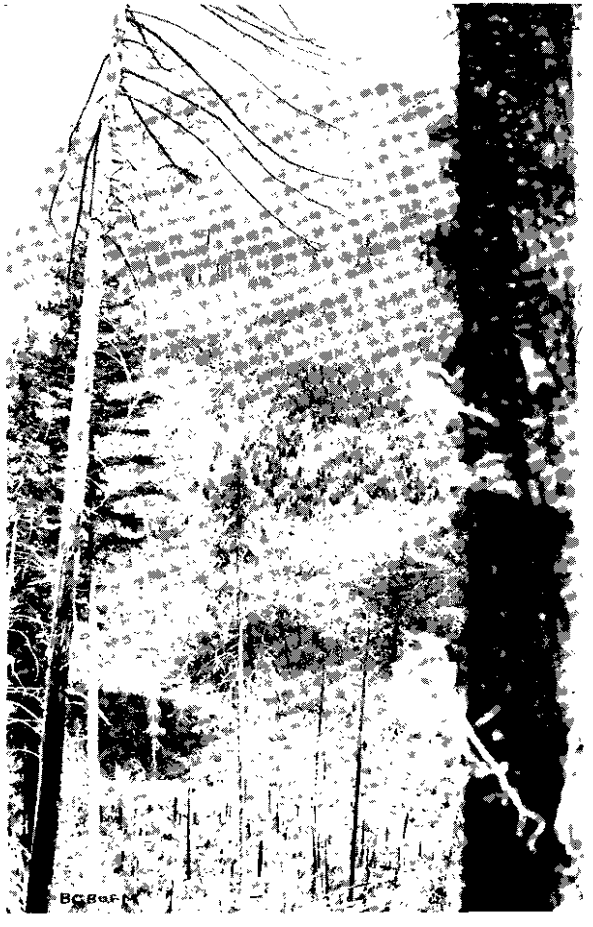
Also on Woodbury creek English Bros., of Kaslo, have been prospecting their *Baltimore* group, a high-grade silver prospect, situated on the north slope of the valley about 7 miles from Kootenay lake. The only reference to the property is contained in the Annual Report for 1904.

Minor activities in the Kootenay Lake and Ainsworth area include: Prospecting of the Otto and *Leviathan* groups on Campbell creek by J. Spiers and J. McLellan, their respective owners, both of Kaslo; prospecting activity by D. M. Wadams in connection with his *Lookout*

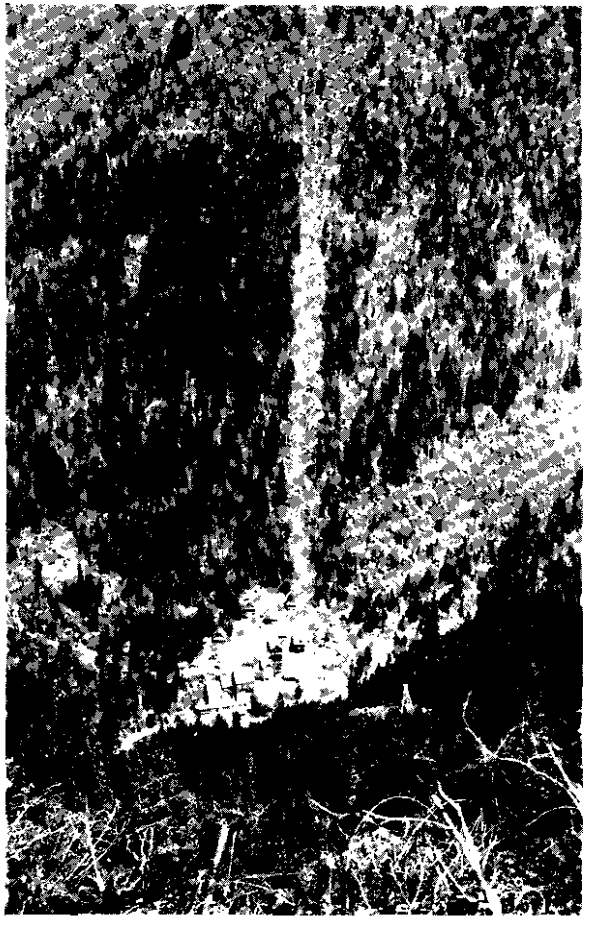


Mammoth Mine, Slocan M.D.

Sturgis Creek Mine Camp, Ainsworth M.D.



Wellington Mine, Slocan M.D.



Hewitt Mill, Slocan M.D.

group on Fry creek; prospecting activity in connection with the *Violet* and *Jessie Bluebird* on Woodbury creek, from both of which shipments of exceptionally high-grade silver ore were made in past years.

Howser Lake and Duncan River.

Riverside. At this silver-lead prospect, situated on the eastern side of the Duncan river, south of McGuire creek, exploration was carried on throughout the season by the Omo Mines Corporation, of Spokane. A. Sorenson was in charge of a small crew engaged in completing a crosscut tunnel to test the vein at depth. The property is at present handicapped by difficult transportation conditions in winter and development-work has been chiefly confined to the open season since the above company became interested in the property in 1928. References to the *Riverside* group, portion of which was formerly known as the *International*, are contained in the Annual Reports for 1918, 1927, 1928, and 1929, also in the recently published Geological Survey of Canada, Memoir 161.

President. This silver-lead prospect is situated on the western side of Howser lake, near its northern end. A detailed description of the workings is contained in the Annual Report for 1929. During the period under review exploratory work was continued in the lowest or No. 4 tunnel. R. S. Gallop has directed the work for President Mines, Limited, of Victoria.

Minor prospecting activities in the Duncan River area were carried on by: D. D. McPhail and J. Gillis, of Kaslo, on their *Fresno* group on Gertrude creek; Cyrus K. Brown, of Kaslo, on his claims below the *Bannockburn* on Hall creek. On Hamill creek, south-easterly from Howser, J. Brochier has been prospecting his *St. Patrick* property. A description of this silver-lead prospect by H. C. Gunning is contained in the recently published Geological Survey of Canada, Memoir 161, "Lardeau Map-area."

Poplar Camp.

White Eagle. Minor exploratory activity occurred during the season at this property, which is situated at the head of Cascade creek, about 12 miles from the Lardeau–Gerrard branch of the Canadian Pacific Railway. J. Gallo has been in charge of work for the Keene Mountain Gold and Silver Mines, Limited, of Calgary, since this company acquired the property in 1928. References to the *White Eagle* are contained in the Annual Reports for 1928 and 1929. The ore contains values in gold, silver, lead, and zinc. Work has necessarily been of a seasonal nature owing to snowslides obstructing the old trail in winter and until late in the spring. This condition is gradually being improved by the construction of a new trail which crosses the snowslides above where they fan out into the Cascade Creek valley.

Comstock. This silver-lead property, described in past Annual Reports, is reached by a branch trail from the main Cascade Creek trail at a point about 7 miles up from the railway. Prospecting-work was carried on during part of the year by P. Short under agreement with the owner, P. J. Sheran, of Nelson.

Snowstorm. At this property, comprising seventeen claims, situated on the divide between Cascade and Poplar creeks, three men were employed all summer under the direction of Joe Gallo, who acquired the *Snowstorm* from C. Green, of Poplar. Exploratory work done includes a 14-foot shaft, a trench 150 feet long and 6 to 7 feet deep, and two other big trenches. Together these workings develop a quartz vein up to 24 feet wide, assays from which are said to give from $3.40 to $9.80 in gold to the ton.

Lardeau River Placers. In Bulletin No. 1, 1929, attention was drawn to promotional literature issued by R. W. Elsom and Company, of Spokane, in regard to a proposed placer-dredging proposition on the Lardeau river from Gold Hill south-easterly. The first activity developed on June 1st, 1930, when a drilling-rig was set up at Gold Hill. The outfit consists of a No. 3 size Keystone traction-type churn-drill complete with tools and some casing. The site for the first hole is located on a bench about 40 feet above the river-level and a few hundred feet easterly from the tracks of the Lardeau–Gerrard branch of the Canadian Pacific Railway. One test-hole was put down to a depth of from 25 to 30 feet. The drilling outfit was left on the ground and no activity has since been reported. More confidence would be felt in this proposition if the services of a reliable engineer were secured

to direct systematic testing of the area. Past attempts to win gold from the Lardeau river are briefly summarized by H. C. Gunning in Geological Survey of Canada, Memoir 161, "Lardeau Map-area," pages 110 and 111, as follows:—

"Placer-mining has received but little attention in the Lardeau. In 1890 some shafts were sunk in the bench on the side of Lardeau river a short distance below 10-Mile and some gold was found. Since that time a few attempts have been made to discover profitable ground in the vicinity. Peter Culkeen did considerable trenching, sluicing, and hydraulicking just above the falls in Lardeau river below 10-Mile. He is reported to have found gold in small amounts, but no profitable extraction is recorded. Small amounts of gold have been found in the bars of the river, near Trout lake, and at one time a dam and flume were constructed by an American company. The operations, unsuccessful, were discontinued after one season.

"A determined attempt was made in 1903 and again in 1914 to win placer gold from the gravels of Lardeau river between Poplar and Cascade creek. The operations have been unsuccessful and the old dredge employed in the latter year may still be seen above the railroad-bridge near Gold Hill. The work done has shown that there are some good values in the gravels, but large boulders, which are abundant, have prevented profitable working with the machinery employed.

"Mr. Board, of Howser, reports that about 25 oz. of gold has been taken from Lardeau river between Howser Station and Poplar, and that the gold was in fine flakes of ⅛ inch diameter or less. He has thoroughly prospected the bars between these places and does not think that there is much profit to be made therefrom. It is also reported that considerable gold was taken from Cascade creek by Chinamen in 1915, but there is no means of ascertaining how much. The low pass between Howser and Howser Station has been prospected by shafts, but no values have been found.

"The source of the gold in the placers is undoubtedly the numerous gold-quartz veins and the gold-bearing sulphide deposits of the district. On the whole, there seems to be little reason to believe that placer-mining will ever become important in the Lardeau. The district has been heavily glaciated and it is unlikely that any pre-Glacial placers will be found. The difficulties of water in the gravels and large boulders have so far discouraged operations after brief intervals of activity."

REVELSTOKE MINING DIVISION.

Publications of the Geological Survey of Canada covering portions of the Revelstoke Mining Division include: "Geology and Mineral Deposits of the Big Bend Map-area," published in the Summary Report for 1928, Part A; and Memoir 161, "Lardeau Map-area." The first-mentioned covers the economic geology of numerous prospects north and east of Revelstoke and the latter covers an area near the southern boundary of this Mining Division. The mineral-deposits of the Big Bend section are being made more easily accessible by the extension of the road north of Revelstoke, which has now reached Downie creek. North of this point an old wagon-road, which extends some 13 miles to near Old Goldstream, could be made passable at comparatively small expense until such time as the new highway is built beyond Downie creek. Previous to the transportation facilities now afforded it was necessary to spend considerable time travelling by pack-train to reach most of the prospects. This area contains some quite interesting mineral occurrences and the new road will be of great benefit to all those having mining properties in the Big Bend and no doubt will lead to increased activity.

Big Bend Section.

Placer-mining.

French Creek Development Co., Ltd.

This Vancouver company has been conducting hydraulicking operations on the *Cougar*, *Goat*, and *Gopher* leases on French creek since 1927. W. G. Watson, of Vancouver, is president and managing director and N. Remillard, of Revelstoke, who has been in charge of the work, is vice-president and mine manager. The latter has worked in the vicinity for over twenty years and, with his former associates, prospected by tunnels and shafts a large area of bench land on the north-western side of French creek, 1 mile from its confluence with Goldstream. These old prospect-workings, according to the management, indicate an old gold-bearing channel.

In 1928 the company erected a small sawmill and built 6,000 feet of 4- by 3-foot flume and some 2,300 feet of pipe-line. Two monitors have been in operation at times and a large area of bed-rock has been uncovered. Towards the end of the 1930 season pay-gravel was encountered and about $2,700 in coarse gold was recovered from 900 cubic yards, according to the report of W. G. Watson.

Lode-mining.

A. and E. Prospecting-work was carried on during the summer months on this group of four claims, owned by A. Kitson and the McBean Estate and situated at the head of Kelly creek. The ore contains values in gold, silver, lead, and zinc. The showings, which are encouraging, are described by H. C. Gunning in Geological Survey of Canada, Summary Report for 1928, Part A.

Among other interesting prospects described in the same publication are: The *J. and L.* gold-silver-lead-zinc property on Carnes creek, owned by the J. and L. Mining Company, of Regina, and represented there by H. A. Rutherford, of the legal firm of McKinnon, Rutherford, McLean & Pitcher; and the *Montgomery* copper property on Boulder creek, a tributary of Downie creek from the north, which is owned by J. C. Montgomery, of Revelstoke.

There was the usual amount of prospecting in the Big Bend area. No activity has yet developed in connection with the cyanite-deposit mentioned in the Annual Report for 1929, but this will probably be investigated during the coming season. Exceptionally good specimens have been brought out at intervals from a slide at the foot of Death rapids on the Columbia river, about 50 miles north of Revelstoke.

SECTION EAST OF REVELSTOKE.

Snowflake.* This property, owned by the Snowflake Mining Company, Limited (N.P.L.), is situated on Woolsey creek, about 8 miles by good trail north of the main line of the Canadian Pacific Railway. Detailed information concerning this property is contained in the following reports: "Report on the Snowflake and Waverley-Tangier," a special bulletin issued by the Department of Mines in November, 1928; Bulletin No. 1, 1929, issued in July, 1929; Summary Report, Part A, Canadian Geological Survey, pages 156, 182 to 186, inclusive; Annual Report of Minister of Mines, B.C., 1922, 1928, and 1929.

Since the work described in the 1929 Annual Report was completed only a small crew of men was retained to continue lateral development-work from the raise connecting the No. 4 and No. 2 level and further development drifting on the No. 4 level west drift.

During 1930 an arrangement was also made by the Regal Silver Mines, Limited, with the Snowflake Mining Company, whereby the latter continued the east No. 4 level drift into Regal Silver ground for approximately 300 feet. At the end of August, on completion of this outside account work, the Snowflake Company stopped all development-work, withdrew its deposit in the hands of the Gold Commissioner to satisfy wage claims, and closed the camp.

When the area was visited in October the property was closed and the results of the limited amount of development-work accomplished in 1930 are not definitely known. Recently a company meeting was held to authorize an increase in capitalization from 2,500,000 shares of 50-cent stock to 5,000,000 shares of 50-cent stock in an endeavour to finance further work at the property.

Regal Silver Mines, Ltd.* This property, which adjoins the *Snowflake* to the south-east, covers the extension of the same vein system down to considerably lower altitudes on Clabon creek. The property has been reported on in detail in the 1929 Annual Report of the Minister of Mines and in the Part A, Summary Report, 1928, of the Geological Survey of Canada.

Recent development at the property is briefly summarized as follows: A crew of twenty-four to ten men was retained during 1930 and a large amount of development drifting, cross-cutting, and raising completed on the various levels of the property. A comprehensive system of level-numbering was adopted during the year, the old No. 1, No. 2, and No. 3 levels described as such in 1929 now being known as the No. 4, No. 6, and No. 10 levels respectively.

No. 10 level at 4,450 feet elevation (at the camp-level) was advanced along the No. 6 west drift for 125 feet and along the No. 6 east drift for 75 feet to the slide portal. The raise from No. 5 west drift (No. 10 level) was extended a short distance above the intermediate level

now known as No. 9 at 4,575 feet elevation. A raise in No. 6 east drift from No. 10 level was also advanced 25 or 30 feet along the vein.

No. 9 level was extended in a north-westerly direction for 275 feet and the south-east drift driven through to a portal on Clabon creek. Total development on this level with crosscuts and drifting was approximately 625 feet.

No. 8 level at 4,669 feet elevation, the portal of which is 260 feet west of No. 9 level portal, was started late in the year, and when examined in October it had advanced about 200 feet and development-work was being pushed on two faces. No. 7 level is non-existent as yet, being reserved for a level between No. 8 and No. 6 (the old No. 2 level at 4,958 feet elevation).

Approximately 1,600 feet of drifting, raising, and crosscutting was done on this latter level during 1930. The No. 6 level drift was extended 700 feet in a north-westerly direction and a raise 240 feet long was put up at a point 335 feet from the portal. Numerous short crosscuts and short drifts were driven at various points along the level.

A future level called No. 5 will be driven from the surface to reach the top of the main raise driven from No. 6 level. On the No. 4 or old No. 1 level there was no advance this year. The new No. 3 and No. 1 levels have not been started as yet.

No. 2 level, which is an extension of the No. 4 level of *Snowflake* workings into Regal Silver ground, was driven under arrangement by the Snowflake Mining Company for the Regal Silver Mines account. A total of 385 feet of drifting and crosscutting in a south-easterly direction from the *Snowflake*-Regal Silver boundary-line was driven before work was stopped. An examination of the assay-maps of this section of the property shows that a certain amount of sulphides, principally pyrite, and galena, with small amounts of sphalerite, stannite, and chalcopyrite, were encountered in the quartz vein following the bedding of the crushed slates. The best section over a length of 60 to 65 feet and in that portion of the drift adjacent to the *Snowflake* boundary showed a varying width of 1.5 to 3 feet of mineralization. In this area assays varying as follows were obtained by the company's assayer: Silver, trace to 2.5 oz. to the ton; lead, *nil* to 4.5 per cent.; zinc, trace to 3.5 per cent.; tin, *nil* to 3.2 per cent.; copper, *nil* to 2.9 per cent.; with the greater proportion of the assays being closely related to the lower limits given.

The whole underground development scheme was remapped on a scale of 20 feet to the inch during the year and a new assay-plan of the property prepared on the same scale. While the large footage of development raising, drifting, and crosscutting accomplished during 1930 has added materially to the knowledge of the quartz veins opened up on the various levels of the property, a careful study of the company's assay-plans indicates that conditions regarding commercial ore-bodies are not materially changed from 1929, as given in the Annual Report for that year.

Work at the end of 1930 was being proceeded with on the two faces mentioned in the No. 8 level tunnel with a small crew of ten men.

Klondyke.* The Alco Syndicate, of Vancouver, in which O. Larson, D. Lougheed, *et al.*, are interested, owns six groups of claims in the vicinity of Albert Canyon. Two of the groups called the *Limestone Dyke* and *Iron Cap* are located near the head of the West fork of Woolsey creek (Silver creek). The ore, according to O. Larson, is grey copper and galena with some stannite.

The remaining four groups of claims are located at Klondyke, 9 miles up Tangier creek from Albert Canyon. During the latter part of the summer months a small crew of men was employed by the syndicate under the direction of C. Arnold and O. Larson. Camps were established and three tunnels totalling 200 feet of underground work were driven to develop surface showings of galena. Numerous surface cuts have also been made at this showing. The property was not visited this year.

Woolsey Mines, Ltd.* The property of this company is situated on the west side of Bostock creek in Glacier National Park, 3 miles by trail from Flat Creek, a small station on the main line of the Canadian Pacific Railway. A limited amount of surface and development work was done early in the season by Eastern interests who were supplying the required capital. However, it was decided to curtail expenses about the first of October, since which time little has been accomplished.

SECTION SOUTH OF REVELSTOKE.

Wigwam.* This property of the Wigwam Mining Company, of Tacoma, Wash., is situated 6 to 7 miles by road east of Wigwam Station, on the north side of the Akolkolex river. It was acquired by the company in 1924 under terms of a 99-year lease and bond. Herbert Blewitt, of Tacoma, is president and W. T. Dumbleton, of Revelstoke, is manager and mining engineer for the company.

In addition to the detailed description of the property contained in the 1929 Annual Report, further data were recently published in Memoir 161, "Lardeau Map-area, B.C.," by H. C. Gunning, issued by the Geological Survey of Canada.

During 1930 a crew varying from eighteen to ten men was employed. A large portion of the road to the railway was improved and gravelled, and with the installation of a tractor-engine-driven air-compressor, machine-drills, and necessary auxiliary equipment, and appreciable amount of underground development tunnelling was accomplished. The management plans to employ eight to ten men throughout the winter months in underground work.

LARDEAU MINING DIVISION.

There has been a considerable falling-off in mining activity in this Division, which is due in large measure to the failure of financial arrangements in connection with some of the propositions initiated in recent years. Geological Survey of Canada, Memoir 161, "Lardeau Map-area," made available in 1930, contains much information of scientific and economic interest in connection with the deposits of this Division.

Lead Star. At this group of six claims, situated on the Stephney branch of Sable creek, 5 miles by trail from the road north of Camborne, development-work has been continued by Duncan McIntosh, of Cranbrook, with three miners. A description of the geology of the deposits is contained in the above-mentioned Memoir 161, Geological Survey of Canada. Since the property was examined in 1926 by H. C. Gunning, author of "Mineral Deposits" in this publication, a substantial amount of work has been done by hand. The workings are situated in a gulch on the very steep hillside, the camp being situated on a bench at about 5,200 feet elevation above sea-level. Three tunnels at approximate elevations (aneroid) of 5,322, 5,100, and 4,675 feet, together with some open-cuts, develop a south-easterly-striking vein which cuts a series of schistose rocks at a slight angle. The upper tunnel, over 100 feet long, has been driven to explore a wide zone of shattered, greenish, and rusty-weathering carbonaceous rock (probably originally a dyke of greenstone, according to Gunning), in which bunches and stringers of quartz are developed in places. The foot-wall of the zone is marked by a heavy graphitic gouge which dips at 45° to the north-east. Scattered small aggregates of galena are visible in the rock adjoining the black gouge. Near the inner extremity of this tunnel and towards the hanging-wall side of the carbonate rock some galena was developed on which a 50-foot vertical winze has been sunk, from which some 13 tons of galena was shipped early in 1930. This working could not be examined on account of water. The intermediate tunnel, in about 400 feet at the time of the writer's examination in the summer, starts as a diagonal crosscut and continues as a drift on the lead which contains bands and stringers of galena and sphalerite. In a 25-foot crosscut driven to the north-east from a point just back from the face of the main tunnel, the rock, heavily pyritized, contains numerous stringers of sphalerite and, near the face, a 6-inch stringer of clean galena. Work was proceeding on this level to develop the galena-shoot opened up in the winze from the upper tunnel. The lower tunnel, adjoining a small creek, has been driven 80 feet in a wide zone of iron-stained silicified rock containing some bands of mixed lead and zinc sulphides and a few tons of this material are on the dump. About 50 feet above this tunnel, in the same gulch, there is a wide showing of iron-stained oxidized material on the foot-wall side, of which some ore is partially covered with debris. Tetrahedrite is reported to have been identified, associated with galena, in ores from the *Lead Star* and appreciable gold values have been shown in some assays. Since the writer's visit some clean galena is reported to have been struck in the intermediate tunnel, a specimen of which assayed: Silver, 57 oz. to the ton; lead, 72 per cent.

Teddy Glacier. At this property, situated to the north-west of the *Lead Star* and on the opposite side of Stephney creek, no activity materialized during the period under review, which was disappointing to those interested in this section

of the district. It is hoped that satisfactory financial arrangements will soon be made to thoroughly test the attractive surface showings on this property.

Multiplex.* This property, situated on the south side of Poole creek, 1½ miles east of Camborne, is owned by the Multiplex Mining, Milling, and Power Company, Limited. O. T. Bibb is president and manager. Past references and descriptions of the development-work are contained in the 1924, 1926, and 1929 Annual Reports, while a recent description of the essential geological features of the property is contained on pages 85–88 of Memoir 161, "Lardeau Map-area, B.C.," recently issued by the Geological Survey of Canada.

The development-work done by Eastern Canadian interests represented by A. Renick was stopped early in January, 1930, due to the depressed state of the metal and financial markets. The proposed crosscut tunnel on the "New Showing" shown on page 341 of the 1929 Annual Report was within 25 or 30 feet of its objective at that time, and it is anticipated that, should market conditions and finances soon permit, this work will be continued to a definite conclusion. At the present time there is no one working at the property.

ARROW LAKE MINING DIVISION.*

Burton District.

The year 1930 saw increased prospecting activity in the area west of Burton, due largely, no doubt, to the continuation of development-work at the *Hailstorm* group by the Consolidated Mining and Smelting Company of Canada, Limited.

Chieftain.* Early in the year the *Chieftain* property, situated about 4 miles west of Dusty's ranch on the south side of Caribou creek, was opened up by a small Vancouver syndicate. Several tons of ore was mined, sorted, and sacked ready for shipment to the smelter, but financial difficulties interfered with the arrangements and the property was of necessity closed.

Caribou Ace.* Vancouver men respresented by D. J. Cleveland took an option on A. A. Burton's *Caribou Ace* and *Caribou Queen* groups of claims. These two groups, comprising seven claims in all, are located about 2 miles west of the *Millie Mac*, on the north side of Caribou creek, and are reached by a branch trail from the main *Millie Mac* trail. Supplies for several weeks' prospecting by a small party were taken in and it is reported that considerable surface prospecting on quartz veins carrying gold values resulted.

Poorman.* This property, consisting of six claims held on location and owned by R. Brett, S. Bradley, S. Perry, T. G. Carter, R. Mitchel, and C. McEllar, is situated on the west side of Bluegrouse creek, 1 mile north of what is locally called Dusty's ranch. A fair trail connects the two places.

The workings, when examined in July, consisted of one short adit-tunnel 27 feet long, one shallow shaft, and several open-cuts on both sides of the creek at 3,650 feet elevation. The 27-foot tunnel driven in a westerly direction on a crushed zone of graphitic slate contains small lenses of zinc and lead sulphides carrying good silver values. A selected sample of material from several of these small pockets assayed: Gold, 0.44 oz. to the ton; silver, 16.6 oz. to the ton; lead, 3 per cent.; zinc, 11 per cent. The open-cuts on both sides of the creek and the shallow shaft on the east side of the creek, 75 feet to the east of the tunnel portal, have indicated the position of the crushed zone in the slates without uncovering further mineralization. The amount of ore uncovered is small and further prospecting will be required to demonstrate any commercial value which may be attached to this group of claims.

Silver Queen.* This group of nine claims—the *Red Fox*, *Red Fox Fraction*, *Black Fox*, *Black Fox Fraction*, *Grey Wolf*, *Grey Wolf Fraction*, *Black Bear*, *Black Bear Fraction*, and *Grizzly No. 2* mineral claims—is situated on the south side of the divide separating Canyon and Snow creeks, about 14 miles by trail east of Burton. The principal owners are H. W. Stones, merchant, of Burton, and his partner, J. Gayford.

During 1930 further prospecting was done by the owners on a series of quartz veins in the quartzite, slate, and shale country-rocks. Mineralization of the quartz consists of pyrite, galena, and blende in small amounts, with associated gold and silver values.

Past development-work at the property done many years ago has been confined to three localities. The lowest work was done at 6,450 feet elevation, where a total of 450 to 500 feet

of drifting and crosscutting in slates and shales has endeavoured to trace broken quartz veins. No mineralization could be definitely traced underground, but a sample of two small dumps at this tunnel portal was taken and assayed: Gold, 0.04 oz. to the ton; silver, 28.5 oz. to the ton; lead, 2.7 per cent.; zinc, 2.6 per cent.

In a north-easterly direction up the steep mountain-slope at 6,650 feet elevation a 40-foot shaft has been sunk on a quartz-outcropping. This shaft could not be examined as no ropes or ladders were available, the past facilities for examination having disappeared.

Near the summit of the ridge at 7,350 feet elevation, and approximately 800 feet N. 70° E. of this 40-foot shaft, several open-cuts have opened up a quartz vein in the quartzites. The vein has a width of 8 to 10 feet and two samples of the material removed in past prospecting were taken from the small dumps, assaying as follows:—Sample No. 1: Gold, 0.08 oz. to the ton; silver, 11 oz. to the ton; lead, 1.3 per cent.; zinc, 1.5 per cent. Sample No. 2: Gold, 0.06 oz. to the ton; silver, 22.7 oz. to the ton; lead, 2.1 per cent.; zinc, 4.2 per cent.

During the year the trail serving the property was improved, but no reports have been received as to what success was met with in the prospecting.

Black Bear.* This property, owned by H. E. Forster, of Wilmer, is situated about 4½ miles by steep trail in a north-easterly direction from Dusty's ranch. Reports were current early in the summer that the owner intended cleaning out the lower tunnels on the property, but since that time no information regarding the results of this work has been received. When the mine camp was visited in July no one was in charge.

*Ora Granda.**—Further prospecting by the owner, J. C. Anderson, was done on the *Ora Granda* claim during 1930. This claim adjoins the *Promestora* property to the east and is situated 3 miles east of Mineral City, on the west side of Mineral creek.

Hailstorm.* Development-work at this group of seven claims, situated on the divide between Canyon and Caribou creeks, was resumed early in the year by the Consolidated Mining and Smelting Company of Canada, Limited, and continued until the late fall, when the crew with all equipment was withdrawn.

An appreciable footage of underground crosscutting, drifting, and raising from the 7,000-foot level described in the 1929 Annual Report met with discouraging results. The downward extension of the favourable oxidized calcite-silver-bearing mineralization exposed on the surface workings was not found and the option on the property has been dropped as a consequence.

Edgewood Section.

In the Arrow Lake Mining Division west of Edgewood and adjacent to the Vernon–Edgewood road but a small amount of development-work has been done during 1930. Work was carried on at the *Meadowview* and *Paradise* groups.

Meadowview.* At this property, situated 1 mile north of the Vernon–Edgewood road, 30 miles west of Edgewood, the Cotton Belt Mines, Limited, of which B. F. Lundy is president, continued development-work with a small crew of men until about March 1st of 1930. The drift to the east from the main crosscut tunnel followed the vein for 132 feet before encountering a faulted section. Further work in a north-easterly direction for 160 to 165 feet failed to locate the vein and work was stopped in this section of the property. In the western drift on the same level the vein, though narrow and crushed, was followed in part for 160 feet, where another faulted section was encountered. Exploratory drifting and crosscutting in a northerly direction in this faulted area failed to pick up the vein again. These disappointing results, together with the small gold and silver values found in the vein as opened up, caused the management to suspend development-work for a short time.

It is reported since the property was visited in June, when it was deserted, that the company has carried out further development with disappointing results. At the present time the camp is closed. The ore-mineralization exposed in several open-cuts and three shafts along a 1,300-foot outcrop of quartz in granite country-rock is chiefly pyrite with small amounts of gold, galena, and zinc-blende.

Paradise and Renown.* These two groups are owned by R. Shiell and associates, of Needles. The *Paradise* group, consisting of the *Paradise, International, Bellview,* and *Lakeview,* is situated on the north-east side of the Vernon–Edgewood road, approximately 29 miles from Edgewood. The trail from the road to the upper camp

at 5,000 feet elevation is about 1½ miles long. The *Renown* group of five claims—the *Renown, Repulse, Hood, Bluebell,* and *Bluebird*—is located half a mile to the north of the *Paradise* at an elevation of 5,700 to 6,500 feet.

Work on the *Paradise* group consists of three open-cuts and two tunnels 43 and 30 feet in length. The 43-foot or No. 1 tunnel at 5,000 feet elevation develops a 14-inch quartz vein in granite. A sample across 12 inches at the face assayed: Gold, *nil;* silver, *nil.* The three open-cuts short distances to the east of the No. 1 tunnel develop this same quartz vein, but the results of two channel samples were very low grade, being as follows:—In the open-cut 30 feet east of No. 1 tunnel and across 32 inches of quartz the assay returned: Gold, trace; silver, 1 oz. to the ton. In the No. 2 tunnel, 600 feet east of No. 1 tunnel and at 5,050 feet elevation, a 4- to 5-foot vein of quartz and decomposed country-rock has been followed along a N. 80° W. direction for 30 feet. The vein is apparently a different one than the one found in the No. 1 tunnel and a sample across 52 inches at the face assayed: Gold, *nil;* silver, *nil.*

The *Renown* group showings consist of a narrow east-west-striking, vertically dipping vein at 5,775 feet elevation, and it has been exposed at four points along a length of 430 feet by four open-cuts. The most easterly or No. 1 open-cut has a showing of 18 to 20 inches of quartz in granite, showing small amounts of pyrite mineralization. The second open-cut, 180 feet west of No. 1 cut, contains better-grade sulphides and a sample across 16 inches assayed: Gold, 0.30 oz. to the ton; silver, 1.4 oz. to the ton. The No. 3 open-cut, 200 feet west of No. 2, was caved and could not be examined. The No. 4 open-cut shows a vein 30 to 26 inches wide in granite, and a sample across a width of 33 inches assayed: Gold, trace; silver, trace.

TROUT LAKE MINING DIVISION.

The geology and character of numerous properties in this Division are described in Memoir 161, Geological Survey of Canada, issued in 1930.

Poplar Section.

Spyglass. At this property, situated on Poplar creek, about 14 miles from the railway, exploratory work on a small scale was carried on during part of the season under the technical direction of E. Foley Bennett, of Penticton. In July a crew of five men, including a foreman, started to drive the new crosscut tunnel to develop the main lead at a depth of 700 feet below the shoots of high-grade silver ore exposed in the workings described by A. G. Langley in the Annual Report for 1928. After proceeding with the tunnel a short distance a heavy stream of water was encountered which caused temporary discontinuation of this work. Work was subsequently continued and this tunnel, including 20 feet of open-cut approach, is now in 125 feet. Close timbering was necessary throughout. After going through 115 feet of granite-wash the last 10-foot section of the tunnel is entering solid formation and high-grade galena float is found mingled with slate. Some work was also done on the big vein adjoining the creek (mentioned in the Annual Report for 1929). A short length of new tunnel driven here exposes a width of 7 feet of strong iron-sulphide mineralization carrying a little gold and some silver. According to the management, it is planned to resume work in both these tunnels in the spring. Owing to difficult transportation conditions in winter exploratory work is necessarily confined to the open season at present.

Ferguson Camp.

True Fissure. This property, controlled by the True Fissure Mining and Milling Company, Limited, of Cincinnati, Ohio, is situated on the eastern slope of Great Northern mountain at an elevation of about 5,500 feet, or 2,500 feet above Ferguson, with which the mine-workings are connected by road 3½ miles in length. Dave Morgan, of Ferguson, has been in charge of exploration since 1922, during which time a large amount of development, mostly under contract, has been done by hand.

The character of the deposits and the development-work done have been described in past Annual Reports. During the period under review the principal activity was in connection with the erection of a 100-ton flotation-mill on the level of "C" tunnel adit, 259 feet above the level of the Morgan crosscut or lowest tunnel, and the installation of a hydro-electric plant on Ferguson creek below the townsite. Both plants were erected under contract by the Nelson Iron Works, the mill flow-sheet having been designed by W. L. Sheeler, formerly of Silverton.

The power plant consists of a Nelson Iron Works double-runner wheel, generating 400 horse-power under a head of approximately 135 feet, controlled by a Lombard governor and driving a 225-kw. General Electric 2,000-volt generator. The transmission-line, about 3¾ miles in length, connects with a 250-horse-power General Electric synchronous motor at the mill. The flow-sheet of this plant follows general practice. From the 100-ton ore-bin at the head of the mill the ore will first pass through a 9 by 15 Blake-type jaw-crusher; thence by bucket elevator to one set of 12 by 36 Chalmers and Williams crushing-rolls. From the fine-ore bin of 100 tons capacity the ore is conveyed by a Hendy continuous-belt ore-feeder to a 5 by 5 Colorado Iron Works ball-mill, which is in closed circuit with a 5 by 20, Model "C," Dorr duplex classifier, the overflow being fed to a Venturi (Sheeler patent) sub-aeration flotation installation which includes one 4- by 12-foot lead-rougher cell, one 4- by 3-foot lead-cleaner cell, one 4- by 2-foot recleaner-cell, one 4- by 12-foot zinc-rougher cell, and one 4- by 3-foot zinc-cleaner cell. The concentrates are dried by a 3-leaf, 4-foot American filter and delivered to two 10-ton bins. The machinery is so arranged that all power is transmitted by belts from the main-line shaft operated by the motor previously mentioned.

Considerable surprise has been caused by this large expenditure on mill and power plant under existing adverse conditions of the metal market and so much in advance of ore-development in the mine. In the Annual Report for 1929 attention was directed to the advisability of proving sufficient ore reserves before mill-construction was undertaken. It was also pointed out that the mill, when warranted by future work, should preferably be located either on Ferguson creek at the foot of the mountain, where there is ample water for a mill, or at Trout Lake, where barge connection could be established with the railway at Gerrard. These views are endorsed by reliable engineers familiar with the conditions. The reason for this premature mill-construction is understood to be that the late G. F. Park, of Cincinnati, who had personally financed work in the mine for many years, was anxious to bring the mine into production. He died during the construction of the mill, but made provision in his will for completion of the work. The Latonia Milling Company was formed by the Park interests to finance installation of the mill and operate it under an agreement with the True Fissure Mining and Milling Company, Limited. The following mining equipment was recently purchased from the Canadian Ingersoll-Rand Company: 500-cubic-foot (actual) capacity compressor, drifter, stoper, and jack-hammer rock-drilling machines, oil-furnace, steel-sharpener, steel, etc. It is understood that the mill will not be operated before next spring or summer.

The *True Fissure* property is described at some length by H. C. Gunning in the recently issued Memoir 161, "Lardeau Map-area," Geological Survey of Canada. The following extract is from page 74 of this publication:—

"The property is one of considerable promise. The *True Fissure* lead is the most important and deserves more development. There is just a suggestion that the ore in the upper workings may rake to the south-east in the vein and that the end of the ore had not been reached in 'C' adit. It is possible that the south drift from Morgan's crosscut has not yet reached the ore, but raising would be less risky than continuing the drift. The exceedingly fine grain of much of the ore will necessitate very fine grinding if a good separation of galena and sphalerite is to be obtained. The intergrowth of these sulphides is frequently so fine that increased magnification merely reveals, under the microscope, more and more minute areas of galena in the sphalerite. In such cases, and, indeed, generally, the grey copper, which is argentiferous, is related to the galena.

"A remarkable thing is that the *St. Elmo* lead, which has produced the highest-grade ore on the property, has remained essentially unprospected along its strike on the surface. This would be cheap work and another body such as that of the old workings would readily repay the owners for their expenditure.

"The *Bluebell*, where work is being done at the time of examination, seems to merit less attention than either of the other leads.

"One thing is certain, before any definite plan of production or extensive development is made, careful milling tests should be run on small shipments of the ore to ascertain just what extraction can be made."

This constructive, reliable, and impartial report is of considerable value in any consideration of proper development of the property.

Great Northern. Since this property, consisting of ten claims adjoining the *True Fissure*, was described in the Annual Report for 1929, it is reported that the lower tunnel has been extended for 32 feet and at the face of an 18-foot crosscut therefrom, driven to the north-west, galena-pyrite mineralization has been developed over minable widths. The face of the drift, according to H. McPherson, of Trout Lake, owner of the property, is now about 560 feet from the *True Fissure* boundary-line. The ore-showings in crosscuts towards the inner end of this tunnel indicate a favourable zone of deposition in which continuity of mineralization might be expected. He also states that the shipment made in 1896, and mentioned at the foot of page 337 of the Annual Report for 1929, was 47 tons. The *Great Northern* might well have been combined in one operation with the *True Fissure* to get the best results.

Nettie L. A small amount of preliminary activity occurred last summer in connection with this mine, 4 miles by road from Ferguson, by the recently incorporated Gold Prospects, Limited, capitalized for 2,000,000 shares of no par value. The head office of the company is at Winnipeg and a branch office has been opened at Vancouver by Isaac Rosenthal, president and managing director. E. K. Allison is secretary-treasurer and E. A. Dowman is consulting engineer, both of Winnipeg. The property is described in past Annual Reports and in Memoir 161, "Lardeau Map-area," Geological Survey of Canada. Past production from the *Nettie L.* between 1900 and 1904 approximated 2,500 tons of ore having an average value of about $75 to the ton, values being chiefly in silver, lead, and gold. From the adjacent *Ajax*, which is included in the deal, some 600 tons is reported to have been shipped between 1912 and 1914. Further exploration is now necessary to seek new ore-bodies similar to those from which past production was made, and in this connection suggestions of value are contained in the report by H. C. Gunning published in the above-mentioned Memoir. In addition to the *Nettie L.* and *Ajax*, Gold Prospects, Limited, is interested in the *Aberdeen* mine near Merritt, in the Nicola Mining Division, and in mineral properties in Central Manitoba.

I.X.L. Fraction. At this claim, adjoining the wagon-road a short distance below the *Nettie L.* mine-workings, prospecting-work was continued by the owners, G. McLaren and W. White, of Ferguson. The principal working is a drift, 400 feet long, containing two short crosscuts and a 30-foot raise. The geology is described by H. C. Gunning in Memoir 161, Geological Survey of Canada. Assay results of samples of the ore taken by A. G. Langley are contained in the Annual Report for 1924. The new showings opened up were sampled by the writer chiefly to ascertain the gold content of the ore. These were as follows:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
Across 5 feet in face of tunnel	0.08	2.4	3.1	1.1
Streak of massive pyrite 10 feet back from face	0.06	9.8	.....	.....
Across 18 inches of pyrite and quartz in main drift north of stope	0.06	0.7	.....	.....
Selected ore from 6-foot quartz vein in open-cut below the road	0.03	18.2	29.7	0.8

Copper Mountain. A trip was made in July, in company with C. M. Tyler, of the B.C. Mining Syndicate, of Calgary, to inspect this prospect, owned by J. T. Lauthers, of Revelstoke, at the head of Surprise creek, a tributary of Ferguson creek. The old workings consist of some open-cuts, at about 6,400 feet elevation, in the rock bluffs below the summit of the ridge. The formation of the area is composed of a wide belt of chlorite-schist in which are found occasional, very widely separated, veinlets and small lenses of quartz containing disseminations of bornite and copper carbonates. No continuity to the erratic mineralization could be seen in any direction. A small amount of work had been financed by the above-mentioned syndicate, including construction of a cabin near Ferguson creek and a short length of tunnel in the same vicinity. Work was discontinued later by the syndicate.

Trout Lake Vicinity.

Lucky Boy.—Prospecting-work was continued by George Yuill, the owner of this high-grade silver property, situated on the western side of the valley near Trout Lake (town), with which point it is connected by a wide trail on a good grade.

U and I, Foggy Day, Alpine, and Hercules.—Mrs. Jowett, as usual, spent several weeks of the summer season in prospecting her claims on the range east of Trout Lake. These are described by H. C. Gunning in Memoir 161, Geological Survey of Canada. The ores in most cases contain gold values.

NELSON MINING DIVISION.

There has been a marked revival of interest in gold-mines and prospects in this Division, work having been resumed at several properties. In other cases where actual mining has not yet developed there is good reason to believe that several new activities will be initiated during the coming year. 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 are described in the recently issued Summary Report, 1929, Part A, Geological Survey of Canada, under "Mineral Developments in Salmo Map-area," by J. F. Walker. This includes the following mining properties: *Queen, Kootenay Belle, Nugget-Motherlode, Reno, Iron Cap, Salmo-Consolidated, Salmo-Malartic, Howard, H.B., Emerald,* and *Molly Molybdenite.* The important new activities of the West Kootenay Power and Light Company are mentioned in the introductory section of the writer's report.

Near Nelson.

Euphrates. This gold prospect, situated on the north-eastern side of the Great Northern Railway, about 9 miles south of Nelson, was described at some length in the Annual Report for 1929. The lower tunnel on the *Ell-Tee* vein has been extended several hundred feet and is now 1,098 feet in from the portal. In the new section opened up no appreciable change in the size of the vein is reported, but sulphides are becoming more prominent. The principal activity during the period under review has consisted in clearing right-of-way and erecting towers for a 2-bucket Riblet aerial tram, 3,400 feet in length, which will connect the lower *Ell-Tee* tunnel with an ore-bin, already completed, at the railway. According to published statements, it is the intention of the management to mine and ship ore. The property is owned by the Euphrates Mining Company, Limited (N.P.L.), with registered office at Nelson. Edward Terzian is president and W. W. Ferguson, of Nelson, is secretary-treasurer.

Humming Bird.—At this gold prospect, situated on Roaring creek and owned by R. Qua, of Nelson, exploratory work was carried on during the summer months by E. B. Rowley, of Vancouver, representing Coast interests.

Venus.* This group of seven Crown-granted claims is owned by R. Heddle and associates, of Nelson. The property is reached by 7 miles of road and trail from Nelson, being situated approximately 2½ miles south-west of town, at elevations of from 4,300 to 6,000 feet, on the north slope of Morning mountain.

Over 3,000 feet of underground drifting on five levels, together with a large amount of stoping above the various levels, has opened up and largely exploited the upper portion of a quartz vein which varies from but a few inches to 5 feet in width. This vein, which occurs near the contact of the granite of the Nelson batholith and volcanic rocks of the Rossland series, has been exploited principally for the gold values it contains. The mineralization takes the form of pyrite and quartz carrying gold and occurs in banded structure, the values and widths being somewhat better in the area of the vein said to be in the granite.

When the property was visited in the summer the underground working-tunnels were caved near the portals and an underground examination was not made. However, according to a report by R. Heddle, the principal owner, values of from $20 to $50 a ton in gold were obtained over narrow stoping-widths in the past working of the property. It is recently reported that outside interests will open up the property in the spring.

California. This group, comprising the *Union, Deadwood, California, Hillside,* and *Exchequer* Crown-granted claims, and the adjoining locations, *Waverley, Star Fraction, Clift,* and *Gold King,* has been acquired by the recently incor-

porated Hillside Mining Company, Limited (N.P.L.), under lease and bond from the owner, William Moore, of Nelson. The property is situated on the north-eastern slope of Toad mountain, about 3 miles by road from Nelson. Approximate elevations, from aneroid readings, of the workings on the claims range from 2,900 to 3,650 feet. The total past production is not exactly known at the time of writing. Smelter returns, shown the writer, for twelve car-load lots of sorted ore from the *California* vein workings, shipped at intervals between 1908 and 1922, show an average gross value of about $34 to the ton, practically all the values being in gold. Several small shipments from the *Union* vein assayed $33 a ton, and a few tons from the *Deadwood* tunnel, shipped to the Hall Mining and Smelting Company in 1900, assayed $13 in gold to the ton. Most of the development-work has been done on the *California* claim and consists of three tunnels, driven mostly as drifts, which develop the vein through a vertical range of about 270 feet. No. 1 tunnel, from which ore was stoped to the surface, is comparatively short; No. 2 tunnel is over 700 feet long; and No. 3 over 1,200 feet in length. There are several short tunnels driven on the *Union* vein and on a parallel vein to the *California*. On the *Deadwood* claim there is a drift-tunnel about 100 feet long and on the *Hillside* and *Clift* claims the superficial workings include numerous open-cuts and trenches. The formation of the area consists of schists of the Rossland volcanic series, intruded by granitic rocks of the Nelson batholith. The *California* vein, from 2 to 10 feet wide, has been formed along a line of shearing in the schists near a granite-contact. It shows persistence in strike and dip and by means of underground and surface work has been found to be continuous for a long distance along the strike, which is westerly, the dip being about 50° to the south. The principal values are in gold, the associated minerals being iron pyrites, zinc-blende, and occasionally a little galena. The vein-filling is schist, containing long attenuated parallel lenses of quartz with which the mineralization is associated. Adjoining the *California* lead a parallel vein has been opened at two points and is said to show fair values. The *Deadwood* "vein" is being investigated as to its possibilities for large tonnage of low-grade gold ore. This deposit, explored by an old 100-foot drift-tunnel, consists of a shear-zone about 300 feet wide. Within these limits the rock, a calcareous member of the Rossland volcanic group, is highly impregnated with iron pyrites and contains numerous little veins and stringers of quartz. Several engineers have sampled accessible areas of the zone, with interesting results. The assay value of the material appears to vary considerably and information is not yet available as to what might be considered a fair average. The few samples taken by the writer averaged $3.90 in gold, but, as the showings sampled are in some cases widely separated, this figure cannot be taken to represent any definite block of ground. The results of this sampling and that done by other engineers would seem to justify careful investigation to determine if the values are confined to streaks in the zone or if there are sufficient values over large widths. Some more definite information could be obtained by crosscutting the full width of the deposit from the inner end of the old tunnel and trenching on the steep side-hill above the tunnel, followed by systematic sampling. As the deposit could be very cheaply worked, a comparatively small average yield in gold would be sufficient to justify work on a large scale. Work was started in August under the direction of F. T. Harbour, of Nelson, who sponsored the new company. Camp buildings were erected and the No. 2 tunnel has been advanced by hand to develop the westerly extension of the *California* vein below good showings of ore reported in superficial workings on the *Exchequer*. The bulk of the small shipment made in 1930 came from ore developed in driving this tunnel.

Alma N. At this gold prospect, situated on the western side of Sandy creek, south-west of Nelson, prospecting-work has been carried on at intervals by G. Matthews, of Salmo. The property is reached by a short length of trail from the end of the steep wagon-road extending up Eagle creek to the *Star*. The workings, located on a bench at an approximate elevation of 5,000 feet, consist of a 30-foot vertical shaft containing a 75-foot drift, a deep wide open-cut 25 feet long, and some trenches. Gold values are found in quartz and silicified crushed country-rock along an irregular contact of the Nelson granite and rocks of the Rossland volcanic group. Along the contact and in the floor of the big open-cut ribs of quartz are to be seen among large masses of decomposed iron-stained material. A grab sample representing broken material from an area of 5 by 20 feet, the longer dimension, paralleling the contact, in this working assayed: Gold, 0.17 oz. to the ton; silver, 1.2 oz. to the ton. The collar of the shaft is about 30 feet north-easterly from the open-cut. At the bottom of the shaft the 75-foot drift has been driven south-westerly or approximately at right angles to the

trend of the contact as indicated on the surface. The tunnel develops a crushed silicified zone in schists which are impregnated with pyrite and iron oxide. The following samples were taken in the drift:—

Description.	Width.	Gold.	Silver.	Copper.
	Inches.	Oz. to Ton.	Oz. to Ton.	Per Cent.
On southern side of drift, 30 feet from shaft	72	0.07	0.6	.....
On southern side of drift, 40 feet from shaft	40	0.50	1.8	.....
On southern side of drift, 40 feet from shaft, including the 40 inches previously sampled	48	0.39	1.7	.....
On northern side of drift, 35 feet from shaft, where copper-carbonate stains show	72	0.09	1.1	0.34

The limited amount of work done does not throw much light on the character and continuity of the deposit. All that can be said at present is that the fair gold assays, obtained in places in the very wide zone along the granite-schist contact, warrants further exploration. Some useful information could be got by connecting the shaft-drift with the large surface working. The granite-contact, which apparently has a very irregular shape, should be carefully prospected to outline the zone of mineralization.

Reah. This group, owned by H. E. Dill, of Nelson, and associates, comprises the *Chubb*, *Macel*, *Salmon*, *Acme*, *Ramona*, and *Ronah* claims, which are situated on the upper slopes of Copper mountain at the head of Hall creek. The property is reached by logging-road for 5 miles from Hall Siding on the Great Northern Railway south of Nelson, thence by trail some 3½ miles. Except for intermittent prospecting activity, no mining has been done for many years. The trail crosses over the summit of a ridge at 6,200 feet elevation and for the last 1,500 feet goes downhill to the cabin at about 6,000 feet elevation. The formation of the area is composed of schists of the Rossland volcanic group. A little below the summit of the ridge, including Copper mountain, and at elevations ranging from 6,800 to 7,000 feet, some deep open-cuts develop a sheared, silicified zone in calcareous schist which strikes diagonally down the hillside to the south-east and dips steeply to the south-west. Widley separated small lenses, apparently conforming to the planes of stratification of the country-rock, are exposed in some of the cuts, the mineralization consisting of pyrite, grey copper, and copper-carbonate stains. A sample across a small lens 12 inches wide, which is typical of the showings, assayed: Gold, trace; silver, trace; copper, 0.9 per cent. On the gentle slope below the cabin two shallow prospect-shafts and six deep trenches develop a quartz vein which strikes north-easterly and has an approximately vertical dip. On account of debris the vein could not be inspected to advantage in the trenches. It can be inspected in a 15-foot shaft near the cabin, where it is from 18 to 24 inches wide and stained with iron oxide. This vein, from which gold assays are reported to have been obtained in places, was not sampled by the writer, as a fair average could not be estimated without access to all the showings. Some distance south-westerly from the cabin, and at an approximate elevation of 5,800 feet, there is a deep open-cut containing a shallow shaft. In the latter there is exposed a short length of oxidized and honeycombed quartz, 12 to 24 inches wide, mineralized with stringers, up to 9 inches wide, of grey-copper ore. An assay across this width gave: Gold, 0.02 oz. to the ton; silver, 89 oz. to the ton; copper, 2.4 per cent. In the open-cut above, the vein has split into stringers of quartz, 9 and 6 inches wide, separated by 3 feet of waste. The country-rock is a calcareous schist. The quartz vein near the cabin seems to be the most definite proposition so far discovered, if reports are correct in regard to gold values obtained in places.

Ymir Section.

Goodenough. At this gold-mine, situated on the north-western side of Ymir creek, 4½ miles by road from Ymir, exploration has been continued by the owners, H. Jackson, A. McDonald, and associates, of Ymir. The property, which consists of four claims, is described in the Annual Reports for 1926, 1927, 1928, and 1929, which cover the chief period of activity. Briefly recapitulating previously published information, the

ore consists of auriferous pyrite associated with zinc-blende and argentiferous galena, the principal values being in gold. The formation is composed of Pend d'Oreille schists intruded by tongues from the Nelson batholith. Cutting diagonally across these rocks, the fissure-veins strike north-east by east, with steep dips to the north-west. The original superficial workings on the summit indicated two distinct veins about 90 feet apart, which converged towards the south-west. From the two upper tunnels the total amount of ore (largely selectively mined) shipped to date is about 4,717 tons, including 1,141 tons shipped in 1930. Information regarding the past shipments is contained in the Annual Reports mentioned above, and the following particulars for the 1930 shipments were extracted from the smelter returns:—

Dry Weight.	Gold.	Silver.	Lead.	Zinc.	Net Value less Freight and Treatment.
Lb.	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.	
90,009	0.95	7.6	5.65	9.0	$737.51
88,076	0.75	5.8	4.75	7.8	559.44
94,788	0.92	6.5	5.85	8.3	774.91
96,564	1.12	6.7	5.85	7.9	1,003.83
93,025	1.15	10.5	8.35	10.0	1,061.94
94,645	0.915	6.0	4.95	7.1	790.42
100,164	0.695	5.6	4.35	5.6	666.32
92,037	0.65	5.4	3.95	6.5	521.02
99,879	0.76	6.4	4.35	6.4	695.23
100,592	0.673	6.1	4.75	7.8	584.61
98,963	0.67	5.8	4.55	7.7	567.86
95,023	0.853	8.5	6.15	9.5	740.20
81,315	0.75	6.5	5.35	8.2	542.76
94,478	0.68	6.8	4.55	7.0	556.94
93,449	0.80	5.7	3.75	5.9	680.79
90,589	0.925	6.4	5.25	8.6	751.31
101,438	0.88	7.9	5.65	10.8	806.55
105,484	1.005	7.7	6.15	10.8	966.26
120,003	0.93	7.2	4.45	8.9	1,012.55
88,283	0.98	5.4	4.05	8.4	762.03
120,476	0.81	6.5	4.95	9.8	869.52

The shipments were made as smelting-ore, payment being made for gold, silver, and lead only. The ore commands a favourable smelting rate on account of its high silica content, which in these shipments ranged between 53.4 and 69.5 per cent. The smelting charges varied from $1.165 to $3.761 a ton. Hauling charges to the railway are from $1.25 to $1.50 a ton and freight rates about $2.40 a ton. The No. 1 and No. 2 tunnels develop an ore-zone about 600 feet long at depths of 220 and 374 feet respectively, measured on the dip of the veins, below their apices. In these workings the character of the deposits has been somewhat irregular owing to the lenticular shape of the ore-bodies and offsetting by numerous small faults and dykes. Material below shipping grade has been left in these tunnels and the strength of the mineralization in No. 2 tunnel is promising for the downward continuation of the ore below that level. The ore-zone is wide and contained numerous small lenses of good ore. The last work done under company management was the driving of a lower (or No. 3) tunnel for a length of about 550 feet to gain an additional depth of 220 feet on the dip of the veins, or rather shear-zone, which best describes the channel of mineralization in the underground workings. A recent survey showed that the No. 3 tunnel was driven too far to the north and the owners changed its direction to cut the shear-zone in the shortest distance. This tunnel, now in about 700 feet from the portal, has not yet cut the shear-zone and is roughly estimated to be about 300 feet away, in a direct line, from the most westerly ore-shoot mined in the No. 2 tunnel above. This work has been temporarily discontinued. At the same elevation and some 300 to 400 feet southerly from the portal of No. 3 level a new surface showing of gold-bearing sulphide ore was made by the owners during the summer. At the point of discovery this was about 10 feet wide, consisting of mixed iron, lead, and zinc sulphides, the lead content being apparently above the average. The gold values here are understood to be about $10 to the ton. Since the writer's inspection a tunnel (No. 4) was driven by hand some 80 feet north-easterly along the apparent

direction of the vein from this surface showing. It is reported that there is ore on the southern side of this tunnel, which would be on the foot-wall side of the vein, and that a hole drilled into this side of the tunnel near the face showed several feet of strong sulphide ore. It seems probable that these newly found showings are in reality along the trend of the same shear-zone as developed in the Nos. 1 and 2 tunnels, suggesting that the inner end of the No. 3 tunnel will have to be driven some little distance farther south to intercept the lead in its position as now indicated at this horizon. Six men were employed during part of the year in driving the No. 3 and No. 4 tunnels and in mining ore in the upper two tunnels. The results of further development on the No. 3 tunnel-level will be watched with interest, only a comparatively small amount of development-work being now necessary to test the ground below the ore-zone in the No. 2 tunnel at further depth of 220 feet.

Ymir-Wilcox. On Ymir creek work was resumed on this long-dormant gold property by F. A. Hebbard, of Vallejo, California. The mill and aerial tramway connecting it with the mine-workings were in a very dilapidated condition, but the mine had been put in shape for stoping by previous operators.

Work on rehabilitating the mill was started in July; new concrete foundations were made, the ten stamps previously used were put in shape, and two Wilfley concentrating-tables were added. Water-power for milling purposes was formerly obtained from Rapid creek; a new flume and penstock have been built to carry the water across the hill to the pipe-line. As the volume of water proved to be insufficient for full power requirements, it was necessary to install auxiliary power, and a new 75-horse-power, 3-cylinder Crossley Diesel engine has been connected to the same shaft as driven by the main Pelton water-wheel. The aerial tram was also put into working condition, five new towers being erected, and an ore-bin built at the mine. Milling was commenced on October 4th and from 10 to 30 tons were put through daily for a short period, when work was discontinued. Some gold bullion was shipped, but the concentrates have not yet been marketed. It is understood that work will be resumed in the spring.

Pilot-Good Hope. Some prospecting-work was done on these claims during the past season, two men being employed by E. W. Widdowson, of Nelson. The property, situated on the north-western side of Ymir creek, about 1 mile by trail from the end of the *Foghorn* road, was described by A. G. Langley in the Annual Report for 1923. Samples taken by the writer in two open-cuts, 50 feet apart, on the upper vein, not specified in his report, assayed as follows:—

Description.	Width.	Gold.	Silver.
	Inches.	Oz. to Ton.	Oz. to Ton.
Most easterly open-cut	7	4.66	26.0
Westerly open-cut	21	0.70	2.4
Same place	8	0.84	4.0

The next open-cut going westerly, being cleaned out at the time of the writer's inspection, is reported to contain high-grade honeycombed quartz. Together these three cuts cover a length of about 150 feet of outcrop. In the *Good Hope* tunnel, at a lower elevation and to the west, no drifting has been done to develop the ground below these surface showings. From the *Pilot* tunnel, at further depth and still more to the west, no drift has been run easterly. Briefly summarizing conditions, the workings seen develop two parallel quartz-filled fissure-veins in Nelson granite. High gold assays are obtained at various points underground and on the surface, but the work done has been scattered and little information is afforded as to possible dimensions of the ore-shoots. Below the *Good Hope* cabin a roof-pendant of the Summit series schist outcrops in cliffs.

X Ray. This group, consisting of the *X Ray*, *Wild Horse*, and *Annie Maud* Crown-granted claims and three adjacent locations, is owned by E. Emilson, C. Anderson, and O. Anderson, all of Ymir. The first mentioned spent part of the season prospecting the claims, which are situated on the eastern slope of the valley of Huckleberry creek (North fork of Ymir creek), opposite the *Ymir* mine. Considerable prospecting has been done on that side of the valley in search of the extension of the *Ymir* vein, which

strikes easterly, but so far this has not been found. The country-rocks are impure quartzites and carbonaceous schists. Granitic dykes are said to traverse the sediments in places, but no igneous rocks were noted in the vicinity of the workings examined, which consist of open-cuts and stripping. Trending diagonally up the hillside from the creek, five parallel veins, all enclosed within a width of 300 to 350 feet, have been exposed. They strike from N. 30° to 40° E., conforming in this respect with the formation. Mineralization consists of disseminations and stringers of pyrite, sphalerite, and rarely galena, in a quartz gangue. The showings in the superficial workings on the five leads, which for convenience have been named A, B, C, D, and E, going up the hill, start near the creek and extend to an elevation of about 500 feet above it. The following samples were taken in the various open-cuts to ascertain the gold values:—

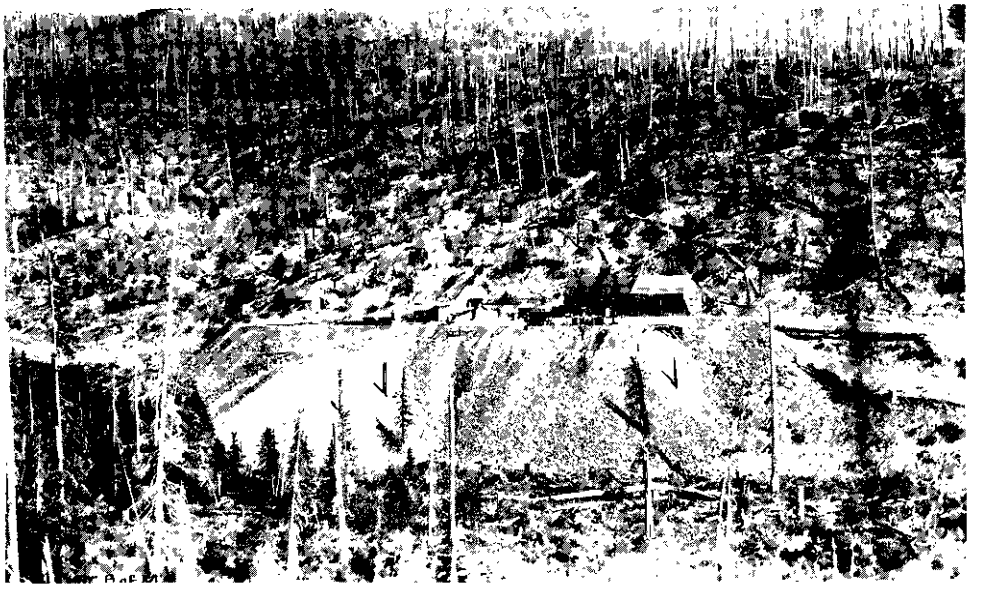
	Width.	Gold.	Silver.	Zinc.
	Inches.	Oz. to Ton.	Oz. to Ton.	Per Cent.
B vein	18	0.07	1.5	2.95
B vein	36	0.04	0.5	2.20
B vein	36	0.06	0.6	0.90
B vein (oxidized)	32	0.12	1.0	1.10
B vein	36	0.06	2.7	2.05
E vein	30	0.06	2.9	6.15
E vein	36	0.04	1.2	1.20
C vein	12	0.08	5.4	6.25
A vein	14	0.02	2.3	2.15
A vein	14	0.03	1.0	0.50
A vein (float-ore)	....	0.02	6.8	9.10
A vein	48	0.04	2.8	7.70

Most of the work done lies north of the point where the easterly extension of the *Ymir* vein might be expected, and some further surface prospecting might advantageously be done at the southern end of the area examined.

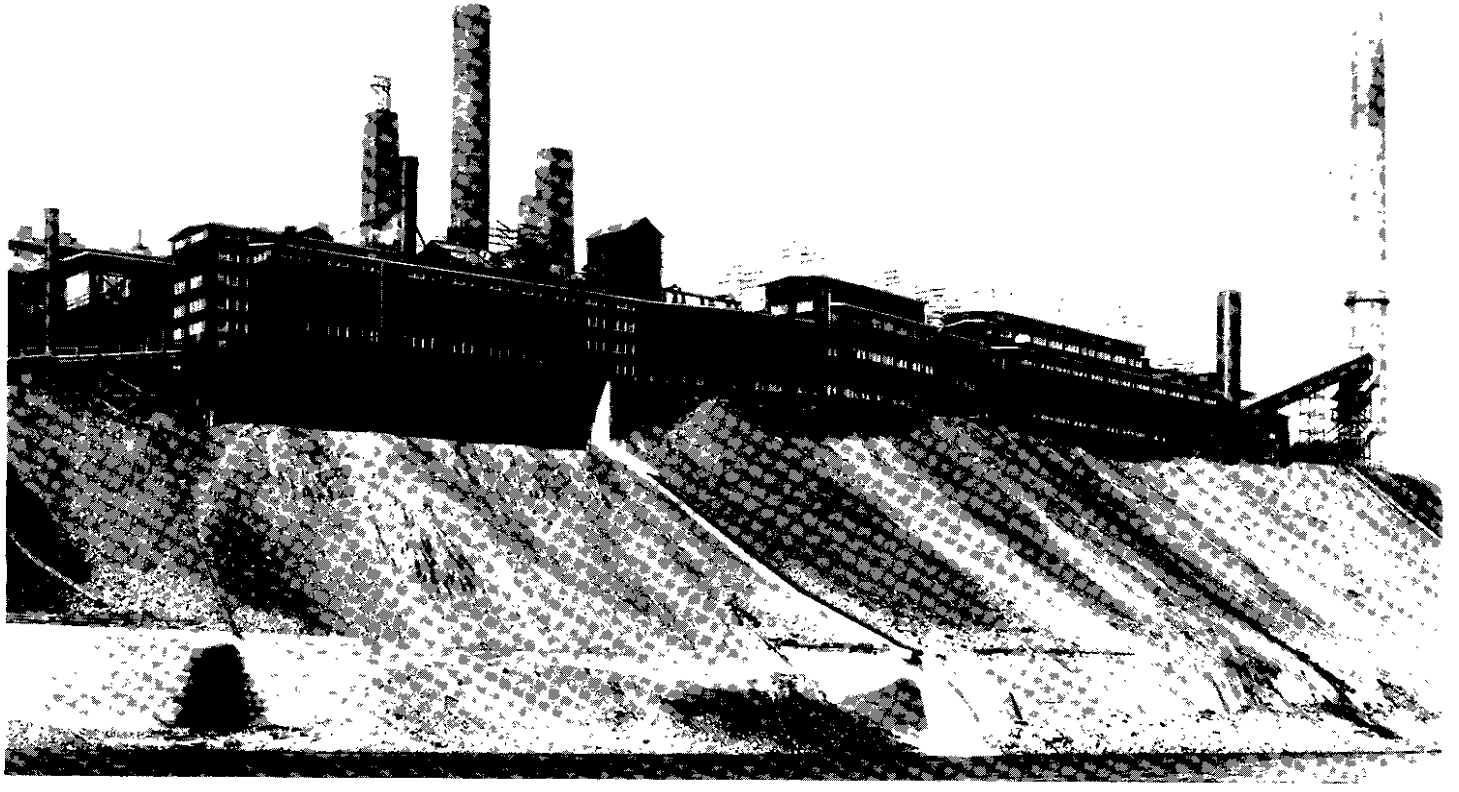
Porcupine. This group of seven claims is situated on the southern side of Porcupine creek, 1½ miles by road from a point on the Great Northern Railway 2 miles south of Ymir. The property is largely owned by Nels Peterson, of Ymir, formerly employed for many years as foreman at the *Yankee Girl* mine, who has been prospecting the *Porcupine* claims at intervals since 1925. The formation of the immediate area is composed of schistose, calcareous members of the Pend d'Oreille group intruded by dykes and tongues of fine-grained, siliceous granite of the Nelson batholith. Occasional lamprophyre dykes cut both formations and the veins without apparently affecting the mineralization. Complex geological conditions have been created by engulfing of the roof-pendant rocks in the granite and the structural relation of the veins, five of which have been identified by the limited amount of work done, although the formation has not yet been definitely established. The ore-deposition occurs in the zone of contact between the igneous and sedimentary rocks. Several short tunnels and some shallow open-cuts on the several veins have exposed promising showings. The veins and workings are shown on the accompanying plan, for which the writer is indebted to C. C. Starr. Underground work amounts to some 426 feet in the aggregate. The associated minerals are pyrite, galena, sphalerite, with occasional chalcopyrite, in a gangue of quartz and silicified country-rock (chiefly granite), gold and silver values being present. The results of sampling at individual showings are shown on the accompanying illustration. In addition to these the following samples were taken:—

	Gold.	Silver.	Lead.	Zinc.
	Oz. to Ton.	Oz. to Ton.	Per Cent.	Per Cent.
Specimens from latest work in tunnel at "N"	0.74	6.1	7.54	1.2
Specimen from narrow streak in shaft at "P"	1.62	16.4	11.82	8.7
Selected ore from pile at portal of tunnel at "N"	0.06	4.9	12.03	4.4
Selected ore from pile at portal of tunnel at "N"	0.04	5.1	12.64	8.5

Howard Mine, Nelson M.D.

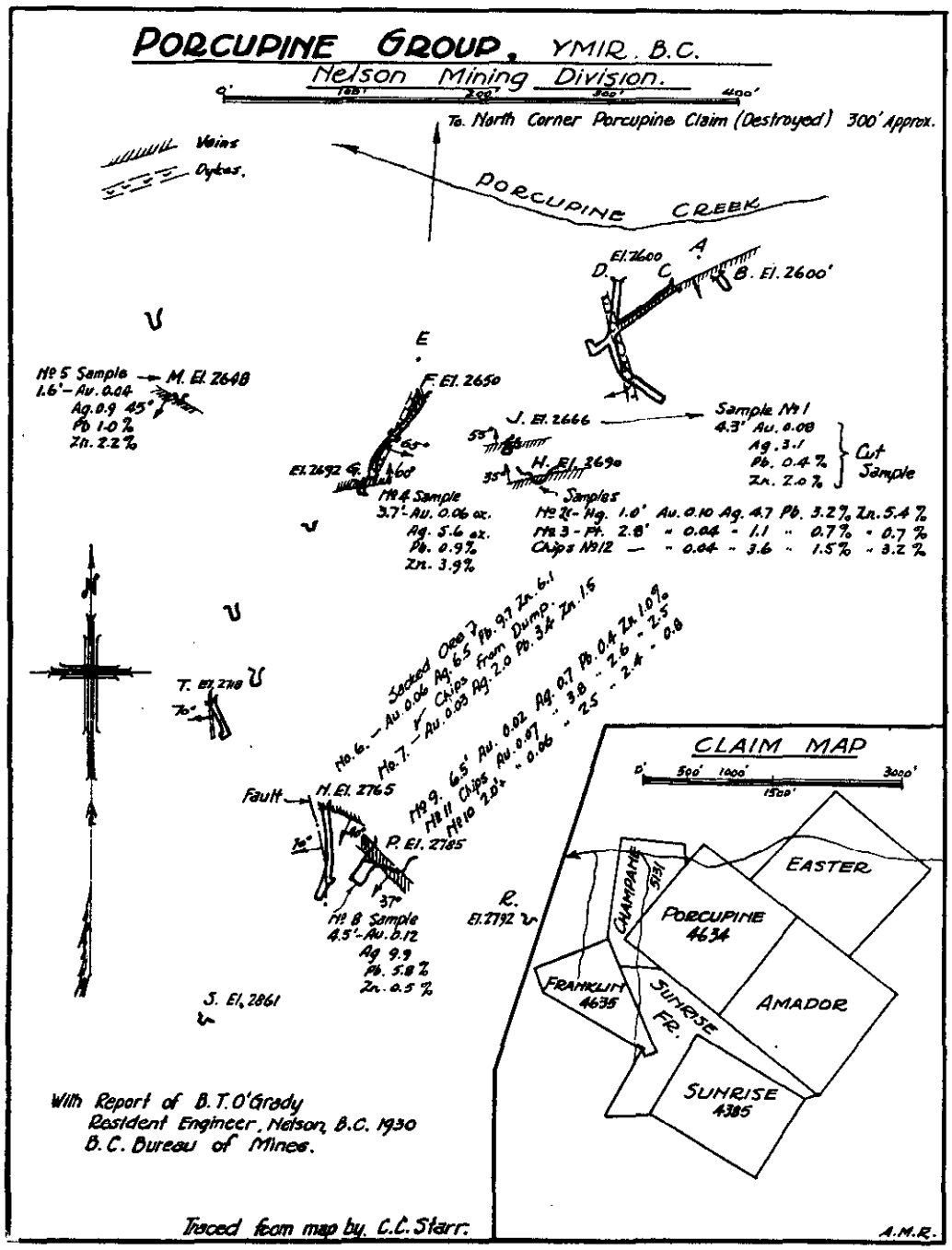


Crow Mine—Phosphate Ore, Fort Steele M.D.



New Slag-fuming Plant producing Zinc Oxide—Consolidated Mining and Smelting Co. of Canada, Ltd., Trail.

All these samples showed traces of copper and some of them contained traces of tin. The most definite proposition indicated by present development seems to be the north-westerly-striking vein opened up at "P," "N," and in open-cuts north-west of "T." This vein is mineralized at all points opened up over widths up to 6.5 feet. Recent work has improved the appearance of this prospect and the gold values obtained in places justify further work in tracing the veins on the surface and in exposing them underground away from the influence of faults and dykes.



Howard. Exploratory operations at this property, situated on the South fork of Porcupine creek, have been suspended pending an improvement in metal-market conditions. Although the gold values predominate in the ore, the silver, lead, and zinc are important factors in considering profitable production. The mine is owned by the Howard Mines, Limited, largely controlled by J. F. Duthie, of Seattle. Special attention is given to the faulting problems at the *Howard* mine by J. F. Walker in the 1929 Summary Report of the Geological Survey of Canada, Part A, under "Mineral Developments in the Salmo Map-area."

May Blossom. 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 leading properties in the Sheep Creek camp, including the *Reno* and *Queen*, are described by J. F. Walker in the recently issued Geological Survey of Canada, Summary Report, 1929, Part A, under "Mineral Developments in Salmo Map-area."

Reno Gold Mines, Ltd. At the property of this company, situated on Fawn creek, production has been steadily maintained since milling was started in August, 1929. Production for the year was $162,259 and the total production made by the company to the end of 1930 was $199,798. The workings consist of four adit-tunnels driven for the most part on the vein or veins, crosscuts, and raises, total development footage now amounting to 3,775 feet, exclusive of raises carried up with stopes.

No. 4 tunnel is connected with No. 3, 160 feet above, by raise now used as an ore-pass and also by a manway through 401 stope. No. 3 tunnel is connected with No. 1, 275 feet above, by a raise and manway. Stoping, which was started in 1929, has been done between No. 4 and No. 3 tunnels and above No. 3 tunnel. All stoping has been by shrinkage, stope-widths varying from 2 to 5 feet, with occasional small sections of greater width. The ore mined and milled to date has been, for the most part, heavily oxidized. Recent development, however, in the inner extremities of Nos. 3 and 4 levels has been in sulphide ore, carrying good gold values, which is apparently primary in origin. At the inner end of No. 3 tunnel recent drifting has opened up a new ore-shoot for a length of 112 feet and an average width of 1.48 feet. This ore, containing sulphides of iron, lead, and zinc, gave an average assay of 1.821 oz. in gold to the ton. Drifting is continuing with similar ore in the face. Good sulphide ore is also reported in the end of the No. 4 level drift. The presence of good values in these sulphide ores opens up possibilities for continuation of profitable production below the zone of oxidation.

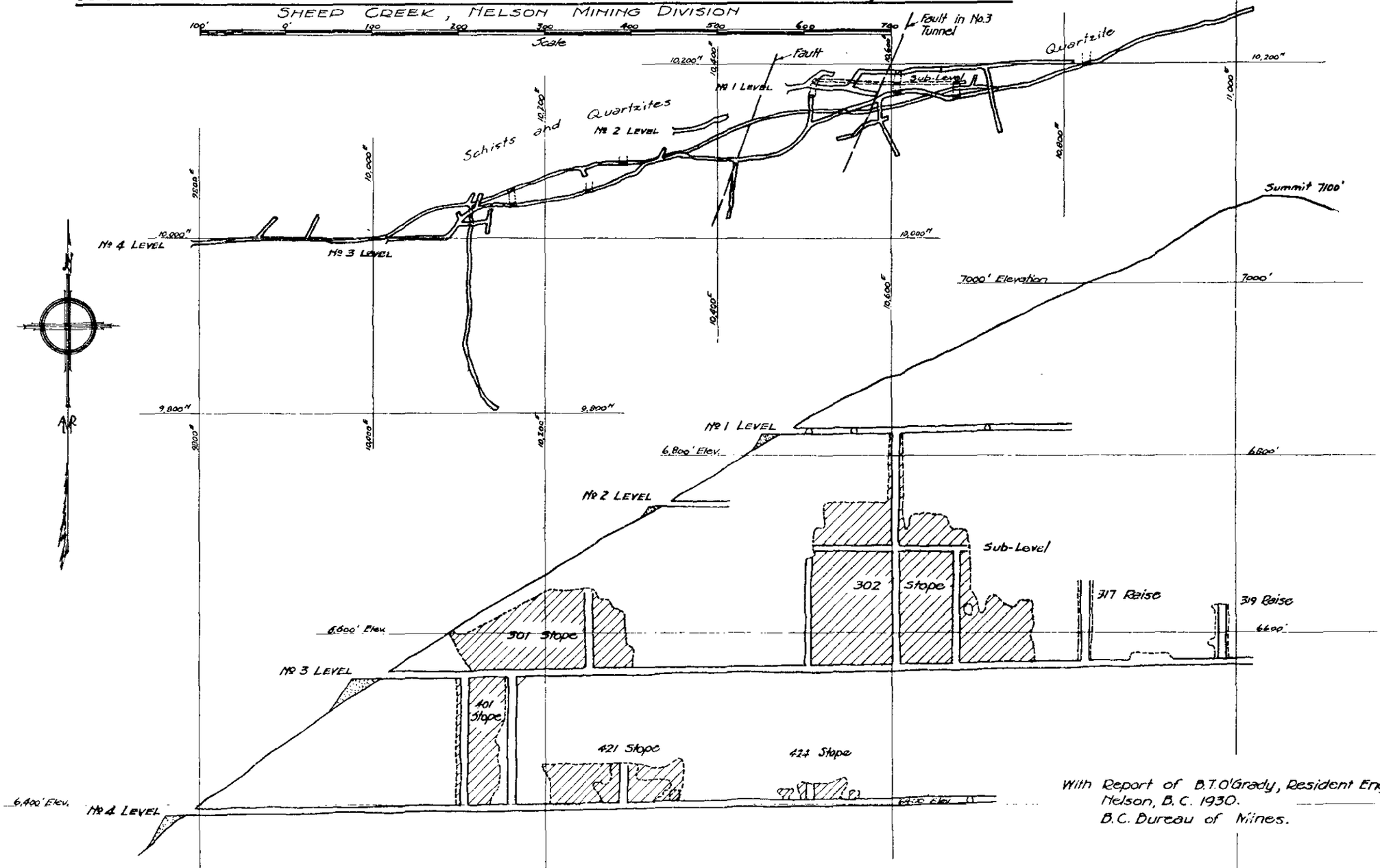
All ore is trammed in cars through No. 4 tunnel to the tram terminal near the portal. From here a 2-bucket gravity-tram, 750 feet in length, conveys the ore to the mill. The milling equipment consists of jaw-crusher, ball-mill, Dorr classifier, blanket tables, four Dorr thickeners, two Dorr repulpers, three Dorr agitators, one Dorr solution classifier, zinc boxes, and the necessary storage-tanks, pumps, etc., for operation by counter-current continuous decantation. The ore is ground in cyanide solution of a maximum strength of about 1 lb. NaCN to a ton. The average cyanide-consumption to the ton of ore treated, including loss in tailings, is about 1 lb. Lime-consumption is about 14 lb. a ton of ore. The company now burns its own supply of lime for milling purposes and will shortly have a sufficient supply to carry on until next summer.

Apart from coarse gold collecting in ball-mill, classifier, and on the blankets, which is amalgamated in a clean-up barrel, all values are recovered by cyanidation, zinc shavings being used to precipitate the gold from the solutions. Approximately 20 per cent. of the total production is obtained by amalgamating the blanket concentrates, this innovation having been introduced by R. V. Neily, superintendent. The tonnage milled at the present time averages around 33 tons a day of twenty-four hours, with recoveries between 95 and 97 per cent.

Power for the mill, for lighting and operating the mill, water-supply pump, etc., is furnished by a Crossley 100-horse-power Diesel engine. Another Crossley engine, 138 horse-power, direct-connected to a 500-cubic-foot delivered air, Alley-McLellan compressor, furnishes air for the mine. The company recently purchased a rotary snow-plough, "Snow King," which will be operated by the "Thirty" tractor provided last winter. Forty-five men are employed in mine and mill.

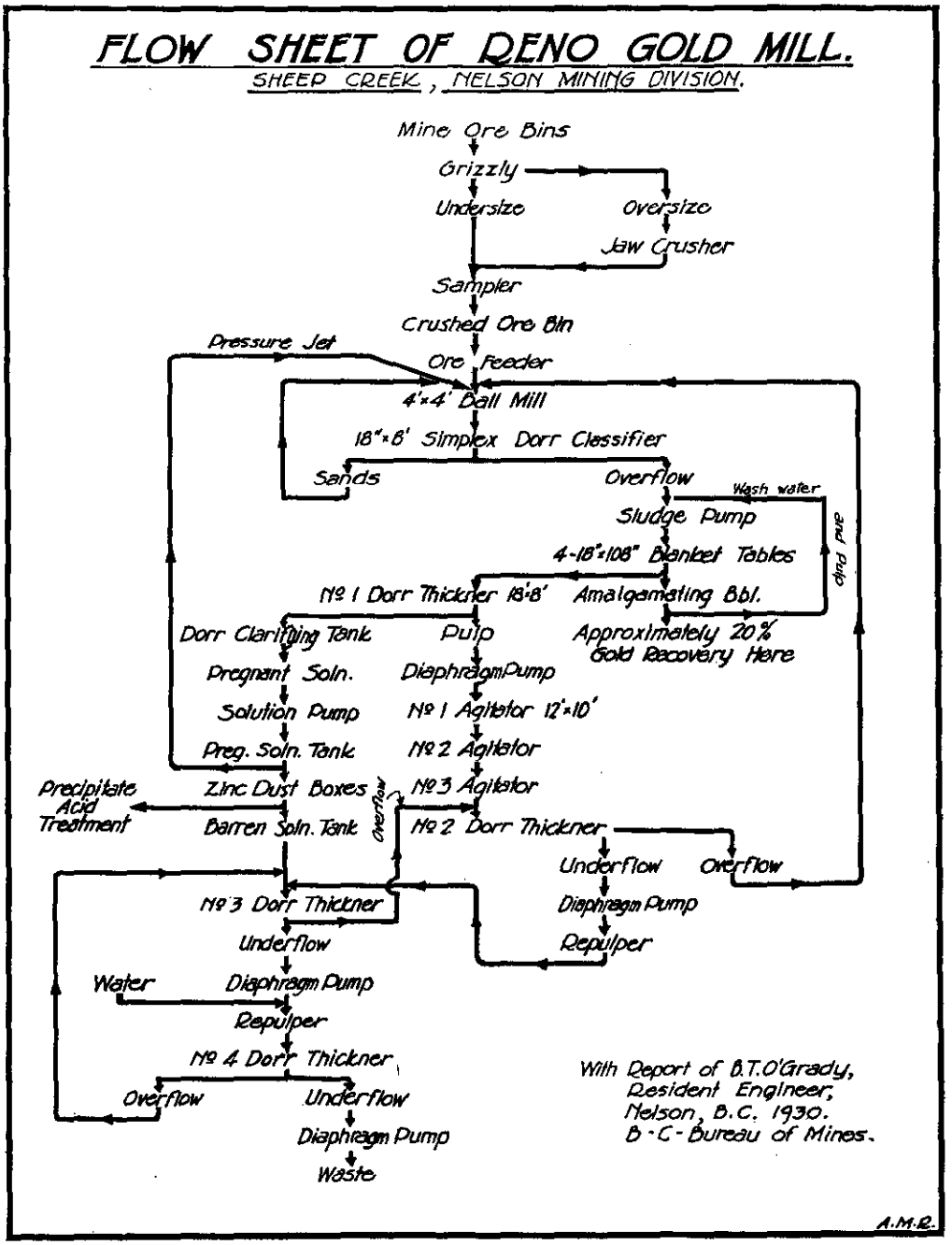
MINE PLAN & SECTION RENO GOLD MINES, LIMITED.

SHEEP CREEK, NELSON MINING DIVISION



With Report of B.T.O'Grady, Resident Engineer, Nelson, B.C. 1930.

B.C. Bureau of Mines.



The writer is indebted to the management for production figures and data relating to mill operation.

Queen. Work was recently resumed at this gold-mine, situated on Sheep creek, by the Queen Mines, Limited, a company recently formed in Wisconsin by W. A. Lavigne, of Riplinger, Wis., and associates. A small crew of men is engaged in preparatory work, including reconditioning of the flume to drive the compressor. Ample funds are understood to have been raised to finance considerable development with a view to again placing the property on a producing basis.

Silver Dollar. No activity occurred at this property, situated on the outskirts of the townsite of Salmo, during the period under review, but the owner, L. R. Clubine, of Salmo, is reported to have formed the Silver Dollar Mines, Limited, to continue exploration. The ore carries values in silver, lead, and zinc. The last work on the property was done by the Consolidated Mining and Smelting Company in the fall of 1928 and subsequent winter months. General conditions surrounding the deposits are not appreciably changed since the *Silver Dollar* was described by J. D. Galloway in the Annual Report for 1915.

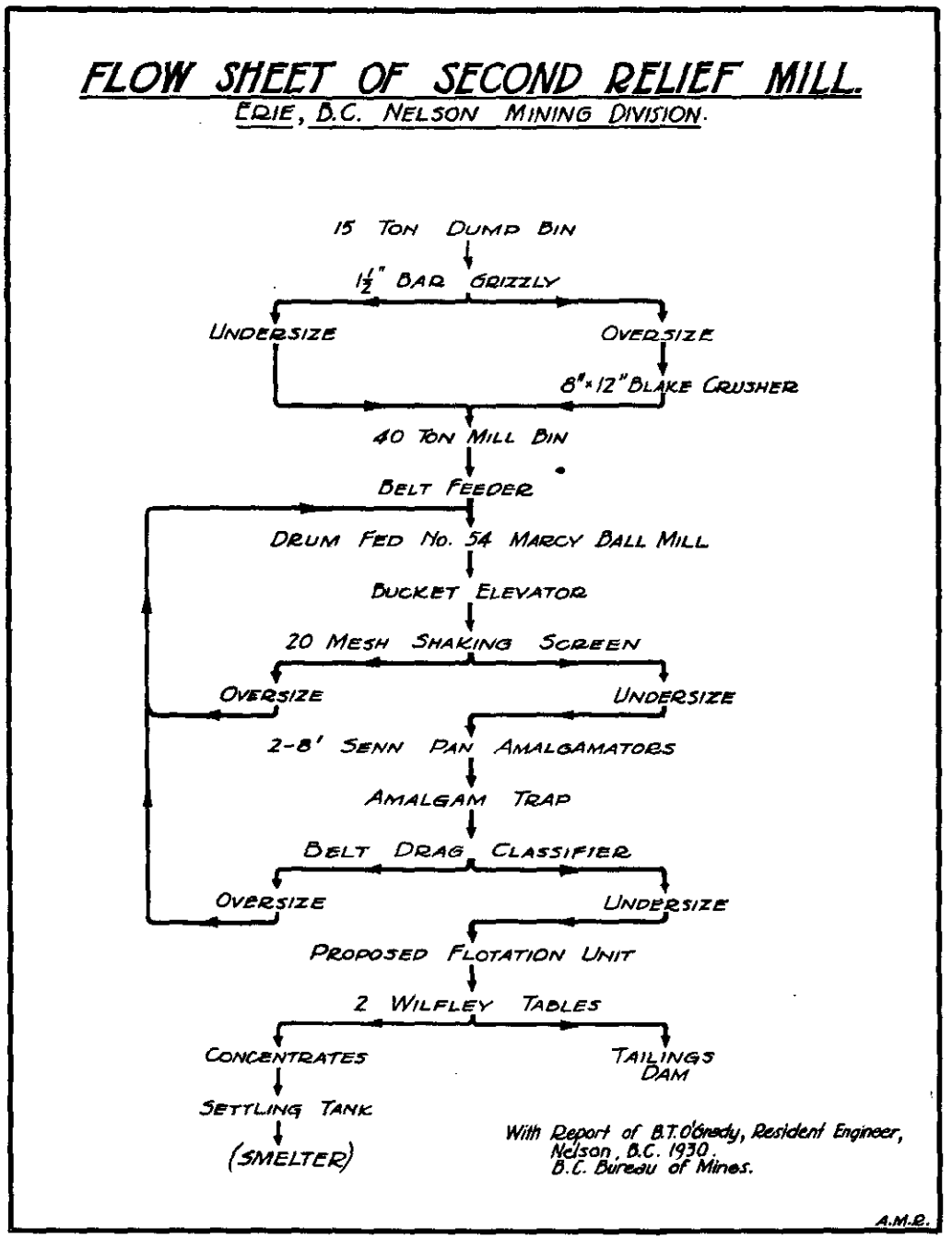
Reeves-MacDonald.—At this zinc-mine, situated on the Pend d'Oreille river, all activity has been suspended pending consideration of future plans. Harold Lakes, of Nelson, has been in charge at the property.

Red Rock. This group, owned by M. Meredith, of Trail, and associates, is situated on the Salmo river, about 1 mile northerly from the *Reeves-MacDonald* mine-workings. Accidental discovery of silver-lead-zinc float-ore led to further investigation and some ore in place was discovered. The property was then bonded by J. W. Falls, of Waneta, and J. S. Ramage, of Spokane. Work done under the direction of the former disclosed a large surface showing of silver-lead-zinc ore of good milling grade. Rough sampling of the sulphide ore assayed: Silver, from 7 to 10 oz. to the ton; zinc, 12 to 15 per cent.; lead, 12 to 15 per cent. Subsequently the bond was taken over by the joint Eastern Canadian and American interests associated in the Base Metals Mining Corporation, of Field, and a small crew of men was put to work to continue surface exploration under the direction of C. F. Cockshutt, of Toronto. The result of this work, which consisted of deep trenching, was not sufficiently conclusive and, a cash payment being due, work was discontinued towards the end of November and the option dropped. The *Red Rock* is still considered a good prospect and it is anticipated that exploration by other interests will be undertaken during the coming season.

Erie Creek (North Fork of Salmo River).

Second Relief. This property of the Relief-Arlington Mines, Limited, situated on Erie creek, 13 miles by road from the Great Northern Railway, was described in the Annual Reports for 1927, 1928, and 1929. During the year under review work was started in April, both mining and milling, when the spring thaw had set in to furnish sufficient water for power. After the installation of two Wilfley concentrating-tables a break-down of the tube-mill in May necessitated shutting down the mill. A Marcy ball-mill, Model No. 54, and a second 8-foot Senn amalgamator were then installed, and milling was resumed under water-power early in July for a short test of mechanical and metallurgical features until the summer dry season exhausted the water-supply. In September, after some revisions in the flow-sheet and the installation of an 80-horse-power Fairbanks-Morse Diesel engine for mill-power, mill operations were resumed on broken ore in the stopes. A dry fall resulted in insufficient water for power to drive the air-compressor, and after the exhaustion of the broken ore in the stope operations were discontinued. Subsequently arrangements were made to drive the No. 5 tunnel by hand, which is being done by contract. Through an extensive series of mill tests carried on throughout the summer it has been found that by the addition of a flotation unit the recovery can be increased to more than 90 per cent. with a satisfactory ratio of concentration, and this improvement is contemplated as soon as warranted by development.

On No. 4 level of the mine 8 feet of crosscutting and 75 feet of raising were done. The new No. 5 level tunnel was started at a point just above the mill-site and, when machine-mining was discontinued, had been driven 296 feet of the 600 feet necessary to tap the downward extension of the *Second Relief* vein mined on No. 4 level. The total ore extracted from stoping and raising was 1,479 tons. According to R. O. Oscarson, secretary-treasurer of the company, approximately $25,000 in gold bullion and concentrates was produced during 1930, and this has paid for development, mining, and new equipment in the mill. Some additional surface work has been done to trace the continuity of the parallel veins, but no underground work has been done to develop them, as the policy of the management is to develop these veins from No. 5 level when it reaches the ore-zone. At the *Arlington*, also controlled by the Relief-Arlington Mines, Limited, a small crew was at work during July and August, reconditioning the old tunnels to make the mine accessible for inspection. The writer is indebted to P. E. Oscarson, until recently managing director of the company, for the data regarding mill operation.



Harvester. A short trip was made to this group, owned by J. E. Read, of Erie, which comprises four claims adjacent to the *Second Relief* property. The formation of the area consists of rocks of the Rossland volcanic group and Nelson granite. Three veins have been prospected by open-cuts, stripping, and shallow shafts. The *Harvester* No. 1 vein strikes north-easterly, roughly parallel to the *Second Relief* vein, but the dip is not yet definitely established. Exposed by stripping on the edge of Slide creek it consists of a wide zone of shearing in augite porphyrite. Some silicification and light iron-sulphide mineralization

is developed along the south-eastern wall of the zone. A sample here for gold and silver gave a negative assay. The *Harvester No. 2 and No. 3 veins are in granite.* The first mentioned is exposed in a deep open-cut on the northern side of Slide creek, at an approximate elevation of 4,200 feet, and consists of a wide zone of fracturing and silicification in the granitic rock, which is partially disintegrated. Selected quartz from this working contained no gold or silver. *At about 4,500 feet elevation the No. 3 vein, which strikes about N. 10° W. and dips steeply* to the east, is developed by two shallow shafts and an open-cut distributed over a length of about 250 feet. Where exposed the vein is from 9 to 12 inches wide. A sample across 9 inches in the most southerly shaft, 4 feet deep, assayed: Gold, 0.80 oz. to the ton; silver, 1.6 oz. to the ton. *In the next working going northerly, a 10-foot shaft, the vein is not easily accessible for debris.* A short distance farther north there is an open-cut in which the vein, from 12 to 18 inches wide, consists of silicified iron-stained country-rock. A sample here gave only a trace in gold to the ton. If these fissures in the granite could be traced into the augite-porphyrite zone to the *south it is possible that more favourable conditions for ore-deposition would be encountered.*

Second Chance.* This property, situated on the old *Keystone* road, a branch of the *Arlington* road and approximately 4 miles north-west of Erie, was further prospected during the past year by Seattle, Wash., interests represented by F. G. Reeve. *Two or three men were employed for several weeks in the summer and the lower tunnel, in* approximately 90 feet, was extended considerably by hand-work. The mineralization, pyrite and galena containing gold and silver values, occurs in quartzites, the vein striking N. 10° W. and dipping 15° to the south-west.

Dixie and Silver.* *This group of two claims, the Dixie and Silver, is held on location by Louis* Matassa and Oscar Peterson, of Erie. Though 2 miles by road and trail from Erie, the outcrop showings are situated on a bluff overlooking the town, about half a mile north-east of the railway-station at an elevation of 3,350 feet, or approximately 1,250 *feet above the tracks.*

The workings consist of two open-cuts and a 20-foot winze at 3,350 feet elevation, exposing in a limited way a quartz vein which outcrops from the schist country-rock. The vein, dipping flatly to the north into the mountain at an angle of 30°, strikes almost due east and west. The *winze shows the vein to be 30 to 32 inches wide at the collar, tapering in slightly as the bottom* of the opening is reached. A small horse of waste at the bottom of the winze splits the vein into two sections, 8 and 14 inches wide. A channel sample across 32 inches in the winze assayed: Gold, 0.04 oz. to the ton; silver, 0.4 oz. to the ton. The owners state that assays of from $3 to *$6 a ton in gold have been obtained from the open-cuts.*

Properties Tributary to Kootenay Lake.

Mining properties tributary to the western side of Kootenay lake, including the *Bayonne, Iva Fern, Wisconsin, Spokane,* and numerous adjacent prospects, have been considerably benefited by the recently completed section of the Canadian Pacific Railway which links Kootenay Landing and Procter and on which regular service is now maintained. It was formerly necessary to make special arrangements for calls by C.P.R. steamers at the mouths of Cultus and Midge creeks.

Sanca Mines, Ltd.—No appreciable mining activity has occurred at the property of this company, which comprises a large number of claims in the vicinity of Ginol Landing and Sanca creek, on the east side of Kootenay lake, and only assessment-work is reported to have been done.

Wisconsin. No activity has yet developed in connection with this gold prospect, situated on the northern side of Hughes creek, 14 miles by trail from the western shore of Kootenay lake at Midge creek. The property, described in the 1929 Annual Report, was investigated during the summer by Eastern Canadian interests, but for various reasons, not considered detrimental to the property, no activity materialized. The *Wisconsin* deposits are exceptionally interesting. The ore, which in the oxidized zone is of complex character, contains consistently good gold values associated with arsenopyrite, and subsidiary values in silver, with small percentages of copper, lead, zinc, and antimony.

Iva Fern. This group, owned by the Iva Fern Mines, Limited, is situated on the northern side of Cultus creek, about 7 miles by road and trail from the western shore of Kootenay lake. Exploration, started by the Consolidated Mining and Smelting Company of Canada in 1929, was continued until May, 1930, when work was suspended.

Since this company's operations were initiated a large amount of trenching and 1,416 feet of underground work have been done. Of this, 457 feet of tunnel was driven and a winze 125 feet deep was sunk during 1930. The Consolidated Mining and Smelting Company of Canada has acquired control of the holdings by purchase of most of the issued stock of the Iva Fern Mines, Limited. Descriptions of the deposits are contained in past Annual Reports.

Spokane. At this property, on Next (formerly Canyon) creek, 18 miles from Kootenay lake, exploratory work has been carried on by the Laib Bros. at intervals for many years. The ore, which contains appreciable gold values, associated with galena and lead carbonates, occurs in fissure-veins in granodiorite. Recent efforts of the owners have been largely concentrated on widening and improving the Cultus–Next Creek trunk trail, which serves the *Spokane* and numerous other prospects in the surrounding area, formerly handicapped through lack of transportation facilities. Through the assistance of the Department of Mines considerable progress has been made in this work, as mentioned below in the report on the *Bayonne*.

Bayonne. Since progress at this gold-mine, situated at the head of Summit creek, was reported in the Annual Report for 1929, development has continued under the direction of B. N. Sharp, of Spokane. In No. 2 tunnel-level 280 feet of drifting and 16 feet of crosscutting have been done and a raise 240 feet long has been put up to the surface; a shaft 50 feet deep has been sunk on the north vein; and 50 feet of caved ground at the portal of No. 3 tunnel was retimbered. The mine has been resampled at 5-foot intervals. A new trail, 4 feet wide and 5 miles in length, has been constructed on a good grade to connect with the Cultus–Next Creek trunk trail. With the assistance of the Department of Mines, in the general interest of the camp, the latter has been widened to a width suitable for caterpillar-tractor haulage to a point some 10 miles up from Kootenay lake. This now makes the distance by trail about 12 miles from the end of the road to the *Bayonne*. The camp at the mine has been improved by the addition of a new bunk-house, 24 by 18 feet; and new blacksmith-shop and timber-sheds have been constructed at the portal of No. 3 tunnel. J. B. Gerrard, of New York, is financing the operation.

Molly Gibson. At this silver-lead mine, on Kokanee creek, tributary to the West arm of Kootenay lake, development was resumed in the spring by the Consolidated Mining and Smelting Company of Canada. Except for leasing operations, the mine had been inactive since 1918. Camp buildings were erected and a new flume was built to provide power for the compressor equipment. A new crosscut tunnel, 888 feet in at the end of the year, is being driven which will gain 1,000 feet of depth below the upper workings. A large development programme, spread over a period of several years, is contemplated. The low-level crosscut tunnel will be driven a total distance of 1,800 feet to the expected intersection with the vein; extensive drifting will then be done and a raise put up to connect with the upper workings. L. W. Oughtred, of Nelson, is directing operations.

Wynndel.

Peggy.* Late in 1929 F. T. Gorkoff, of Brilliant, staked this claim to cover a discovery of lead-zinc mineralization in mica-schist which he found on the abandoned grade of the Great Northern Railway, 2 miles south of Wynndel. Two open-cuts 15 feet apart have disclosed a quartz vein striking N. 10° E. and dipping to the north-west at 80°. The quartz vein (as exposed) varies in width from 1 to 4 feet and contains minor amounts of galena and blende with small associated silver values. A sample of selected sulphides from the north open-cut assayed for gold and silver returned 0.02 oz. and 0.30 oz. to the ton respectively. This sample, assayed for lead and zinc, returned 3.25 per cent. and 0.4 per cent. respectively.

Lower Arrow Lake.

Chin Chin.* This group of two claims, the *Chin Chin* and the *Westward Ho*, situated about 1½ miles east of Deer Park, on Lower Arrow lake, is owned by F. G. Hamblin. The claims are on the western slope of Little Cayuse creek, half a mile from and approximately 1,000 feet above the lake-shore. The quartz vein, containing small segregations and pockets of oxidized pyrite, pyrrhotite, and zinc sulphides, strikes N. 60° E. and dips into the granite to granodiorite country-rock at 40° to 45° to the north-west. The work to date on this vein consists of two shallow open-cuts, 150 feet apart, and a 10-foot shaft near the

eastern cut. The vein as exposed in the shaft is 48 to 54 inches wide, and a sample taken across 48 inches normal to the dip of the vein assayed: Gold, 0.04 oz. to the ton; silver, 1 oz. to the ton; lead, *nil;* zinc, 1 per cent.; copper, trace. From this shaft and the adjoining open-cut at 2,375 feet elevation a small pile of selected ore has been obtained, and a sample of this ore-dump assayed: Gold, 0.02 oz. to the ton; silver, 2 oz. to the ton; lead, *nil;* zinc, 9 per cent.; copper, *nil.*

TRAIL CREEK MINING DIVISION.*

Rossland Area.

O.K. Mountain.* During 1930 there has been considerable activity amongst the small gold properties on O.K. mountain and in one or two cases very encouraging results have been obtained. Martin Dally and partners have mined and shipped a small tonnage of high-grade ore from stopes in the *Midnight* property. John Hawkins, Jim Cullinane, George Brown, and associates have installed a portable compressor plant and machine-drill equipment at the *I.X.L.*, and have continued underground prospecting and development on the No. 3 level and on a new level close to the *Midnight-I.X.L.* boundary-line. On the *Golden Drip*, which adjoins the *I.X.L.* to the south, J. C. Penny and associates, of Rossland, found some high-grade gold ore near the surface and after making a small shipment to the smelter continued underground development-work on the lower level of the claim. John Hendrickson, Tom Minsick, and associates, of the *O.K.* property, have continued exploratory drifting on the claim to reach the ground on the inside of the caved portion of the mine. Ole Osing and F. McIntyre and partners have continued development stoping and raising from the lower level of the *Snowdrop* workings; and John Lindberg did further surface prospecting at the *Camden*, located to the west of the *Snowdrop*.

Further activities in the vicinity of Rossland include surface prospecting, and the construction of a road by J. Tomich, of Rossland, to his *Caribou* group, located half a mile north of the Cascade highway on Little Sheep creek; the continuation of underground development by Alex. Constantine and son at their *Pearl* group, located on the first summit west of Rossland to the north of the Cascade highway.

Trail Plant.*

Steady expansion of the various metallurgical plants in the area contiguous to Tadanac characterized the year's programme of the Consolidated Mining and Smelting Company of Canada. The major undertaking, begun and more than half completed in 1930, with the first $10,000,000 unit of the chemical-fertilizer plant situated on Warfield flats, a short distance south-west from the smelting and refining units of the company. In this work the construction of the many contiguous units, both at Tadanac and Warfield, progressed with unusual rapidity throughout the year, and favoured by exceptionally mild weather the company has kept pace with its time-progress chart and it is confidently expected that at least a portion of the fertilizer plant will be in operation some time in January, 1931.

To supply this new plant with the 34,000-horse-power electrical energy required the West Kootenay Power and Light Company, a Consolidated subsidiary, in the summer of 1930, began the construction of a fourth power unit, of 40,000-horse-power rating. The new plant is to be located 1 mile above the No. 1 plant of the company at Bonnington Falls on the Kootenay river, near Nelson. The work on this fourth power plant is progressing rapidly, a large crew of men under several excavation contracts being employed in altering the channel of the Kootenay river from above Taghum bridge down to Corra Linn falls, where the new dam and power unit is being constructed.

The metallurgical improvements and additions to the smelter in 1930 included the completion and placing in operation in August of a new slag re-treatment plant, more familiarly called the zinc-fuming plant. A new lead-furnace and a lead-rolling mill were installed and a number of minor operating and technical improvements were made throughout all departments of the smelter and refineries during the past year.

Fertilizer Plant.

The following notes, kindly furnished by the company, summarize briefly at this time the fertilizer unit under construction by the Consolidated Mining and Smelting Company of Canada:—

"The fertilizer programme of the company as at present outlined calls for the manufacture of phosphorus and nitrogenous products. The primary phosphorus product, phosphoric acid, will be manufactured by the interaction of phosphate rock and sulphuric acid made from the sulphur-dioxide gases now going to waste from smelter operations. The primary nitrogen product, ammonia, will be synthesized from the nitrogen of the air and electrolytic hydrogen. The final products will include, in the first instance, triple superphosphate, ammonium sulphate, and ammonium phosphates. Finely divided gypsum and oxygen in large amounts, and fluorine compounds, will appear as by-products.

"Sulphuric acid for the manufacture of triple superphosphate, ammonium sulphate, etc., is now being made in 39-short-ton-per-day unit of the contact, modified Grillo type. The gas from the zinc-roasters undergoes a very complete purification from flue-dust, arsenic compounds, sulphuric-acid mist, water-vapour, etc., before entering the conversion system, where a 96.5-per-cent. conversion to sulphur trioxide is obtained. Platinum masses distributed on magnesium sulphate and asbestos are used as catalysts in the oxidation chambers. Three new units, each of 113 short tons capacity, one of which is to be started about February 1st (1931), are now under construction. The complete plant, including the small 39-ton unit, will have a total capacity of 375 short tons of 100-per-cent. acid per day.

"The process to be used for the manufacture of phosphoric acid is the recently developed Dorr strong-acid process. The total capacity of this plant will be 450 tons phosphate rock leached per 24 hours; this, on the basis of 72-per-cent. B.P.L. rock, will produce about 175 tons of 100-per-cent. phosphoric acid. The plant consists of three units, each of 150 tons rock leached per day capacity. In series with the three phosphoric-acid units there will be three fertilizer units, each of which can be used interchangeably for either triple-superphosphate or ammonium-phosphate manufacture. One of the phosphoric-acid units was started on January 7th, 1931; the other two will be ready for operation about June 1st, 1931.

"The nitrogen will be produced by the well-known Claude liquid-air process and the hydrogen by electrolysis of water. Several types of electrolytic cells are to be tried out, including those of Knowles, Fauser, Pechkranz, and Stuart.

"The first unit for synthetic-ammonia production, using the Fauser process, will have a capacity of 35 metric tons of fixed nitrogen per day, equivalent to 46.75 short tons of anhydrous ammonia.

"Ammonium sulphate and phosphates will be produced by interaction of ammonia with the respective acids. The ammonium-sulphate plant will have a capacity of 150 short tons ammonium sulphate per day.

"The ammonium-phosphate and triple-superphosphate production are complementary to one another, since the same equipment is used for each, and so production will depend on market demands.

"The construction programme as outlined above will, it is anticipated, be completed early in the fall of 1931."

The following is a brief description of the various units and their approximate production capacity (in these statistics tonnages are referred to in short tons of 2,000 lb.):—

General Information.—The plant will cover 60 acres, will employ about 400 men, and require 34,000 horse-power electrical energy. Steel and brick construction throughout. Daily capacity, 300 to 400 tons finished products, depending on proportion of ammonium sulphate, mono-ammonium phosphate, and triple superphosphate manufactured.

Sulphuric-acid Plant.—Contact process, 375 tons a day. Produced from waste sulphur-dioxide gas from roasting of zinc concentrates.

Electrolytic Hydrogen Plant.—Knowles, Fauser, Pechkranz, and Stuart electrolytic 10,000-ampere cells. Capacity, 3,148,000 cubic feet hydrogen and 1,574,000 cubic feet oxygen a day.

Nitrogen Plant.—Claude liquid-air process; capacity, 2,395,000 cubic feet nitrogen a day.

Ammonia Synthesis Plant.—Fauser process, 47 tons anhydrous ammonium a day.

Ammonium Sulphate Plant.—Parrish process, 150 tons a day.

Phosphoric Acid, Triple-superphosphate, and Mono-ammonium Phosphate Plant.—Dorr strong-acid filtration process. Capacity, 450 tons phosphate rock leached a day; 175 to 285 tons finished product, depending on proportions of triple superphosphate and mono-ammonium phosphate manufactured.

Storage Plant.—Capacity, 50,000 tons finished product, handled by 7-ton overhead electric travelling grab-bucket crane.

Shops.—Machine-shop; floor-space, 5,950 square feet. Carpenter-shop; floor-space, 2,250 square feet.

Warehouse.—Fire-proof; floor-space, 5,800 square feet.

Two Laboratories.—Floor-space, each 2,600 square feet. Research laboratory on manufacturing problems and new development. Soil-research laboratory.

Smelter.

Slag Re-treatment Plant.—The new slag-fuming plant was brought into operation during August, 1930, and at the present time is producing between 60 and 70 tons of metallic zinc and 9 to 10 tons of metallic lead a day by the re-treatment of lead-furnace slags. This new plant adds materially to the efficiency of the lead and zinc metallurgy. The operation of the plant is briefly described by G. E. Murray, assistant smelter superintendent, as follows:—

"The operation consists of taking molten slag from the lead-blast furnaces which carries 16 to 18 per cent. zinc in the form of zinc oxide, combined with other slag-forming materials, and, after it is poured into a water-cooled vessel with a hearth area of 20 by 10 feet, powdered coal is blown through the slag-bath and a reducing atmosphere maintained, which causes the zinc oxide to be reduced to metallic zinc, which then vaporizes and ultimately burns to zinc oxide.

"The problem then is to cool the oxide-laden gases so as to allow the solids to be caught in woollen bags. This was the problem that gave us the most cause for worry, as there were no data available on cooling gases in this condition and our cooling installation, as far as we know, is the first of its kind to be constructed. The gases, rising from the furnace, pass by way of a flue to either one of two 1,750-b.h.p. Babcock & Wilcox waste-heat boilers. These, as far as we know, are the largest waste-heat boilers in existence. The gases enter at a temperature of 2,000° F. and leave the boiler at 600° F. These then pass by means of a flue to a large installation of Greene economizer units, where they are cooled to approximately 200° F. and are now ready for treatment in the Dracco automatic bag-house, where the final oxide is caught ready for shipment to the zinc plant for treatment.

"The plant is designed to treat 800 tons of molten slag per day, but as yet only one furnace unit has been completed. It is working at a higher capacity than it was designed for and has produced as much as 70 tons of zinc a day in fume.

"The rated capacity of the plant at present is between 50 and 60 tons of zinc in fume.

"The plant uses 125 tons of Corbin slack coal a day, and though it has operated successfully now for nearly four months, there are many ways in which we feel the process can be improved. We have to determine yet the optimum conditions of charge, rate of coal feed and blowing-time, all of which will take time. Incidentally, the waste heat generated by this installation will be used to supply the heat required for the fertilizer operations at Warfield."

In connection with the operation of the slag-fuming plant, experiments are at present being conducted with a view to finding an economic balance point in the operation of the lead-furnaces when used in conjunction with the slag-re-treatment plant. In ordinary lead-smelter practice the speed of the lead-furnace depends (within limits) on the amount of reduction that takes place; the higher the reduction (or really the lower the lead in the slag) the slower the furnace runs. Where no re-treatment of the slag is possible the point at which reduction must stop is an economic one governed by the extra cost of reduction as compared to the recoveries of lead made. However, where a slag re-treatment plant is used in conjunction with the lead-furnaces (as at Trail), it is believed possible to stop the reduction at some point before the ordinary economic end point, transfer the slags containing extra lead and the usual zinc to the re-treatment furnaces, recover the remaining lead in the slag as well as the zinc in the slag by the fuming process, and do the whole operation faster and more economically than could be done by making the maximum reduction of the lead in the lead-furnaces and recovering the zinc alone by the fuming process. It is to find this new economic end point of reduction in the lead-furnaces (or the economic point of transfer of lead slags to the fuming plant) that the present experiments are being conducted.

Lead-smelter.—In connection with the lead-smelter, a new No. 12 lead-furnace 270 inches long by 48 inches wide was installed early in the year and has been operated very successfully ever since. This new furnace is equipped with a vaporizer working on the thermal-siphon

principle, which, in addition to keeping all the cooling-jackets at the same temperature, allows the same cooling-water to be used over and over again. (A furnace half as long again as the ordinary furnace uses only one-tenth as much water.) The new furnace has one tier of water-jackets about 5½ feet high, the rest of the shaft being constructed of brick. Instead of extending the entire length of the furnace, as in the ordinary lead-smelter, the crucible for the lead occupies but one-third of the furnace-length. The hood is of brick supported on water-cooled beams.

To meet the demand for sheet lead used at various places around the plant, more especially for tank linings and launder linings in the new sulphuric-acid plants, the Consolidated Mining and Smelting Company in December installed an 8-foot rolling-mill in the idle copper-rod mill building. This mill is capable of rolling lead sheets 8 feet wide and of desirable length and thickness.

Miscellaneous.—The huge expansion programme at Trail, Warfield, and Corra Linn falls by the Consolidated and its subsidiary, the West Kootenay Power and Light Company, has been mainly responsible for the lack of any severe depression in the West Kootenay in 1930, there being roughly 3,800 men on the Trail pay-roll and indirectly 1,200 men on the Corra Linn pay-roll.

The production of the Trail plant for the year 1930 was as follows: Gold, 25,782 oz.; silver, 6,936,759 oz.; copper, 14,128,000 lb.; lead, 302,984,000 lb.; zinc, 239,100,000 lb.; cadmium, 456,000 lb.

WESTERN MINERAL SURVEY DISTRICT (No. 6).

By George A. Clothier, Resident Mining Engineer (Headquarters, Vancouver).

INTRODUCTION.

The Western Mineral Survey District (No. 6) includes the seven Mining Divisions of the Province—Victoria, Alberni, Clayoquot, Quatsino, and part of Nanaimo Division, covering Vancouver island; and the remainder of Nanaimo, Vancouver, and New Westminster, on the Mainland. They comprise the whole of Vancouver island, the Coast islands, and Mainland west of the summit of the Coast range, north to Seymour inlet; certainly a wonderful setting and an ideal geographical situation for prospecting and mine operation.

The reader is referred to the map called the "Vancouver Sheet," issued by the Geological Survey of Canada, for an outline of the geology of the district. This is procurable from the Geological Survey, 739 Hastings Street West, Vancouver, B.C. Also to a list of references on page 358 of the 1928 Annual Report, from which details of the geology, etc., of many sections of the district can be obtained. Also to an index on page 333, 1927 Annual Report, containing the mineral claims, groups of claims, and mining companies reported in the Annual Reports since 1917.

H. C. Gunning, of the Geological Survey of Canada, covered the area of Strathcona Park in 1930 instead of the continuation of the Quatsino Sound-Nimpkish Lake area. This latter ground has, however, been covered by aerial photographs this year which will furnish topographical data sufficient for the resumption of the survey in the Nimpkish area during 1931. The last report by Dr. Gunning is contained in Summary Report, 1929, Part A, now available from the Vancouver office of the Geological Survey of Canada.

The district has a very diversified mining industry: Placer gold in the Leech River area and along the west and north coasts of Vancouver island; lode gold in the Cowichan Lake area, West Mainland coast around Phillips arm, Texada island, etc.; silver, no high-grade ores but distributed as an associated metal; lead and zinc in the northern end of Vancouver island and Chilliwack Lake section; copper, well distributed throughout the district; coal, on Vancouver island at Nanaimo and Cumberland; building materials, lime, cement, crushed rock of all kinds, brick, building-stone, etc., at many places along the coast, brick and tile especially in the Fraser River valley; iron ore, mainly magnetite, is distributed over Vancouver island and Texada island.

Trails.

During 1930 a substantial amount was expended on recommended trail-work throughout the district, both as assistance to prospectors and operators as well as pushing new trails into mineralized areas.

The Alberni Canal–Cowichan Lake trail was further improved this year by reconditioning the old C.N.R. grade around by the head of Nitinat lake. Also a portion of a new trail was blazed and slashed out from Kissinger, the last station on the C.N.R. at the head of Cowichan lake, to a point on a small creek running into Tuck lake from the north. This trail follows an old logging-road for a distance from Kissinger, swings north up the Nitinat river, across Lot 137, crosses the river, and extends to the west line of Lot 497. (*See* sketch in Cowichan Lake section.) It is hoped to have this trail finished through to Francis lake in 1931, which will make available an interesting copper-prospecting section.

The Kennedy Lake–Sproat Lake trail was completed this year under the supervision of H. H. Browne, Alberni. From the head of Sproat lake the old trail is followed for about 2½ miles to the *Morning* group trail. From here for a mile the old trail was abandoned for a better location along the river-bottom, which is followed to the Sutton Creek canyon at about 5 miles where the Taylor river is crossed by foot-logs, usable at ordinary water. The crossing at flood-water is about a mile farther up. The summit is crossed at 8 miles and from there to Kennedy lake is about 13½ miles, a total of 21½ miles between lakes. Mr. Browne reports plenty of pyritized quartz float was found throughout the length of the trail. A float is being built at the trail end at the head of Sproat lake to facilitate handling of supplies.

Assistance was also granted toward repairing the old trail from Port Hardy to Kains lake, a distance of 12 miles. This trail was used in the fall by the American Smelting and Refining

Company in getting supplies to the camp at the *H.P.H.* group, about 2 miles from Nahwitti lake and about 6 miles from the head of Kains lake. It branches from the Port Hardy–Coal Harbour auto-road about a mile out of Port Hardy, follows up Glenlion creek, then crosses to Tsulquate creek, which it follows to the foot of Kains lake.

Assistance was also granted for the road from Nimpkish lake to the *Kinman* groups, about 15 miles.

The Fire Mountain trail is reached from Douglas, at the head of Harrison lake, by the old road crossing the Lillooet river at the Indian reserve, from which it is about a mile down to Fire creek. The trail is on the north side of the creek to Fire lake, about 12 miles, from which there are old trails to the different properties. A pack-horse can be taken to Fire lake without difficulty. I would suggest prospecting the range above the trail all the way through in the hope of finding quartz veins carrying iron and copper sulphides with good gold values. Farther up in the Fire Lake area the gold is free and too erratic to be commercial.

A number of shorter trails to prospects were given assistance.

Prospecting.

Prospecting has been widespread, but not so intensive in the Nimpkish Lake area nor the New Westminster Division as last year, with the result that fewer claims were staked. The assessments, however, were about equal to last year and much higher than the average of the past ten years. The outstanding discovery of the season is probably that about 2 miles from Nahwitti lake, about 15 miles directly west of Port Hardy. This will be described later under Nanaimo Mining Division.

For the person contemplating prospecting in the district the following brief outline of the geological features may be of some assistance:—

There are two separate and distinct geological areas—the Vancouver range, comprising Vancouver island, and the western flank of the Coast range. Vancouver island is predominantly composed of volcanic rocks, mainly andesitic, basalt, and porphyries, with which are associated limestone-beds. In this formation ore-bodies may be looked for within zones of extensive movement (shear-zones); also along the contacts of later intrusive rocks, such as granodiorite, diorite, or other dykes, with the andesite, and particularly with the limestone, which is more readily altered and replaced by the metallic minerals. The Coast range is composed of granodiorite, in which are included great masses and belts (roof-pendants) of highly altered volcanics and sedimentaries which were the overlying formations before the vast upheaval of the Coast range. These belts have had intensive movement and have been intruded by many dykes, forming favourable conditions for deposition of minerals emanating from the granodiorite batholith, such as copper, lead and zinc, gold and silver, as exemplified in the *Britannia* mine on Howe sound. The whole western flank is therefore a promising prospecting-field.

It is rather surprising, in view of the importance of the *Britannia* operation, that no systematic scheme of prospecting the western coast has been attempted by any of the larger companies.

The "Vancouver Sheet" of the Geological Survey indicates a great number of included belts similar in origin to the *Britannia* belt, and with equal possibilities. The *Britannia* itself was first found by a hunter, later staked by a trapper, and preliminary work done by a fur-trading company of Victoria. The geographical features of the coast are very adaptable to placing several prospecting-parties in the field under the general supervision of a competent engineer.

Development.

More development has been carried on than might have been expected under the general conditions. It has certainly been much more selective than for the past two boom years, when the development of a prospect depended not at all on its merits, but more on the luck attending financing. Besides the 940 assessments done this year throughout the district, there has been extensive development on several properties by the larger companies.

The Quatsino Gold-Copper Mines, Limited, carried out a diamond-drilling programme this year. The Coast Copper Company with sixty men continued development on the *Old Sport*. The *June* group with fifteen men was opened up by the Coast Copper Company. The Caledonia Mines, Limited, property was extensively explored by the Consolidated Mining and Smelting

Company, which also carried out intensive exploration of the *Kinman* and *Smith* groups in the Nimpkish Lake area. The *Nahwitti* claims are being explored by the American Smelting and Refining Company. The Alexandria Mining Company, Limited, has continued the development of its property all season. The Santana Copper Syndicate carried out further work on its Quadra Island property. The Romana Copper Company, Limited, operating on Goat island, Powell lake, has been driving a deep crosscut tunnel this year. The Lasco Development Company bonded its property on Lasqueti island and ore is being shipped. The Pitt Mining Company, Limited, on Pitt lake, has carried out construction-work this year, making altogether a very appreciable and encouraging amount of development-work for the year.

Referring to the iron and steel industry for the Coast, the fact that the Coast Range Steel Corporation has retained its option on the iron-showings of the Puget Sound Iron Company on Texada island and made exhaustive investigations of the operating and marketing ends of such an undertaking would seem to augur well for its ultimate success.

"Iron-ore Supply Act."

Under the provisions of this Act the Government of British Columbia furnished the Ore Testing Laboratories of the Mines Branch of Canada at Ottawa with 1 ton of Texada Island magnetite in 1930 for experimental purposes.

Esquimalt & Nanaimo Railway.

The Esquimalt & Nanaimo land grant, covering about a third of Vancouver island, is outlined on all Government maps. For the information of the prospector unfamiliar with the regulations pertaining to minerals in the grant, the following is 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, divided into sections as follows:—

Victoria Mining Division—Sooke section; Jordan River section; Cowichan Lake section.

Alberni Mining Division—Alberni Canal section; Barkley Sound section; Sproat Lake section.

Clayoquot Mining Division—Kennedy Lake and River section; Clayoquot Sound section.

Nanaimo Mining Division—Port Hardy section; Nimpkish Lake section; Sayward section; Campbell River and Buttle Lake section; Courtenay section; Nanaimo River section; North-west Coast (Islands and Mainland) 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 River section.

VICTORIA MINING DIVISION.

This Division, comprising the southern end of Vancouver island up to the divide between Nitinat lake and Alberni canal, has had a fair amount of mining activity this year, in that there has been considerable prospecting, mainly in the vicinity of Cowichan lake, and a number of properties under development in a small way. However, none of the larger properties, such as the *Gabbro* and *Sunloch*, have been worked.

Sooke Section.

In the Leech River area some placering has been done in Martin's gulch by F. C. Steinberger on his claim, about half a mile up from Leech river. A couple of hundred tons of gravel were taken out preparatory to washing when water was plentiful. The gravel pans good values, but the quantity would seem limited for an important operation.

The Eagle Talc Company, Limited, whose plant is about a mile from Leechtown, leased its property to Messrs. Kennedy and Holland. These men reconditioned the mine and plant, repaired the road to the railway at Leechtown, and shipped a considerable tonnage of talc.

They are extending their operations by mining a green shale near the Kapoor Lumber Company station, which is shipped to the Sidney Roofing Company. They are also experimenting with different-coloured shales and other products that are utilized by the roofing companies.

Jordan River Section.

Kootenay Central Mining & Development Co., Ltd. (Sombrio Placers).

This company has a capitalization of $500,000, divided into 2,000,000 shares at 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 and extending up 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 the average depth of gravel is probably between 200 and 300 feet. The ground has been prospected for many years, shallow pits in many places, 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 many of 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 adequate 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 improved, 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 makes 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 deposit constituting pay-dirt, and I think are sufficiently encouraging to justify the installation of a small "pilot" plant.

Bugaboo Creek (Iron-showings).

These magnetite-showings are situated about 10 miles up from the mouth of the Gordon river, which flows into the head of Port San Juan on the west coast of Vancouver island. Considerable development-work was done on a number of groups along Bugaboo creek about twenty years ago, a description of which is given by Young and Uglow.* The conclusions indicate favourable possibilities for ore-bodies, but production would be heavily handicapped by transportation and shipping

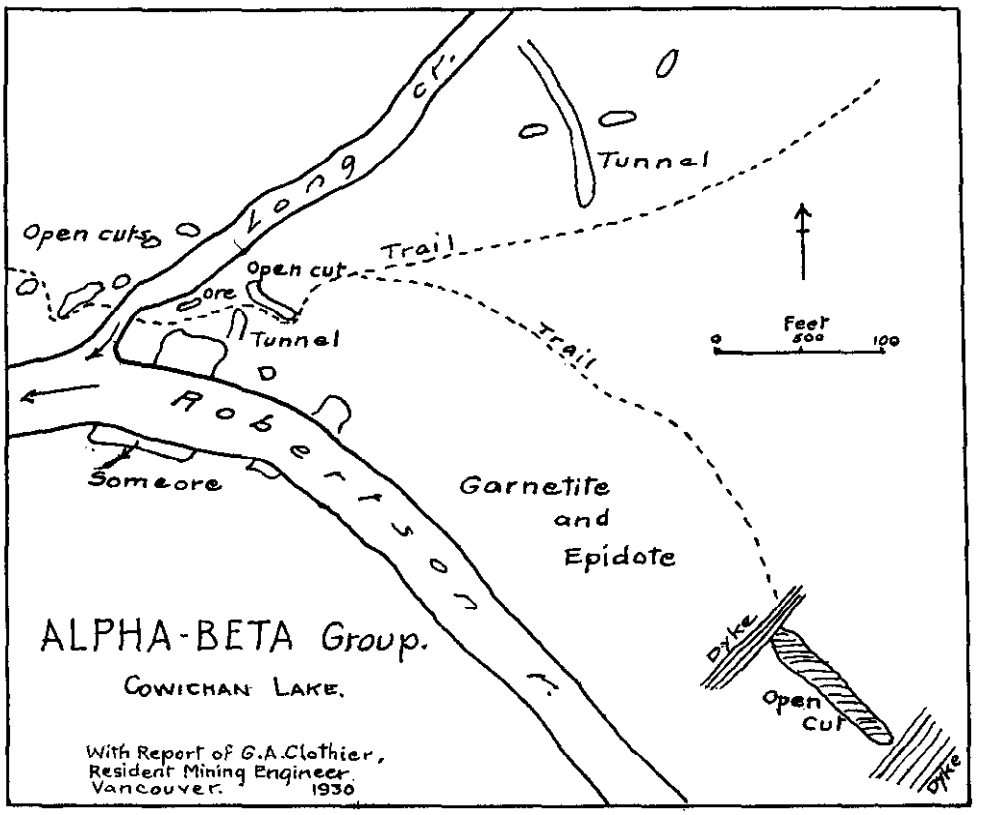
* Iron Ores of Canada, Vol. I., Geol. Surv., Canada, 1926.

conditions. Mention is made of these showings because of the interest in iron-deposits caused by the investigations of the Coast Range Steel Corporation with the object of establishing steel production on the Pacific coast.

Cowichan Lake Section.

Alpha-Beta. This group consists of three mineral claims—*Alpha*, *Beta*, and *Taboga*—staked in 1904. They are under bond to P. Pearson, Cowichan Station, and J. Long, Chemainus, who have added several claims to the group by staking. Considerable work has been done on the property, which was described in the 1929 Annual Report, pages 369 and 370.

This spring some further work was done on the east showing, about 125 feet above the creek, getting more depth and increasing the ore possibilities. Ore has been exposed in many places



on the surface, but not enough has been done toward driving in on them to gain much information as to the extent of the bodies. The ore is a mixture of chalcopyrite and pyrite, and, in places, magnetite, in an apparently extensive contact-metamorphic zone between limestone and granodiorite. The minerals occur in masses, small veins, and disseminated through the garnetite-epidote gangue. The showings, with the favourable transportation facilities, make the property worthy of investigation.

Crown. This group consists of eight claims—*Crown* and *Crown Nos. 1* to *7*—owned by Pete Pearson, Cowichan Station, and associates. The claims were staked in the spring of 1930 and optioned to the American Smelting and Refining Company. They are reached by a good foot-trail from the logging-railway of the Victoria Logging and Manufacturing Company of Chemainus, a distance of about a mile.

The company did extensive stripping and open-cutting, exposing in one place, at 2,250 feet elevation, a width of 60 feet heavily mineralized with pyrrhotite and chalcopyrite, averaging

between 3 and 4 per cent. copper. The gangue is a fine-grained greenish rock altered to masses of garnetite, epidote, and hornblende. Patches of ore have been exposed on the surface both above and below this main showing. About 40 feet below it some deeper open-cutting shows a width of 30 feet of oxidized capping containing bunches of sulphides and in places small bunches of graphite. At 2,500 feet elevation an outcropping of magnetite carrying a small chalcopyrite content has been exposed. After carrying out this development the American Smelting and Refining Company relinquished the option.

The whole gives the impression of a shallow ore-deposit, replacing a flat limestone-bed, the scattered surface showings being the roots of the original ore-body. It would require further work to determine whether the exposed ore-bodies extend to sufficient depth to constitute important tonnages or not.

El Capitan. This property consists of the *El Capitan* and *El Capitan Nos. 2, 3,* and *4,* owned by a syndicate under the management of E. F. Miller, Duncan. The property is situated at the head of Cottonwood creek, which empties into Cowichan lake, on the divide between Cowichan lake and the headwaters of the Chemainus river at 4,300 feet elevation. It is reached from Youbou, a station on the Canadian National Railway on the north shore of Cowichan lake, by an old logging-railway grade to the foot of the mountain, about 5 miles, and from there by a good foot-trail to the camp at 3,800 feet elevation.

The showings consist of two veins on either side of a 10-foot dyke in andesitic country-rock. The south vein is the more promising on the surface. It varies from a few inches to 3 or 4 feet in width and is intensely oxidized, with ribs and bunches of chalcopyrite in it carrying values up to $40 in gold to the ton. Two tunnels have been driven on the vein, the first about 100 feet below the apex of the hill, but which did not get below the oxides, and the second about 50 feet vertically lower. The upper one was driven about 50 feet and the lower one is now in 100 feet, with its face about half-way under the upper.

The lower tunnel is still in heavily oxidized material, but shows considerably more sulphides. The face at present shows the vein to have split into three small ones, the centre one being about 1 foot wide, of oxides. A sample from a few tons of this on the dump gave assays of over $100 in gold to the ton. The continuation of this tunnel is fully warranted in the hope of getting into sulphides. The vein is small, but the persistent high gold values would seem to justify its development.

Paint Pot. The two claims, *Paint Pot* and *Lakeview,* adjoining the *El Capitan,* were staked this year by Martin Smith, of Duncan, and associates. The discovery showing is a 2-foot vein of oxidized chalcopyrite, assaying $2.80 gold, 1.5 oz. silver, and 6.1 per cent. copper. No work had been done on it when I saw it, but the extension of the vein could be seen in the perpendicular cliff for about 100 feet above. It is worth some development.

Blue Grouse. This group consists of the *Blue Grouse Nos. 1, 2,* and *3,* situated about 1 mile from the south side of Cowichan lake and about 6 miles up from the south end. In 1917–18 the property was under bond to the Consolidated Mining and Smelting Company, which did extensive diamond-drilling. About 1,500 tons of 7-per-cent. copper ore was shipped in 1917.

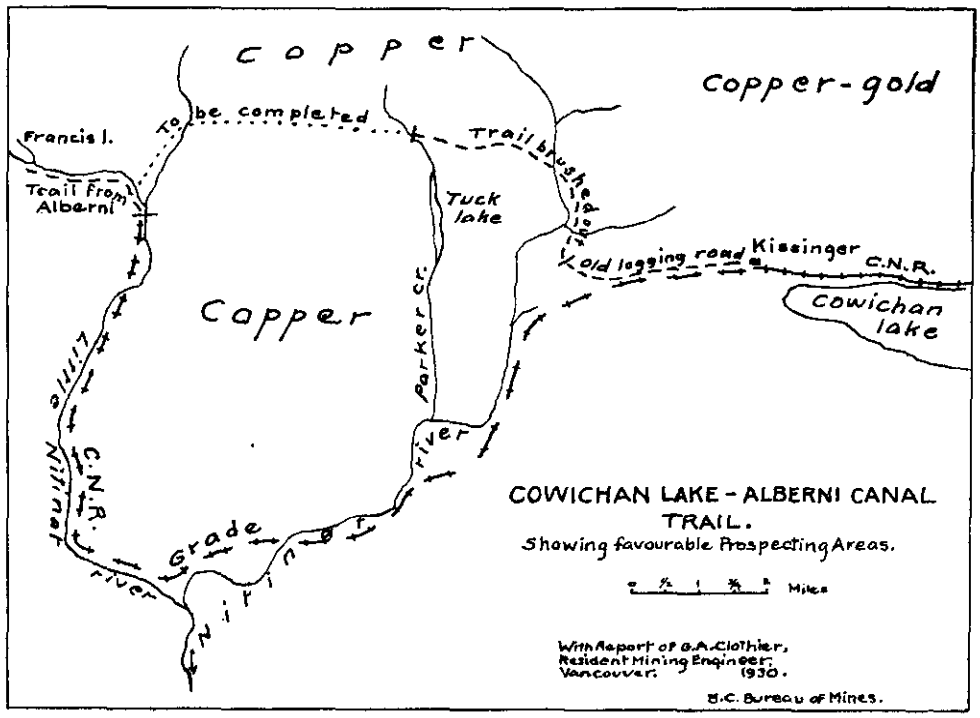
In 1928 the Pacific Tidewater Company, Limited, procured a lease on Lot 107, which contained the most of the surface showings, from the owners, the Empire Logging Company, and also leased the reverted Crown-granted claims from the Government. This company then reconditioned the camp and road, installed a small compressor plant, and started a crosscut tunnel, following a drill-hole in which a substantial ore-body was indicated at 220 feet. The tunnel had advanced about 85 feet when all but the major operations of the company were suspended, and nothing has been done on this property since.

The ore-deposits are of the contact-metamorphic type, disseminated and masses of chalcopyrite in a garnetite gangue. The extent of the showings as described in old reports and the fact that 1,500 tons of ore was shipped from the surface workings would indicate that the property is worth further investigation.

Tyee, Richard III., and Lenora. The Tyee Copper Company holdings, consisting of the *Tyee, Imperial, Muriel, Tony, Donald, Thelma, Herbert, N.T., Doubtful,* and *X.L.* claims, were acquired by the Pacific Tidewater Mines, Limited, in 1928. The company also held leases on the adjoining claims, *Richard III.* and *Lenora.* The later work

done on these claims was briefly described in the 1928 Annual Report. Since then the Ladysmith Tidewater Smelters Company, Vancouver Block, Vancouver, absorbed the holdings of the Pacific Tidewater Mines, Limited, but dropped the leases on the *Richard III.* and *Lenora.* It therefore holds the *Tyee* group yet, but it is not under operation.

The trail through to Alberni canal from the head of Cowichan lake was further improved this year and is now passable without difficulty. Some prospecting has resulted along the old Canadian National Railway grade and around Nitinat river and lake. The Canadian National Railway has also been extended this year from Youbou to Kissinger, the station at the head of the lake, making that area around the head of the lake and through to Alberni canal very accessible for prospecting and development work and much more promising for transportation.



ALBERNI MINING DIVISION.

This is one of the most accessible Divisions in the Province for prospecting and mine operating. From Port Alberni, which can be reached by Canadian Pacific Coast boats from Victoria, by Canadian Pacific Railway and by buses from Nanaimo, one can reach any part of the Division by auto or boat. Boats are available on Sproat lake and Great Central lake, and launches are obtainable at Port Alberni for down the canal and the west coast. There is also mail-boat service twice a week from Port Alberni to points down the canal and Barkley sound as far as Ucluelet, from which point one can get by auto to Tofino. The trail from the head of Sproat lake over the divide to the head of Kennedy lake was completed this year by the Department of Mines (*see* under "Trails"), making available for prospecting a 20-mile cross-section of the island. The surveyor in charge of the work, H. H. Browne, of Alberni, reports plenty of quartz float. I hope to see this very promising gold-quartz area thoroughly prospected. As this trail is the proposed route of an auto-road from the west coast to Alberni, transportation is assured for shipping purposes.

Twenty years ago this was a very live Mining Division, particularly adjacent to Alberni canal. No outstanding property developed, however, and inactivity resulted until 1928–29, when there was a renewal of interest both in prospecting and some of the old properties; 1930 has not been so active, although there has been considerable prospecting and exploratory work.

ALBERNI CANAL SECTION.

This includes the country contiguous to Alberni canal, on both sides, down to Barkley sound. It is reached by launch or mail-boat from Port Alberni.

Regina. This group consists of three claims—*Regina*, *Regina No. 1*, and *Regina No. 2*—situated about 9 miles from Port Alberni on the logging-railway of the Alberni Pacific Lumber Company. It is an old property, but is now owned by E. Maralia, of Port Alberni. From the track at the foot of the hill at 1,000 feet elevation there is a good foot-trail to the old cabin at 2,100 feet. Transportation therefore presents no difficulties.

The mineralization consists of a mixture of pyrite, sphalerite, and chalcopyrite in a siliceous gangue replacing a shear in the volcanic country-rock. The vein strikes north-south and dips east into the hill at about 30°. It has been opened up by a wide open-cut along the face of the hill and an incline shaft sunk a few feet on the vein. There appears to be a fault in the vein just where the shaft was sunk, but further open-cutting south shows its continuation to be about 2 feet wide, of fair ore. About 20 tons of ore was taken out from this work and piled on the dump. This sampled $3.60 in gold to the ton, 5 oz. silver to the ton, and 5 per cent. copper. About 100 feet south of this the vein is again exposed, showing pyritized quartz carrying little chalcopyrite. The vein could be opened by further cutting or a shallow tunnel and depth obtained by sinking at a favourable point. It is a promising prospect.

Dauntless. The four claims comprising this group—*Dauntless Nos. 1* and *2*, *Evelyn*, and *Lewis and Cora*—are owned by Isaac C. Lewis, of Vancouver. They are situated on the west side of Alberni canal, about 4 miles down from Port Alberni. There are two series of shears within the volcanics of the Vancouver series. One strikes S. 50° W. from the beach, in which there are two or three parallel shears showing no important mineralization. About 200 feet up the hill a north-south shear had some work done on it by way of open-cutting, and a short tunnel at the mouth of which a shaft had been sunk on a 2-foot vein of pyrrhotite and chalcopyrite. Some further work was done here, but I have not examined the property since.

Thistle. This group of four claims is owned by Andy Watson, of Port Alberni, and associates. The claims are situated about 10 miles from a point about 12 miles down Alberni canal on the east side. At one time a wagon-road was graded from the beach for 6 miles, but is almost impassable now.

The country-rock is volcanic, in which are shear-zones carrying lenses of pyrite and chalcopyrite. A considerable amount of useless work was done higher up the hill from the camp, where only residual patches of mineral were showing. I think the lower showings deserve some deeper and more extensive work than has so far been done. The reader is referred to the 1927 Annual Report.

W.W.W. This group consists of the four Crown-granted claims—*W.W.W. Nos. 1*, *2*, *3*, and *4*—owned by A. James, Vancouver, and situated about 12 miles up the Franklin river on the east side of Alberni canal. This is one of the oldest properties in this section. The ore consists of gold-bearing pyritized quartz occurring within a shear-zone in altered andesite of the Vancouver volcanics.

Two tunnels, one 72 feet and a lower one 117 feet, from which a 60-foot winze was sunk, were driven several years ago, but nothing has since been done on the property. Very high gold values are found in places, but apparently erratically distributed. Several examinations have been made of the property this summer, and it is now under bond to Vancouver interests, who propose to extend the development in the hope of developing a workable tonnage of milling-ore.

Island Copper Co., Ltd. This company was incorporated in 1929, with its registered office in Port Alberni. It is capitalized at $250,000, divided into 1,000,000 shares at 25 cents each. The company's holdings consist of two old Crown-granted claims, the *Modoc* and *Kitchener*, purchased from the owners; the *Ogilvie* group of seven claims adjoining the above; and nine claims staked by the company. They are ideally situated for mining and transportation along the east side of Alberni canal, about 12 miles down from Port Alberni. The reader is referred to a description of the property in the 1929 Annual Report, and as nothing of importance has since been done the report need not be repeated here. Suffice it to say that sufficient surface work has been done along the contacts of the limestone-beds with the volcanics where the mineralization occurs, to indicate very favourable possibilities of opening

up commercial bodies of copper ore with more extensive deeper development-work. There is a good dock, camp on the beach, and mining equipment ready for immediate use.

Alberni Mines, Ltd. This company was incorporated in January, 1928, with a capitalization of $2,000,000, divided into 4,000,000 shares of 50 cents par value. The registered office is 525 Seymour Street, Vancouver. The company acquired the old "Hayes" mine or *Three Jays* group of seven Crown-granted claims situated on the west side of Alberni canal, just below the Nahmint river and about 15 miles down from Port Alberni. Up to 1901 some 2,000 tons of 8-per-cent. copper ore was shipped, obtained mainly from the surface. Subsequently about 6,000 feet of underground work was done on three levels which failed to disclose any important ore-bodies. The property was dormant until the present company took it over in 1928. Some surface work was done on another portion of the claims, exposing some promising showings of chalcopyrite. However, nothing further has been done in the past two years. (*See* the 1928 Annual Report.)

Barkley Sound Section.

Sunshine. (*See* the 1928 Annual Report.) This property, consisting of eight Crown-granted claims, is situated on Cascade creek, which empties into Uchucklesit harbour at the Kildonan cannery. It was bonded two years ago to the Canada British Finance Corporation, Limited, of Vancouver, by the owners, L. Manson and E. G. Calvaskey, of Nanaimo, but no work has been done on it in that time.

Black Prince No. 3.—This claim, owned by Jas. Wilkinson, of Port Alberni, lies above the *Sunshine* and is reached by the extension of that trail. It contains a big surface showing of magnetite.

Canadian Quicksilver Co., Ltd. This company was incorporated in 1928 with a capitalization of $250,000, divided into 1,000,000 shares of 25 cents par value. The reader is referred to the 1927 and 1928 Annual Reports. Early this year the property was acquired by Messrs. Campbell, Hunter, Lozier, and associates, of Vancouver, who apparently have not been successful in financing further development. *I understand that Mr. Shipton is endeavouring to extract the mercury from the ore on the dump,* obtained from the shaft and surface work.

Sproat Lake Section.

As stated elsewhere, the trail from Sproat lake to Kennedy lake was completed this year. A float is now under construction at the head of Sproat lake to facilitate the landing of supplies at the end of the trail. The extension of the trail up to Taylor river will be recommended for 1931. *This area is favoured by prospectors, but access to it has been too difficult to encourage* very much prospecting.

Murphy & Johnson Claims. These claims are situated on the south side of Sproat lake, about 8 miles up the lake, and extend back from the beach. They cover a belt about 100 feet wide of a mixture of calcite and siderite, in which are small patches of sparsely pyritized silica carrying low values in gold. The surrounding country-rock is volcanic. The surface of the belt has weathered to a thin crust of deep-red oxide, giving it a very attractive appearance for prospecting.

A few shots have been put in along the shore of the lake and a shallow shaft sunk about 75 feet back. The ground lies flatly for a couple of hundred feet from the lake and therefore no depth can be obtained without getting seepage from the lake. The work exposes, as stated, small patches and stringers of quartz slightly mineralized with fine-grained pyrite, and traces of sphalerite, carrying low values in gold. There are not sufficient mineral indications to give anything definite to work on. The belt might be traced to higher ground and a little further surface prospecting done.

Morning. The *Morning* group is comprised of three claims—*Morning*, *Morning No. 1*, and *Apex*. The first two extend from the base of the mountain to about 1,000 feet elevation, while the *Apex* is higher, the showings being about 3,000 feet elevation. The claims are owned by Andrew Smith, Alberni, and W. P. Beavan, Victoria, and are new held under option by a syndicate headed by Gordon Campbell, Port Alberni, and P. L. Anderton, Courtenay. The claims lie on the north-east side of Taylor river, about 3½ miles

from the head of Sproat lake, and are reached by a branch trail from the main Sproat Lake–Kennedy Lake trail.

Since the present syndicate has acquired the property further work has been done, mainly on the *Apex* claim, under the able direction of R. N. Dickinson, Comox. The older work on the *Morning* claim was described in the 1927 Annual Report and need not be repeated. Subsequent work consists of stripping and open-cutting on the *Morning* claim between the elevations of 650 feet and 800 feet, and three open-cuts on the *Apex* claim at approximately 3,000 feet. This work shows a number of parallel veins consisting of quartz-filled fissures in basaltic country-rock. The veins are from 1 to 6 feet wide, with an average of probably 3 to 4 feet, and are mineralized with pyrite chiefly, and in places some sphalerite, galena, and chalcopyrite. The values in the quartz are mainly gold, running up to $18 a ton in the heavy pyrite, but averaging around $6 to $7 a ton. The wall-rock is generally somewhat silicified and mineralized and also carries some gold values. The ore apparently shows increased value in depth, and while it will require extensive work to prove bodies of workable ore, the possibilities of the property are encouraging.

Other properties in the Alberni Mining Division and the Annual Reports in which they are described are: *Big Interior*, 1916; *Bank*, 1917; *Canadian*, 1916–17–18; *Victoria*, 1917; *Edith*, 1916; *Monitor*, 1916–17–18; *Happy John*, 1916–18; *Sunshine*, 1928; *Rainy Day*, 1928; *Southern Cross*, 1928; *Copper King*, 1928.

CLAYOQUOT MINING DIVISION.

This Division occupies the central 100 miles of the west coast of Vancouver island and is accessible only by coast-plying boats from Victoria or Port Alberni. Tofino, on Clayoquot sound, may be reached by auto-road via Long Beach, under favourable conditions of the road from Ucluelet, on the north entrance of Barkley sound. The proposed auto-road from Alberni via Sproat lake and Kennedy river, following the trail completed this year by the Department of Mines to Kennedy lake, thence to Tofino, would therefore be a wonderful benefit to the west coast. Prospectors are urged to investigate the country from Kennedy lake across to Sproat lake, now traversed by a good foot-trail, for gold-bearing quartz veins. (*See* under "Trails.")

Kennedy Lake and River Section.

This section is reached by launch from Tofino to the foot of the rapids on lower Kennedy river, the outlet of Kennedy lake near the cannery. A small boat can readily be lined up the rapids, a few hundred yards long, into Kennedy lake, which is 12 miles to its head. No mining of note has been done in this area in late years, and the reader is therefore referred to the following properties described in the Annual Reports for the years indicated: *Jo Jo*, 1927; *Rose Marie*, 1927; *Gold Queen*, 1927; *O.K.*, 1928; *Northern Cross*, 1928.

Clayoquot Sound Section.

The many hundreds of miles of inland waters in Clayoquot sound, from Kennedy lake on the south to the head of Sydney inlet on the north, and its immediate proximity to Long Beach, will, when connected by motor-road with the Island highway at Alberni, make it the greatest summer playground on the Pacific coast. Any part of this section is accessible by launch from Tofino. The trail up Bedwell river from the head of Bedwell sound has been repaired this year by the Department of Mines. (*See* under "Trails.")

Douglas (Walton Claims). This group, consisting of four mineral claims—*Alpha No. 1*, *Norman*, *Douglas*, and *Omego No. 1*—is situated about 2 miles up Tofino creek from the head of Tofino inlet. It is owned by Duncan McMillan, Vancouver, and William Walton, of Tofino. The property was under option this year to Ed. G. Brown, of Vancouver, who did a considerable amount of exploration and development work. Work was stopped in the fall owing to financial conditions and the bond was relinquished.

The predominating rock formation is the volcanics of the Vancouver series, mainly andesite. In the volcanics is a flat-lying bed of limestone varying in width up to 25 to 35 feet. This bed crops along the face of steep bluffs at 800 feet elevation and can be traced for over a claim-length. The whole formation is intruded by vertical basic dykes. The work this summer shows at least six such dykes within a distance of 500 feet.

The limestone has been altered on each side of these intrusions to garnetite and epidote, in which occurs, disseminated, veinlets of and massive chalcopyrite. A tunnel was driven following along one of the dykes a distance of 43 feet. There was a nice body of ore at the collar of the tunnel, but it broke up into small veins and patches, gradually decreasing to a low-grade ore. East of this along the bluff-face three big open-cuts were opened up, altogether, including the tunnel, producing about 85 tons of clean chalcopyrite stored at the foot of the bluff and down at the camp. The faces of the open-cuts show patches of chalcopyrite in the garnetite, out in the limestone, and in the cracks in the dykes, but apparently nothing in the country-rock above or below the limestone along the intrusions. Ore would therefore be confined to the width of the limestone-bed and principally in the width of altered limestone laterally from the dykes. Judging from the amount of mineralization disclosed in the tunnel-work in the three big open-cuts and other cuts along the bluff, it is doubtful whether sufficient ore could be developed for a large operation.

Limestone.—I understand that the limestone-beds starting at the head of Tofino inlet were staked in 1930 for about a mile toward the *Douglas* group. The ground is being surveyed this winter.

Craigellachie and Copper King.—These groups are owned by D. A. Grant, of Tofino. As only assessment was done this year the reader is referred to the 1928 Annual Report for a description of them.

Ormond. This group consists of two Crown-granted claims, *Ormond* and *Ormond No. 3*, owned by Jas. Beck, of Victoria. They are now under option to Mr. Hodgkinson, of Victoria, who has been operating the property all year. The claims are situated on Matilda creek, on Flores island, the showings being at about 1,000 feet elevation. Matilda Creek Landing, a port of call of the C.P.R. west coast boats, is a short distance from the camp. This year a very comfortable cabin was built at the beach sufficient for a small crew and a compressor building is now under construction. A new road is contemplated, but with the camp and compressor at the beach the present foot-trail will be adequate for sufficient development-work for future operations and necessities.

The showings consist of replacements in a shear-zone about 25 feet wide in the Vancouver volcanics. The metallic minerals are pyrite, pyrrhotite, and chalcopyrite, carrying fair gold and silver values. Previous work consisted of open-cuts across the shear on the top of the hill, showing in places up to 6 feet in width of well-mineralized vein; and some open-cutting; and an incline shaft about 100 feet vertically lower, on the west side of the hill. The incline is full of water, but the face of the cut shows small ribs of chalcopyrite and pyrite. The only new work seen was the widening of this open-cut to the right of the incline, showing some mineralization along the fractures in the volcanic rock. A tunnel from here to get under the ore-exposures will tell the story.

Ptarmigan. (*See* the 1914 and 1926 Annual Reports.) These claims are situated on the west slope of Big Interior mountain, between Great Central lake and Clayoquot sound, and were reached by way of a road up from the head of Bedwell sound, a distance of about 13 miles. The property was under operation when the war started in 1914 and was closed down; nothing has been done since then. The old road for 9 miles and trail the balance of the way have, of course, become impassable. From old reports it seems probable that the showings are a continuation, across the range, of the low-grade contact-metamorphic copper-deposits of the *Big Interior* group, which would call for extensive development.

You. This is another property up the Bedwell River valley that was worked a number of years ago by the owner, J. B. Woodworth, of Vancouver. The showing is described as a gold-bearing quartz vein in a shear-zone in the Vancouver volcanics. A drift-tunnel was driven about 80 feet on the vein, showing it to be about 3 feet wide, of which 9 inches is quartz assaying from a dump sample about $60 in gold to the ton. The Department of Mines this year repaired the lower end of the trail and restored some of the bridges to again make this section accessible for prospecting and operating.

Farther up the west coast are situated the *Shannon* group and the *Star of the West* group in Nootka sound, both described in the 1928 Annual Report.

In Espinoza inlet, up the Zeballos river from the head of Zeballos arm, the Marks Gold and Copper Mines, Limited (*see* the 1929 Annual Report), was granted assistance toward repairing

the trail from tide-water to the company holdings, a distance of about 6 miles. Prospecting beyond this property this year resulted in the staking of a number of claims.

QUATSINO MINING DIVISION.

This is the north-western portion of Vancouver island, made very accessible by Kyuquot and Quatsino sounds, the latter reached either by Canadian Pacific west coast boats or from the east coast via Port Hardy, over the Port Hardy–Coal Harbour auto-road to Coal Harbour, where there is hotel accommodation and launches available to any point in Quatsino sound. Kyuquot is only reached by the west coast boats.

KYUQUOT SOUND SECTION.

Copper Cup Mines, Ltd. This company was incorporated in 1929 with a capitalization of 1,000,000 shares of no par value. The company's registered office is in the Dominion Building, Vancouver. Its holdings consist of fifty-two adjoining claims situated a few miles up from the head of Kokshittle arm. I am informed that a good trail has been built to the property from tide-water and a considerable amount of surface prospecting done this year, with favourable results reported by the company.

Canada Copper, Ltd. This is a $5,000,000 organization, divided into 20,000,000 shares of 25 cents each, with its head office in the Standard Bank Building, Vancouver. The holdings are comprised of an old group acquired from Frank Devoe and a number of claims staked, totalling forty-three claims. I have not heard of anything being done on the property.

QUATSINO SOUND SECTION.

The chief mining activities of this section are the operations of the Coast Copper Company on Elk lake.

The Geological Survey of Canada made a survey of this area in 1929 under the direction of H. C. Gunning. This report is contained in Summary Report, 1929, Part A, recently issued and obtainable at the Geological Survey office at 739 Hastings Street West, Vancouver. The following is excerpted from Dr. Gunning's "Summary and Conclusions":—

"The most important mineral properties of the Quatsino-Nimpkish area are pyro-metasomatic (contact metamorphic) copper-deposits. . . . The mineralization is found most commonly as replacement of limestone, less commonly in volcanics, in close proximity to stock-like bodies of intrusive rock which varies in composition from gabbro to granodiorite. Consequently, in prospecting, particular attention should be paid to areas underlain by limestone near granitic intrusions or where complementary basic and acidic dykes are abundantly developed."

Millington.* This property of six claims, situated about 3½ miles up the valley from Holberg, at the head of the West arm of Quatsino sound, is owned by the Spooner Bros., of Holberg. As nothing but assessment was done this year the reader is referred to previous Annual Reports descriptive of the properties.

Marble Creek. This group is comprised of the *Lucky Jim*, *Winner*, *Royal*, *Old Dog*, *Hard Tack*, and *Marble Creek* claims, owned by the Spooner Bros., Pete Obling, and Jas. Cordy, all of Holberg. The claims are situated on Marble creek, 3 miles up from the head of Marble bay on Quatsino sound. Marble creek runs out of Alice lake. A foot-trail was built by the owners this summer, starting from low-tide mark on the west side of Marble bay. At high tide one can go to the head of the bay and take the trail from that point, saving about a mile of walk.

The mineral-showings are along the right or west bank of the creek at an elevation of 125 feet. Alice lake, 4 miles farther on, has an elevation of about 200 feet. The minerals are bornite and chalcopyrite contained in a mass of amygdaloidal basalt very similar to the *Millington* deposit. They occur as disseminated crystals, in small bunches, in veinlets, and with small quartz veinlets. Mineralization is exposed along the river-bank for 400 feet in the ridges of bed-rock that extend to the water's edge. On these there is a space of about 15 feet to high-water mark, beyond which is heavy overburden. A few shots have been put in along the exposed

* H. C. Gunning: Summary Report, 1929, Part A, G.S.C., page 139A.

rock, and a little trenching done back of high-water mark shows a width of 25 feet. Across the river, about 150 feet, the same formation has been found, but only slightly mineralized. It has not been determined whether it is a mass of mineralized basalt or a belt of it extending up the river. Where shot into and where cropping on the exposed ridges I judge it would average over 3 per cent. copper, and containing only the copper sulphides, bornite, and chalcopyrite, would give a high-grade concentrate. Open-cuts will be driven in from the water's edge as far as mineralization extends to gain some idea of the extent of the deposit. There is an excellent water-power in Marble creek.

Alice.

(*See* previous Annual Reports.) This property is owned by W. Clancy and W. Kinsey, of Quatsino. There are seven claims in the group, situated about 4 miles from Jeune Landing, the Coast Copper Company's dock, and half a mile off the road to Alice lake. The workings are about 1,000 feet elevation or 700 feet above the road. The work this year has been the extension of the tunnel to about 85 feet, following an 18-inch vein of lead-zinc sulphides carrying gold values of about $12 to the ton and silver about 8.5 oz. to the ton. The ore is a replacement of limestone which, previous work has demonstrated, must be "followed" to develop it.

June.

(*See* the 1929 Annual Report.) The Coast Copper Company acquired this property in the fall of 1929 and did about 4,500 feet of diamond-drilling. A portable compressor was installed and 435 feet of underground work done. Exploratory work was continued for some time this year until some 640 feet of drifting and 516 feet of crosscutting had been done, when the property was closed down.

The work encountered important bodies of pyrrhotite carrying some copper and appreciable values in gold and silver. Disseminated copper was also found where metamorphism was greater, and altogether the results were probably sufficiently encouraging to justify further exploration under more favourable general conditions.

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, as it is a subsidiary company of the Consolidated Mining and Smelting Company of Canada. The company started the development of this property in 1916 and has operated continuously to date. During that time about 6 miles of underground development-work has been done, obtaining some 2,000 feet depth below the croppings on the dip of the vein and about 300 feet below sea-level. The lowest adit is the 800-foot level, below which four levels have been opened up at 200-foot intervals by a 3-compartment shaft.

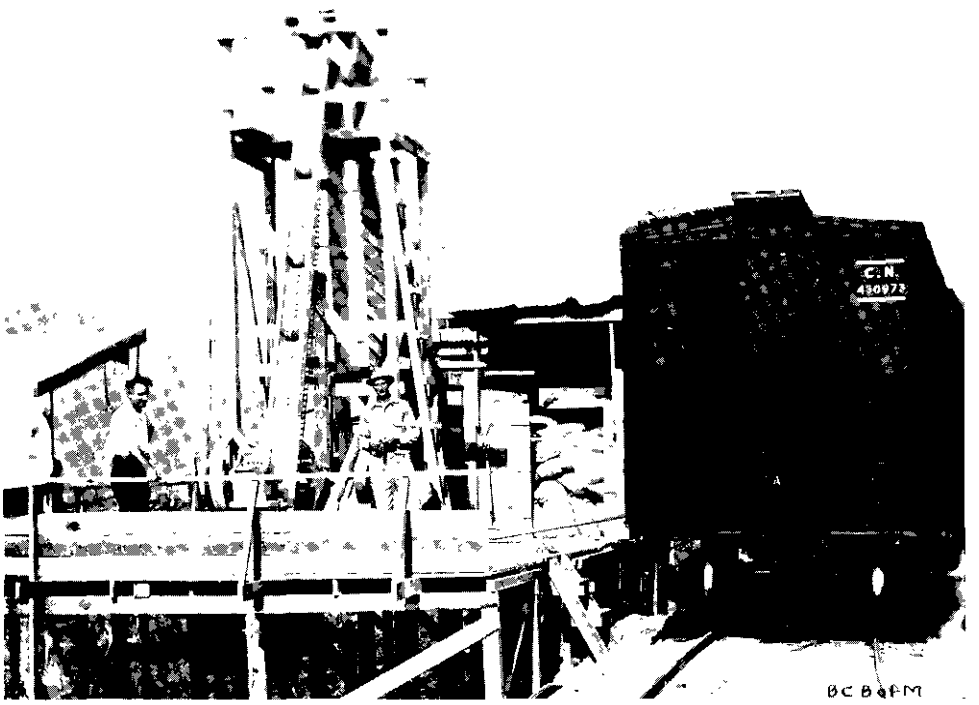
This year, with an average pay-roll of sixty men, 750 feet of drilling south was done on the eighth or adit level; the 1,000-foot level was advanced southerly 886 feet; the 1,400-foot level was extended 1,430 feet, opening up some promising ore-shoots; and the 1,600-foot level was driven 1,301 feet south and 196 feet north; in addition, there were 192 feet of sinking and 25 feet of short raises to connect ore and waste pockets with the shaft; making a total of 5,964 feet for the year. Diamond-drilling of short holes through the vein to the hanging-wall amounted to 2,470 feet.

Present ore reserves justify the construction of an adequate concentrating plant and providing transportation facilities for an important output when general conditions warrant. Camp-construction, power-installation, surface and underground equipment have kept pace with development, and the mine is in shape to go into production any time. The personnel of the staff at the mine is C. A. Seaton, superintendent; P. T. Bloomer, foreman; and J. H. Burrows, accountant.

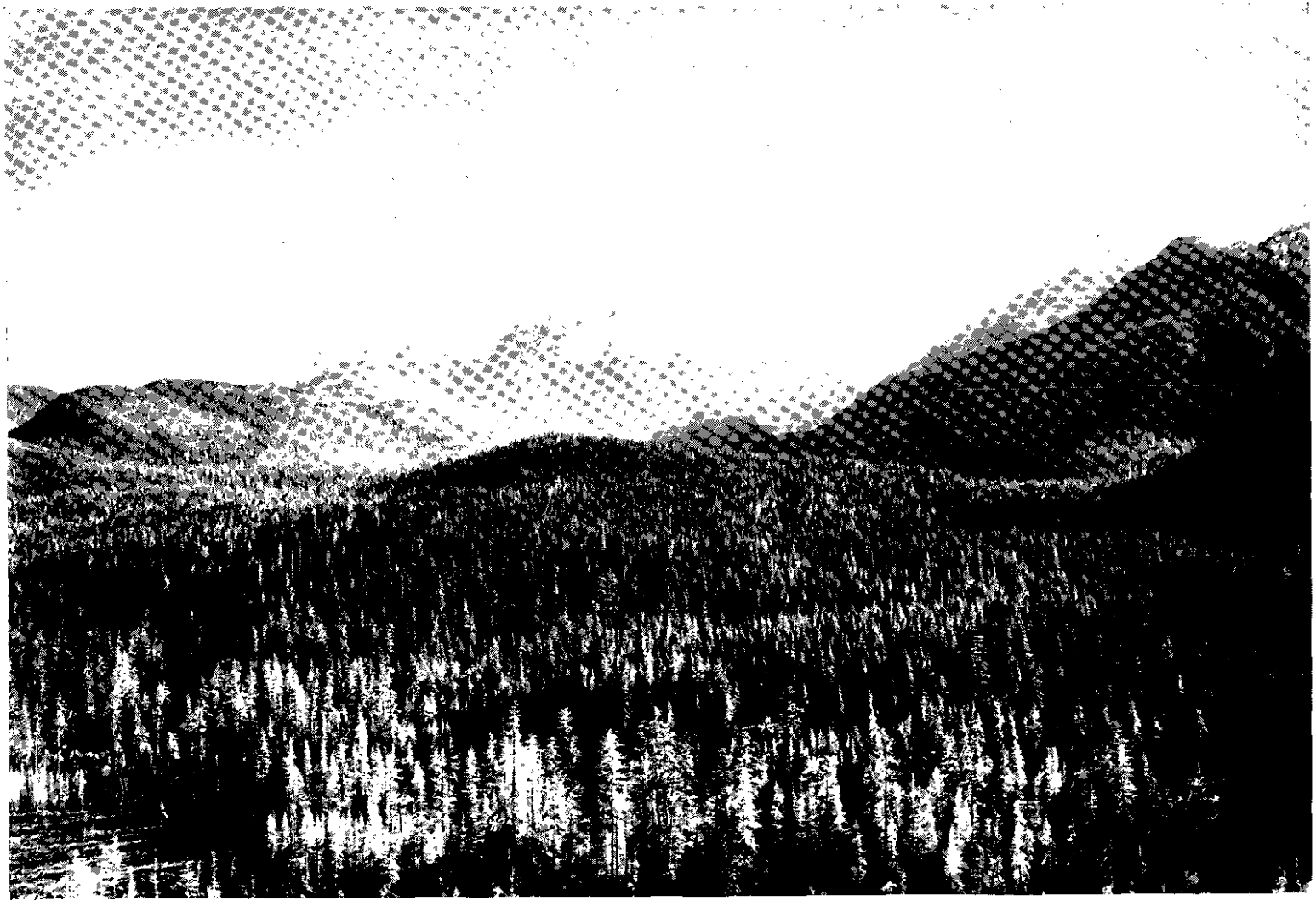
Quatsino Gold-Copper Mines, Ltd.

(*See* the 1928 and 1929 Annual Reports.) 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 mineral claims on the west side of Elk river, south of and adjoining the property of the Coast Copper Company, Limited. The property is reached by foot-trail from the adit-tunnel level of the Coast Copper Company's mine, to which that company has boat and truck transportation from tide-water at Jeune Landing on Quatsino sound. This year the trail was reconditioned and reconstructed to enable the transportation of diamond-drilling equipment to the property. Assistance was granted by the Department of Mines towards the trail-work.

Nimpkish Lake Copper Area, Nanaimo M.D.



Eagle Talc and Mining Co., Victoria M.D.



Pinder Mountain, South of Nimpkish Lake, Vancouver Island.

Five holes were drilled, aggregating 4,845 feet. They furnished much information as to general structure and also showed that there is generally ore along the dykes or lava-flows in the limestone. Commercial ore was indicated in hole B. At 85 feet depth the cores showed 5 feet of 23-per-cent. copper ore, and at 849 feet 6 feet of 26.5-per-cent. copper ore. The work was under the direction of Guy Wilson.

NANAIMO MINING DIVISION.

This is one of the largest and most important of the Mining Divisions, as it includes all the east coast of Vancouver island and all the west coast of the Mainland from Texada island north to Seymour inlet. Its recording office is at Nanaimo. Its mining industry is very diversified—coal at Nanaimo, Cumberland, etc.; placer gold on the north beaches of Vancouver island; lead and zinc in the northern part of Vancouver island; gold on the north coast and coast islands; copper distributed, iron ores distributed, building materials, as cement, building-stone, brick, sand, gravel, and lime, at different places on the coast.

Port Hardy Section.

Caledonia Mines, Ltd.

This company was incorporated in 1926 with a capitalization of $250,000, divided into 2,500 shares of $100 each, which in September, 1928, was increased to $1,000,000, divided into 1,000,000 shares of $1 each. The company has done a very appreciable amount of work in building a road of 5 miles from the main Port Hardy–Coal Harbour auto-road, installing compressor plant and equipment, and surface and underground work. Further exploration-work was done by the Consolidated Mining and Smelting Company during the life of an option on the property in 1929. This work has been described in previous reports and need not be reported here. The company is therefore now in the rather difficult position of having to refinance for further operations. Because of the disappointing results of underground work, the only alternative would be to follow down on the surface ore-exposures and do further surface prospecting along the limestone-contact. Murray Potts, Alert Bay, is looking after the affairs of the company.

H.P.H.

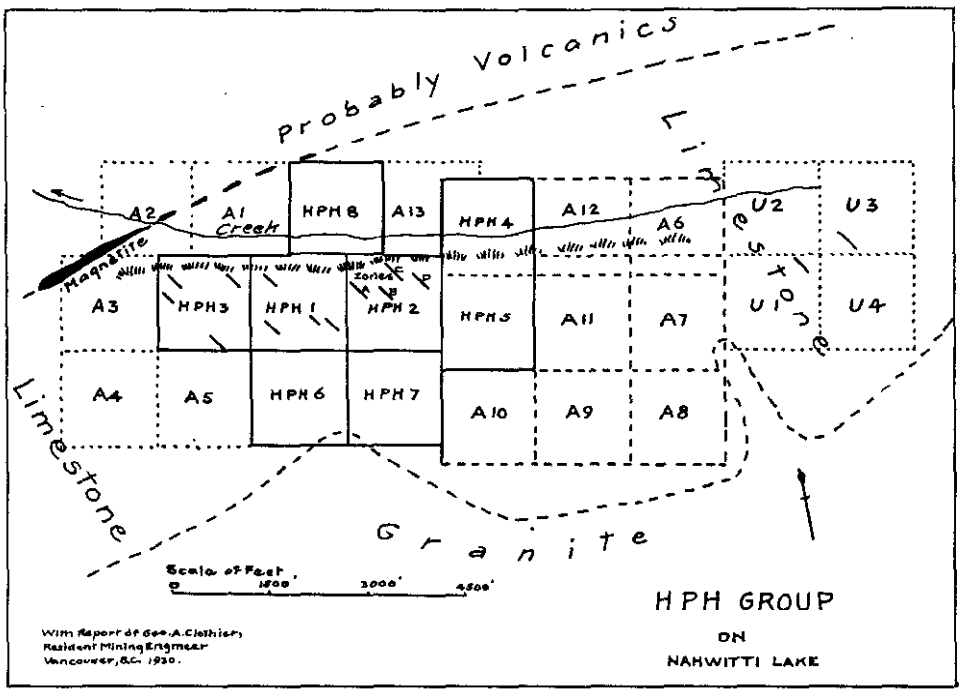
This group of eight claims—*H.P.H. Nos. 1* to *8*—was staked in June of this year by S. Pugh, M. Heppler, and Frank Hicklenton, all of Port Hardy. These men had been prospecting in the vicinity of Nahwitti lake, about 16 miles directly west of Port Hardy. They were returning to their main camp, but got lost in a dense fog and had to camp. Next day in cutting across country they found outcroppings of galena and zinc-blende. Further prospecting showed promising surface ore-exposures, the ground was staked, and later work indicated extensive ore possibilities. The American Smelting and Refining Company, represented by Henry Lee, of Vancouver, procured an option and after close examination development-work was decided upon. Two other groups, *Annex* of thirteen claims and *U Can* of four claims, were staked adjoining and added to the original group. (*See* accompanying sketch.)

The property is situated about 2 miles south of Nahwitti lake and reached by an old trail from Port Hardy to Kains lake, 12 miles; then 3 miles up from Kains lake to its head; then 6 miles across country to the showings. First supplies were man-packed to Kains lake and a camp established at the head of the lake. From here a trail was built and camps erected at the showings. Early in October 5 tons of supplies were taken in by hydroplane from Port Hardy to the Kains Lake camp, and a little later another 3 tons were delivered, the plane making a round trip from Port Hardy with from 1,600 to 1,800 lb. of supplies in twenty-five minutes. It would have been otherwise impossible to get sufficient supplies and equipment in for a winter's work with twelve to fifteen men, which is now being carried on under the personal supervision of Mr. Lee.

The ore-showings occur in quartz-filled fissures or shears in a limestone-belt about a mile wide, lying between granodiorite on the south and very probably volcanics on the north. There is a 30-foot vein of magnetite lying on the limestone between it and the volcanics. So far as known, the ore occurrences are on or near the limestone-magnetite contact. The fissuring strikes S. 40° E. diagonally from the magnetite into the limestone and occurs in a series of parallel veins. So far thirteen of these series or fracture-zones have been found across a length of three full claims, or about 4,500 feet. They vary in width from 30 to 140 feet, each containing a number of parallel veins showing from a foot to 18 inches of clean galena and zinc-blende to

14 feet of mixed ore of mill-feed grade. The veins are well defined, with little or no alteration or metamorphism of the limestone-walls. The only altered limestone is contained within the veins themselves. Between the veins is pure unbroken limestone.

In zone A, the discovery, a few shots and some stripping show one vein to be at least 15 feet wide of mill-feed, with a 4-foot section of altered lime in the middle of the ore. The parallel veins in this one zone occupy a width of 140 feet.



The ore assays from 20 to 60 cents in gold to the ton; from 7 to 55 per cent. lead; and 7 to 39 per cent. zinc, the silver content averaging about ¾ oz. to the unit of lead. A sample of clean galena assayed 40 cents in gold to the ton, 108 oz. silver to the ton, 68 per cent. lead, and 8 per cent. zinc. A sample of zinc from a cropping about a mile east of the known zones assayed $8 in gold to the ton, 1 oz. silver to the ton, and 33 per cent. zinc. It therefore has the indications of a very interesting property. From twelve to fifteen men are now employed and work will be continued through the winter.

Nimpkish Lake Section.

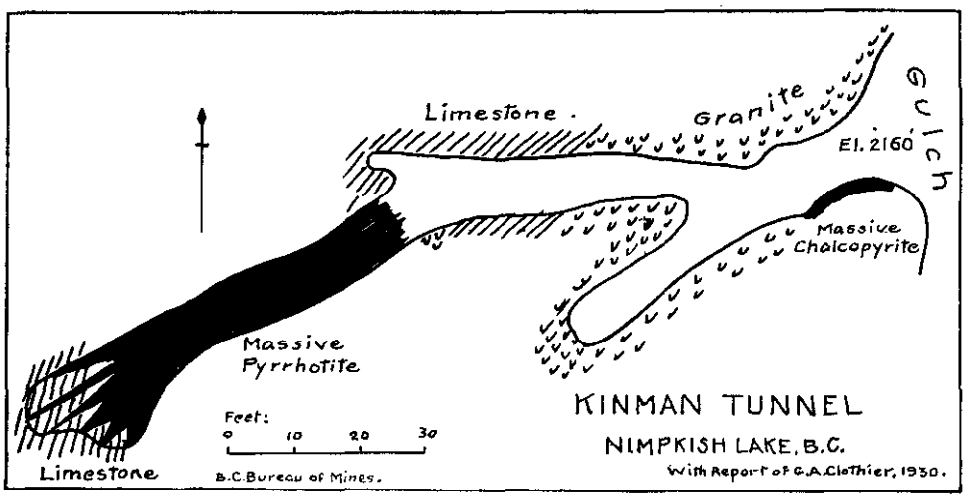
This area is contiguous to Nimpkish lake and reached from Englewood, a port of call of the Coast boats. The sawmill of the English-Wood Logging Company is located here and a good logging-railway runs back to the north end of Nimpkish lake, a distance of about 12 miles. The logging company's boat plies on the lake to two camps.

The general rock formation consists of a wide belt of limestone underlain and bordered on the east by andesite and basalt flows of the Vancouver series, and in contact on the west with a massive intrusion of granodiorite, probably contemporaneous with the Coast Range batholith. Fine-grained greenish dykes cut the granodiorite, limestone, and volcanics. The mineralizations consist of magnetite, pyrite, zinc-blende, and chalcopyrite occurring as replacements of the limestone along or near the granodiorite-limestone contact, and in the volcanics along the andesite-granodiorite contact as found on the *Smith* group.

Last year about 200 claims were staked in this area. The two more promising properties were the *Kinman* holdings and the *Smith* groups. Both these properties were under option to and extensively explored by the Consolidated Mining and Smelting Company early in 1930, but the results were not encouraging and neither option was exercised. Because of the outstandingly

attractive surface ore-exposures of chalcopyrite and zinc-blende on the *Kinman* ground, high hopes were entertained that they would hold to depth or similar bodies recur that would develop into an important mine. The results have therefore been most disappointing.

Kinman. (*See* the 1929 Annual Report.) This property comprises six groups of about fifty claims owned by E. L. Kinman, of Vancouver. Four main ore-exposures were made on this property over a length of 3,000 feet. The upper showing stripped across 60 feet showed 15 feet of solid chalcopyrite, with the remainder a good-grade milling-ore. A diamond-drill hole through this showed only 8 feet of chalcopyrite and limestone below. An open-cut driven through this ore showed a body lying on the limestone like an inverted soup-plate, the thickest point being 8 feet of solid ore. There is a clean line between the ore and the limestone; that is, the ore did not gradually die out in the limestone. South of this 3,000 feet and nearly 1,000 feet vertically lower another open-cut at the top of the canyon showed a width of chalcopyrite of 25 feet. A tunnel under this went through 18 feet of massive chalcopyrite, when it was cut off by a tongue of granite. Through the granite the tunnel was in limestone for about 40 feet, when a body of massive pyrrhotite was encountered and driven in for about 60 feet to the face, when it fingered out into the limestone. The pyrrhotite contains



little or no copper. A crosscut from the face south to the contact might have given some information. Between these two extreme showings there were two large strippings and small open-cuts, disclosing promising bodies of chalcopyrite and zinc-blende.

The Consolidated Mining and Smelting Company drilled twenty diamond-drill holes, aggregating 6,800 feet, and did an immense amount of open-cutting and stripping along and near the contact for about a mile, producing a considerable tonnage of ore. Of the twenty diamond-drill holes, five were wholly in limestone and one wholly in granite; the remaining fourteen all cut the contact; of these, four showed no mineral, seven showed mineralization with some values and three large bodies of pyrrhotite, and three holes showed commercial ore, 2.5 feet of $49 gold ore showing in one hole. The percentage of holes crossing the contact that showed sufficient mineralization and values to indicate ore-bodies would seem to warrant extensive drifting along the contact. Ore-channels on the contact might lead to ore-bodies in the limestone similar to the surface exposures.

Nothing in the way of development has been done on the property since the Consolidated stopped in April. E. L. Kinman has put in the whole season in prospecting the extension of the contact-belt toward the Bonanza Lake area.

Smith. There are five groups in this property owned by A. F. Smith, of Englewood. They lie to the north of and about 1½ miles from the *Kinman* showings. The owners had uncovered a number of promising copper-showings occurring along a granodiorite-limestone contact, and where the limestone had eroded down to the underlying volcanics there were some copper-showings in the volcanics. The Consolidated Mining

and Smelting Company, after closing operations on the *Kinman* property, took an option on this and did a considerable amount of exploratory work, which did not, however, fulfil expectations and the option was dropped.

Other Properties.—Other groups in this area, including the *Larson*, *Lennie*, and others, have had nothing done on them during 1930.

Sayward Section.

This section is reached from the port of call of Sayward at the mouth of the Salmon river on the north-east coast of the island. There has been some prospecting done up the Salmon and Adams rivers, but more as a side-line in timber-cruising, etc. There is a fair wagon-road from Sayward to the forks of the Salmon and White rivers, about 7 miles, and from this point there is a trail extending 10 miles to the head of Adams river. This trail was put in repair three years ago when the Consolidated Mining and Smelting Company had an option on the *Lucky Jim* group.

Lucky Jim. This group of three claims—*Lucky Jim*, *Lucky John*, and *Marjorie*—owned by Alex. and Walter McKay, of Vancouver, is situated at the head of Adams river, about 17 miles from Sayward. The only report on this property is in the 1918 Annual Report, which states: "The deposit of ore, which occurs on the *Lucky Jim* claim, belongs to the contact-metamorphic type, with copper minerals occurring at the contact of granodiorite and limestone. The mineralization consists of pyrrhotite, iron pyrite, marcasite, and chalcopyrite, in a breccia gangue containing much hornblende and some calcite. The main outcroppings are in the bed and along the bank of the river, where they show for about 10 feet wide and 50 feet long. A sample taken from the workings assayed: Gold, 0.9 oz. to the ton; silver, 1.8 oz. to the ton; copper, 5.35 per cent."

In 1927 the Consolidated Mining and Smelting Company diamond-drilled the property, but gave up the option.

Copper Queen. This group of five claims is owned by Thos. Russell, of Vancouver, and situated about a mile from the beach from a small bay just south of Humpback bay in Johnstone strait. The showings at 675 feet elevation are reached by a good foot-trail from the cabin on the beach. The showings are small veins of chalcopyrite exposed in the face of a steep gulch. An open-cut and tunnel did not show much mineralization. Later prospecting up the hill on the strike of the small veins is reported to have found other croppings, but very little has been done on them.

Campbell River and Buttle Lake Section.

This section includes the Campbell lakes and Strathcona Park and is reached from Campbell River, a port of call for Coast boats. The stage runs from Campbell River to Forbes Landing, a summer resort on Lower Campbell lake. From this point there is a fair auto-road to Sutherland Bros.' camp on Upper Campbell lake, another 12 miles. From this point to Buttle lake is about 14 miles, 5 miles by boat to the head of the lake and 9 miles by trail to the north end of Buttle lake. The Sutherland Bros. have pack and saddle horses for the trail and on Buttle lake, which is 25 miles long, a boat equipped with an outboard motor.

The logging-railway is gradually being extended to timber limits at the north end of Buttle lake and will eventually furnish transportation to that area. There is an immense field for prospecting around Buttle lake, which lies east of the main range of the island.

There was considerable mining activity in the Campbell Lakes area some years ago and the old properties have been described from time to time in past Annual Reports, but very little interest has been taken for the past few years.

Considerable prospecting has been done on Myra and Price creeks, at the south end of Buttle lake, and a very creditable amount of prospecting-work done by the one or two old-time prospectors, when the difficulties of earlier transportation are considered.

These sections were the field of the Geological Survey investigations this year under H. C. Gunning. This is the first survey of this area and will furnish much-needed geological information.

Lorraine F. and Elizabeth F. These claims are owned by Jas. Forbes, Forbes Landing, and are situated on the north side of Campbell lake on the water-front. This is the old *Sumpter* group described in the 1916 Annual Report. The claims are located along a contact of granodiorite and limestone paralleling the lake, a couple of hundred feet up the hill. The mineralization is chalcopyrite, sparingly distributed in a 4-foot vein of

metamorphosed rock consisting mainly of garnetite. Several open-cuts trace the vein some distance along the side-hill, but have not exposed any mineralization of importance. A little further surface work is justified in the hope of finding an ore-showing on which it would be worth obtaining some depth.

Farther along the lake what is probably the westward extension of the contact has been found on the *Elizabeth F.* claim. A shaft has been sunk about 25 feet on a slightly mineralized, 2-foot vein of garnetite. A tunnel which will give a depth of about 50 feet below the surface has been driven about 150 feet toward the shaft. It will have to be continued about 15 feet to reach its objective. Some drifting might then be done on the vein if the ore indications are more favourable than the surface.

Jim and Frank. These two claims—the *Jim and Frank Nos. 1* and *2*—were staked in 1928 by Frank Gardiner and Jas. Forbes, of Forbes Landing. They are situated on the north side of the range, on the north side of the lake. The trail leads over the summit at 1,000 feet elevation and down 200 feet on the north side to a short distance above Bacon lake. The mineralization consists mainly of pyrite on the seams of a broken-up belt of volcanics bordering a dyke striking about north and south. I did not recommend any further work.

Price Creek. (*See* the 1929 Annual Report.) These groups consist of the *Cross* and *Revercomb* groups of six claims each, situated on the west side of Price creek, which empties into the south end or head of Buttle lake. There is a fair foot-trail from the head of the lake to the different showings. The claims are controlled by James Cross, St. James Hotel, Victoria. Mr. Cross did some further work this season on the higher showing at 2,080 feet elevation by cutting deeper into the loose, leached surface material, and says that sulphides are coming in as the more solid ground is reached. The middle or barite showing had nothing done on it this year. The lower showing, a 6-foot vein of nearly solid iron sulphides carrying a little chalcopyrite, was extended east a little farther with no change in the ore.

Lynx. This group is composed of three Crown-granted claims—*Lynx*, *Grey Squirrel*, and *Cougar*—and probably other claims held by assessment. They are owned by James Cross, St. James Hotel, Victoria, and associates, and situated on the north side of Myra creek, about 2 miles up from its mouth at the south-west end of Buttle lake.

The general rock formation is volcanic with associated belts of crystalline limestone. In this and adjoining groups and extending through to Price creek is a wide zone of schists, the result of intense shearing in the volcanics. General strike of the zone is N. 80° W. (mag.). Within the schist-zone are veins or lenses up to 20 feet wide which have been more or less silicified and accompanied by calcite and some barite. The metallic minerals pyrite, chalcopyrite, galena, and zinc-blende occur mainly in these siliceous lenses, either disseminated or in small veinlets.

The highest showing on the *Cougar* claim is at 1,650 feet elevation and consists of small veins and bunches of fine-grained galena, zinc-blende, and chalcopyrite across a width of 6 feet. The zone has been traced through an adjoining group above, on which little work has been done. Below this showing at 1,500 feet elevation the schist is exposed across a width of over 100 feet. About the centre of it is a width of 7 feet of light-grey rock, carrying bunches of zinc-blende with traces of galena and chalcopyrite. I understand some further work was done at this point this summer. About 250 feet east of this zone is another similar one, about 40 feet wide, showing the same mineralization.

Mr. Cross did some more open-cutting this season on the main zone and reports encouraging results. These ore-exposures indicate extensive mineralization within the schist-zone, but the surface is so soft and intensely leached that some depth is necessary to get into the solid to find out the extent of mineralization and values. Though the owners have done much under adverse conditions, it does not mean much toward the exploration of a zone of this magnitude.

Other properties in this section are described in past Annual Reports as follows: Paramount Mining Co., 1927; *Lynx*, 1927; Price Creek Mining Co. (Cross holdings), 1929; *Big G.*, 1929.

Courtenay Section.

I am informed that some prospecting was done in 1930 in the Mount Albert Edward area, about 15 miles west of Courtenay. It is reached by the tourist horseback trail over the Forbidden plateau, a legendary "No Man's Land" of the Indians and fabled as the abode of a dwarf

tribe. The trail was extended last year and eventually will make a good route through to Buttle lake and the south end of Strathcona Park. This area was included in the region examined in 1930 by H. C. Gunning, of the Geological Survey of Canada.

New Bronsville. This group of four claims is owned by J. H. Brown, of Cumberland, and situated on Mount Albert Edward. The showings are described as iron sulphides and chalcopyrite in a shear-zone in the volcanics. This group will be examined early in the season of 1931.

At the head of Oyster river the "Ralph River Syndicate" Nos. 1 to 19 claims were staked in the fall of 1929, owned by local people, as well as several other locations, showing a little interest being taken in that section.

Nanaimo River Section.

This includes the drainage area of the Nanaimo river, accessible by auto from the main highway to lower Nanaimo lake on the main river, and from there by good foot-trail to the headwaters; and also by auto to the City Waterworks dam on Jump creek, from which there is a horse-trail to the headwaters. An appreciable amount of development-work was done on several properties in this section years ago, which, however, did not produce a shipper and nothing has been done since.

Silver Leaf. The three claims comprising this group—*Silver Leaf*, *Hemlock*, and *Mountain Ash*—are owned by Thos. Service, Duncan. They are situated on a branch of Jump creek. The property is accessible either from the Cowichan Lake side over the *El Capitan* trail or by trail up the Nanaimo river. Either, however, would be difficult for ore transportation, as the Cowichan Lake side could only be reached by going over a high range and the Nanaimo River route is 20 miles long.

The showings consist of three shear-zones in the andesite of the Vancouver volcanics, in which occur mineral-bearing lenses. Only one of these lenses has had any considerable amount of work, while another, 50 feet north of it, has been open-cut in only a couple of places. The south vein strikes S. 30° W. (mag.) into the hill and dips south-east, while the north vein strikes east-west and dips east. They converge down the hill and their intersection should be worth finding and prospecting.

A tunnel has been driven 70 feet on the south vein under a surface ore-showing. This exposed an ore-shoot about 50 feet long, of from 16 inches of clean chalcopyrite to 2 feet of mixed ore assaying: Gold, $10 to $15 to the ton; silver, 5 oz. to the ton; copper, 9 to 17 per cent. A 6-foot winze 25 feet back from the face shows the downward extension of the clean chalcopyrite in a 2-foot vein. The clean ore does not show in the vein on the face, but can, I think, be found by cutting the hanging-wall. The extension of this tunnel would be good work.

On the north vein, 50 feet over from the mouth of the tunnel, a few shots have exposed a 2-foot vein of oxidized vein-matter with ribs of chalcopyrite. A sample across the 2 feet gave: Gold, $13 to the ton; silver, 2.2 oz. to the ton; copper, 16 per cent. About 500 feet above this, at 2,800 feet elevation, another cut on this vein shows a 5-foot vein with 18 inches of clean chalcopyrite on the hanging-wall. Some stripping 200 feet above has exposed the vein again, but it has not been broken into.

The two properties, the *El Capitan* on the summit and the *Silver Leaf*, might be worked under one operation, and it might then be feasible to tram the *Silver Leaf* ore up over the summit, about 1,400 feet above the tunnel, and down to the C.N.R. at Cowichan lake.

Nanaimo Copper Syndicate, Ltd. (Jubilee Group). This company was organized in 1929 with a capitalization of $85,000, divided into 8,500 shares of $10 each. The registered office is Nanaimo. The company acquired the old *Jubilee* property, consisting of three Crown-granted claims—*Tyro*, *Brass*, and *Iron Crown*—on Mount Spencer, at the head of Jump creek (the South fork of the Nanaimo river), and the *Pittston* claim, also Crown-granted, situated on Green mountain, over the divide from the head of Jump creek, on Bell creek, which runs into Green river, which empties into the main Nanaimo river. The cabin at 2,450 feet elevation is on the *Iron Crown* claim and reached by auto-road from the main highway to the City Waterworks dam, about 12 miles; thence by good foot-trail another 10 miles.

Considerable work was done in the vicinity of the cabin. The principal work is a shaft sunk probably 60 feet, judging from the dump, on a small quartz vein which outcrops in the creek-bed just above the shaft, in an andesitic country-rock. The vein on the surface is from

4 to 12 inches wide and grades from quartz to clean pyrite. It strikes N. 20° W. (mag.) and dips 75° east. The dump shows a small percentage of quartz, indicating that the size of the vein did not increase at depth. A sample of the pyritized quartz taken from the dump gave only a trace of gold and 1 per cent. copper. The pyritized wall-rock gave no values. Another shallow shaft west of this was full of water, but the dump showed nothing of importance.

About half a mile from the cabin, and about 200 feet higher, a tunnel about 60 feet long was driven under a ridge showing small barren stringers of quartz in a few feet of sheared country-rock. The tunnel in that distance is not entirely in the solid rock, the top still being in the sand and gravel overburden. If continued on its present bearing it would come out to the surface in a short distance.

It is 4 miles from the cabin to the other claim of the property, the *Pittston*, 2 miles up Jump creek to its source at 3,000 feet elevation and then 2 miles down the north slope to the old cabin-site at 2,450 feet elevation. The workings are up the hill from there, the first tunnel at 3,000 feet elevation and another short one 150 feet higher. This work was done thirty-three years ago by the Nanaimo owners of the property.

The upper tunnel had been cleared the previous year, but a cave at the collar had backed up the water about 3 feet deep. Nothing could be seen on the surface because of the overburden, so I waded the water 150 feet to the face to find a 6-foot shear in the volcanics carrying an occasional small stringer of magnetite or pyrite and pyrrhotite. No drifting had been done either way on the shear. A sample of the mineral at the face gave only traces of gold, silver, and copper.

The lower tunnel was then driven a distance of about 475 feet through the volcanic country-rock, and intersected the shear, which shows about the same as in the upper tunnel, but with a considerable seepage of iron oxide through it. No lateral work was done here and, so far as mineral indications show, no drifting is warranted. Unless promising ore indications were found on the surface the shear is not worth drifting on.

The ore on the lower claims near the present cabin would have to be high grade to stand mining and transportation or the vein would have to widen and carry good values. Neither being the case, the possibilities of the property are not encouraging.

Robbins Property. This is an old property owned by Mr. Robbins, one time manager of the Western Fuel Company, of Nanaimo, and now owned by J. R. Kingham, of Victoria. There are four Crown-granted claims—*Vulcan*, *Austrian*, *African*, and *Alliance*—in the group, situated on Dead Horse creek, a small tributary of Dash creek, which empties into the Nanaimo river just above the Second Nanaimo lake. There is a fair auto-road from the main highway to about half-way up on the Second lake. To the head of the lake by boat or trail is about a mile and from there to the property about 5 miles, of which about half the distance has been kept open by Fire Rangers, but the remainder is so thick with the new growth and covered with down timber that the trail is not seen for long stretches. It would cost $1,500 a mile in such places to make it again passable.

The Second lake is 700 feet elevation; the Third lake, about 4½ miles farther, is 800 feet; and the Fourth lake, 9¼ miles from the Second, is 1,100 feet elevation, gaining most of the height in the last 1¼ miles. This chain of lakes and drainage has been investigated for water-power.

The elevation at the old shaft on the property is 2,050 feet, or 1,350 feet above the Second lake. The shaft is about 100 feet deep, filled with water. It was sunk on a vein about 2 feet wide in a shear in the andesite, the vein-filling consisting of a streak of pyritized quartz about 3 inches wide, the remainder consisting of streaks of barren quartz in greenstone. The values are apparently all in the small streak of pyritized quartz, which assays up to $100 a ton in gold, depending on the pyrite content. If the 3-inch streak of vein averaged $100 a ton it would not, of course, pay production costs. It would require shaft-mining, entailing pumping and hoisting, and at least 3 feet in width would have to be broken, reducing the values to $8.50 a ton. The occasional high gold values were evidently the incentive for the amount of work done.

Maple Leaf (New Beaver Group). This is an old group of three claims—the *Maple Leaf*, *Richard 1st*, and *Red Jacket*—owned by Richard Nichol, of Ladysmith. They were originally owned by the Dunsmuir family, whose engineer, W. F. Sutton, built the trail from Ladysmith known as the Sutton trail, a distance of about 20 miles. The claims lie at the headwaters of the Chemainus river and may therefore be in the Victoria Mining

Division. The claims have been worked and the trail kept open for the past twenty years by the present owner.

Two tunnels have been driven, the lower one about 460 feet long, which was abandoned several years ago, and another about 100 feet vertically higher, which is now in 210 feet. The upper tunnel is at 2,600 feet elevation and the cabin 2,700 feet elevation. These tunnels were driven to cut one or more broad belts or veins of jasper which are exposed on the bare side-hill for some distance. I examined the surface exposures carefully, but could not find any very encouraging mineral indications anywhere. The tunnel-work therefore had no objective other than cutting the silica-bodies, on the long chance that ore might be found, but unfortunately the hope has not been fulfilled.

North-west Coast (Islands and Mainland) Section.

The many ports of call, at logging camps, canneries, etc., throughout this section make any part of it easily and comfortably reached by the numerous coastwise boats from Vancouver. There is little difficulty, as a rule, in obtaining launches from these points to outlying places. There has been some prospecting in this section this year, but actual operations have been confined to the *Alexandria* on Phillips arm and the *Santana* on Quadra island.

Cambria Copper Co., Ltd.

(*See* the 1929 Annual Report.) This company was incorporated in 1928 with 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, nearly opposite the Knight Inlet cannery. The claims cover a portion of one of the belts or roof-pendants included in the Coast Range granodiorite batholith. The general rock formation therefore is composed of crystalline limestone and altered volcanics and limestone, intruded by many dykes. Very little was done this year and the reader is therefore referred to a description of the property in the 1929 Annual Report.

Alexandria Mining Co., Ltd.

(*See* previous 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 905 Credit Foncier Building, Vancouver. The property is under the supervision of T. S. Davey, Vancouver. The company's holdings of seven Crown-granted claims are situated on the west side of the entrance to Phillips arm, off Cordero channel. The nearest boat call is across the channel at Shoal bay (Thurlow Post-office).

Work has proceeded during the year with the exception of a couple of months, resuming about December 1st. The drift west into the hill from the bottom of the 100-foot shaft was extended to 125 feet, all in ore, which the management states averages about $14 in gold to the ton. New equipment, consisting of a 700-cubic-foot compressor driven by a 125-horse-power Crossley engine, a heavier pump, and a new hoist good for 1,000 feet of depth, has been installed and an extensive development programme undertaken.

A contract has been let for the sinking of the 2-compartment shaft another 500 feet. Cross-cuts to the vein will be driven at each 100-foot level and exploratory drifts both ways on the vein at each 200-foot level. This work is fully justified by the present showings and should conclusively decide the merits of the property. This work is now well under way and very promising results have already been obtained. At 8 feet below the first level a vein was cut, coming in from the foot-wall, which assayed $29.20 in gold to the ton. At 13 feet the bottom of the shaft showed 4 feet of ore assaying $23.40 in gold to the ton. The present development plans should definitely prove this property one way or another.

Douglas Pine.

There are three Crown-granted claims in this group—the *Douglas Pine*, *Gold Exchange*, and *Cone Fraction*. They were acquired last year by A. C. Gerhardi, of Vancouver, who staked the adjoining *Rand* group of six claims—the *Rand* and *Rand Nos. 1, 2, 5, 6*, and 7. They are located on the north-east corner of Thurlow island just above Shoal bay.

There are encouraging croppings of gold-bearing pyritized quartz in what is probably the southerly extension of the *Alexandria* belt. A trail was built from the beach, with assistance from the Department of Mines, to a new tunnel which was driven 70 feet toward cutting the exposed veins in a distance of 650 feet. Two blind leads were cut in the 70 feet, one, 29 inches wide, assaying $8.60 in gold to the ton, and the other, 21 inches, assaying $6 in gold to the ton.

Progress on this property has been slow because of the difficulties of financing under present conditions, but no doubt the gold values will make this property worth some development.

White Pine.—This is another group in this vicinity whose gold values indicate possibilities. It is owned by Seymour Campbell, of Vancouver.

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 in the Dominion Building, Vancouver. The holdings are the *Hope* group of three claims and twelve adjoining claims staked by the company, all situated on the east end of Thurlow island, about a mile south-east of Shoal bay.

The showings consist of a gold-bearing pyritized quartz vein in granodiorite. The vein extends from the beach, but the main showings and work is at 300 feet elevation, about half a mile from the beach, from which there is a good road. Here a shaft has been sunk about 30 feet, and 250 feet east of it a 90-foot tunnel driven on the vein to a cross-fault in the face that cut off the vein. The vein varies from 2 to 5 feet or more in width and some very encouraging gold values have been found. The work done indicates a continuous ore-shoot from the shaft to the face of the tunnel, over 300 feet. Two tons of ore sorted from the tunnel dump gave smelter returns of about $50 a ton in gold.

I think the present indications justify the sinking of the shaft to 100 feet and a drift from the bottom on the vein to the fault. This has every chance of opening an ore-shoot 300 feet long of milling-grade ore and sufficient tonnage to make a profitable small operation. The property is equipped with camps, tractor, compressor plant, and mining outfit, etc., and I estimate that $10,000 spent on the above-mentioned work would tell the story.

Sonora Gold Mines, Ltd.

This company was organized in 1929 with a capitalization of $625,000, divided into 2,500,000 shares at 25 cents each, with its head office in the Dominion Building, Vancouver. Its property of twenty-one claims is situated on the north-west end of Sonora island. As nothing of importance has been done on the property this year the reader is referred to the 1929 Annual Report.

Colossus Copper Co., Ltd.

This company was incorporated in May, 1929, with a capitalization of $1,000,000, divided into 1,000,000 shares of $1 each; the registered office is at 311 Rogers Building, Vancouver. The holdings are fifteen claims, including the old *Colossus* group of four Crown-granted and two other claims, situated on the north side of Estero basin, which is entered at the head of Frederick arm, off Cordero channel. There is now a good trail from the beach to the top showings and workings. This is rather an interesting old copper property on which some 3,000 feet of underground work was done about 1900. It was fully described in the 1929 Annual Report, and as nothing was done on the property in 1930 the reader is referred to that report.

Santana Copper Syndicate.

The syndicate has a capitalization of $300,000, divided into 3,000 units of $100 each, with its office at that of its fiscal agents, J. M. Taylor & Co., 574 Howe Street, Vancouver. The holdings are twenty-six claims situated on Quadra island, about a mile from the dock at Bold point. The old *Santa Anna* group was abandoned and restaked as the *Santana* and the syndicate therefore owns the property outright. The original owner was John McConville, who is now heavily interested in the syndicate and has charge of operations. This year the road from the beach to the mine was reconditioned and a good camp erected, consisting of mess-house, office, and bunk-houses to accommodate up to fifteen men.

The old work consisted of a tunnel about 85 feet long driven on the vein, from which a shipment of 174 tons was made in 1917 of 4.5-per-cent. copper ore. About 200 feet east of this a crosscut tunnel was driven 165 feet, crossing the strike of the contact on the surface. This tunnel was all in granite.

The eastern portion of Quadra island is granodiorite and the western side volcanics, containing belts of limestone. It is along the contact of the granite with a bed of limestone that the mineralization occurs on this property. The limestone has been altered to a garnetite to a width of several feet, in places up to 40 to 50 feet, along the granodiorite, and in this contact-metamorphic belt, which has been exposed by open-cuts and stripping for 1,500 feet, are the iron and copper sulphides. These minerals are deposited as scattered crystals, small irregular veinlets, as small bunches, and in considerable-sized masses as evidenced by the tonnage mined from the mouth of the upper tunnel.

Surface work has exposed bodies of commercial ore, averaging a milling grade, in several places along the contact, and it is reasonable to surmise that such bodies will continue or recur as far down as the limestone extends. Some doubt has been created as to the depth of the limestone by the crosscut tunnel, which, as stated, is all in granite. Whether this is a tongue of granite extending into the limestone from the main mass or whether the limestone is eroded to the underlying granite has not been determined. The present situation is therefore to find out whether the limestone is deep enough on the contact to contain adequate tonnage of low-grade copper for an operation, and then to find out the extent of the ore-bodies along the contact. This, I think, could best be done by a few deep holes across the contact, and if satisfactory depth is found, then by shallower holes along the contact-belt. The cost of the deep holes would not be heavy and they might be final, but, if encouraging, the shallower holes would be justified.

Gowlland Harbour.—Around this harbour on Quadra island and just opposite Campbell River is a very interesting copper-bearing area. Some years ago several hundred tons of high-grade copper ore, mainly chalcocite, were shipped from Steep island in the harbour, and from the old *Ingersoll* property on Quadra island. This ore was all taken from shallow surface showings, no appreciable depth of ore being found anywhere. A great deal of surface prospecting has been done with little result in the way of ore.

Apparently there have been successive flows of basaltic lava over that area, at least one of which was mineralized with chalcocite and bornite. These minerals had concentrated sufficiently in a few places to form masses of shipping-grade ore. Erosion has no doubt removed a great deal of the flow and what is being found now are the remaining patches. There may be, however, places where the overlying flow has protected the mineralized flow from erosion and there are therefore possibilities of other ore-bodies. I consider this area worth a very close study and probably some diamond-drilling exploration.

Inca. This group of four claims—*Inca*, *Greba*, *Cinderella*, and *Rhodaplus*—is owned by Thos. Noble, Quathiaski Cove, and situated about 500 feet west of Hyacinthe bay. The showings are about 100 feet elevation and reached from Hyacinthe bay, or by auto-road from Quathiaski cove, which is just opposite Campbell River.

The minerals are pyrite and chalcopyrite in a quartz vein, about 2 feet wide on the surface, in an andesitic country-rock. A shaft sunk on the vein from an open-cut shows a width of 5 feet of quartz in the bottom sparsely mineralized. An open-cut was driven cutting the vein, showing a width of 6 feet of quartz. A drift on the vein will give a depth of about 40 feet, which I think should be done to decide the merits of the property.

Geiler. This is an old group situated about 4 miles south-east of Granite bay, on a branch from the main road. The two claims in the group, *Geiler* and *Copper Hill*, were staked in 1929 by the present owner, T. Noble, Quathiaski Cove. Having no one with me familiar with the property, the only showing I saw was near the compressor building. A short way up the hill a small pyritized quartz vein outcrops in a diabase country-rock. Below this a tunnel 54 feet long had been driven toward cutting this vein. The extension of the vein along the surface to the north is not very encouraging, as it splits up into a number of small barren quartz stringers.

I was later informed by the owner that the more recent work had been done on some showings south of the tunnel. This was described as an open-cut across 52 feet of arsenical iron in a porphyry country-rock. Very little values were obtained, except in some small quartz stringers which assayed high in gold, which sounds encouraging.

Wyho. The two claims *Wyho* and *Prospector* are owned by Albert Ross, Granite Bay, and situated about 7 miles from that port of call of the Union Steamship Company. This is an old property and between 300 and 400 feet of underground work has been done on a shear-zone in amygdaloidal basalt, with which are lenses and small veins of calcite replacing the sheared country-rock, carrying chalcocite and bornite. The present owner has been working on the property about seven years and has accumulated 50 to 60 tons on the dump of ore obtained from the stringers and bunches found in drifting. The ore does not carry any appreciable gold or silver values. There is a fair foot-trail from the main road to the property.

Lucky Jim. This old group was worked in 1910, shipping some tonnage to the Ladysmith smelter. It lies about 3 miles back of Granite Bay on the granite-limestone contact, which extends from the mouth of the bay across the island to Open

bay on the south-east. The property was one time equipped with a compressor plant, boilers, etc., which were wiped out by fire. The shaft is said to be down 150 feet, with reported ore in the bottom. It may be worth further investigation.

Solyman and Freya. These two claims are owned by H. N. Bacon, Quathiaski Cove, and situated on the west shore of Read island, nearly opposite Bold point on Quadra island. The showing consists of a belt or mass of quartzose rock about 150 feet wide in granodiorite. The owner explained that it is overlain by the granodiorite up the hill. It apparently shades into granodiorite on either side, so I think it a siliceous phase of the granodiorite.

The owners have put in shots across the face of the bluff about 100 feet above the water, showing the quartz to be sparsely mineralized with specks and small patches of chalcopyrite. The weathering has given the bluff a fine blue coloration in places. The mineralization appears to be a little greater on the north wall, across a width of about 15 feet. Several tons of ore were piled on the dump at this point, from which a chipped sample was taken to verify the gold values claimed by the owner, but gave very low values. A sample carrying more copper gave $4 in gold to the ton.

The situation is certainly an ideal one and a very low-grade ore could be worked, but so far as exposed the grade is too low. I would advise getting a little more depth where the best ore shows.

Powell River Section.

Romana Copper Co., Ltd. (*See* the 1929 Annual Report.) This company was organized in 1928 with a capitalization of $500,000, divided into 2,000,000 shares of 25 cents each; the office is at 615 Hastings Street West, Vancouver. The holdings consist of nine claims—*Victoria, Paul, Jessie, Joan, Betty, Peter, X Frac., Hope,* and *Humming Bird;* the last being the only one Crown-granted. They are located on Goat island in Powell lake, about 15 miles from the town of Powell River.

The property covers a wide zone of highly altered volcanics and sedimentary rocks contained in the Coast Range granodiorite. Within this zone is a belt, 100 feet or more in width, of contact-metamorphic rocks of garnetite, epidote, etc., in which occur masses and lenses of iron sulphides and chalcopyrite. These have furnished small shipments of 8 to 11 per cent. copper ore from time to time. The present work is therefore being done in the hope of encountering important ore-bodies of this type.

Considerable surface-stripping and open-cutting were done and a tunnel driven 110 feet, with a crosscut of 65 feet, obtaining a depth of 90 feet under the surface showings. Some ore was found in this tunnel and deemed sufficiently encouraging by the management to warrant deeper work. Accordingly, another tunnel was undertaken this year 475 feet vertically lower than the croppings. This has been driven 400 feet and is estimated to be 40 to 50 feet west of the downward extension of the surface ore. Work was suspended before this was completed, but I understand will be resumed shortly.

Other properties in this section are: *John Bull*, 1926 Annual Report; Malaspina Mines, Ltd., 1927 and 1928 Annual Reports.

Texada Island Section.

With the exception of the operations of the Pacific Lime Company (*see* the 1927 Annual Report) on the north end of the island at Blubber bay, this section has had a very quiet mining year. The acquisition of the Puget Sound Iron Company's property on the west coast of the island by the Coast Range Steel, Limited, and subsequent investigations by that company have encouraged the hope of a steel industry on the Coast. The exploratory work by the Central Copper and Gold Company, Limited (*see* the 1928 Annual Report), which has been carried out for the past three years on the old Vananda copper properties was suspended this year.

Nothing further has been done by the Marble Bay Copper Mines, Limited (*see* the 1928 Annual Report), on the old *Marble Bay* mine at Vananda.

Other properties on Texada island are described in past Annual Reports as follows: *Burdett*, 1927; *Nancy Bell*, 1927; B.C. Gold Mines, Ltd., 1927; Texada Gulf Mining Co., Ltd., 1928; *Sentinel* and *Stromberg*, 1927.

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 and Quarries for the year ended December 31st, 1930. Appended hereto 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 and quarries; 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" and the "Metalliferous 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.
John MacDonald	Inspector, Fernie.
Henry E. Miard	Inspector, Fernie.
H. H. Johnstone	Inspector, Rossland.
Geo. O'Brien	Inspector, Nanaimo.
Thomas R. Jackson	Inspector, Nanaimo.
John G. Biggs	Inspector, Princeton.
Thomas J. Shenton	Inspector, Prince Rupert.

Instructors, Mine-rescue Stations.

John D. Stewart	Nanaimo Station.
John Thomson	Cumberland Station.
John T. Puckey	Fernie Station.
Wm. 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.

Over 60 miles of underground work has been done, this year totalling over 4 miles, divided into 6,928 feet of drifts, 3,845 feet of crosscuts, 10,640 feet of raises, and 1,436 feet of winzes. In addition to this about 16,000 feet of diamond-drilling has been done. The company was working about 1,000 men at the end of the year.

There were produced from the various sections of the mine 2,215,600 tons of ore, of which 2,152,647 dry tons were milled, producing 88,515 dry tons of copper concentrates and 36,653 tons of iron pyrites. The operation is credited with an output for 1930 of 44,294,446 lb. copper, 13,062 oz. gold, and 206,345 oz. silver, a substantial increase of 2,306,331 lb. of copper over 1929. Of this, the precipitation plant at the portal of the 2,200-foot level of the mine produced 682,661 lb. of copper, using 1.7 lb. of scrap-tin per pound of copper produced.

The main haulage of the mine is the 1,700-foot level; i.e., 1,700 feet above sea-level. The ore is delivered to this level from all parts of the mines by a system of transfer raises. Here it goes over grizzlies, crushed to 24-inch size, and taken, in 20-ton gable-bottom cars installed last year, through a 1,100-foot haulage-tunnel to the crusher at the top of a 1,400-foot incline raise. It is reduced to 6-inch size and delivered through the incline to the mill haulage-level at 300 feet above sea-level, thence in 15-ton hopper-bottom cars to the mill-bins. The latest flow-sheet of the 6,000-ton mill accompanies this report.

Approximately $2,000,000 is expended in wages and over $1,000,000 in supplies each year. The company maintains an exploration department for the investigation and development of prospects and mines with attractive possibilities. The *Toric* mine at Alice Arm has been under development during the past two years, but work was suspended in May because of the low price of silver and its uncertainty. The Chelan property in the State of Washington was actively developed in the past two years with encouraging results. This work is under the superintendency of Jas. I. Moore, Jr., former *Britannia* mine superintendent. The personnel of the *Britannia* staff is: C. P. Browning, general manager; C. V. Brennan, assistant general manager; E. F. Emmons, mine superintendent; A. C. Munro, general superintendent of mills; W. A. Matheson, purchasing agent and secretary-treasurer; Ed. C. Gillingham, chief accountant.

McVicar, Manson, and Tocher.

(*See* the 1929 Annual Report.) These three groups, representing thirty-six adjoining claims, have been grouped for assessment and sale purposes. The claims are as follows, from the top of the hill down: *Jupiter* and *Morning* (abreast); then *Baldwin* and *Hawk; Lily, Whistler,* and *Cave; Star Fr.; Grouse Fr.; Hemlock; Star; Harding* and *Heather; Tea Pot; Coffee Pot; Rainstorm* and *Jumbo; Mamquam; Slide Frac.* and *Cabin Frac.; Noonday; Winnifred; Larch Frac.; Hillside; Woodpecker* and *Manson; Moss* and *Horseshoe; Cypress; Arctic; Globe; Clyde,* at the bottom of the hill. They are owned respectively by Jas. McVicar, Britannia Beach, J. Manson, and J. Tocher. The claims are located about 12 miles from Squamish on Raffuse creek, a tributary of Mamquam river. The owners have built a good horse-trail to the property with assistance from the Department of Mines and have a comfortable cabin at 2,800 feet elevation. The showings extend from a short distance above the cabin to the summit at 4,300 feet and a short way down the opposite slope.

The general rock formation of this whole area is a wide zone of altered volcanics and sedimentaries contained in the granodiorite. Within this zone is a width of 2,000 to 3,000 feet of schists and within the schists are smaller belts of more intense shearing and silicification. The minerals, iron sulphides, chalcopyrite, galena, and zinc-blende, occur in the lenses of quartz. The top of the hill shows some cross-fissuring, but below the mineralized lenses conform to the strike and dip of the schistosity.

The work done was described in the 1929 Annual Report, but considerable work was done this year which has added to the possibilities of the property. Six open-cuts were made, one on the *Lily* claim showing 14 feet of 3.8-per-cent. copper ore; one cut on the *Star Frac.* showing 2 feet of good ore; three on the *Grouse Frac.* exposing 8 feet of 5-per-cent. copper ore; 4 feet of 2.5-per-cent. copper ore and 10 feet of 1-per-cent. copper ore; and one cut on the *Baldwin* showing fair indications of ore.

The property therefore has a number of attractive surface showings, some of which have been drilled under by diamond-drill without results, but none have been developed from the surface to find out what happens. If all the surface ore-exposures were under development they would produce a considerable tonnage, and they are certainly sufficient to warrant a thorough examination of the property.

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 50-cent shares. There are three groups in the holdings of the company, situated on Ray creek, a tributary of the Stawamus river, and reached by horse-trail from Squamish, a distance of 10 miles. The claims cover a zone of altered sedimentaries and volcanics, probably over 1,000 feet wide, contained in the granodiorite. The surface-prospecting work showed lenticular bodies of silica mineralized with pyrite and sufficient chalcopyrite to indicate possibilities. Last year a Radiore survey was made which indicated a number of mineral-bodies. It now remains to decide whether these bodies are to be diamond-drilled to ascertain whether there is sufficient chalcopyrite content to constitute a workable ore, or whether their mineral content is iron.

Golden Coin (Golden King).

This group, then called the *Golden King*, was owned and developed by the late Fred Pykett and partners. It is now grouped as the *Golden Coin* group, containing eight claims—*Golden Coin*, *Robbie Burns*, *Grandview*, *Derby*, *Devonian*, *Fonk*, *Petro*, and *Highlander*—owned by the Pykett Estate; C. Anderson, of Cheekye, and R. J. Carson, Squamish, and associates.

The claims are situated 10 miles up Ashlu creek, which empties into the Squamish river at upper Squamish, 22 miles from Squamish by fair auto-road. The Squamish river is crossed by boat at the old bridge, and from there to the property is 10 miles by fair foot-trail, except the first 3 miles across the Ashlu flat, in which there are a number of sloughs impassable on foot in high water, and this part of the trail is badly overgrown and washed out in places along the river-bank.

The predominating rock formation is granodiorite intruded here by a wide diabase-belt. On the contact between the diabase and granite is a pyritized quartz vein up to 5 feet in width in places, but averaging about 3 feet. The chief value is gold, associated with the iron sulphides. The vein has been drifted on for 300 feet in a tunnel on the south side of Ashlu creek and is again exposed on the bank of a small creek coming in from the north for 200 or 300 feet.

The vein strikes north and south and dips west at a flat angle, about 45°, therefore lying on the granite. The tunnel follows the foot-wall of the vein for 170 feet, gradually bearing away from it, so that at that point the vein is above the back of the drift and is reached by a short raise. A few feet farther another vein, or the same one faulted, appears in the bottom of the tunnel, and this is drifted on for 75 feet until it also disappears in the roof and is also tapped with a short raise. A few feet farther in the tunnel a third vein is exposed in the bottom, and it is followed to the face, a distance of 55 feet, showing 2 feet of banded quartz and country-rock. It is difficult to say without some lateral work whether the three veins exposed are three sections of the same vein or three parallel veins breaking away from the granite at about a 20° angle.

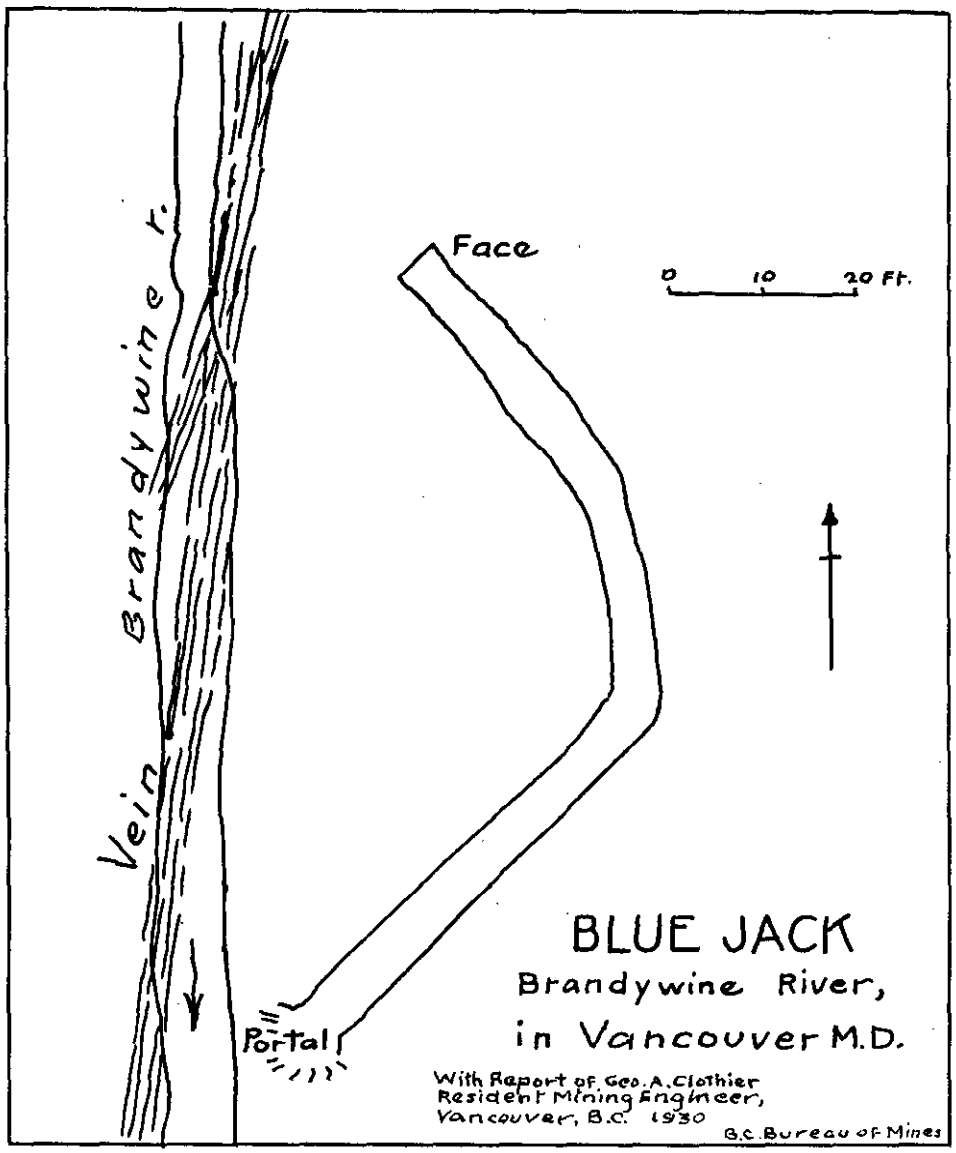
Throughout the exposed portion of the vein—i.e., 200 to 300 feet along the small creek where it was shot into in several places, and 300 feet in the tunnel—it was found that the pyrite mineralization and consequently the values were very erratic. The pyrite carries up to $100 in gold to the ton, but the average values would be very small. The tunnel, thoroughly sampled at 5-foot intervals, shows commercial values only in a few spots where the pyrites are found. The tunnel-work was done on the foot-wall side of the vein, and it might be a good idea to crosscut to the hanging-wall in a few places to make sure that nothing is being overlooked.

Garibaldi Park Area.—There are some interesting quartz-showings along the foot of the mountain across the river from the Pacific Great Eastern Railway near Daisy lake, within the park area. As all the natural attractions of the park, such as the mountain lakes, flowers, peaks, altitude, outlook, and alpine exercisers have been placed up around Garibaldi peak, the development of a mining property at the base of the mountain could not in any way detract from the beauties of the park. In fact, no one would even suspect that a mine at this point was in the park and it would therefore be rather an attraction as well as possibly supply some much-needed freight to the Pacific Great Eastern Railway.

Blue Jack.

This group, consisting of eight claims—*Blue Jack Nos. 1* to 8, inclusive—is owned by A. E. Snow, of Vancouver. The claims are located about a mile west of Brandywine Falls, on the Pacific Great Eastern Railway, from which point or from Bill Barclay's cabin there is a good foot-trail to the cabin at 2,200 feet elevation. There is a lodge at Brandywine Falls.

The showings are exposed in a small creek 350 feet above the cabin, where a few shots have exposed a pyritized greenstone-schist across a width of about 24 feet. This schist-belt strikes north-south (mag.) and dips 75° to 80° west. The minerals are pyrite, zinc-blende, and galena occurring mainly in siliceous bands, but also by themselves in small patches and veinlets. A sample across 3 feet of good-looking ore assayed: Gold, $6.80 to the ton; silver, 9.6 oz. to the ton; lead, 2 per cent.; zinc, 5 per cent.



About 100 feet down the creek a tunnel has been driven about 100 feet, the first 45 feet bearing away from the creek and vein, the next 24 feet about paralleling the vein, and the last 40 feet bearing toward the vein at an angle of about 45°. It will take about 25 feet further driving to intersect the mineralization which is on the hanging-wall of the schist-belt. The showing, values, and location warrant some development-work.

Astra and Doffofy. The groups adjoin the *Blue Jack* group on the north and contain the following claims: *Astra, Findis, Royal Oak, Stewart, Alfred, Robert, Doffofy, Triumph,* and *Ruth.* They are owned by B. A. Falconer and Frank Price, of Vancouver, and associates. The trail from Brandywine Falls to the *Blue Jack* cabin continues through to the *Astra* cabin at 3,100 feet elevation.

Some open-cutting has been done on two schist-belts, one below the cabin at 2,900 feet elevation and another above the cabin at 3,325 feet elevation. The lower cuts show a schist-width of 25 feet or more, in which are small ribs of silica sparingly mineralized with pyrite, chalcopyrite, galena, and zinc-blende, but the remainder is badly weathered and leached. A little depth to get away from surface leaching might improve this showing. The cut above the cabin shows a belt of limestone, and mixed limestone and volcanics. A little sulphides show in the silica-seams in the limestone, but are unimportant.

Venus. This group is owned by Dan McKinnon, of Vancouver. There are seven claims in the group—*Venus Nos. 1* to *5*, inclusive, and *Venus Nos. 9* and *10*—situated north of and adjoining the *Astra* group. Mr. McKinnon brought in some good-looking ore, but not being familiar with the property I could not find the showings.

Horstman. This is an old group situated on Sproat mountain at 5,300 feet and reached by a branch trail from the old tote-road at a point about half a mile below Mons, a station on the Pacific Great Eastern Railway. The claims are owned by H. Horstman, Alta Lake, an old-time prospector in that district. The old cabin is at 3,200 feet elevation, the upper camp (temporary) is 5,075 feet, and the crosscut tunnel is at 5,300 feet. An open-cut 200 feet higher was covered with snow when the examination was made in the middle of July.

The formation carrying the mineralization is a belt of volcanics, in which there is considerable hornblende and calcite, in contact with a wide belt of granodiorite on the north-east. The minerals are pyrite and pyrrhotite, with which is associated a small percentage of chalcopyrite. They occur as short lenses of solid sulphides, as masses of sulphides, and as masses of mixed sulphides and country-rock. So far as showing on the surface, there is no continuity to any individual showing, though there seems to be a general strike of the croppings paralleling the contact, but some little distance from it. Wherever exposed so far, the mineralization shows too low a chalcopyrite content to approach a workable ore. Altogether it is too big an undertaking for a prospector to attempt to open up.

London. This is an old property staked about 1903 and was one time organized as the Green Lake Mining and Milling Company, Limited, which did the work on the property. There are six Crown-granted claims—*London, Royal Edward, Hard Cash, Iron Hat, Albany,* and *Tonopah*—now owned by the F. J. Proctor Estate; W. Lewis; A. P. Barnfield and others, c/o Edwards & Ames, 744 Hastings Street West, Vancouver. The claims are situated on Fitzsimmons creek, about 6 miles up from the Pacific Great Eastern Railway at Alta Lake, from which point there is a good trail to the old cabin. The cabin is on the south side of the creek at 3,300 feet elevation and from which there is a foot-trail to the workings at 4,000 feet.

The general rock formation is a wide zone of altered schists contained in the Coast Range granodiorite, striking N. 60° W. (mag.) and dipping from 30° to 35° west into the mountain. The schist outcrops along the mountain-side at a general elevation of about 4,050 feet. A wide belt of quartz porphyry extending up and down the mountain cuts the schist-zone at about right angles. On either side of this dyke the schists have eroded to form deep gulches, exposing the zone for a width of 300 feet or more. Within the schist-zone is a siliceous belt about 15 feet wide, striking with the schists, heavily mineralized in places with sulphides of iron and chalcopyrite and in places bands and bunches of magnetite carrying some chalcopyrite.

The chief working is a crosscut tunnel started on the foot-wall of the schists and just south of the quartz porphyry. This was driven over 400 feet, following on or close to the dyke all the way, and consequently was in a ground-up, soft formation throughout. The only mineralization showing is a blue copper-stain from the seepage, an occasional quartz rib carrying chalcopyrite, or a bunch of sulphides. Nothing of importance occurs, nor could anything be expected in this soft formation.

In the gulch on the right or north side of the dyke there are some promising-looking chalcopyrite-croppings which I think justify some little exploratory work, by way of a short

crosscut from the surface and a drift on the mineralized silica-belt when intersected. The length of the crosscut tunnel would depend on the depth desired below the croppings. This work could be done cheaply in this formation.

NEW WESTMINSTER MINING DIVISION.

This Division comprises the drainage area of the Fraser river from Point Grey to near Hope, therefore including the areas of Pitt, Stave, and Harrison lakes; and to the International boundary on the south side of the Fraser.

While there has been considerable prospecting throughout this Division, the number of claims recorded has fallen away below the abnormal record of 1929, but about equal to 1928. The number of assessments, however, for 1930 exceeds even that of 1929, as is the case in several of the Divisions of this district.

Pitt Lake Section.

Pitt Mining Co., Ltd.

This company was incorporated in June, 1929, with a capitalization of $250,000, divided into 250,000 shares of $1 each. The head office of the company is at 535 Georgia Street West, Vancouver. The holdings consist of eight Crown-granted and nine claims held by assessment, situated on the east side of Pitt lake near the south end and ideally located for mining and milling operations and for shipping.

The minerals occurring are pyrite, pyrrhotite, and chalcopyrite in a gangue of quartz and calcite in two shear-zones, called the "North" and "South" veins, in the granodiorite country-rock. The South vein has had very little work done on it. The North vein has been opened up by a 550-foot drift-tunnel and a raise of 180 feet through to the surface, from which two short levels have been opened. There appears to be ample available ore above the main level to supply a 75-ton concentrator for some considerable time. Thorough sampling gives average values of: Gold, $1.20 a ton; silver, $2.40 a ton; and copper 3.9 per cent.

For the past two years construction-work and plant-installation has been carried on until at the present time the property is one of the best-equipped small properties in the Province. An hydro-electric plant has been installed, using water from high lakes, which have been dammed for water-conservation, furnishing a head of 650 feet through a 14-inch pipe to a 36-inch Pelton wheel, developing 300 horse-power. A 600-cubic-foot compressor at the mine is driven by a 100-horse-power, 220-volt, Westinghouse motor. A full equipment of cars, rails, machines, drill-sharpeners, blacksmith's outfit, etc., has also been provided. The concentrator building has been erected and connected by surface tramway with the mine. The concentrating machinery of the *Iron Mask* mill has been purchased and is now in the concentrator ready for setting up. The flotation concentrates will be conveyed to the filter plant and storage-bins on the beach through a 2-inch pipe, and loaded for shipping by a travelling-belt. The foundations for the beach unit are now being built.

Operations have been somewhat retarded this year by the general financial conditions, but the affairs of the company, both operating and financial, have been well handled by the management under the direction of W. H. Woolley. It is hoped that a pending deal will supply the necessary funds to put the property on a producing basis in the near future.

Katanga.

This group of sixteen claims, owned by J. W. Johnson, 424 Ninth Street East, North Vancouver, is situated on the east side of Pitt lake, near the mouth of Scott creek. The property includes the old *Maple Leaf* group of four claims owned by Wagner Bros., who drove a tunnel about 70 feet on a vein in the granodiorite country-rock. There is a little chalcopyrite showing near the mouth of the tunnel, but nothing of an encouraging size. For the past two years Mr. Johnson has done an appreciable amount of surface prospecting and development-work with encouraging results.

The minerals are pyrite and chalcopyrite, which occur in dykes or veins of a fine-grained feldspathic rock up to 20 feet wide. An open-cut across 20 feet on one of these at 900 feet elevation shows 18 inches of good chalcopyrite, with the remainder milling-grade ore. A cross-cut tunnel has been driven 52 feet toward gaining a depth of 50 feet on this cropping, but its objective has not been reached yet. There is a comfortable cabin on the lake-shore and the three men interested in the property are doing good work.

HARRISON LAKE SECTION.

This is an old mining section in the Province. Much prospecting has been done and a lot of exploratory work carried out on properties around Harrison lake, up the Lillooet river along the old Cariboo road, and in the Fire Mountain area. Interesting molybdenum discoveries were made this year on the divide east of Harrison lake.

Harrison Gold Mining and Development Co., Ltd.—This company was incorporated in 1929 with a capitalization of $500,000, divided into 1,000,000 shares of 50 cents each, with its head office at 590 Richards Street, Vancouver. A description of the property was given in the 1929 Annual Report, to which the reader is referred. No work was done on it this year.

Dandy. This is the old *Mayflower* group a little above and across the Lillooet river from the Indian reserve at Skookumchuck, which is about 18 miles up the river, following the old Cariboo road from the head of Harrison lake at Douglas. The *Dandy* group of two claims is a restaking, in September, 1929, of the old claims on which some underground work had been done in the early days.

The mineral-bearing formation is a belt of breccia from 100 to 200 feet wide, consisting of broken-up sedimentaries cemented with quartz and calcite containing disseminated crystals of pyrite. A crosscut tunnel 157 feet long was driven under this, gaining a depth of about 80 feet under the highest part of the ridge. At 23 feet from the collar an 8-foot winze was sunk on a small seam of ore said to assay high in gold. At 57 feet the mineralized belt was encountered and the drivage continued 100 feet in it, showing the same mineralization as the surface. A 2-stamp Joshua Hendy mill had been set up and probably 50 tons of ore run through. Sampling of the tunnel in 5-foot sections failed to find any gold values approaching a workable ore.

I made a short examination of the Fire Mountain area this season. The old trail has been reconditioned, making that section accessible from the head of Harrison lake by pack-horses, a distance of about 12 miles to Fire lake, which is at 3,400 feet elevation. From there to the *Money Spinner* camp and mill-site at 4,300 feet elevation is about 3 miles of good foot-trail, though horses can be taken through. Pack-horses can be obtained from the Indians at Douglas, the head of Harrison lake. Thirty years ago there was much activity in this area due to the bonanza gold ore found at different places, and one property, the *Money Spinner*, was developed to the stage of building a concentrator. Nothing has been done in the past twenty-five years.

Money Spinner. There were sixteen claims in this group, of which eight—*Money Spinner*, *Baby*, *Tellurium*, *Wonderful*, *Prince*, *Neptune*, *Gold Queen*, and *Free Gold*—were Crown-granted. The property is owned by R. J. Leckie, of the Leckie Shoe Company, Vancouver. The predominating country-rock is fine-grained to porphyritic greenstone of volcanic origin, intensely sheared in places, forming belts of schists. The mountain is apparently capped with sedimentaries.

The showing consists of a quartz vein about 4 feet wide and containing some calcite, traceable on the surface for over 1,000 feet on a strike of N. 25° W. (mag.) and dipping 60° west. The mineralization is with a little iron sulphides, traces of chalcopyrite, and free gold. The vein has a banded or ribbon structure. A tunnel 400 feet long was driven on the vein and a shaft sunk about 100 feet at a point 50 feet in from the tunnel portal. The shaft is closely timbered, apparently dry, but, as the ladders had not been renewed in thirty years, no attempt was made to examine it. The tunnel is open for about 300 feet to a cave-in. At 100 feet in from the portal some better ore was evidently found, as there has been a little stoping done. Judging from the waste-dump from the concentrator, possibly 50 tons had been milled altogether and the property closed down.

There are several hundred tons of quartz on the dump, which has been sampled a number of times, but found too low grade. The tramway and concentrator, of about 50-ton capacity, are totally dilapidated and the camp buildings all down. I presume the little free gold found was the incentive for driving the tunnel, but I cannot account for the concentrator.

Barkoola. This group consists of five Crown-granted claims—*Barkoola*, *Toledo*, *Monterey*, *Washington*, and *Golden Eagle*—and is owned by A. Boley, Abbotsford. The claims are situated farther north along Fire mountain from the *Money Spinner* at an elevation of 5,350 feet. There is a foot-trail, now hard to follow in places, from the *Money Spinner* mill to this property and others farther along.

The showings here are a number of gash-veins or lenses of quartz in greenstone, showing traces of copper and free gold in spots. The veins are more or less parallel, up to 2 feet wide, tapering down to nothing, and occupy a width of about 25 feet. A little open-cutting has been done at the foot of the bluff, and a few tons of white quartz, showing only copper-stain and no free gold, are piled on the dump

Blue Lead. This group consists of one Crown-granted claim and some adjoining claims held by assessment, owned by D. Morgan, of Vancouver. The showings are at an elevation of 5,550 feet and comprise four parallel quartz-lenses about 10 feet apart. An incline shaft has been sunk 30 feet on the largest, about 2 feet wide. As these lenses are apparently less than 100 feet in length, the ore would have to be high grade to be profitable. The veins are banded quartz showing some copper-stain and an occasional speck of gold. A sample taken from a pile of quartz on the dump gave negligible values in gold.

This area is evidently gold-bearing and may have possibilities for that reason, but, judging from the three properties just described, the gold occurrences are very erratic, but there may be quartz veins carrying more iron and copper sulphides and therefore better distributed gold values.

Chilliwack River Section.

This in general is the area south of the Fraser river to the International boundary. The Chilliwack River area is probably the most active. Chilliwack lake is reached by auto to Allison's ranch, about 15 miles from Vedders Crossing, and from there by saddle-horse another 32 miles. Last year a great many claims were staked in this area, mainly around the lake, and on Pearce mountain, which is east of Sleese creek. I made a trip in to the lake about the middle of June, but unfortunately was too early for the claims on the high ground on account of snow conditions. The elevation of the lake is 2,100 feet and the property of the Chilliwack Lake Zinc Company, Limited, is a couple of thousand feet higher. The trail follows a good grade throughout and in the event of important mining operations could be converted into a road at nominal cost.

Faith. This property and two other claims, *No One* and *Victory*, were staked in 1927 by G. R. Wright, of Vancouver, as a relocation of the *Dolly Varden* group, owned at one time by the Silver Chief Mining Company, Limited, in which I am informed Mr. Wright was interested and had charge of the work done by the company. The claims are situated up the hill at the mouth of Dolly Varden creek, which flows in at the head of the lake. The camp, consisting of a main bunk and cook house, sheds, and smaller cabin, was all lighted at one time by electricity, generated on Dolly Varden creek, about a mile up. A string of lights also followed the trail from the camp to the showings at 150 feet elevation above the camp.

These showings consist of two seams about 15 feet apart in solid granite. The seams are only a few inches wide, filled with ground-up granite, and in places up to 2 inches of quartz sparingly mineralized with zinc-blende and a little galena. It looks as if a hole of some kind had been dug on the east seam a few feet deep, but it is now filled in. This, apparently, was the operation of the Silver Chief Mining Company, Limited.

Later, in 1927, when Mr. Wright acquired the property in his own name, a tunnel was driven about 20 feet on the west seam, then a crosscut to the east seam, and a drift on it of 35 feet, showing nothing but the seams. If this is the only showing on the property I cannot see any possibilities for it.

On the east side of the lake, about a quarter of a mile from the head, there is a wide belt of quartz porphyry in which are scattered small patches and crystals of chalcopyrite. The amount of mineralization would make only a very low-grade ore, but it indicates prospecting possibilities.

On Pearce mountain Mr. Allison and associates have a number of claims on which favourable gold-bearing showings are reported.

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 and Quarries for the year ended December 31st, 1930. Appended hereto 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 and quarries; 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" and the "Metalliferous 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.
John MacDonald	Inspector, Fernie.
Henry E. Miard	Inspector, Fernie.
H. H. Johnstone	Inspector, Rossland.
Geo. O'Brien	Inspector, Nanaimo.
Thomas R. Jackson	Inspector, Nanaimo.
John G. Biggs	Inspector, Princeton.
Thomas J. Shenton	Inspector, Prince Rupert.

Instructors, Mine-rescue Stations.

John D. Stewart	Nanaimo Station.
John Thomson	Cumberland Station.
John T. Puckey	Fernie Station.
Wm. 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.

Inspection District.	Mining Divisions covered by Inspection Districts.
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.
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, 1930, was 1,887,130 tons, being a decrease of 364,122 tons or 16.1 per cent. below the production of 1929.

The Coast District, which includes Vancouver Island, Nicola-Princeton, and Northern Districts, produced 1,197,894 tons, a decrease of 166,652 tons or 12.21 per cent. from 1929.

Vancouver Island Collieries produced during 1930 988,805 tons, a decrease of 132,000 tons or 11.77 per cent. from 1929.

The Northern District produced 1,029 tons, a decrease of 476 tons compared with 1929.

Nicola-Princeton District produced 208,060 tons, a decrease of 34,176 tons or 14.11 per cent. from 1929.

East Kootenay District produced 689,236 tons, a decrease of 197,470 tons or 22.27 per cent. under 1929.

The coal companies producing during the year were: The Crow's Nest Pass Coal Company, Limited, and Corbin Coals, Limited, in the East Kootenay District; the Coalmont Collieries, Limited, Middlesboro Collieries, Limited, Tulameen Coal Mine Company, Blue Flame Collieries, Limited, and Pleasant Valley Coal Company, in the Nicola-Princeton District; Telkwa Collieries, Limited, and Bulkley Valley Coal Mine, 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 Collieries, Limited, Fiddick mine, Richardson mine, Little Ash mine, Little Jingle Pot mine, Morden 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 Underground.	Tons of Coal mined per Underground Employee daily.	Tons of Coal mined per Underground Employee for Year.
Nanaimo—								
No. 1 mine	328,315	239	917	1.50	358	633	2.17	518
Reserve mine	37,344	46	279	2.90	134	216	3.75	173
Wakesiah mine	4,204	5	94	8.95	44	73	11.50	57
South Wellington, No. 5 mine	75,974	211	235	1.11	323	188	1.91	404
Extension Colliery	134,183	224	298	2.01	450	221	2.71	607
Comox Colliery	243,929	227	613	1.75	398	465	2.30	524
Granby Consolidated M.S. & P. Co.	148,675	237	229	2.73	649	165	3.80	901
Lantzville Colliery	4,024	274	15	1.00	268	11	1.36	366
Fiddick mine	1,559	232	11	0.69	160	7	0.96	223
Little Ash mine	5,587	275	20	1.00	229	15	1.33	372
Richardson mine	386	109	5	0.60	77	3	1.00	128
Morden Colliery	3,001	122	48	0.50	62	21	1.14	143
Biggs' mine	1,108	166	3	2.23	369	2	3.23	554
Little Jingle Pot mine	421	70	4	1.50	105	3	2.00	140
Middlesboro Colliery	36,322	233	112	1.40	324	80	1.94	454
Coalmont Collieries, Ltd.	104,004	227	276	1.65	376	179	2.55	580
Tulameen Coal Mines, Ltd.	36,581	266	98	1.40	373	81	1.92	451
Pleasant Valley Coal Mines, Ltd.	20,557	305	83	0.72	221	55	1.22	373
Blue Flame Collieries, Ltd.	10,596	158	33	2.03	321	23	2.91	460
Bulkley Valley Coal Mine	470	44	10	1.07	47	9	1.18	52
Telkwa Colliery	559	77	8	0.87	70	6	1.16	93
Coal Creek Colliery	210,262	155	474	2.86	444	356	3.81	590
Michel Colliery	265,562	178	526	2.83	503	379	3.93	700
Corbin Colliery	213,412	238	252	3.55	847	196	4.57	1,088

Collieries of Vancouver Island Inspection District.

The output of the Vancouver Island collieries was 988,805 tons. Of this amount, 86,674 tons or 8.76 per cent. was lost in preparation for the market; 96,174 tons or 9.72 per cent. was consumed by producing companies as fuel; and 815,310 tons or 83.34 per cent. was sold in the competitive markets.

Of the amount sold in the competitive markets, 750,031 tons or 91.99 per cent. of the amount sold and 75.85 per cent. of the total output mined was sold in Canada, and 45,941 tons or 5.63 per cent. of the amount sold and 4.64 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 208,060 tons produced by the collieries of the Nicola-Princeton District, 18,868 tons or 9.06 per cent. was consumed by producing companies as fuel and 187,550 tons or 90.14 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 186,370 tons or 99.37 per cent. of the amount sold and 89.14 per cent. of the total amount mined was sold in Canada, and 1,180 tons or 0.63 per cent. of the amount sold and 0.56 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 689,236 tons produced by the collieries of the East Kootenay District, 30,007 tons or 4.35 per cent. was consumed as fuel, 98,174 tons or 14.24 per cent. was made into coke, and 533,685 tons or 77.43 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 456,933 tons or 85.62 per cent. of the amount sold and 66.29 per cent. of the total output was sold in Canada, and 76,752 tons or 14.38 per cent. of the amount sold and 11.13 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.
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	1,849,385	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
1930	East Kootenay District	689,230	1,252	550	931	740
	Coast District	1,197,894	3,393	353	2,458	487
	Whole Province	1,887,130	4,645	406	3,389	556

The following table shows the production and distribution of coal and coke by the various collieries and districts, compiled from returns furnished by the owners:—

Collieries of British Columbia—Production, 1930.

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 1930.
	In Canada.	In U.S.A.	Elsewhere.						First of Year.	Last of Year.	Added to.	Taken from.	
Vancouver Island.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons. (2,240 lb.)
Canadian Collieries (D.), Ltd.—													
South Wellington, No. 5 mine	65,984	.....	.....	65,984	6,943	.....	3,047	9,990	.....	.....	.....	.....	75,974
Extension Colliery	66,255	26,953	6,118	99,326	23,221	.....	12,030	35,251	2,537	2,143	.....	394	134,183
Comox Colliery	210,832	4,284	.....	215,116	21,801	.....	7,964	29,765	6,824	5,872	.....	952	243,929
Western Fuel Corporation of Canada, Ltd.—													
No. 1 mine	213,020	13,173	13,220	239,413	13,259	.....	58,320	71,579	.....	17,323	17,323	.....	328,315
Reserve mine	55,227	.....	.....	55,227	1,226	.....	2,213	3,439	21,322	.....	.....	21,322	37,344
Wakesiah mine	7,601	.....	.....	7,601	156	.....	737	893	4,204	.....	.....	4,204	4,290
Granby Consolidated M.S. & P. Co., Ltd.	118,944	1,531	.....	120,475	20,068	.....	7,936	28,004	991	1,187	196	.....	148,675
Lantzville Colliery	3,236	.....	.....	3,236	.....	.....	788	788	.....	.....	.....	.....	4,024
Fiddick mine	1,559	.....	.....	1,559	.....	.....	.....	.....	.....	.....	.....	.....	1,559
Little Ash mine	5,349	.....	.....	5,349	.....	.....	247	247	.....	.....	.....	.....	5,596
Richardson mine	386	.....	.....	386	.....	.....	.....	.....	.....	.....	.....	.....	386
Morden Colliery	109	.....	.....	109	.....	.....	2,892	2,892	.....	.....	.....	.....	3,001
Biggs' mine	1,108	.....	.....	1,108	.....	.....	.....	.....	.....	.....	.....	.....	1,108
Little Jingle Pot mine	421	.....	.....	421	.....	.....	.....	.....	.....	.....	.....	.....	421
Totals, Vancouver Island	750,031	45,941	19,338	815,310	86,674	.....	96,174	182,848	35,878	26,525	17,519	26,872	988,805
Nicola-Princeton District.													
Middlesboro Collieries, Ltd.	35,022	.....	.....	35,022	.....	.....	1,318	1,318	223	205	.....	18	36,322
Coalmont Collieries, Ltd.	93,653	.....	.....	93,653	.....	.....	10,351	10,351	.....	.....	.....	.....	104,004
Tulameen Coal Mines, Ltd.	33,307	220	.....	33,527	.....	.....	2,857	2,857	1,003	1,200	197	.....	36,581
Pleasant Valley Coal Mining Co.	16,207	853	.....	17,060	.....	.....	3,497	3,497	.....	.....	.....	.....	20,557
Blue Flame Collieries, Ltd.	8,181	107	.....	8,288	.....	.....	845	845	.....	1,463	1,463	.....	10,596
Totals, Nicola-Princeton District	186,370	1,180	.....	187,550	.....	.....	18,868	18,868	1,226	2,868	1,660	18	208,060
Northern District.													
Bulkley Valley Coal Mine	470	.....	.....	470	.....	.....	.....	.....	.....	.....	.....	.....	470
Telkwa Collieries, Ltd.	559	.....	.....	559	.....	.....	.....	.....	.....	.....	.....	.....	559
Totals, Northern District	1,029	.....	.....	1,029	.....	.....	.....	.....	.....	.....	.....	.....	1,029
Grand totals, Coast District	937,430	47,121	19,338	1,003,889	86,674	.....	115,042	201,716	37,104	29,393	19,179	26,890	1,197,894
East Kootenay District.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery	102,312	55,478	.....	157,790	.....	43,814	8,294	52,108	331	695	364	.....	210,262
Michel Colliery	195,780	.....	.....	195,780	.....	54,360	14,684	69,044	.....	738	738	.....	265,562
Corbin Collieries, Ltd.	158,841	21,274	.....	180,115	30,126	.....	7,029	37,155	67,110	63,252	.....	3,858	213,412
Totals, East Kootenay District	456,933	76,752	.....	533,685	30,126	98,174	30,007	158,307	67,441	64,685	1,102	3,858	689,236
Coal.													
Grand totals for Province	1,394,363	123,873	19,338	1,537,574	116,800	98,174	145,049	360,023	104,545	94,078	20,281	30,748	1,887,130
Coke.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery	5,781	22,350	.....	28,131	.....	.....	.....	.....	330	241	.....	89	28,042
Michel Colliery	37,395	322	.....	37,717	.....	.....	.....	.....	152	203	51	.....	37,768
Total coke for Province	43,176	22,672	.....	65,848	.....	.....	.....	.....	482	444	51	89	65,810

Collieries of British Columbia—Men employed, 1930.

MINE.	WHITE MEN.																		INDIANS.			JAPANESE AND CHINESE.									Total Men employed.		
	Supervision and Clerical.			Miners.			Helpers.			Labourers.			Mechanics and Skilled Labour.			Boys.			Labourers.			Miners.			Helpers.			Labourers.					
	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.
Vancouver Island.																																	
Canadian Collieries (D.), Ltd.—																																	
South Wellington, No. 5 mine	10	6	16	137	.....	137	.....	.....	.....	34	14	48	7	13	20	.....	14	14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	188	47	235
Extension Colliery	17	10	27	150	.....	150	5	.....	5	39	13	52	8	13	21	.....	9	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	32	34	221	77	298
Comox Colliery	27	13	40	115	.....	115	.....	.....	.....	90	41	131	62	52	114	13	15	28	.....	.....	.....	80	.....	80	52	.....	52	26	27	53	465	148	613
Western Fuel Corp. of Canada, Ltd.—																																	
No. 1 mine	33	27	60	200	.....	200	.....	.....	.....	261	81	342	95	65	160	43	30	73	1	.....	1	.....	.....	.....	.....	.....	.....	.....	81	81	633	284	917
Reserve mine	7	2	9	107	.....	107	.....	.....	.....	64	13	77	19	10	29	18	11	29	1	.....	1	.....	.....	.....	.....	.....	.....	.....	27	27	216	63	279
Wakesiah mine	5	1	6	46	.....	46	.....	.....	.....	13	6	19	4	4	8	5	4	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	6	73	21	94
Granby Cons. M.S. & P. Co.	7	4	11	119	.....	119	37	.....	37	.....	30	30	2	22	24	.....	5	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	3	165	64	229
Lantzville Colliery	1	.....	1	7	.....	7	3	.....	3	.....	.....	.....	.....	3	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	11	4	15
Fiddick mine	1	.....	1	3	.....	3	2	.....	2	.....	4	4	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	4	11
Little Ash mine	.....	.....	.....	10	.....	10	3	.....	3	2	3	5	.....	2	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	5	20
Richardson mine	1	.....	1	2	.....	2	.....	.....	.....	.....	.....	.....	.....	1	1	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	2	5
Morden Colliery	3	3	6	4	.....	4	.....	.....	.....	.....	.....	.....	14	17	31	.....	7	7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21	27	48
Biggs' mine	.....	1	1	2	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	1	3
Little Jingle Pot mine	.....	1	1	3	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	1	4
Totals, Vancouver Island	112	68	180	905	.....	905	50	.....	50	503	205	708	212	202	414	79	96	175	2	.....	2	80	.....	80	52	.....	52	28	177	205	2023	748	2771
Nicola-Princeton District.																																	
Middlesboro Collieries, Ltd.	7	3	10	39	.....	39	16	.....	16	18	10	28	.....	12	12	.....	7	7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	80	32	112
Coalmont Collieries, Ltd.	11	18	29	86	.....	86	.....	.....	.....	78	40	118	1	36	37	3	2	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	179	97	276
Tulameen Coal Mines, Ltd.	7	2	9	30	.....	30	44	.....	44	.....	8	8	.....	6	6	2	1	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	83	17	100
Pleasant Valley Coal Mining Co.	5	2	7	17	.....	17	6	.....	6	14	12	26	11	14	25	2	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	55	28	83
Blue Flame Collieries, Ltd.	2	2	4	10	.....	10	8	.....	8	.....	5	5	3	3	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	10	33
Totals, Nicola-Princeton District	32	27	59	182	.....	182	74	.....	74	110	75	185	15	71	86	7	10	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	420	184	604
Northern District.																																	
Bulkley Valley Coal Mine	1	1	2	5	.....	5	3	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	1	10
Telkwa Collieries, Ltd.	.....	.....	.....	4	.....	4	2	.....	2	.....	1	1	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	2	8
Totals, Northern District	1	1	2	9	.....	9	5	.....	5	.....	1	1	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	3	18
Grand totals, Coast District	145	96	241	1096	.....	1096	129	.....	129	613	281	894	227	274	501	86	106	192	2	.....	2	80	.....	80	52	.....	52	28	178	206	2458	935	3393
East Kootenay District.																																	
Crow's Nest Pass Coal Co., Ltd.—																																	
Coal Creek Colliery	17	9	26	195	.....	195	.....	.....	.....	28	46	74	111	58	169	5	5	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	356	118	474
Michel Colliery	21	13	34	207	.....	207	.....	.....	.....	20	54	74	118	71	189	13	9	22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	379	147	526
Corbin Collieries, Ltd.	11	12	23	94	.....	94	34	.....	34	50	29	79	7	12	19	.....	3	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	196	56	252
Totals, East Kootenay District	49	34	83	496	.....	496	34	.....	34	98	129	227	236	141	377	18	17	35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	931	321	1252
Grand totals for Province	194	130	324	1592	.....	1592	163	.....	163	711	410	1121	463	415	878	104	123	227	2	.....	2	80	.....	80	52	.....	52	28	178	206	3389	1256	4645

NOTE.—U=Underground; A=Above ground; T=Total.

LABOUR AND EMPLOYMENT.

During the year 1930 there were 4,645 persons employed in and about the coal-mines of the Province, a decrease of about 7.6 per cent. compared with 1930.

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 30 per cent. of the working-days were lost through lack of trade. Wakesiah and Reserve mines were closed early in the year.

In the Nicola-Princeton District the different collieries worked from 76 to 90 per cent. of the working-days, averaging for the district about 85 per cent. of the working-days. No. 4 mine, Coalmont Collieries, lost practically six weeks due to an explosion.

The mines in the East Kootenay District worked from 51 per cent. at the lowest to 79 per cent. at the highest of the working-days during the year, and worked for an average for the whole district about 63.4 per cent. of the time.

The table on page 321 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 the year 1910, when the output was nearly 3,000,000 tons; since that time the use of coal has not kept pace with the expansion of general industry, 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.; and 1930, 9.3 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 ½ 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:—

	Imported Fuel-oil subject to ½ 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	140,000,000
1930	34,560,000	137,000,000 (est.)

In addition to the above, 21,195,000 gallons of fuel-oil entered British Columbia ports for use on shipping; this is duty-free.

COMPETITION OF IMPORTED AND ALBERTA COALS IN BRITISH COLUMBIA.

During 1930 the imports into British Columbia totalled 27,941 short tons, and consisted of 17,940 tons of lignite and 8,879 tons of bituminous coal from United States and 1,122 tons of anthracite from French East Indies.

The following table shows the amount of Alberta coal sold in British Columbia during past years:—

	Tons.		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	1930	227,385

The total tonnage of coal brought into British Columbia during 1930 was 255,326 tons.

HYDRO-ELECTRIC DEVELOPMENT.

There is at present in British Columbia 630,792 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:—

	Water-power developed. Horse-power.		Water-power developed. Horse-power.
1900	9,366	1924	355,718
1905	29,334	1925	414,702
1910	64,474	1926	460,562
1915	254,065	1927	473,142
1920	309,184	1928	523,902
1921	309,762	1929	559,792
1922	329,057	1930	630,792
1923	355,718		

In addition to the above developed hydro-power, new installations are nearing completion that will provide a further 108,000 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 latter part of 1930 a new power plant was installed at the New Westminster Mental Home, consisting of two boiler units each of 185 horse-power, one boiler being fitted with a chain-grate stoker and the other equipped for burning pulverized coal; the latter unit is provided with water-walls in the furnace and the air for combustion is carried through the hollow floor of the furnace.

The coal is pulverized by an impact pulverizer, Combustion Engineering Company type, and can be supplied to the furnace at the proper degree of fineness to give the best efficiency of different coals.

It has been found that the Nanaimo coals give their highest efficiency when pulverized so that 75 to 80 per cent. will pass through a 200-mesh screen; grinding to this fineness requires very little power and no trouble has been experienced with slagging of the ash.

While complete tests of this installation have not been completed, it is reported that with a consumption of 4 tons of coal a day the same amount of steam is produced from this boiler, equipped with pulverized coal, as was produced by the old power plant from a daily consumption of 12 tons of coal.

The Department of Mines was largely instrumental in having this modern equipment installed and is keeping in close touch with results, as it is anticipated that many of our British Columbia coals will be thoroughly tested here to show their efficiency when used in accordance with modern methods.

The unit equipped with the chain-grate stoker shows a similarly increased efficiency and economy as compared with the old plant.

The Department of Mines also took a leading part in the installation of a pulverized-coal system on the tug "Pacific Monarch," owned by the Coyle Navigation Company, of Vancouver.

The vessel was designed for hand-firing and did not permit the full advantage that would accrue to a similar ship capable, as many new vessels are, of being easily changed to derive the full advantage of a pulverized-coal-firing system.

In spite of this disadvantage it was found that not only was the operating cost a day reduced, but the maximum horse-power was raised from 536 when hand-fired to 763 horse-power when using pulverized coal; an increase of 42 per cent.

During the year 1930 the Honourable the Minister of Mines arranged to have tests made on a commercial scale of all British Columbia coals at the new Dominion Testing Laboratory at Ottawa, and was able to obtain the co-operation of the Canadian National Railway Company and the Canadian Pacific Railway Company to the extent that above companies transported ten car-loads of British Columbia coal to Ottawa free of charge.

Shipments were sent from the following collieries: Michel, Tulameen, Coalmont, Middlesboro, Pleasant Valley, Telkwa, Comox, South Wellington, Reserve, and Cassidy.

The preliminary reports of the tests of all British Columbia coals showed that they were easily and cheaply pulverized and gave highly efficient results in steam-generation.

Results of the above nature should be investigated by the owners of more or less obsolete coal-burning power-installations, many of which are inefficient and costly to operate; comparisons are frequently made between the results of such obsolete plants and some of the modern boiler-installations using fuel to the detriment of the installation using coal.

Careful investigation will show that a modern power-installation using coal either by mechanical stoker or in the pulverized form can compare favourably with any other form of power-generation.

While the increased efficiency of using coal by modern methods will reduce the amount of coal required in individual power plants, the advantage shown should greatly increase the use of coal and materially aid this important industry in British Columbia.

ACCIDENTS IN AND AROUND COAL-MINES.

During 1930 there were 4,645 persons in and around the coal-mines. Fifty-four fatal accidents occurred during the year, as compared with twelve for 1929.

The ratio of fatal accidents per 1,000 persons employed was 11.62, as compared with 2.38 in 1929. In 1928 the ratio was 2.64; in 1927, 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; the average for the ten-year period being 3.61.

The number of fatal accidents per 1,000,000 tons produced during 1930 was 28.61; during 1929 the fatalities per 1,000,000 tons mined was 5.33; in 1928, 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; the average for the ten-year period being 8.56 per 1,000,000 tons of coal mined.

The following table shows the collieries at which the fatal accidents occurred during 1930 and comparative figures for 1929:—

Name of Company.	*Name of Colliery.*	*1930.*	*1929.*
Western Fuel Corporation, Ltd.	No. 1 mine	2	2
Canadian Collieries (D.), Ltd.	Extension	1	1
Canadian Collieries (D.), Ltd.	Comox	1	2
Coalmont Collieries, Ltd.	No. 3 mine	....	2
Coalmont Collieries, Ltd.	No. 4 mine	45	2
Tulameen Collieries, Ltd.	No. 2 mine	1	....
Crow's Nest Pass Coal Co.	Coal Creek	....	2
Crow's Nest Pass Coal Co.	Michel	4	....
Lantzville Collieries, Ltd.	No. 2 slope	....	1
Totals		54	12

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for 1929:—

Cause.	1930.		1929.	
	No.	Per Cent.	No.	Per Cent.
By falls of roof and coal	6	11.11	6	50.00
By mine-cars and haulage	2	3.71	6	50.00
By blasting	1	1.85	....	.....
By explosion of gas	45	83.33	....	.....
Totals	54	100.00	12	100.00

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1930 and 1929:—

Cause.	1930.		1929.	
	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 falls of roof and coal	6	314,521	6	375,208
By mine-cars and haulage	2	943,565	6	375,208
By blasting	1	1,887,130	....	.....
By explosion of gas	45	41,936	....	.....
Totals	54	34,947	12	187,604

The number of tons mined per fatal accident during 1930 was 34,947 tons, compared with 187,604 tons for 1929. The average for the last ten years was 116,704 tons.

The following table shows the fatalities from various causes in coal-mines during the year 1930, compared with 1929, according to Inspection Districts:—

District.	Number of Deaths from Accidents.						Total.		Accident Death-rate.			
	Explosions of Fire-damp.	Falls of Roof and Coal.	Mine-cars and Haulage.	Blasting.	Miscellaneous (Underground).	On Surface.	1930.	1929.	Per 1,000 Persons employed.		Per 1,000,000 Tons of Coal mined.	
									1930.	1929.	1930.	1929.
Vancouver Island	....	4	....	....	....	....	4	6	1.44	2.18	0.04	5.33
Nicola-Princeton	45	....	....	1	....	....	46	4	76.15	5.19	24.09	16.51
East Kootenay	....	2	2	....	....	....	4	2	3.19	1.33	5.80	2.23
Northern	....	....	....	....	....	....	....	....	.....	.....	.....	.....
Province (1930)	45	6	2	1	....	....	54	....	11.62	.....	28.61	.....
Province (1929)	....	....	....	....	....	....	....	12	.....	2.38	.....	5.33

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, 1930:—

District.	No. of Fatalities.	Accident Death-rate.	
		Per 1,000 Employees.	Per 1,000,000 Tons of Coal mined.
Coast	50	14.73	41.82
East Kootenay	4	3.19	5.80
For Province	54	11.63	28.61

The details regarding the occurrences of the fatal accidents in coal-mines during 1930 are as follows:—

The fatal accident which occurred to Joseph Reciputo, miner, No. 2 mine, Extension Colliery, on February 19th was due to a fall of coal. Deceased was taking out bottom coal at the time when some top coal which was not properly secured fell on him.

The fatal accident which occurred to G. Martin, miner, No. 1 mine, Michel Colliery, on March 17th was due to his being apparently hit by some coal while at work at the coal-face. Deceased and partner were at work at the coal-face and partner heard him call out that he was hurt, and on looking round found him lying on the floor with some small coal on his feet and a wound on his head. Deceased was taken to the hospital, where he died that night. A post mortem showed that he had sustained a fractured pelvis. It is probable that a small amount of coal was projected from the face by natural pressure and hit deceased, with resultant injuries.

The fatal accident which occurred to Steve Bardosi, timberman, "B" mine, Michel Colliery, on April 25th was due to a fall of roof from a "pot-hole." Deceased was testing this part of the roof at the time the rock fell on him.

The fatal accident which occurred to Antonio Percko, miner, No. 1 mine, Western Fuel Corporation of Canada, Limited, on May 26th was due to a fall of rock which caused a compound fracture of the right leg. Deceased died from shock the following day.

The fatal accident which occurred to A. Miknovich, driver, No. 1 mine, Michel Colliery, on June 6th was due to his vertebræ being injured when hit by some timbers which he was conveying. Deceased said his horse was going too fast and when he checked the horse by means of the reins the car of timber came ahead; some of the projecting timbers hit him on the spine. He died on November 3rd.

The fatal accident which occurred to Paul Pavlich, labourer, No. 1 mine, Western Fuel Corporation of Canada, Limited, on June 23rd was due to a fall of rock. Deceased was moving a conveyor when a post either swung out or was knocked out, allowing a thin slab of rock to fall on deceased, forcing his face into the fine coal cuttings on the floor. He suffocated before he could be released.

The fatal accident which occurred to A. Guy, miner, No. 5 mine, Comox Colliery, on June 30th was due to a fall of rock in his working-place. Deceased and partner were preparing to set a prop under this part of the roof when it fell. Deceased noticed the roof giving and shouted to his partner to jump, but was caught himself.

The fatal accidents which occurred to Thomas Gibson, Albert Cole, C. A. Smith, Harry Edwards, Frank Stanich, Jos. Stanich, John Dreffrf, Wm. Soupronuk, John C. Smith, A. Kruk, Vide Kresich, William Smith, John Njegovan, Donald McDonald, Paul Fleischman, Herbert Buckledge, Walter Lawrie, Mike Babich, William Ewing, John Vidosh, James Adamson, Robert Simpson, Matthew Marshall, John Purss, Peter Stillinovich, William Ross, Joseph Sutich, Josiah Bradbury, Samuel Milligan, Frank Gailus, Frank Jerosyk, Zeke Lubardo, Frank Plut, Mike Lubardo, John Millitich, Nicholas Storyk, Joseph Knopka, Chas. H. Smith, William Sim, Corneluis Hupton, Jas. Hatfield, Peter Smith, Ralph Hale, Jos. Nagode, and John Nesbitt in No. 4 mine, Coalmont Collieries, Limited, on August 13th were due to an explosion and following after-damp. This accident is dealt with fully in another part of this report.

The fatal accident which occurred to J. Sakal, labourer, "B" mine, Michel Colliery, on August 30th was due to his being thrown from a mine-car, on which he was riding, which was derailed when travelling at a high speed. Deceased suffered a fractured skull and died on September 2nd.

The fatal accident which occurred to Robert Spruston, fireboss, No. 2 mine, Tulameen Coal Mines, Limited, on November 23rd was due to the explosion of a number of detonators which deceased had apparently carried inside his shirt. When in the act of firing a shot by means of a shot-firing battery and cable, nineteen of the detonators referred to above exploded and inflicted injuries from which he died three hours later. The regulation leather bag for carrying detonators was found hanging some distance away from the scene of the accident.

EXPLOSIVES.

The following table shows the quantity of explosives used in coal-mines during 1930, 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 for 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	80,191	328,315	147,540	4.09	0.54
Reserve mine, Nanaimo	9,667	37,344	12,559	3.86	0.76
Wakesiah mine, Nanaimo	230	4,290	430	18.27	0.53
South Wellington, No. 5 mine	37,250	75,974	53,450	2.04	0.69
Extension Colliery	61,687	134,183	89,780	2.17	0.68
Comox Colliery	73,091	243,929	101,610	3.34	0.71
Granby Cons. M.S. & P. Co.	60,097	148,675	65,916	2.47	0.91
Lantzville mine	3,600	4,024	3,840	1.11	0.93
Fiddick mine	1,000	1,559	1,400	1.56	0.71
Little Ash mine	3,250	5,596	4,500	1.72	0.72
Richardson mine	15	386	30	25.73	0.50
Morden Colliery	3,000	3,001	4,000	1.00	0.75
Biggs' mine	500	1,108	750	2.54	0.66
Little Jingle Pot mine	150	421	330	2.80	0.45
Totals for district	333,728	988,805	479,095	2.96	0.69

NICOLA-PRINCETON DISTRICT.

Middlesboro Collieries	7,200	36,322	13,775	5.04	0.52
Coalmont Collieries, Ltd.	12,144	104,004	21,000	8.56	0.57
Tulameen Valley Coal Co.	8,750	36,581	8,750	4.18	1.00
Pleasant Valley Coal Mining Co.	5,350	20,557	14,899	3.84	0.35
Blue Flame Collieries, Ltd.	4,500	10,596	5,000	2.35	0.90
Totals for district	37,944	208,060	63,424	5.48	0.59

NORTHERN DISTRICT.

Bulkley Valley Coal Mine	250	470	350	1.88	0.71
Telkwa Collieries, Ltd.	235	559	323	2.38	0.72
Totals for district	485	1,029	673	2.12	0.72

EAST KOOTENAY DISTRICT.

Coal Creek Colliery	1,621	210,262	1,519	129.71	1.06
Michel Colliery	14,424	265,562	20,648	18.41	0.69
Corbin Colliery	28,030	213,412	32,200	7.61	0.87
Totals for district	44,075	689,236	54,367	15.63	0.81
Totals for Province	416,232	1,887,130	597,559	4.53	0.69

QUANTITIES OF DIFFERENT EXPLOSIVES USED.

	Lb.
Monobel of different grades	367,745
Miner's Friend	12,800
Permissible rock-powder	35,687
Total	416,232

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":—

Polar Monobel No. 4.
Polar Monobel No. 6.
Polar Monobel No. 12.
Polar CXL-ite No. 2.

MACHINE-MINED COAL.

During the year 1930 mining-machines produced approximately 355,000 tons of coal, or about 19 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	30	9	18	7	....
Nicola-Princeton	....	20	....	9	....	11
East Kootenay	....	....	....	....	....	....
Northern	....	....	....	....	....	....
Totals	4	50	9	27	7	11

SAFETY-LAMPS.

There were 4,041 safety-lamps in use in the coal-mines of the Province. Of this number, 320 were flame safety-lamps of the Wolf type and 3,721 were electric lamps of various makes, as follows: Edison, 3,270; Wheat, 408; and Wolf electric, 43.

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	40	635	40	635
Reserve mine, Nanaimo	8	223	8	223
Wakesiah mine, Nanaimo	6	80	6	80
No. 5 mine, South Wellington	10	212	10	212
Wellington Extension Colliery	14	219	14	219
Comox Colliery	42	526	43	525
Granby Colliery	6	176	6	176
Lantzville Colliery	1	11	1	11
Fiddick mine	7	.....	7	.....
Little Ash mine	2	17	2	17
Richardson mine	3	.....	3	.....
Morden mine	3	20	3	20
Biggs' mine	2	.....	2	.....
Little Jingle Pot mine	3	.....	3	.....
Totals for district	147	2,119	148	2,118

Nicola-Princeton District.

Middlesboro Collieries	7	85	7	85
Coalmont Collieries	11	269	11	269
Tulameen Coal Mines, Ltd.	4	132	4	132
Pleasant Valley Coal Mining Co.	5	72	5	72
Blue Flame Collieries, Ltd.	3	30	3	30
Totals for district	30	588	30	588

NORTHERN DISTRICT.

Colliery and Mine.	Method of Locking Lamp.		Illuminant used.	
	Magnetic Lock.	Screw or Automatic Clip.	Naphtha Gasoline.	Electricity.
Bulkley Valley Coal Mine	6	.....	6	.....
Telkwa Collieries, Ltd.	9	.....	9	.....
Totals for district	15	.....	15	.....

EAST KOOTENAY DISTRICT.

Coal Creek Colliery	50	430	50	430
Michel Colliery	58	435	58	435
Corbin Colliery	18	151	19	150
Totals for district	126	1,016	127	1,015
Totals for Province	318	3,723	320	3,721

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 specifications 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 maunfactured 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.

No. 7.—The Wolf safety electric cap-lamp, "Light Model" No. 830–C, approved by the British Home Office, manufactured by Friemann & Wolf, Zwickau, Germany. This lamp shall be used with a 1.2-amp. single-filament Osram bulb and with a rubber-covered corded cable, with a rubber sleeve protection at the head end, and double spiral armour protection at the accumulator end.

(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 serium-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.

Electricity is used for various purposes on the surface at fourteen mines and underground at eight 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	1,592
Ventilation	2,670
Haulage	430
Coal-washing	1,883
Miscellaneous	3,874
Total horse-power	10,449

Underground— Nature of its Use.	Aggregate H.P.
Haulage	2,085
Pumping	1,515
Coal-cutting	140
Miscellaneous	80
Total horse-power	3,820
Total horse-power above and under ground	14,269

Of the above amount, approximately 2,565 horse-power was operated as direct current and 11,704 as alternating current.

Electrical regulations passed in 1925 prohibited 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 exemptions 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 CH_4 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 238 samples were collected in the various coal-mines of the Province; of this number, thirty-three 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 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 1930 (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 1930.

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 Minute.	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.																		
8C	Feb. 13..	No. 5, Comox (C.C.)	No. 4 East	Working	200		0.07	20.77	0.61	78.55	400	16,000	29.5	49.0	50.0	93.0	97	139,680	698	2.98
15C	April 15..	No. 5, Comox (C.C.)	No. 4 East	Working	250		0.05	20.67	0.94	78.34	600	24,000	29.5	49.0	50.0	93.0	225	324,000	1,296	6.93
35C	June 14..	No. 5, Comox (C.C.)	Main return	Working	350		0.12	20.66	0.38	78.84	1,400	160,000	29.6	56.0	56.0	100.0	608	875,520	2,501	18.73
36C	,, 18..	No. 5, Comox (C.C.)	Main return	Working	350		0.12	20.62	0.92	78.34	600	24,000	29.7	49.0	50.0	93.0	221	318,240	1,273	6.81
38C	,, 18..	No. 5, Comox (C.C.)	No. 5 East	Working	350	50	0.08	20.61	1.24	78.07	250	9,700	29.7	49.0	50.0	93.0	110	158,400	3,168	3.38
39C	,, 18..	No. 4 Comox (C.C.)	No. 1 District	Working	800	400	0.38	20.21	0.05	79.35	600	36,000	29.7	60.0	60.0	100.0	18	30,720	38	0.65
12N	Feb. 25..	No. 5, South Wellington	Main return	Working	350		0.16	20.71	0.10	79.03	220	15,840	29.6	50.0	50.0	100.0	16	23,040	65	0.49
13N	,, 26..	No. 2, Extension	Main return	Working	400		0.79	19.82	0.02	79.37	200	16,800	29.5	60.0	60.0	100.0	3	4,320	10	0.09
21N	Sept. 10..	No. 1, Extension	Main return	Working	135		0.78	19.49	0.04	79.69	400	20,000	29.5	62.0	63.0	93.0	8	10,520	78	0.22
22N	,, 10..	No. 2, Extension	Main return	Working	440		1.18	19.01	0.04	79.75	400	21,600	29.5	64.0	65.0	93.0	8	10,520	24	0.22
27N	,, 23..	No. 1, W.F. Corporation	No. 5 wall	Working	1300	300	0.36	20.04	0.21	79.39	300	8,000	29.7	53.0	53.0	100.0	17	24,480	81	0.52
43N	Oct. 24..	No. 1, W.F. Corporation	No. 5 wall	Working	1300	300	0.34	20.01	0.25	79.40	1,000	10,000	29.8	62.0	64.0	90.0	25	36,000	120	0.77
44N	,, 24..	No. 1, W.F. Corporation	No. 6 wall	Working	1300	115	0.21	20.28	0.04	79.49	160	4,800	29.8	55.0	57.0	88.0	2	2,800	24	0.06
		Coal Creek Colliery.																		
1694	Feb. 4..	No. 3 mine	No. 1 split	Working	400	100	0.18	20.54	1.07	78.21	200	14,000	25.8	61.0	62.0	93.0	150	216,000	2,160	3.99
1695	,, 7..	No. 2 mine	No. 2 split	Working	400	200	0.24	20.56	0.31	78.89	650	45,500	25.8	58.0	62.0	77.0	141	203,040	1,015	3.75
1696	,, 7..	No. 2 mine	No. 1 split	Working	400	200	0.15	20.68	0.40	78.77	540	37,800	25.8	55.0	58.5	79.0	151	217,440	1,087	4.02
1697	,, 10..	No. 3 mine	No. 2 split	Working	400	300	0.29	20.20	1.64	77.87	780	46,800	25.7	70.0	71.0	93.0	767	1,104,480	3,681	20.43
1698	,, 10..	No. 3 mine	Main return	Working	400		0.29	20.27	1.22	78.22	1,120	67,200	25.7	65.0	66.0	93.0	823	1,185,120	2,962	21.92
1701	,, 21..	No. 1 East mine	No. 2 split	Working	930	30	0.20	20.28	0.97	78.55	90	3,600	25.6	61.0	65.0	77.0	35	50,400	1,680	0.93
1703	,, 21..	No. 1 East mine	No. 4 split	Working	930	105	0.15	20.40	1.78	77.67	200	18,000	25.6	50.0	50.0	100.0	320	460,800	5,719	8.52
1714	July 11..	No. 3 mine	No. 2 split	Working	300	230	0.19	20.41	1.20	78.20	370	29,600	26.0	62.0	64.0	88.0	355	511,200	2,222	9.45
1715	,, 11..	No. 3 mine	Main return	Working	300		0.30	20.29	0.95	78.46	1,060	63,600	26.0	66.0	67.0	94.0	604	869,760	2,899	16.09
1717	,, 14..	No. 2 mine	No. 2 split	Working	300	300	0.21	20.61	0.29	78.89	450	50,400	26.0	62.0	62.5	97.0	146	210,240	700	3.88
1719	,, 17..	No. 1 East mine	No. 2 split	Working	600	255	0.12	20.54	0.82	78.52	300	24,000	25.8	56.0	57.5	89.0	197	283,680	1,112	5.26
1721	,, 17..	No. 1 East mine	No. 4 split	Working	600	45	0.14	20.33	1.47	78.06	330	23,100	25.8	54.0	55.0	93.0	339	488,160	10,848	9.13
1722	,, 17..	No. 1 East mine	North return	Working	600	300	0.17	20.40	1.15	78.28	1,200	108,000	25.8	55.0	56.5	89.0	1,242	1,788,480	5,961	33.07
1723	,, 23..	No. 3 mine	No. 1 split	Working	300	70	0.21	20.55	0.81	78.43	210	12,600	25.9	60.0	62.0	88.0	102	146,880	2,098	2.71
1724	,, 25..	No. 1 East mine	No. 1 split	Working	600	270	0.19	20.50	0.85	78.46	380	38,000	25.9	58.0	60.0	88.0	323	465,120	1,722	8.60
1725	,, 26..	No. 2 mine	Main return	Working	300		0.20	20.48	0.34	78.98	1,100	77,000	25.7	61.0	62.0	93.0	262	377,280	1,257	6.97
1731	Sept. 3..	No. 3 mine	No. 2 split	Working	300	230	0.09	20.48	1.11	78.32	280	22,400	26.1	63.0	65.0	88.0	248	357,120	1,553	6.60
1732	,, 8..	No. 9 mine	Main return	Working	20		0.10	20.71	0.20	78.99	150	6,000	25.6	62.0	62.0	100.0	12	17,280	1,314	0.32
1737	Oct. 6..	No. 2 mine	No. 2 split	Working	300	300	0.16	20.62	0.26	78.96	300	33,600	25.6	63.0	63.0	100.0	87	125,280	418	2.31
		Michel Colliery.																		
673	Feb. 6..	No. 3 mine	No. 5 split	Working	750	120	0.06	20.87	0.38	78.69	370	18,500	26.1	44.0	45.0	93.0	70	100,800	840	1.86
674	,, 12..	No. 3 mine	Main return	Working	750		0.16	20.64	0.39	78.81	1,250	125,000	26.1	48.0	48.0	100.0	487	701,280	935	12.97
677	,, 18..	No. 3 East mine	Main return	Idle			0.17	20.67	0.54	78.62	1,350	60,750	26.0	45.0	45.0	100.0	328	472,320		8.73
678	,, 18..	No. 3 mine	No. 2 split	Working	750	550	0.18	20.57	0.62	78.63	450	27,000	26.0	47.0	48.0	93.0	167	240,480	437	4.45
679	,, 24..	No. 8 mine	No. 2 split	Working	500	250	0.48	20.22	0.18	79.12	360	21,600	25.4	55.0	55.0	100.0	39	56,160	224	1.03
680	,, 24..	No. 3 mine	No. 1 split	Working	500	250	0.29	20.51	0.09	79.11	420	29,400	25.4	57.0	57.0	100.0	26	37,440	150	0.69
681	,, 24..	No. 3 mine	Main return	Working	500		0.47	20.21	0.12	79.20	1,300	65,000	25.4	58.0	58.0	100.0	78	112,320	224	2.07
691	Aug. 5..	No. 3 mine	No. 5 split	Working	892	135	0.09	20.73	0.49	78.69	400	24,000	26.3	50.0	50.0	100.0	117	168,480	1,247	3.11

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.

During the year 1,456 samples were taken in the different mines in the Province, and where the analysis showed less than 50 per cent. of incombustible content the area from which the sample was taken was immediately re-treated.

DANGEROUS OCCURRENCES.

During 1930 there were reported, as provided for by section 71, subsections (*c*) to (*h*), ten occurrences, as follows: Eight fires, one bump, and one explosion; the latter causing forty-five deaths.

EXPLOSIONS AND IGNITIONS.

A serious explosion causing the deaths of forty-five men occurred at No. 4 mine, Coalmont, on August 13th, 1930. Two special reports have been made on this disaster—one by the Chief Inspector of Mines and the other by Thomas Graham, who was specially engaged for this purpose by the Department of Mines. These two reports are published in full immediately following the general report of the Chief Inspector.

PROSECUTIONS.

During 1930 there were ten prosecutions made for infractions of the "Coal-mines Regulation Act" and special rules, all of which resulted in convictions.

MINE-RESCUE AND TRAINING.

The Department of Mines has now five mine-rescue stations in different parts of the Province and centrally located in the mining districts—namely, at Nanaimo, Cumberland, Merritt, Princeton, and Fernie.

The stations are equipped with the most modern rescue apparatus and adequate supplies to maintain emergency service.

The maintenance of rescue crews depends on voluntary service by mining employees and there has been no scarcity of men when their services were required.

There are a number of mine-rescue and first-aid associations in British Columbia—the East Kootenay Association, with headquarters in Fernie; the Princeton and District Association at Princeton; and the Vancouver Island Mine Rescue and First Aid Association at Nanaimo. These associations carry on much valuable work in fostering the safety-work in our coal and metalliferous mines by holding demonstrations of mine-rescue and first-aid work and in maintaining classes of instruction of a nature to induce new men to take an interest in safety measures.

The training in mine-rescue work is carried on by qualified Government instructors at the different stations and is free to all who wish to undertake the course.

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.
656	Edward Surtees	Nanaimo.	678	Percy Johnson	Kimberley.
657	Frank Hunter	Nanaimo.	679	Alfred Vogt	Kimberley.
658	William Lowther	Nanaimo.	680	Thos. Hulland	Kimberley.
659	Mike Drall	Nanaimo.	681	Otto Buterman	Kimberley.
660	William Ball	Nanaimo.	682	Clifford Vickers	Kimberley.
661	John Craig	Nanaimo.	683	Thos. H. Pierce	Kimberley.
662	John Heaton	Nanaimo.	684	Ernest H. Brunner	Kimberley.
663	Robert A. Good	Nanaimo.	685	Joseph McLay	Kimberley.
664	Geo. Potter	Nanaimo.	686	Sutherland R. Smith	Kimberley.
665	James Merner	Nanaimo.	687	Joseph H. Shaw	Kimberley.
666	Robert Plaskett	Nanaimo.	688	Gus Franson	Kimberley.
667	Alford Churchill	Nanaimo.	689	Anton Kadin	Kimberley.
668	Andrew Dickie	Nanaimo.	690	John J. McKay	Kimberley.
669	Geo. D. Cottle	Nanaimo.	691	William Turnbull	Kimberley.
670	James Cochrane	Nanaimo.	692	Rodick McQuarrie	Kimberley.
671	Peter Wilkinson	Nanaimo.	693	Glen McLeod	Kimberley.
672	Edward H. Mottle	Nanaimo.	694	Werner Sjoman	Kimberley.
673	Colville C. Graham	Cumberland.	695	John Vaughan	Cumberland.
674	Stanley Lewis	Cumberland.	696	Samuel English	Cumberland.
675	David Price	Cumberland.	697	George Marshall	Cumberland.
376	James Dick	Cumberland.	698	Charles Francioli	Cumberland.
677	Norman Etherington	Cumberland.	699	George Dunn Brown	Cumberland.

During the year first-aid demonstrations and competitions were held at Britannia and Kimberley by local associations, and were very successful in showing what can be done by properly trained first-aid men to immediately relieve the suffering of the injured and to prevent injuries from being aggravated by improper handling.

The larger district mine-rescue and first-aid associations held demonstrations and open competitions at Fernie, Nanaimo, and Cumberland, which did much to spread this valuable work over a wide field.

At some of the above competitions teams from the *Sullivan* mine took part in Fernie, while on Vancouver island teams from logging camps competed at Cumberland, and teams from Bamberton cement-works took part in the Nanaimo competitions in addition to holding a first-aid demonstration at Bamberton.

In this connection it may be stated that the Minister of Mines has provided a competition first-aid cup for teams, employed in any industry, competing on Vancouver island, and has distributed several hundred small first-aid kits to competitors as a recognition of their efforts to further this work, which is of vital importance in mining and other industries.

EXAMINATIONS FOR CERTIFICATES OF COMPETENCY.

Two examinations for certificates of competency for coal-mine officials were held during 1930; 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 1930 at the various mines.

SUPERVISION OF COAL-MINES.

During 1930 nineteen coal companies operated twenty-one collieries, with forty-three mines, employing 3,389 men underground. In the supervision of underground employees there were sixteen managers, two safety engineers, twenty-six overmen, 146 firebosses and shotlighters, a total of 190, or one official for every eighteen persons employed underground.

METALLIFEROUS MINES.

PRODUCTION.

The output from the metalliferous mines for 1930 was 6,803,846 tons, a decrease of 173,835 tons from the tonnage of 1929. This tonnage was produced from sixty-eight mines, of which thirty-two shipped 100 tons or more.

ACCIDENTS.

There were nineteen fatal accidents in and about the metalliferous mines in 1930, being five more than the figures for 1929.

There were 3,576 persons employed in and about the metalliferous mines in 1930.

The ratio of fatal accidents was 5.31, compared with 2.81 in 1929. The ratio for the last ten-year period was 2.52.

The tonnage mined per fatal accident was 358,097, compared with 498,406 tons per fatal accident in 1929.

The tonnage mined per fatal accident for the last ten-year period was 426,214 tons.

The following table shows the mines at which fatal accidents occurred during 1930 and comparative figures for 1929:—

Mining Division.	Mine.	No. of Accidents.	
		1930.	1929.
Vancouver	Britannia	2	7
Slocan	Mammoth	....	1
Ainsworth	Whitewater	....	1
Fort Steele	Sullivan	4	1
Similkameen	Copper Mountain	6	....
Nass River (Northern)	Hidden Creek	1	1
Nass River (Northern)	Bonanza	1	....
Portland Canal (Northern)	Big Missouri	....	2
Portland Canal (Northern)	Silverado	1	....
Skeena	Bonanza	....	1
Grand Forks	Union	1	....
Greenwood	Bell	1	....
Golden	Monarch	2	....
Totals		19	14

The following table shows the cause, the percentage to the whole of the fatal accidents, with comparative figures for 1929:—

Cause.	1930.		1929.	
	No.	Per Cent.	No.	Per Cent.
By blasting	1	5.26	3	21.43
By gases following blasting	4	21.05	....	.....
By moving ore in stopes and raises	4	21.05	....	.....
By falling in chutes, raises, and shafts	3	15.80	4	28.57
Haulage	2	10.52	3	21.43
By falls of ground	5	26.32	4	28.57
Totals	19	100.00	14	100.00

The fatal accident which occurred to Victor Parvich, chuteman, *Copper Mountain* mine, on January 3rd was due to his being crushed by muck in a chute. The muck had "hung up" and deceased had unnecessarily gone into the chute with a charge of explosive when the muck broke away and caught him.

The fatal accident which occurred to Peter McLaughlin, miner, *Britannia* mine, was due to a fall of ground farther up a stope from where deceased was working. This piece of ground was being drilled at the time it fell.

The fatal accident which occurred to Jim Basoff, sinker, *Hidden Creek* mine, on March 3rd was due to his falling from the hoisting-bucket in a shaft-sinking operation. A number of men were being lowered in the bucket when the hoistman lost control of the hoisting-motor and allowed the bucket to descend for some distance at a high speed. When the speed was checked and the bucket stopped some 100 feet from the shaft-bottom the men were apprehensive and clambered from the bucket to the shaft-timbers. Deceased fell from this point to the bottom of the shaft.

The fatal accident which occurred to Steve Pavicich, miner, *Copper Mountain* mine, on March 17th was due to the muck, on which his drilling-machine was set, settling suddenly owing to chute drawing.

The fatal accident which occurred to Thomas Young, miner, *Sullivan* mine, was due to his being crushed by a rock which rolled down the stope where he was drilling.

The fatal accident which occurred to Ever Beck, barman, *Sullivan* mine, on April 30th was due to his being crushed by a large rock which he was in the act of barring down.

The fatal accident which occurred to A. J. Finch, superintendent, *Bell* mine, on May 9th was due to his being hit by a runaway car on the main haulage-slope, pitching 25 per cent., when the hoisting-cable broke. Deceased knew this cable was in a defective condition and had warned employees *re* this danger, but was caught himself. A new hoisting-cable was at the mine, but deceased had omitted to have same put in service; this would have entailed very few minutes.

The fatal accident which occurred to Victor Ostergord, miner, *Britannia* mine, on May 10th was due to blasting. Deceased had a bulldoze charge of seven sticks of powder in his hands when he sent his partner to warn men in the vicinity that he was going to blast. From unknown causes the powder apparently went off while he was holding it.

The fatal accident which occurred to Sam Raycevich, miner, and Nick Palovina, nipper, *Copper Mountain* mine, on May 16th was due to their being gassed, due to blasting, in a raise between two levels. This raise was blocked by fine muck and attempts had been made to start the muck running by blasting both above and below the blockage. Several heavy blasts had been fired on the shift preceding and it is not known whether the deceased had used any explosives on their shift. Raycevich was dead when found and Palovina died eight hours later. Both died from carbon-monoxide poisoning. It is probable that ordinary dynamite was used in above blasting. This is now prohibited underground.

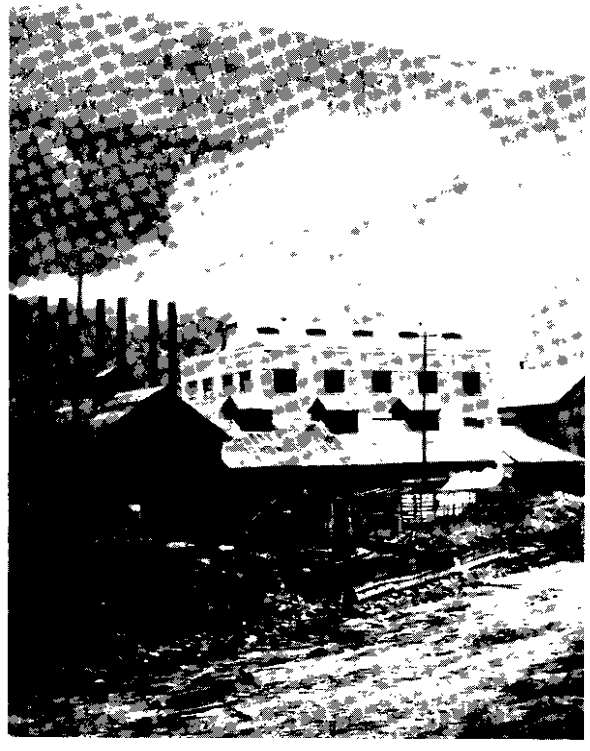
The fatal accident which occurred to Sivert Petterson, miner, and Max Weber, mucker, *Monarch* mine, on June 7th was due to their being gassed following blasting. A round of shots had been fired in a new drift by the shift quitting work at 11 p.m. on June 6th, and prior to blasting the ventilating-pipes exposed to the blast had been taken down. The deceased had gone into this drift about 7 a.m. on the 7th to replace the ventilating-pipes in preparation for the day shift, but had omitted to start the ventilating-fan while engaged in this work. The men were missed in a short time and search made for them, but both were dead when found, death being due to carbon-monoxide poisoning. It is probable that ordinary dynamite was used in above blasting. The use of ordinary dynamite is now prohibited underground.

The fatal accident which occurred to Peter Hestwick, miner, *Silverado* mine, on June 30th was due to falling in a raise in which he was repairing a section of slide. He was using a lever to raise a timber and apparently lost his footing and fell 140 feet, with fatal results.

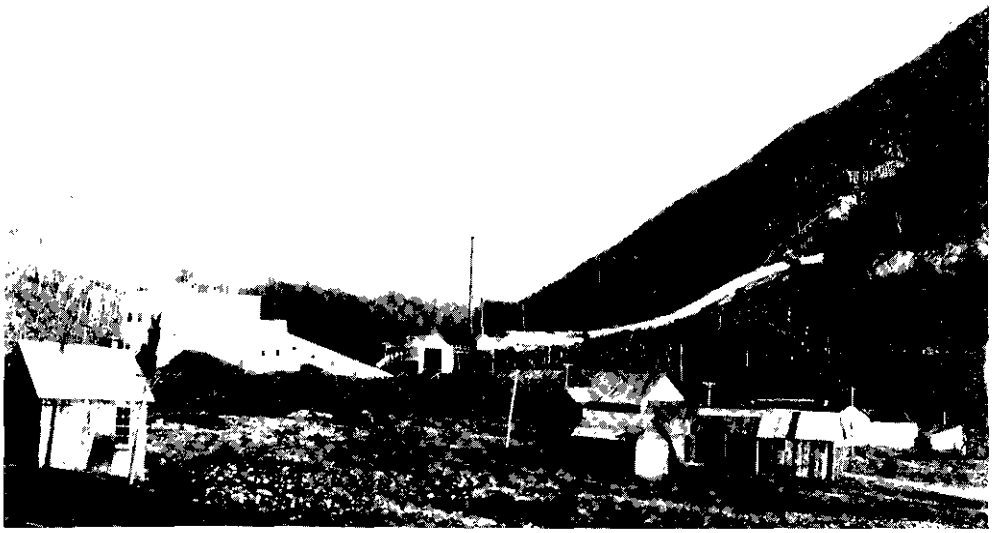
The fatal accident which occurred to Helmer Frantzen, barman, *Copper Mountain* mine, on August 6th was due to a fall of ground from a side-wall. Frantzen had been barring down this immediate area and had told the miners that it was all safe. While still in this place the ground broke and caught Frantzen, while the miners were able to jump clear.

The fatal accident which occurred to Gus Franson, barman, *Sullivan* mine, on August 19th was due to his falling about 20 feet on to the muck-pile, fracturing his skull. Deceased was barring down at the time and using a safety-rope which he had secured to a steel which was

Corbin Colliery—Open-cut in Coal.



Michel Colliery—New Power-house.



Corbin Colliery—New Tipple.

Michel Colliery—New Stokers.

inserted and wedged in a drill-hole by himself some days prior to the accident. He had been using this rope daily. The wedge had loosened, permitting the steel to pull out of the hole, and so caused deceased to fall.

The fatal accident which occurred to Louis Kazanegra, miner, *Bonanza* mine, on September 16th was due to his being crushed between the top of a car, on which he was riding, and the roof. Deceased and another man were riding up a slope on their way out to lunch when the accident happened. Riding on the cars was prohibited and notice to this effect posted at the mine at the time. The other man was prosecuted and fined for riding on the car.

The fatal accident which occurred to Antonio F. Pelle, miner, *Sullivan* mine, on September 20th was due to his being crushed by ore in a chute. Deceased and partner had asked the man in charge of chute drawing to draw the ore from their chute. While this was being done the chute "hung up" and a shot was fired to release it, but without immediate success. Pelle went in to inspect his place and the muck started to run while he was there. The muck carried him down and it was five and a half hours before he was recovered. He sustained a fractured leg and an injured shoulder; he died from shock the following day.

The fatal accident which occurred to Joseph Shangalo, driver, *Union* mine, on October 3rd was due to his being struck on the head by some object which had apparently come down a timber chute where he was loading steel.

The fatal accident which occurred to C. J. Macdonald, timberman, *Copper Mountain* mine, on November 4th was due to a fall of ground when securing same. Deceased had been warned regarding the danger of one particular loose piece of rock and was told how to secure it with safety to himself. He disregarded orders in this respect and lost his life.

A number of above fatalities were directly due to the individuals disregarding safe mining practice and orders, and it is notable that in such cases the deceased were all men of long experience in mining.

Explosives.

Two accidents, each causing the loss of two lives, were caused by gases due to blasting; in each case straight dynamite was the explosive used. In one case one man was recovered alive, but succumbed eight hours later. Following above, a test was made by firing six sticks of straight dynamite in a bulldoze charge and taking a sample of the atmosphere one minute after firing; analysis of the sample showed 0.10 per cent. carbon monoxide and 0.07 per cent. nitric oxide from this comparatively small charge. The use of straight dynamite is now prohibited underground.

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, 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 to take 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.

EXPLOSION AT No. 4 MINE, COALMONT COLLIERIES, LTD.

REPORT BY THOMAS GRAHAM.

Pursuant to section 81, "Coal-mines Regulation Act," chapter 171, R.S.B.C. 1924, I received on October 6th your letter of October 4th, appointing me to make a special investigation relative to an explosion which took place in No. 4 mine, Coalmont Collieries, on August 13th last. My instructions were to make a complete investigation covering, as far as possible, mining conditions prior to and up to the time of the explosion, and in my report to incorporate conclusions as to the probable cause or causes of the explosion, and any recommendation or recommendations the adoption of which, in my judgment, would be a further safeguard to the lives of those employed under-surface in the Coalmont or any other coalfields of the Province. Accepting your appointment, I reached Princeton on the morning of October 9th. James Dickson, Chief Inspector of Mines, accompanied and remained with me throughout my examination of the property.

The mines of the Coalmont Collieries are situated about 12 miles west of Princeton, B.C. The coal-seam mined is a detached portion of the Princeton field and is unusually and peculiarly situated. The outcrop lies at an elevation of approximately 4,000 feet above sea-level; this is about 1,600 feet above the town of Coalmont, which is located on the line of the Kettle Valley Railway, and is the site of the preparation plant or tipple and shipping-point serving the colliery. The outcrop forms an irregular circle around the mountain and dips toward a common centre, having a pitch varying from 20° to 25° so far as it has been followed. The mines are located at Blakeburn, on Blakeburn (North fork of Granite) creek, and the coal is transported from this point to Coalmont by an aerial tramway. The mine-cars are so constructed that the superstructure or box can be lifted from the trucks or running-gear and are thus used in the transportation over the aerial tramway. The box or car carries 1 ton and the capacity of the tramway is sixty cars per hour. Adjacent to the Blakeburn terminal of the tramway No. 3 mine of the colliery is situated. No. 4 mine is 5,400 feet west of this point and is reached by a mine-track constructed along the mountain-face and operated by electric trolley-motors.

The No. 4 mine was opened in 1924. The original portal, now known as the upper portal, is at an elevation of 4,002 feet and consists of a rock tunnel intersecting the coal-seam which outcropped about 120 feet vertically above the portal. On intersecting the seam a slope was started on the pitch and levels projected right and left, sometimes called East and West levels. From No. 1 Left level an incline was driven to the rise and pushed through to the outcrop, giving a second opening to the surface, and at this opening is located the ventilating-fan. From the mouth of the upper portal a surface gravity-incline, 800 feet long, carried the coal to the level of the electric motor-road, which road connected with the aerial terminal at Blakeburn.

Some years later a tunnel was projected from the level of this electric motor-road and cut the measures below the seam for a distance of 1,600 feet, where the coal-seam was again intersected at No. 6 levels of the upper portal slope. This tunnel permitted the trolley-motor connecting the Blakeburn terminal to reach a point 1,000 feet from the mouth of the upper portal, thus giving the mine a third opening to the surface and eliminated the surface gravity-incline. After completion of this tunnel the mine had two intakes, the upper and lower portals, as far as their point of intersection.

The main power plant is located at Coalmont, electricity being generated at 550 volts and stepped up to 10,000 volts, at which pressure it is carried to the mines, where it is again stepped down to 550 volts. The system is 3-phase alternating current, 60 cycles. Adjacent to the mouth of the upper portal of No. 4 mine there is situated a transformer-station, and from this station electric energy was carried to the compressor-room just west of the upper portal, and to the fan, these being surface and open circuits. Two open circuits of 550 volts are carried into the mine through the upper portal, and at No. 6 levels these are placed in conduit for 800 feet, and from that point on to the hoist at the top of No. 1 slope off No. 15 level an armoured cable is used. From No. 1 slope, No. 15 Left level, to No. 2 slope on the same level the line is carried in conduit.

Compressed air is also carried into the mine through the upper portal by a 4-inch line. The electrical and compressed-air energy are used in running hoists, pumps, and other mechanical appliances.

On the side-hill immediately below the upper portal there stood a rough shed constructed of 1- by 12-inch boards and which had at one time been used as a stable. A portion of the gable and roof of this shed rose above the level of the upper portal floor, and immediately adjoining it, but a little more to the west, and just out of line of the tunnel, stood another building, designated on the plan as dwelling. This building was below the level of the upper portal floor. I mention the location of these buildings here, as later on in this report it will be necessary to again refer to them. The fan, a Sirocco multiblade and double-inlet type, 84 inches in diameter, is driven by a 50-horse-power motor, through a belt. Speed of motor 720 r.p.m. and fan 260 r.p.m. The fan is reversible and was operating on the negative or exhaust principle, and according to the reports of J. G. Biggs, District Inspector of Mines, was delivering from 30,000 to 35,000 cubic feet of air a minute. There was no water-gauge on the fan, either of the usual U or self-recording types.

On the evening of August 13th, 1930, about 6.30 p.m., an explosion occurred in No. 4 mine which caused the deaths of forty-five men. At the time of the explosion there were forty-six men in the mine; only one escaped, this party being about midway in the lower rock tunnel, and whilst shaken and slightly affected by fumes was able to reach the surface unaided. It is generally conceded that August 13th was a very hot day and along towards evening became close and sultry, the atmosphere being charged with electricity and a thunder-storm threatened. This storm broke about 6 p.m. and the lightning-discharges were exceedingly vivid and close. From the reports of eye-witnesses, Frederick Fielding, Frederick Pope, and others, the closest and most vivid of the electrical discharges occurred simultaneously with the discharge of the cloud of dust and debris from the mouth of the upper portal. This was accompanied by an ear-splitting detonation, and which most people in the community believed to be resultant of the mine explosion. This, I am confident, is an erroneous conclusion, as mine explosions are not accompanied by striking detonations. James B. Pendergast, engineer in charge of the compressor plant, which is located less than 200 feet to the west of the upper portal, and who had served in the U.S. Navy, said he had many times been close to 13-inch guns when discharged and that the detonation from these had nothing like the ear-splitting sound experienced that night. Some three weeks following, or, to be exact, on September 6th, another electrical storm broke over Blakeburn and during its progress lightning was seen to strike the mountains on the opposite side of the valley, when a similar detonation was heard in Blakeburn. My own conclusions are that the detonation heard at the moment of the explosion was not from the mine, but the result of the lightning seen simultaneously with the explosion and which must have hit the mountain-side somewhere in the valley.

I do not wish you to infer that I attribute the explosion in the mine to this electrical discharge, although in the general summary it cannot be altogether ignored, as a similar incident occurred at Michel, in the Crowsnest pass, on August 8th, 1916, when an explosion occurred in No. 3 mine during a violent thunder-storm and simultaneously with one of the lightning-discharges. (*See* report on this explosion, page K 412, Report of the Minister of Mines, 1916.) In the Michel case no one suspected an explosion and it was some time later when the fan engineer discovered that something was wrong with the fan, when he gave the general alarm. Contrary, in the Blakeburn case, the detonation was generally accepted as resultant of the mine explosion and the community was immediately on hand to render assistance. It is claimed that a heavy cloud of dust was emitted from the upper portal. Frederick Fielding, an old and experienced miner with fifty-three years' service underground, was travelling up the grade of the now disused outside gravity-plane, which formerly connected the lower motor-level with the upper portal, accompanied by a daughter who was visiting from Vancouver, the object being to visit another daughter, Mrs. David Gilmour, who lived in the dwelling formerly described as being immediately below the level of the upper portal. On looking up, following the lightning-flash, he clearly saw the debris and the boards of the old stable or shed hurtling through the air, the whole accompanied by a clear, sharp-cut detonation like that accompanying a dynamite discharge when used in the open, in what is known to miners as a bulldozing shot. This was followed by a cloud of smoke or dust which he states rose 50 to 100 feet in the air and drifted up the mountain-side. Frederick Pope, who lived near by the upper tunnel, also saw a large column of smoke and dust

rise from the upper portal and drift up the mountain-side. John Rhodes, also living near the portal, was sitting on his verandah when the detonation occurred, but claims there was no large cloud of smoke or dust emitted from the upper portal. On the other hand, James Cuthbertson, outside foreman at Blakeburn, heard the report, taking it for thunder; the electrical discharge seemed to come straight to the ground on the mountain-side in the direction of No. 4 mine; the detonation was like the discharge of dynamite in the open. On seeing the cloud of dust and smoke drift up the mountain-side from near No. 4 mine, he concluded the transformer-house had been hit and the oil from the transformers was being burned. John G. Biggs, District Inspector of Mines, was in Blakeburn at the time of the explosion and was about to enter No. 3 mine. He also saw the cloud of smoke and dust rise from the vicinity of No. 4 mine upper portal simultaneously with the lightning-discharge, and attributed the detonation to the lightning striking the mountain or to thunder, although there was very little thunder accompanying the storm. Mr. Biggs was one of the first men to reach the lower portal—say, fifteen or twenty minutes following the report—and states that smoke was just beginning to emerge from the mouth of the lower portal. It is also a significant fact that whilst the drifting of the cloud of smoke and dust from the upper portal up the mountain-side obscured a view of the fan, later examination shows no evidence of much force at the fan or the debouching of debris. Even the explosion-doors placed in the fan-drift to relieve pressures developed in an explosion, and so placed to save the ventilating machinery from being destroyed, were undisturbed. This feature and the lapse of twenty minutes' time before smoke was seen coming from the lower portal would indicate that the explosion was nearly spent before reaching the surface.

The description of the relief efforts following the explosion I shall leave to those engaged in them, as my knowledge comes only from contact with those who were engaged in the work and from reading the evidence taken at the Coroner's inquest. I may, however, say that, in keeping with the best traditions of the coal-miner, the call for rescue parties met with a hearty response and untiring and self-sacrificing efforts were put forth in the endeavour to reach and assist the unfortunate men known to be in the mine. It would be invidious to specially mention any, as Government and mine officials, with workmen of all classes, even outsiders, volunteered their services, and all gave their best in the dangers which invariably accompany rescue-work following a mine explosion, and which all too often prove a forlorn hope as in the present case.

Leaving Princeton on the morning of October 9th, accompanied by James Dickson and J. G. Biggs, Chief and District Inspectors of Mines respectively, I motored to Blakeburn. The mountain road from the mouth of Granite creek to Blakeburn, with its rise of 1,600 feet in 4 miles, is a creditable piece of work and was in very good shape. The forenoon was spent in looking over the surface arrangements at the Blakeburn terminal of the aerial tramway, the mine reports and plans. I have formerly stated that the Coalmont area is a detached portion of the Princeton field, the measures adjacent to the coal and the seam itself having many similar characteristics. The seam was originally a lignite similar to the Princeton seams, but at some time was subjected to the influence of volcanic action, the area being cut in many places by intrusive dykes of volcanic origin and hence has been altered. Much of the moisture and some of the volatile combustibles have been driven off, altering the coal and improving the heating values.

The following proximate analyses show the difference:—

	Coalmont.	Princeton.
Moisture	8.20	13.75
Ash	11.60	8.60
V.C.M.	32.80	34.30
F. Car.	47.40	43.35
Totals	100.00	100.00

These analyses are from coal as received. The seam at Coalmont is estimated to be about 80 feet in thickness. A section of 45 feet is shown on the accompanying plan. Only about 9 to 10 feet of the middle 12-foot section was found profitable to mine and it is in that section that the mine operations were conducted. In common with the rest of the Princeton field, the proximity of a seam of what is termed lime-rock on the section shown in plan; this has a thickness of almost 2 feet and upon exposure to air swells and creates a heavy load upon the mine-timbers, and in caved ground this material is the chief factor in promoting spontaneous

combustion, a feature to which the whole field is highly susceptible. During the afternoon of October 9th, accompanied by Messrs. Dickson and Biggs, of the Mines Department; George Murray, mine manager; and Harry Hopkins, overman, we entered the mine through the lower portal, travelling the 1,600 feet of rock tunnel to the intersection of the coal-seam at the sixth levels, right and left.

The tunnel showed no evidence of having been subjected to any violent force. At the inby end of the tunnel a landing exists, this being the terminus of the electric trolley-motor haulage and the start of the slope which is driven on the seam, the pitch being about 20° to 22°. An electric hoist of 200 horse-power was situated here in an overhead position and served to haul the coal up the slope, feeding the trolley-motor which ran between this point and the tramway terminal at Blakeburn. The hoistman and rope-rider were both killed, and whilst there is little evidence of fire in the hoist-room, both men are reported as having shown burns, the cause of death being burns and carbon-monoxide poisoning. C. A. Smith, the hoistman, was found on the track outby the hoist and may, or may not, have moved from his position at the hoist after the explosion occurred. He may have been down from such position, although the fact that he was a crippple and had difficulty in getting about, and the means of entering or leaving the hoist-room was rather difficult, suggests little likelihood of him being out of the engine-room at the time of the explosion. This engine-room was, as stated before, cut into the roof and presented a background for considerable force, and should have shown strong indications of flame if much had been present.

Immediately inby the hoist the body of A. Cole, rope-rider, was found. This body also was reported as burned about the face, neck, chest, and arms, with coal-dust blown into the skin. Cause of death, shock and carbon-monoxide poisoning. A horse used in making up motor-trips and hauling empty cars to slope-knuckle was also killed. The horse had a deep triangular cut on the chest as if he had come in contact with the corner of a mine-car. On this knuckle it is presumed a trip of empty cars stood, and as the cars comprising the trip were afterwards found on the slope just inby No. 8 Left level and were not attached to the rope, the rope being in the position it would be in when a trip of loads was landed on the siding, it has been suggested by one witness, John Gillham, that this trip of cars ran away from the knuckle previous to the explosion, and at the point of derailment on the slope threw a cloud of fine coal-dust into suspension in the atmosphere, and that a short was created in the electric cable, ignition occurring here. There may be some doubt as to whether the trip of empty cars ran away previous to the explosion or was carried over the knuckle by the back-lash of the explosion, but there is no evidence of any kind to indicate that the initial point of the explosion was at or near the runaway trip or at any other point on the Main slope. I will again refer to this theory later on in the report.

Proceeding down the slope, a careful watch was kept for evidence of lines of force, coke, or other signs of intense heat or flame. Immediately below the slope-knuckle it was noted that a felt covering used for insulation on the compressed-air line gave little indication of intense heat; the extreme ends of the fibres in the felt showed a slight, but very slight, evidence of fire. The inby sides of the timbers showed occasionally adhesions of coal-dust, which had been driven against the timber in the form of mud, but no evidence of coke was found.

The slope was wet underfoot, presumably from water ejected into the ventilating-current from the discharge pipe-line of the mine pumping system, this water being in the form of a very fine spray or mist. A series of these sprays were located on the slope between the knuckle and No. 12 level. It would appear that these sprays ran only when the pumps were in operation. When they were running the slope was quite wet underfoot and the general effect was to prevent the accumulation of dust along the slope.

Reaching No. 15 Left level, where the body of H. Edwards was found, I gather from the evidence at the Coroner's inquest that Edwards's body was stripped completely of clothing, only the boots remaining; the body was found on the right-hand side of the slope, opposite No. 15 Left level, on which level he was a driver. The doctor describes the body as having had superficial burns on the face, neck, hands, arms, and to a lesser degree on the rest of the body; fracture of left thigh; fracture of right leg; hair badly singed; had bled at mouth, nose, and ears. Probable cause of death, concussion. It is presumed that Edwards was thrown and carried with considerable force. Pieces of his clothing, shirt, etc., were found attached to a cog

situated on the lower side of No. 15 level adjacent to the slope, and indicate the force coming out of No. 15 Left level towards the Main slope.

We proceeded down the slope to a point below No. 17 Right, where workmen were engaged in finishing a concrete stopping on the Main slope and also one on No. 17 slope; this work, I was informed, being necessary to seal off the workings of No. 1 slope off No. 15 Left level, where stoppings had also been erected in the slope, the area showing signs of spontaneous combustion. The sealing-off of No. 1 slope by stoppings and the filling of No. 2 slope by water precluded the possibility of any examination of those portions of the mine where actual mining was in progress previous to and at the time of the explosion. From this you will readily understand that my facilities for carrying out the instructions contained in your letter would be very much reduced.

After examining the stoppings the party proceeded into No. 15 Left level. From the evidence of newly timbered ground it was apparent that much caving had occurred on this level. Considerable of this caving took place after the explosion, as evidenced by the fact that when the rescue parties had first reached this point and had been recalled for a few days through the menace of a fire at No. 15 Left level, that on return several caves had occurred during their absence. There is, however, no doubt that the maximum pressures and heat occurred in and adjacent to the top of No. 1 slope off this level and the intersection of the level with the Main slope. On the parting outby the top of No. 1 slope the body of Thomas Gibson, driver-boss, was found, but not until September 9th, the body being buried under a cave. The hair only showed signs of singeing, body badly crushed. The doctor's report reads: "Fractured skull, fractured jaw, crushing injury to left chest, fractured arm, fractured nose; cause of death, crushing injury to skull and chest." It is presumed these injuries were sustained by the caved ground.

The hoist-room at top of No. 1 slope, in which were found the bodies of Roy Bradbury and S. Milligan, is in direct line with No. 1 slope and was set to the rise of the No. 15 level. The opening in which the hoist was located is a blind end or cul-de-sac. The hoist was driven by a 50-horse-power motor. Subsequent examination of the electrical apparatus showed that the motor, switches, etc., were all in good shape, there being no evidence of fusing anywhere. It is evident that at the moment of the explosion the hoist was operating as the controller was in contact when found. The rope was attached to a trip of four cars found on the slope just inby No. 2 Right level, where the trip was derailed. It is assumed that when the power went off the weight of the loaded trip reversed the engine and motor, and the cars ran backward on the slope for a short distance until derailment took place. The engine-room shows greater evidence of fire than any other point examined in the mine. The heat must have been intense, but of short duration. It is conceivable that, being a cul-de-sac, it lingered slightly here. The timber supports in the engine-room were mostly of fir and the bark showed evidence of charring, this being quite perceptible not only to the eye, but to the touch of the hand. The lagging between the timber sets, mainly slabs with the sawn side outward, also at various places, showed a very slight discoloration, chiefly the saw-fibres. The extreme back of the engine-room showed no evidence of force or of having been blackened by adherence of coal-dust blown by force, nor was there any evidence of coke found.

On October 10th, accompanied by Messrs. Dickson, Biggs, Murray, and Hopkins, the area on No. 15 Left level, lying beyond the hoist at No. 1 slope, was examined. Immediately inby the hoist an electric switch-box on the cable-line had the switch-handle bent inby, giving an indication of line of force. Throughout this area there was little evidence of force other than a few board stoppings and curtains being blown out, and from the location where the bodies were found it is obvious that all of these men had moved from their working-place inby No. 1 slope after the explosion, and all of them had died from carbon-monoxide poisoning. Five hundred feet inby the intersection of No. 1 slope with No. 15 Left level the bodies of five men were found, including that of Wm. Ross, the fireboss in No. 2 Slope section.

Two hundred feet farther inby a 35-horse-power electric hoist was located for operation of an incline projected to the rise. Here a board was found on the level upon which was written in chalk, "Up here." The incline was up a distance of 200 feet from No. 15 level on a pitch of 22½° and was 110 feet above the counter-level. Twelve bodies were found above the counter-level, where an attempt had been made to seal themselves off with a brattice-cloth stopping. It would appear, however, that before this could be completed death had overtaken them, all

having died by carbon-monoxide poisoning. The type of lamp used throughout the mine was the Edison electric of the older type. In this type there is no switch to cut off the light, and to cut off the light the battery must be unlocked, breaking the contact. Several of the batteries had been unlocked, and it is presumed this was done so that light would be preserved to them for a period longer than the normal life of the battery, which is fourteen to sixteen hours.

Two men who had worked in the incline had tried to retreat by way of the counter-level, travelling the return airway. Their bodies were found about 400 feet outby, death being caused by carbon-monoxide poisoning. A vist to No. 2 slope showed that these working-places were full of water close up to No. 1 level; this made impossible a visit to any of the places where work had been in progress on the night of the explosion. A similar electric hoist to that used at the incline was used at the top of No. 2 slope; this and the electric equipment were found in good shape.

The party returned by No. 1 Right level off No. 2 slope to where a small area between No. 15 Left level and the No. 1 Right level off No. 2 slope showed indications of spontaneous combustion and had been sealed off by concrete stoppings. This area is shown on plan to dip of No. 15 level just outby the incline. There is no evidence of violence or fire in the area known as No. 2 slope, and so far as being a factor in the explosion it can be eliminated.

On October 11th, accompanied by Inspectors Dickson and Biggs, Mine Manager Murray, Overman Hopkins, and Robert Murray, fireboss (Robert Murray is what is known as patrolman, his duties consisting entirely of examination of return airways, old workings, and stoppings which enclosed fire areas throughout the mine), the party travelled the return air-course and old workings on the left side of the slope from No. 5 to No. 15 levels. A careful examination showed all permanent stoppings around fire areas to be in perfect shape. All indications of force showed that stoppings between the Main slope and return had all been blown from the slope towards the return. There were a number of caves, some of which had existed prior to and some had occurred since the explosion, but very little evidence of any severe pressures. No evidence of coke was found anywhere. In the lower levels, Nos. 13 and 14, the timbers showed signs of heat, slight blistering on the bark of the hemlock, and exudation of pitch from the pine-bark. The lines of force were all upward and outward from No. 15 Left level, from outby the intersection of No. 1 slope with No. 15 level.

On October 13th, accompanied by Inspectors Dickson and Biggs and Mine Manager Murray, the party during the forenoon made a visit to No. 3 mine to see the modes of operation carried on there; as only pillar-extraction was being conducted little was learned of the general condition of places in the original development. The roadways were heavily timbered and subject to a heavy movement, all timber being badly crushed, and maintenance of roadways thereby made extremely difficult and costly. The area under operation was exceedingly small. Ventilation was good and there was no evidence of any gas in the mine.

In the afternoon the same party, joined by Robert Murray, travelled and examined the return airway on the right side of the slope from No. 5 level to No. 17 Right level. The permanent stoppings around fire areas were here found intact and in good shape. The stoppings between the Main slope and the return on this side were mostly blown from the intake towards the return. In a few instances there were conflicting lines, probably due to equalization of pressures or to back-lashes. There was no mistaking the general trend as coming from the lower workings of the mine. When between Nos. 15 and 17 Right levels the influence of flame was again visible on the timbers. Close to No. 17 level a small triangular piece of paper taken from the lining of the cases containing explosives and which were used to designate the destination of timber to various portions of the mine—these tags were tacked to the timbers when routed into the mine and in the present case the tag was still tacked to the timber and was on the inby side—clearly showed signs of flame having passed that way, the edges being discoloured. The duration of flame must have been short or this tag, being specially treated or water-proofed and highly inflammable, would have been completely consumed. No. 17 level also shows indications of the passage of flame. All force-lines were directed towards the Main slope and return airway and coming from the area known as No. 1 slope off No. 15 Left level. This area contains some 4.06 acres of gob or pillared ground, the extracted area being 53.3 per cent. of the total development through No. 1 slope. All of the pillars on Nos. 2 and 3 levels to the right of No. 1 slope had

been extracted, those on No. 4 were almost extracted, No. 5 was partially extracted, with extraction just starting in No. 6 level.

Twenty bodies were taken from the workings of No. 1 slope, all of whom, according to the rescue parties and the evidence given at the inquest, had died from carbon-monoxide poisoning; no evidence of violence on any of the bodies, except C. H. Smith, rope-rider. The doctor reported that Smith's nose was flattened, no fractures, and an abrasion on the forehead. In examination the doctor said the flattening could have occurred through being dragged or lying on his face; not absolutely sure flattening was due to violence. Smith's body was found at the point where trip of cars derailed opposite No. 2 Right room.

One body found opposite No. 2 Left; eight bodies between No. 2 Left and No. 3 Right; one body between No. 3 Right and No. 3 Left; two bodies on No. 4 Right level, 200 feet inby the slope; one body in the next crosscut or rise still farther inby No. 4 level; six bodies near face of No. 6 Right level, this being the lowest level in the mine and between 600 and 700 feet from No. 1 slope.

From evidence deduced it is apparent that all these men, except C. H. Smith, had moved from their working-places. The mining was being conducted on Nos. 5 and 6 levels and it is assumed that the eight men found on the slope between No. 2 Left and No. 3 Right, in their efforts to get out, were caught in the after-damp, dropping as they reached this point. No work was being done in No. 4 level and it is surmised that the men found there, on seeing the men ahead dropping, had retreated to No. 4 level, and endeavoured to follow the return airway; if such was their intent they had missed seeing the opening where the airway leaves No. 4 level and pushed on inby the return, two bodies being found 70 feet beyond the return; the third man had gone farther and turned up the next rise, which led into the gob. The movements of the six men found at the face of No. 6 level are uncertain. Among these was J. C. Smith, fireboss in the section. His case, in which he carried detonating-caps for shot-firing, was found near the junction of the slope and No. 6 level, and the shot-firing battery was in the case with the caps and is looked upon as evidence that Smith had been out at the slope with the other men and had retreated inby again to the point where found.

On October 14th the party personnel was Inspectors Dickson, Biggs, and Miard, Mine Manager Murray, Overman Hopkins, and Robert Murray. Entering the return airway at No. 5 level and travelling outby towards the fan, the tunnel leading to the upper portal was examined, the party returning down the original slope to the point of intersection with the lower tunnel. The permanent fire stoppings in the area were found in good shape; there was little evidence of extreme force in the returns. The upper tunnel showed evidence of force and the mouth of the adit had been heavily caved. Several other caves occurred at points farther down the slope. Outside the portal, a pole in the electric transmission-line, carrying the cables to the mine portal, the compressor-room, and the fan-house, was broken about 10 feet from the ground, evidently hit by something hurled from the mine-mouth. The breaking of this pole deranged the power system, throwing the circuit-breakers at compressor and fan houses. The lightning-arresters at the mine-mouth came down with the pole. As soon as the cables could be segregated, power was passed through the lines starting the compressor and fan, no injury being done to either unit.

There was a lightning-arrester set inside the portal; this has never been seen since; presumed to have been around where the portal caved, and as this cave of surface soil and gravel was cleared by a tractor-scraper, the arrester might easily have been carried over the dump in such work without being noticed. Before this portal cave was removed a fire started in the debris from the heat generated in the compressor air-line, and was one of the factors in delaying rescue-work. A second fire developed close to the slope at No. 5 Left level and had to be sealed off. This also delayed the rescue parties for a few days. There was no evidence of flame in the upper portions of the mine and no coke found. The examination of the fan found the machinery in good shape and, as already stated, the explosion-doors were not even blown open.

A study of the reports of the District Inspector, John G. Biggs, the mine officials, firebosses, and of the gas committee appointed by the workmen, covering the period from July 1st up to and including the off-coming shift at 3 p.m., August 13th, shows not one entry where gas had been detected in the mine. My own observations made at a time when ventilation was still impaired convinces me that the mine was singularly free from explosive gas and could in no sense be termed a gaseous mine.

CONCLUSIONS.

I have already stated the difficulties under which the examination was made, due to the filling of No. 2 slope with water, the erection of fire stoppings in the No. 1 slope intake and return, these being the areas in which the actual mining operations were conducted when the explosion occurred.

The lines of force clearly indicate that the source of the explosion was in the worked-out area of No. 1 slope off No. 15. This opinion has been arrived at through a series of eliminations. First, the runaway trip on the Main slope formerly spoken of, and which I stated earlier in the report would be further treated upon. It is evident that the block used to prevent the empty cars from going over the knuckle on the slope-landing was rarely, if ever, used. The gradient approaching the slope was low and the rope-rider was unable to push the trip over, and hence the horse had to be used in pulling the trip forward. Usually the tail-chain was attached to the top of the rear car, the horse travelling alongside the cars until the first or second car went over the knuckle; hence the block was usually pinned back in same manner and undoubtedly was mostly left in this position. It would have been possible for the back-lash of the explosion to carry the trip over the knuckle, as the explosion coming up the slope on a 22° pitch would have a tendency to follow the original slope to the upper portal rather than the opening over the knuckle to the landing formed by the lower tunnel intersection of the original slope. That there was some back-lash on the knuckle-landing is evidenced by the finding of a small fan between the hoist-room and the knuckle of the slope. This fan was a fixture in the hoist-room and was used to circulate a current of air through the hoist-motor. It was one of the few objects the position of which prior to and after the explosion was certain. The fan had been carried inby from the hoist a distance of 70 or 80 feet, but, apart from the fact that the block should have been in place, I am certain that the explosion was not the result of the runaway trip, as already stated; the lines of force inby the mine prove conclusively that ignition did not occur on the slope where the trip came to rest, nor is there any evidence to show that it was a dust-explosion as suggested by Mr. Gillham at the inquest.

The stoppings around the various areas which had been sealed off for fire were all intact, and eliminated the possibility of leakage of gases or fire from this source. No. 2 slope I have already eliminated, and the only other place in the mine where an accumulation of gas could exist, without possibility of detection, would be in the worked-out area of No. 1 slope off No. 15 Left level, and the lines of force on No. 1 slope and No. 15 Left level from intersection of No. 1 slope with this level and outward on the Main slope, together with similar indications on that portion of the Main slope below No. 15 Left level to the connection with the return air-course on No. 17 level to the right of Main slope, all point to this area as the seat of the explosion.

The pillar-extraction on this area was started on No. 2 Right level and worked downward on the pitch, Nos. 3 and 4 levels following in sequence. No. 1 level off No. 1 slope right through to the intersection of No. 17 incline off No. 17 Left level was used as a return airway for the section. The airway thus ran a level course along the upper or rise side of the section to be pillared. During the pillaring operations the management deemed it advisable to cut off by permanent stoppings all direct openings leading from the area being pillared to the airway described. There are two stoppings in that portion of the airway to the right of the Main slope extension below No. 15 Left level and the airway's intersection of the No. 17 Right slope: one stopping on the Main slope extension where it intersected the airway and one between the intersection of the Main slope and No. 1 slope off No. 15 Right level. One range of pillars was left to the right of the No. 1 slope to act as a return, and inside this stoppings were placed on all openings down to Nos. 2 and 2½ levels, No. 3 level being the highest point with direct connection to the return. The management claim these stoppings were built to prevent air circulating through the pillared area as this might give rise to spontaneous combustion. They claim there was no direct evidence of spontaneous combustion being in existence, the measures being entirely precautionary.

There, however, can be no doubt but the hope of the management was that the upper reaches of the pillared area would fill with gas either in the form of carbon dioxide, depleted air in the form of excess nitrogen, or even carburated hydrogen in such ratio as to form an inexplosive mixture, and by intensive pillaring, keeping the ground caving close upon their operations, excluding oxygen and thus avoiding fire. The nature of the overlying ground made caving easy

and it was rare that an opening sufficiently large was found to permit access to the pillared ground or gob. The caves were reported as close along the marginal work-line at all times. There is no evidence of gas having been detected issuing from this gob area, and only one witness, T. Ewing, a miner who worked in No. 5 Right off No. 1 slope, suggested that on the morning shift of the day of the explosion he smelled smoke as from a fire. Mr. Ewing says he did not mention this to any official, nor to Hugh McGarvie, the man who was working with him that day. He claims to have mentioned it only to his brother; this brother was one of the men lost in the explosion. The condition must not have impressed Mr. Ewing seriously or he would certainly have talked the matter over with his partner, Hugh McGarvie, and then, if both had been satisfied that they smelled smoke, reported same to the officials. Mr. McGarvie in his evidence claims he noted nothing unusual in the conditions on that day. The area did hold possibilities of containing gas; even if gas was rarely found or known in the mine under normal conditions, a heated gob would undoubtedly give off gases which the area from the manner in which it was stopped must act as a reservoir for such product.

It is therefore reasonable to assume that the area did contain gas and that it was the ignition of this gas that caused the explosion.

IGNITION.

We are now confronted with the manner of ignition. There are various ways in which ignition could have taken place.

LAMPS.

The use of electric lamps has reduced to a large extent the percentage of risk in lamp-failures in comparison with the former practice when flame-lamps were in use. Under present conditions there were only two flame safety-lamps in the mine, these being carried by J. C. Smith, fireboss in No. 1 slope, and W. Ross, fireboss in No. 2 slope; both lamps were found to be in good condition. The electric lamps were all in good shape, except a few among the men from No. 2 slope, who tried to seal themselves off in the incline off No. 15 level north. In this case the locks on the self-contained batteries had been picked, breaking the contact, and it is evident that this was done so that they could conserve as long as possible some means of having light.

SHOT-FIRING.

Another means of ignition would be from shot-firing. Again, only two men, J. C. Smith and W. Ross, firebosses, were equipped to fire shots. The section in which Mr. Ross was in charge has been eliminated, and the cap-bag and battery of Mr. Smith, as stated at another place in this report, was found outby the actual operating places in No. 6 level, so that there is no evidence of any shot having been fired immediately preceding the explosion. A feeder of gas might have been ignited by a shot fired some time before, creating a fire behind the shot coal, which might have been unnoticed for a short time; but I am assured by the Inspection staff, the management, and others who were during the rescue-work able to reach the face of the No. 6 level, where J. C. Smith, fireboss, and five other men were found, that there was no evidence found to indicate that they had been engaged in fighting such a fire.

Another source is an open light from matches. I am informed that the examination of the clothing of the men taken from the mine found them free from matches, except in one case only, where one match was found. This match looked as if it had been carried for an indefinite time in the pocket, as it was so black with mine-dirt as to almost be unrecognizable as a match, and suggested the possibility of its presence in the clothing as unknown to the owner. The clothing in which it was found was picked up in the mine-workings and therefore the owner was unknown.

ELECTRICAL SHORT.

An electrical short or arc might also be a means of ignition, and there are many who believe that the ignition and explosion were caused by the electrical storm already referred to in this report, and the incident of the severe lightning-discharge almost simultaneous with the blast from the upper portal of the mine. I have already mentioned the severe detonation which accompanied the electrical discharge, and as it was simultaneous with the explosion was attributed as caused by the explosion. Again I say I cannot subscribe to the theory that this detonation was from

the explosion. The evidences contained in the mine do not bear out the theory that the explosion was of such violence as to make such a report; on the other hand, I believe it had nearly spent itself before reaching the mine-mouth. Therefore I attribute the detonation either to thunder or the lightning-bolt hitting on the mountain somewhere in the valley, as it was seen to do a few weeks afterwards and already mentioned in the report. I cannot subscribe to the lightning hitting direct at the mine-mouth, as in that event such a discharge would have released millions of volts and would have fused rails, pipes, electrical conductors, and equipment. There is no evidence of fusing to be found anywhere, or of even any derangement of the electrical equipment, other than the breaking of a pole carrying the electric transmission-lines and lightning-arrester, this pole being situated in line with the upper portal of the mine and was undoubtedly hit by something coming from the mine. It is believed this was a dimension-timber frame carrying a wheel formerly used as a rope-guide in the haulage when this portal was used for such purpose.

In a former reference to the shed and dwelling immediately adjoining the upper portal, I stated it would again be necessary to refer to these buildings. The dwelling here spoken of was occupied by David Gilmour and his family. Immediately preceding and at the time of the explosion Mr. Gilmour was splitting firewood in the old shed. In the shed with him were the children. This shed was in direct line of the upper portal and the gable stood up above the level of the portal floor. The dwelling was slightly to the west of the line of the portal and was under the level of the portal floor. Mrs. Gilmour was sitting on the porch of the dwelling reading. The night being close and very warm she was lightly clothed, the arms being bare. She states that she felt a tickling sensation on her arms and on looking down at them found the cause to be a deposit of very fine coal-dust. She rose, intending to go to the shed where her husband was and ask him what could be the cause; before she could get off the porch the electrical discharge and detonation formerly mentioned, together with the blast from the mine, occurred, destroying the shed where her husband and children were at the moment and enveloping them all in the debris and cloud of dust which debouched from the mine portal. Fortunately all four of this family escaped serious injury.

The significant point of Mrs. Gilmour's statement is that of the fine coal-dust falling on her arms, which was a few seconds before the electrical discharge, and indicates that the explosion in the mine had taken place previous to such discharge, the dust from the atmosphere being the pioneering movement of the reversal of the mine air-current which was followed by the final cloud of dust and debris.

It is also conceivable that there may have been a number of smaller explosions within the mine along the fringe of the gob following the initial ignition, each one getting more violent with the inrush of oxygen from the mine, culminating in the final blast which licked up all the oxygen available. It would therefore appear as if the cause of ignition would have to be accounted for in the mine and not from any outside phenomena.

It is claimed by the management that there was nothing in the mine conditions prior to the explosion to in any way indicate the existence of fire in the pillared area in No. 1 slope. This belief of the management is fully borne out by a series of mine-air samples taken by J. G. Biggs on September 18th and 19th within the area and on the direct return from such area. These samples were taken in vacuum-bottles, the analyses being made in the laboratory of the Mines Department at Ottawa, and consist of samples known as Nos. 78, 79, 86, 87, and 88, all marked (special). It will be observed that these samples were taken approximately five weeks after the date of the explosion and none of the samples indicates the presence of carbon monoxide CO, which gas should have been present in the event of the area having active fire.

A few days following the taking of these samples a rapid rise occurred in temperature within the area, which led the management to suspect the possibility of the area developing active fire, and after consultation with the Inspectors of the Mines Department, and with the consent of such officials, it was decided to completely seal off the area by permanent stoppings. This action I believe to have been justified in the interest of safety to the men employed in the recovery-work and to safeguard the property in general. This, as already stated, made any examination of the area impossible by the writer. Under such conditions I am unable to arrive at a definite conclusion as to the cause or point of ignition.

It will also be obvious I cannot speak with direct knowledge of the method of operation within this area, although from observations in the areas open, but not working, the general face operations seem to have been conducted along lines of recognized good practice.

It has already been stated in the report that the fan was delivering from 30,000 to 35,000 cubic feet of air a minute; this quantity was adequate to ventilate the area opened. That the mine normally did not make much gas is amply illustrated by the rise place off No. 15 Left level, where twelve men attempted to seal themselves off. This place was driven to the rise on a pitch of 22½° and was up a distance of 200 feet from No. 15 level and 110 feet above the counter-level. My visit was on October 10th, almost two months following the explosion, and while ventilation had been restored in the mine in general and a good current of air was passing up the incline to the counter-level, no effort had been made to carry ventilation up the remaining 110 feet to the face, which was a blind end. The curtain erected by the men on the night of the explosion was still in place, precluding any chance of air circulating in this cul-de-sac, and here above any other place in the mine one would have expected and looked for an accumulation of gas. Examination failed to even find a cap on the flame safety-lamp, and a sample of air taken by vacuum-bottle on September 19th gave a laboratory analysis of 0.05 per cent. of methane. (*See* analysis sample 77.)

The plan indicates that down to No. 15 level the mine had been developed through one slope, with single levels driven to right and left off this slope at irregular distances ranging from 100 to 200 feet, rather than by the usual method of two or more parallel slopes and levels. During development this method of opening must have entailed the erection and use of much brattice to maintain adequate face ventilation until such times as connections were made by crosscuts or rises between the various levels. It is also to be noted by the plan that the rises which connect such levels had purposely been driven at irregular distances on the separate levels, so that they would not intersect the levels at the same point and form a direct line with the slope. I cannot see that any advantage, economic or otherwise, was to be gained by adoption of this method; on the other hand, it added much unnecessary length to the return air-courses and friction to the ventilation coursing these returns to reach the fan than would have been the case had the usual method of parallel slopes been adopted. (*See* plan.)

I mention these uncommon features of the mine opening because they have given rise to an erroneous impression that there was only one means of entering and returning from the mine, and that therefore the mine did not comply with the requirements of section 20 of the "Coal-mines Regulation Act." The rises between the various levels formed on each side of the slope the means of ingress and egress required by the Act, and, apart from the difference in distance to that of parallel slopes, furnished separate means of reaching the surface from the interior mine-workings.

The development of a mine by the single-slope and single-entry system is one that should not be commended. In a gaseous field it would be impossible, as ventilation could not be carried the necessary distances on brattice until openings were established for complete circulation of air, and generally is not in keeping with modern practice.

The lignite-field of the central plateau of the Province, wherever it has been opened, is very susceptible to spontaneous combustion. The mine at Blakeburn had eight areas sealed off for fire, and some mines in the Princeton field were abandoned because of mine fires, all of which were from spontaneous combustion.

The fires in the Blakeburn mine have so far been controlled and isolated without any serious accident or loss of life, but fire above all things is dreaded by the management of a coal-mine. Therefore a field subject to spontaneous combustion should receive special study in modes of planning and development, to permit segregation of areas suspected of fire with the greatest possible speed, and with a minimum of effort and risk to those employed in such work. It is also desirable from a conservation view-point that the mine be so planned that the fire can be controlled with a minimum loss of area. I do not propose to suggest the method, as I believe that should be a matter for the management in each instance to determine, but it would appear advisable in such a field to adopt some one of the many forms of panel operation.

The accompanying plan was prepared by the staff of the Coalmont Collieries, Limited.

RECOMMENDATIONS.

Section 28 of the "Coal-mines Regulation Act," covering submarine areas, reads as follows: "Before commencing to mine any coal or stratified deposit thereof in a submarine area, the owner, agent, or lessee shall submit to the Chief Inspector a plan of the system whereby the submarine area is proposed to be worked, and the system must receive the written approval of

the Chief Inspector before mining operations are commenced, and no change shall be made in such approved system without the written consent of the Chief Inspector."

I would recommend that the Act be so amended that before commencing to mine coal in any area the owner, agent, or lessee shall submit to the Chief Inspector a plan of the system whereby the area is proposed to be opened and worked, and the system should receive the written approval of the Chief Inspector before mining operations are commenced, and no change shall be made in such approved system without the written consent of the Chief Inspector.

You, Sir, and your Department officials may make the claim that such an amendment would place responsibility for the success or failure upon the Department. We already have the precedent in sections 27 and 28 of the present Act, covering submarine areas, and I see no good reason why it should not be made applicable to all areas.

I am aware that there has in past years been not only in this Province, but throughout Canada, a general tendency to increase the responsibilities of the inspection forces, even to holding them responsible for the major accidents in the mining industries. This tendency is entirely at variance with the policy in Great Britain, from which country our mining regulations are chiefly derived.

In Great Britain the responsibility of operations rests with the owner and his management, the Inspector's duties being those of seeing that the various regulations laid down in the Act are carried out by the management. This, I believe, should be our policy here.

It is not intended to define any fixed method in which an area shall be opened or worked, nor is it expected that the methods proposed shall always work successfully. It will undoubtedly be found that changes of conditions within any area may necessitate employing different methods, as a change from pillar and stall to long-wall or the reverse, from one form of pillar and stall to another, or from one form of panel system to another. These changes can be made by a submittal to the Chief Inspector of the necessity of such change and a plan showing the proposed new method.

It is, however, in the interest not only of safety in operations, but in the conservation of the coal areas, that each and every new mine should be opened along lines that comply with accepted general advanced practice.

Some areas may be of such a gaseous nature as to require special precautions that past operations in the field might suggest. Some may be subject to spontaneous combustion and should be so laid out that such phenomena can be most readily controlled. The regulation proposed in no way fixes the mode nor limits the possible variations in individual ingenuity in practice; it merely provides for the assurance that the plan proposed is somewhere in keeping with the character of the field to be opened and with advanced modern practice in mining.

I have referred to the lack of a water-gauge on the fan at No. 4 mine, Coalmont. The omission to have a gauge in no way interfered with the efficiency of the fan.. I do, however, think that all mine-fans should be equipped with a water-gauge where it can be seen at all times by the fan attendant; and where the attendance is not continuous, then the self-recording type should be used; if such type is arranged with a release-valve and the attendant has instructions to operate the release-valve on each visit to the fan, a record is made upon the chart showing the number of visits made by the attendant, and also the exact time of such visits—or with some other automatic device to give notice when the fan stops.

I have to express my appreciation and thanks for many courtesies extended to me by George Murray and other officials of the Coalmont Collieries, Limited; also to James Dickson, Chief Inspector of Mines, Victoria, and John G. Biggs, District Inspector of Mines, Princeton, all of whom willingly assisted in every way possible my examination of the mine, furnishing information, reports of officials, mine-plans, etc.

EXPLOSION AT No. 4 MINE, COALMONT COLLIERIES, LTD.

REPORT BY JAMES DICKSON, CHIEF INSPECTOR OF MINES.

I beg to submit herewith my report on the disastrous explosion which occurred in No. 4 mine, Coalmont Collieries, on August 13th. This explosion occurred about 6.30 p.m., and of the forty-six men in the mine at the time only one man escaped alive.

I received telegraphic information of the explosion at 8 p.m. and left at once for Blakeburn, arriving there at 5.30 p.m. on the 14th, accompanied by Inspector of Mines James Strang. Instructions were issued immediately to rush the mine-rescue equipment from the Rescue Stations at Nanaimo, Fernie, and Merritt to Blakeburn. The rescue equipment from the Princeton Station had been immediately called to the mine and reached there shortly after the explosion. Senior Inspector Strachan, of Fernie, and Inspector Jackson and Instructor Stewart, of Nanaimo Rescue Station, were notified to report at Blakeburn without delay and all arrived without loss of time. District Inspector of Mines John Biggs was at Blakeburn when the explosion occurred and reached the mine within a very few minutes.

On arriving at the mine I learned that the bodies of two men had been recovered and that exploration parties had penetrated to a point on the Main slope between Nos. 14 and 15 Left levels.

A copy of the mine-plan, accompanying this report, shows the workings of No. 4 mine where the bodies were found, where timber was displaced, fire and heated areas, electric- and air-power systems, and ventilation course. The mode of operation in this mine is pillar and stall and apparently some attempt has been made to arrange the workings somewhat after the panel system. At the time of the explosion practically all the production was from pillar-extraction.

When I reached the mine at 6 p.m. on the 14th, work was being concentrated on making temporary repairs to the ventilating system by means of temporary stoppings between the main intake (Main slope) and the return airways on either side. In the attempts to penetrate the lower workings in order to find the men who were missing, many members of the exploration parties had been overcome by the after-damp; this made it imperative to advance partial ventilation before further progress could be made. A cave between Nos. 14 and 15 Left levels obstructed the advance parties until the morning of the 15th, when a passage-way was made over the top and access was then gained to the entrance of No. 15 Left level; this is the main working-level of the mine. The body of H. Edwards, driver, was found at this point. No. 15 level was found to be heavily caved in places and recovery-work was much retarded on this account.

On the 16th dense smoke was discovered coming from the main return at the fan and all men were withdrawn from the mine until the source of the smoke was discovered. On the morning of the 17th it was found that the seals of a fire area between Nos. 5 and 6 Left levels had been broken by the explosion and that the fire was breaking out afresh. This fire area was resealed temporarily and the exploration-work restarted. It was found that further caving had occurred on No. 15 level in the meantime, with the result that it took some considerable time to again reach the point formerly reached.

On August 18th a party comprising Inspectors Strachan and Strang, Instructor Stewart, Manager George Murray, and myself reached No. 1 slope, off No. 15 level, and were able to proceed down for several hundred feet, and found the bodies of ten men who had apparently tried to come up the slope; all had been overcome and died from after-damp. The above bodies and three others from this area were recovered and brought outside on the 19th. It was found that the No. 6 level in this No. 1 slope had filled with the water being made in this part of the mine, and that further exploration on this level was impossible until such time as pumping could be started. The atmosphere in this No. 1 slope area showed a decided gas-cap, and testing by means of canaries proved that there was considerable carbon monoxide present; this was particularly so inby of the points reached by the partly restored ventilation.

On August 20th access was gained over the caved ground on No. 15 level and two bodies were found at No. 1 slope hoist.

On the 21st a team using the oxygen apparatus located five bodies on No. 15 level between No. 1 slope and the incline, and on the 22nd the teams located twelve bodies up this incline. These twelve men had attempted to barricade themselves in the upper part of the incline by means of a brattice stopping which had proved ineffective.

I am of the opinion that by the time the men had reached this incline and started to build this stopping they were already affected by the after-damp, and probably before the stopping was completed the atmosphere inside was almost as bad as that outside; it is very probable that these men died within half an hour after the explosion.

On the following day two more bodies were found; those were the men who had been at work in the incline where the twelve men later barricaded themselves. The two men from the incline probably left the incline immediately following the shock of the explosion and tried to travel out by way of the counter-level; they were found about 400 feet outby and had probably died about one minute after the explosion.

On August 27th one body was found in a crosscut off No. 4 level, No. 1 slope, and on September 9th another body was found under a cave on No. 15 level, near No. 1 slope hoist.

Meanwhile dewatering of No. 6 level had been carried on, and on September 11th the bodies of the last six men were found near the inner end of No. 6 level, No. 1 slope; these bodies were recovered on the following day, making a total of forty-five.

EXTENT AND VIOLENCE OF THE EXPLOSION.

Indications show that the violence of the explosion extended from the original portal of the Main slope to some distance down No. 1 slope. At intervals over the distance some of the mine-timbers were displaced, followed in almost every instance by caving ground. None of the timbers appeared to have been thrown any distance from their original position, but appeared to have been dislodged and dropped. There are a number of large caves in the roadways and airways on both sides of the Main slope, and this caving is more pronounced on the right side, particularly in the upper levels. Very few signs of violence were found on the main haulage-tunnel (No. 2 tunnel).

On the Main slope about forty sets of timber were out between the main tunnel and No. 15 level and the timber at the portal of the Main slope was out; surface gravel and subsoil closed this entrance. There was little indication of burning or heat on the Main slope beyond that shown by the bodies of Smith, Cole, and Edwards. The compressed-air line on the Main slope is covered with a very soft and loosely woven felt heat insulation; the only signs of burning on this felt was on the outer hair, and this indication, while beyond doubt, was very slight.

Careful examination failed to discover any signs of coking anywhere in the mine. Several sets of timber in No. 1 slope hoist-room showed signs of intense heat; this was the only part of the mine where there was any marked evidence of burning.

On the Main slope all the evidence of force pointed upwards, and on No. 15 Left level the lines of force were outward from No. 1 slope towards the Main slope and inwards, in a lesser degree, from No. 1 slope towards No. 2 slope; practically no damage was done in the latter direction. In No. 1 slope workings the force appeared to be outwards from the waste area towards No. 1 slope, particularly through Nos. 2 and 3 Right levels, off No. 1 slope. There were evidences of heat in this part as shown by melted resin on several timbers and on ragged edges of brattice-cloth. There was also evidence that in No. 1 Right, off No. 1 slope, the force was outwards toward the Main slope; there was no caving on this level, but some reinforcing-timbers were displaced in an outward direction.

While the explosion was extensive, the violence, except on No. 15 level, had not been intense. No. 15 Left level was badly caved in places between the Main slope and No. 1 slope.

POSSIBLE CAUSES OF THE EXPLOSION.

Shot-firing can safely be eliminated as a source of ignition in this explosion, as the shot-firing equipment of the two firebosses on shift were found some considerable distance from any working-face.

COALMONT COLLIERIES LTD.

MAP OF No 4 MINE.

Scale of Feet;

0 100 200 300 400 500 600 700 800

After W.D. Vallance, Mine Surveyor, Coalmont.

Date of Explosion, Aug 13 1930

Number of Men killed and asphyxiated: 45

" " " escaped: 1

Area of Pillar Extraction No 1 Slope 4.06 Ac 53.3%.

SECTION OF COAL MEASURES

Total thickness of Coal opp. 80 Ft.

Approximately correct for ... Ft.

0 Feet

80' to 400' Closely laminated Clays
0' to 8' Sandstone
1' 0" Inferior Coal
0' 8" Sandstone
0' 4" Coal and bone
0' 10" Sandstone
0' 6" Coal and bone
1' 0" Sandstone

10 Feet

14' 0" Inferior Coal interspersed with thin seams of rock

El 4042.6 Portal Prospect Tunnel

20 Feet Capping of Seam

1' 8" Limerock

Seam Opened at

12' Coal (average thickness)

30 Feet

Footwall

0' 6" Soft Sandstone
0' 1" Streak of Coal
0' 5" Soft Sandstone
0' 6" Coal
0' 7" Soft Sandstone

40 Feet

7' 0" Coal

50 Feet

5' 0" Soft grey shale

LEGEND

Electrical Signs		Other Signs:	
Conduit		Location of men	
Armoured Cable		Mealed Areas	
Open Circuit		Fire	
Trolley Wires		Pillars Drawn	
Light		Rock Tunnels	
Lights	*	Caved Roadways	
Hoists	•	Intake Airways	→
Pumps (Centrifugal)	⊗	Return "	←
Circuit Breaker	-o-		
Lightning Arrester	-oo-	Beam Stoppings with Valve	
AC Alternating Current		Board	
DC Direct "		Curtains	
V Voltage		Doors	
NB Lights at No 1 and No 2 Slopes are connected to Main Circuit.		Fan	

B.C. Bureau of Mines.

On the afternoon of the 13th a violent thunder and lightning storm was in progress in this area, and some witnesses gave evidence at the Coroner's inquest, held in connection with this accident, to the effect that they had observed a vivid flash of lightning in the vicinity of the mine portal at the exact moment of the explosion. The electrical-power cables enter the mine by the original slope and are provided with lightning-arresters both outside and inside the mine. The lightning-arresters were found to be in good order, electrically, after the explosion.

In addition to the electrical cables, there are continuous pipe-lines for compressed air and water from the surface to all parts of the mine which would provide a fair conductor for lightning. A careful examination was made for any signs of fusion on cables, pipes, or wiring, but no such indications were found.

The question of ignition and explosion in a mine following a lightning-discharge has been raised at different disasters, particularly in the case of the explosion in No. 3 mine, Michel Colliery, in 1916, where a violent explosion occurred during a severe electrical storm. While, apart from the fact that an electrical storm was in progress in the immediate vicinity of No. 4 mine at the time of the explosion, there is no evidence directly connecting this explosion with a lightning-discharge, the possibility cannot be lightly dismissed.

The possibility of a runaway trip having been a primary cause of the explosion has also been considered. A trip of six empty cars was found on the Main slope some 500 feet below the main tunnel. This trip had probably been standing on the inner end of the main tunnel when the explosion occurred, but was sheltered from the force coming up the Main slope. The rush of air entering the mine after the explosion could easily account for this trip being forced over the knuckle and down the slope after the explosion. On this point there was a fairly large cave between the knuckle and the point where the trip was found. This cave could easily occur after the trip had passed.

The empty trip was practically undamaged, although derailed; had this trip been on the Main slope at the time of the explosion the cars would have been at least partly destroyed. The only way in which a runaway trip could cause an explosion on a main intake is by raising a cloud of coal-dust and causing sparks or flame from some source which would ignite the dust.

There was one place where the electric cables were drawn apart (near No. 7 Left level); on this part of the slope the cables are inside a conduit which was undamaged for 100 feet from the point where the cables parted; there was no indication of arcing or fusion at this point.

This Main slope was provided with a number of water-sprays for the purpose of preventing dry coal-dust collecting on the slope. Some of the evidence submitted by witnesses at the inquest was to the effect that this spraying system was in operation on the day of the explosion and that the slope was in a damp condition; other witnesses were not so positive on above points.

Apart from the distance this explosion travelled, there is no indication that dust played an important part.

The coal in this district is very subject to spontaneous combustion, and in this No. 4 mine there are a number of areas that have been sealed off on account of fire or heating.

The area that has been worked from No. 1 slope has an area of over 4 acres in which the pillars have been extracted; this area was partly sealed off by fire seals and there can be no doubt that this area is heavily caved. In regard to the heated or fire area in No. 1 slope abandoned workings, this may be regarded as a very possible source of ignition.

There was a decidedly high temperature in the accessible area after the explosion even after allowing for the fact that the ordinary ventilation was cut off. This temperature increased to the extent that this whole district is now sealed off as a fire precaution.

Fires or heating had occurred in this area, and while very little gas is produced in this mine from natural sources, there can be no doubt that spontaneous heating or actual fires will distil explosive gas from the coal and carbonaceous matter left in the abandoned ground, and it is very probable that this particular area contained a very large volume of potentially explosive gas.

This atmosphere would be normally extinctive due to a shortage of oxygen and the presence of carbon dioxide, but on being forced out of this area by any means and coming into a supply of good air it would rapidly change from an extinctive to an explosive nature.

On the afternoon of August 13th there was, according to authentic report, a violent thunder and lightning storm in this immediate vicinity, accompanied, in all probability, by a reduced

atmospheric pressure, which in turn would tend to permit gases to escape from abandoned areas; any such movement in the atmosphere in this waste area would have a very decided effect on any otherwise dormant fire.

If any gases escaped from this waste area in No. 1 slope, such gas would pass into the Right side return; the roadways used as a return airway on this side and the other roadways between the Right return and the main intake are heavily caved; to a much greater extent than the Main slope. This would indicate that the explosion was at least as severe in this return as in the main intake.

The daily report-books in which the firebosses enter the reports of their examinations of the workings, including examination for gas, show that no gas has been found in this mine over a long period.

In view of the serious loss of life due to this explosion and the difficulty in ascertaining the exact cause, I respectfully recommend that an investigation, as provided by the "Coal-mines Regulation Act," section 81, be made with a view to determining the cause and, if possible, help to prevent such a disaster occurring again in British Columbia.

This report would be incomplete if I failed to make reference to the men who, in the face of known and apprehended dangers, unfalteringly worked on the rescue and recovery parties following the explosion. Their desire to find the missing men far outweighed any thought of self.

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 1930 on the Northern Inspection District, including the following Mining Divisions: Atlin, Portland Canal, Nass River, Omineca, and Skeena. 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. Bob, president, New York; L. P. Jubian, secretary; C. H. Herscham, manager, Engineer, B.C.; R. Roxborough, superintendent. This property recommenced operations in the early part of June and closed again in October. No ore was shipped. The lower workings of the mine have been allowed to fill with water and the work during the year was done in No. 5 level; sixteen men were employed during the period of operation. The prevailing conditions of camp accommodation, water, mine-timbering, ventilation, safety of power-storage, safety-first precautions, and first-aid arrangements were satisfactory.

TAKU ARM SECTION.

Taku Arm.—This mine, situated half a mile distant in a north-easterly direction from the *Engineer* mine, has been idle for several years and is full of water.

Gleaner.—This mine has not operated for several years.

FOURTH OF JULY CREEK SECTION.

Ruffner.—Under option to C. V. Body and associates; C. H. Herscham, general manager; E. W. Helzer, superintendent. This mine reopened at the end of April. The management installed a new 45-horse-power portable Ingersoll-Rand compressor and a new tool-sharpener. Fifteen men were employed in general development-work. During my visit a more permanent magazine for the safe storage of powder was arranged; also found the camp accommodative and sanitary. First aid and first-aid supplies were provided and general operations were carried on in compliance with the "Metalliferous Mines Regulation Act."

PLACER OPERATIONS.

Surprise Lake Section.

Discovery.—Owned by Discovery Mining and Power Company; C. H. Herscham, general manager; Gus Holmgren, superintendent. During my last inspection seventeen men were employed and three large monitors were in operation. The camp was found to be accommodative and clean and the powder was properly stored. Conditions in general were found to be in compliance with the "Metalliferous Mines Regulation Act."

Boulder Creek.—Under option to the Consolidated Mining and Smelting Company. Name of company is Boulder Creek Placer Company; W. White, general manager; H. P. Pearse, superintendent. At the time of my last visit no clean-up of gold had taken place; two large monitors were in operation and twelve men were employed. Camp accommodations were found to be ample and sanitary; first-aid provisions satisfactory, explosives properly cared for, and conditions in general satisfactory.

Ruby Creek.—Owned by Lake Superior Mining Company; P. Matson, superintendent. Work here was maintained throughout the year by surface work in summer and underground mining in winter, with an average of five men being employed. There are two openings to the underground section—one a level and the other a shaft of 80 feet depth. The surface placering is done by hydraulicking. From underground the gravel is hoisted by skips. During my inspection camp accommodation was found to be satisfactory and the provisions for first aid

made in case of accident. Also found the timbering good, the ventilation fair, and conditions in general to be satisfactory.

Ophir Lease.—Owned by F. Fitch, Brodhead, Wisconsin, U.S.A.; C. M. Sands, Atlin, agent. Work commenced at this operation during March and was expected to continue throughout the year; three men being employed at the time of my visit. The workings are entered by a tunnel driven some 390 feet and paralleling the creek. During my inspection the timbering was found to be in order, ventilation rather sluggish, camp accommodation adequate and sanitary, explosives cared for, first-aid material kept on hand, and conditions in general to be satisfactory.

Farmer Lease.—Owned by E. Lindquist and J. Roxborough, Atlin; E. Lindquist, superintendent. Work on this operation commenced during the month of May with an average employment of two men, and it was the intention of the company to continue throughout the year. During my inspection the timbering was found to be good and ventilation rather sluggish; this, I was informed, would be remedied by connecting a second opening at an early date. Also found camp accommodation to be good, explosives properly cared for, first-aid material kept on hand, and conditions in general to be in compliance with the Act.

Otter Creek.—Owned by the Compagnie Française des Mines d'Or du Canada; J. E. Moran, general manager. This is one of the largest open or surface placers of the district. Operations began during May with an employment of twenty men, and the management advised me that it was expected to continue until November. New ground has been entered upon during the year and the work is carried on by three large monitors. A small sawmill is attached to the operation, rendering effective help in the production of flume-timbers. The camp accommodation is good, explosives are properly cared for, and arrangements for first aid are made.

Wright Creek.—Owned by L. Hodge and J. E. Moran, Atlin. One large monitor is in operation with an average employment of two men. The camp is fully accommodative and sanitary and I found the explosives properly cared for and first-aid material kept on hand.

Spruce Creek Section.

Lynx Creek.—Owned by M. Bride, Atlin. Only one man was employed here at the time of my visit and I found this operation to be in general good order.

Lorna Lease.—Owned by Mrs. E. Erickson, who lives near the property. One man was employed washing gravel from the river-bed.

Hardscrabble Lease.—Owned by J. R. Clay, Atlin. No monitors are employed here, the work being done by loading the gravel from the river-bed and hoisting it by a primitive method to the sluice-box. A 5-horse-power engine was in operation for hoisting and three men were employed.

Gladstone Lease.—Owners, J. Tintinger and J. Cole, Atlin. Operations commenced during January with two men employed. The work consisted of drifting underground up-stream to the extent of 1,100 feet. Timbering was good, ventilation fair, care of explosives satisfactory, and provisions for first-aid material in order.

Croker Lease.—Owned by I. Matthews, Atlin. This is an underground placer entered by a shaft 58 feet deep. Operations recommenced during May, three men being employed. The hoisting of material is accomplished by means of a water-wheel geared to the hoisting-drum, by which means ½-ton loads are raised. During my inspection ladders and platforms in the shaft were found in order, timbering good, powder properly stored, and first-aid material kept on hand. In general, conditions were found to be in fairly good order.

Storm King and Dorothy Lease.—Owned by M. McKern, Bratt, and Koppacker, Atlin. The *Storm* lease workings are entered by a shaft 52 feet deep, with tunnels to the face of the workings, a distance of 400 feet. The owners expect to tap the workings of the *Dorothy* mine, about 20 feet from the face of these workings; this will make two openings to the operation and will greatly improve the ventilation. During my last visit the shaft and mine workings were found to be well timbered and the operation generally in good condition. Three men were employed during operation.

Clysdale Lease.—Owned by D. Buchanan, Atlin. This is a new undertaking and two men were employed at the time of my visit. Work commenced in March and consisted of making ready sluice-boxes. The sinking of a shaft 90 feet deep was the next undertaking, the owners informed me.

Second Clysdale Lease.—Owned by A. Beaton and McPherson, Atlin. This is the original *Clysdale* lease and at present is operated by J. McPherson. Operations were continuous throughout the year. The workings are entered by a well-timbered shaft 80 feet deep and a manway with ladder and platforms is constructed. During my last visit general conditions in the mine were found to be satisfactory.

McKee Creek Section.

McKee Creek.—Operated by the Delta Gold Mining Company, Limited; G. W. Adams, superintendent, Atlin. At this placer two monitors are in operation, employing four men. The camp is both adequate and sanitary, powder is properly stored, provisions for first aid satisfactory, and conditions in general were found to be good.

Taku River Section.

Manville.—Under option to the Alaska Juneau Gold Mining Company, Juneau, Alaska; L. H. Metzgar, general superintendent; J. A. Williams, assistant superintendent; P. R. Bradley, consulting engineer; P. Ringdal, mine foreman. This property is located some 60 miles from Juneau, Alaska. Operations were continuous from January to August, when the above company relinquished its option. During that time twenty men were employed in driving a tunnel 1,500 feet in length. Two portable compressors of the Ingersoll-Rand type furnished the power for operation.

Mrs. W. Strong was in charge of the first-aid work, being a registered nurse, and in addition a first-aid man was also kept at the property. During my visit of inspection the mine was found to be well timbered and the ventilation fair; this was aided by a blower-fan. The camp accommodation was adequate and sanitary and transportation between the mine and the city of Juneau was fully maintained. In general, all other matters were found to be in good order.

My work of inspection in this area was much facilitated by the courtesy of this company in making suitable transportation arrangements to permit me visiting other mining prospects. I am also indebted to them for permission to visit their main operation at Juneau while returning to Prince Rupert.

United Eastern.—This mine is 8 miles in a northerly direction from the *Manville* mine. During the fall of 1929 this property did some 2,200 feet of development-work in tunnelling and crosscutting, employing about forty men. At the time of my visit the mine was idle; the machinery had been collected together and placed under cover. The mine has remained idle since.

River Group.—Under option to the Juneau Gold Mining Company, Alaska; R. Boyd, superintendent. Operations at this mine consisted of stripping and general exploration-work, with four men employed. Tents were in use to house the men. During my visit general conditions were found to be in good order.

Walker Group.—This property is a part of the holdings of the Juneau Gold Mining Company. Four men were employed in general prospecting and development work. During my inspection general conditions were found to be in good order.

SKEENA MINING DIVISION.

Coast Section.

Surf Point.—Owned and operated by Timmins & Woodworth; J. S. Woodworth, manager; M. Shaughnessy, mine superintendent; T. Riley, mine foreman. This property is situated on Porcher island, 25 miles south of Prince Rupert. Operations were continuous throughout the year with an average employment of twenty men. During the year a railway was built to connect the mine with tide-water, a distance of approximately 1 mile. Two shipments of ore, totalling 155 tons, have been made during the year by scow and tug to Granby smelter at Anyox. It is further contemplated to build a mill so that shipments may be made in concentrate instead of dry ore. Camp accommodation at this time has been ample, yet of a poor type, but now that the mine is coming into permanent operation, improvements in these matters are anticipated. In general, all conditions were found to be in reasonable compliance with the "Metalliferous Mines Regulation Act."

I.X.L.—This property joins the *Surf Point* mine and, except for assessment-work, has been idle throughout the year.

Douglas Channel Section.

Los Angeles-Vancouver.—Owned by the Los Angeles-Vancouver Mining Company, Limited; J. Broatch, manager; F. Rannells, superintendent; A. Chisholm, mine foreman. This mine worked continuously with an average of twenty men until the end of September, when a breakage of some parts of the compressor took place, causing operations to cease. During the time it operated a considerable amount of work was done. During my inspections conditions in general were found to be within reasonable compliance with the "Metalliferous Mines Regulation Act."

Khutze Inlet Section.

Khutze Inlet.—Owned by the Detroit Western Mining Company, Limited; W. B. Smith, manager; S. Bryant, mine superintendent. No work was done on this property during the year.

NASS RIVER MINING DIVISION.

Anyox Section.

Hidden Creek.—Owned by the Granby Consolidated Mining, Smelting, and Power Company; C. Bocking, president and general manager; W. R. Lindsay, general superintendent; G. Maxwell, assistant superintendent; A. Donaldson, mine foreman; F. S. Nicholas, mine superintendent. Operations have been continuous throughout the year, the actual time worked being 280 days. Owing to the serious slump in the copper market the company decided to curtail the operation somewhat. For this reason the time of operation has not been full time as usually worked. Tonnage of ore from *Hidden Creek* mine was 1,424,594 tons.

Powder used for the period of operation was 44,271 cases; this is made up of 35, 40, 50, 55, and 60 per cent. Detonators used are Nos. 6 and 8. Total caps used for No. 6 was 255,700 and for No. 8 was 8,143,700. Number of electric caps used was 22,275. No straight Giant powder is allowed in the mine since the order of the Chief Inspector of Mines to the Inspectors prohibiting its use as a menace to the safety and health of the miner.

The officials of the company have used much effort to induce all underground employees to use the "hard-boiled hat" as a protection against injuries to the head; many of the men now wear this safety precaution. A stench warning for fires within the mine has been installed during the year; this is made to operate through the air-lines, so that in any emergency this stench arrangement will immediately warn the men to escape to the surface. All mine officials are trained in mine-rescue work and the use of oxygen apparatus and Burrell all-service gas-masks. Training is given twice a month by S. Murray, mine-safety inspector. He makes regular examinations regarding the general safety measures and devices and reports thereon twice a month to the management.

Each level of the *Hidden Creek* mine is provided with three self-rescue apparatus.

A new water-line has been installed at 150 and 130 stations in the main shaft. At the points mentioned a ring of perforated pipes encircle the shaft, so that when the water is turned on the shaft is immediately drenched. This constitutes an efficient safeguard against fire in the shaft.

The main shaft has reached a depth of 1,365 feet, a distance of 800 feet below sea-level, or zero. Levels 530 and 800 below zero are being developed, and arrangements for manways and a second means of exit to the surface are being made by the management to comply with the "Metalliferous Mines Regulation Act."

One fatal and one serious accident only were reported during the year in the *Hidden Creek* mine, and this was due to the hoistman losing control of the engine. The management is much interested in the prevention of accidents and is quick to respond to suggestions made in this direction.

During my inspections at various times throughout the year I have always found general conditions to be in compliance with the "Metalliferous Mines Regulation Act."

Bonanza.—Owned by the Granby Consolidated Mining, Smelting, and Power Company, Limited; W. R. Lindsay, general superintendent; G. Maxwell, assistant superintendent; E. M. Merrill, superintendent. This mine is made up of two separate underground operations, one by an inclined shaft and the second entered by a tunnel; fifty-three men are employed in the total operation. With the exception of some time being lost when a disastrous mud-slide killed six men and destroyed the bunk-house, this operation worked continuously throughout the year.

There was one fatal accident during the year in the mine-workings; this was caused when two men rode a skip up the mine-shaft, which is against the law. One man was killed and the other prosecuted.

The output for the year was 88,317 tons.

In connection with the operation of the Granby mines it appears that many non-English-speaking men are employed, and I am of the opinion that, notwithstanding the endeavour of the management to instruct these men in the English language, there is in this fact a reason for many of the accidents suffered. During my inspections conditions in general were found to be satisfactory.

Granby Point.—Owned by the Granby Consolidated Mining, Smelting, and Power Company, Limited; W. R. Lindsay, general superintendent; G. Maxwell, assistant superintendent; J. D. Ferguson, mine superintendent. This mine operated continuously from the beginning of the year until February, when it closed down temporarily. This mine shipped to smelter 665 tons of ore during the period of operation and had an average employment of eight men a day. No work has been resumed since. During my inspection general conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

Hastings Arm Section.

Saddle.—Owned by the Silver Crest Mining Company, Limited; P. E. Peterson, consulting engineer; A. Knox, mine superintendent; E. Olson, mine foreman. This mine is located near the headwaters of Hastings arm. Development-work was continuous from January until the commencement of April, when the mine closed; nothing has been done since. Four men were employed driving a tunnel some 375 feet during the above period.

Alice Arm Section.

Tidewater.—Owned by Dalhousie Mining Company, Limited; A. McLeod, mine superintendent. This mine is located at tide-water on the way from Anyox to Alice Arm. Operations began in the fall and continued to the end of the year with an average employment of nine men. No ore has been shipped. At the time of my last visit of inspection the camp was adequate and sanitary, the mine well timbered, first-aid material provided, and in general conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

Esperanza.—Owned by the Esperanza Mines, Limited; A. E. Mortimer, secretary, Prince Rupert; J. Hinton, president. This mine did not operate during the year.

Toric.—Owned by the Torbrit Mining Company, Limited; J. Sleeman, mine superintendent; B. G. Brock, engineer. This mine operated during the first quarter of the year with an average employment of twenty-three men a day, and then suspended operations.

PORTLAND CANAL MINING DIVISION.

Salmon River Section.

Woodbine.—Owned by the Woodbine Gold Mining Company, Limited; H. McGuire, managing director, Vancouver; G. D. Leyson, mine superintendent. Operations were suspended in the early part of January and resumed again in September with an average employment of thirteen men. After a short period of operation in September the mine again ceased work owing to a break-down of the compressor, and from this date to the end of the year work was not resumed. Only a watchman is kept on the premises. During my inspections operating conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

Silver Bar.—Owned by the Outland Silver Bar Mining Company, Limited; F. C. Outland, acting manager; C. L. Hibbard, superintendent. This mine did not operate during the current year.

Silver Crest.—Owned by the Silver Crest Mining Company, Limited; J. V. Clegg, mine superintendent. This mine did not operate during the current year.

Big Missouri.—Operated by the Buena Vista Mining Company, Limited; A. W. Aitchison, superintendent; T. Thomas, mine foreman. Work was continued throughout the year with an average employment of twenty-five men in the first half of the year and fifty men in the second half. During the latter part of the year the construction of a mill, buildings, mess-house, and bunk-house was completed. The capacity of the mill is 100 tons. It is intended to stock the concentrates throughout the winter.

The power plant has been increased by the installation of a Westinghouse generator set, driven by a 360-horse-power Fairbanks-Morse marine Diesel engine and two compressors; one Sullivan straight-line 12- by 10-inch and one Ingersoll-Rand straight-line 12- by 12-inch, both driven by a 60-horse-power Fairbanks-Morse engine. Snow-shedding to cover the tracks from the portal of the mine to the mill-bins has been constructed over a distance of 700 feet. The amount of work accomplished by the management of the *Big Missouri* mine in the short period of some three months and a half is creditable. As soon as possible a second opening to the workings will be accomplished to assist the ventilation. Three fans are employed and the results have been found so far to be fair in effecting reasonable ventilation within the mine; however, I am urging upon the management to have a second opening made at the earliest possible date. In all my inspections I found the requirements of the "Metalliferous Mines Regulation Act" fully observed.

Unicorn.—Owned by the Unicorn Mines, Limited; J. Hovland, managing director. This mine is within a mile of the *Big Missouri* mine in a northerly direction. Work was carried on from January to the end of February, when the operations were suspended. Work was recommenced in June with an average employment of two men and continued until the end of November, when the mine closed for the winter season. During my inspection I found bunkhouse accommodation adequate and sanitary and the operation in compliance with the "Metalliferous Mines Regulation Act."

Bush.—Owned by the Bush Consolidated Mines, Limited; O. Bush, managing director; W. Irvine, mine superintendent. This mine was not operated during the year.

Sebakwe.—Owned by the Sebakwe and District Mines, Limited; B. Banks, managing director; D. Rae, mine superintendent. Twelve men were employed at this mine during January, when operations were suspended for the year. The operation was carried on in fair compliance with the "Metalliferous Mines Regulation Act."

B.C. Silver.—Owned and operated by the B.C. Silver Mines, Limited; C. Banks, managing director; D. Rae, mine superintendent. General development-work has been carried throughout the year with an average employment of twenty men. No ore was shipped during the year. During my various inspections I found the operation conducted in compliance with the "Metalliferous Mines Regulation Act."

Premier.—Owned by the Premier Gold Mining Company, Limited; D. L. Pitt, general manager; B. Smith, assistant manager; H. McDonald, mine superintendent; C. Chapman, mine foreman. Operations were continuous throughout the year with an average employment of 260 men. During the year this operation used 7,389 cases of explosives and 860,000 feet of fuse.

I am pleased to note that there has been no serious accident within the mine during the year. I regret, however, an accident occurred due to the slipping of a grip on a bucket on the aerial tram-line, which caused serious injuries to two repairmen who were on the aerial. Steps were taken to prevent a recurrence of this nature.

The camp accommodation is adequate and sanitary, the water good, and hospital service provided. The timbering and ventilation of the mine were in good order and the storage of powder properly cared for. In all my inspections of this operation I have found conditions to be in compliance with the "Metalliferous Mines Regulation Act."

Northern Light.—Owned and operated by the Northern Light Mining Company, Limited; G. Bancroft, managing director; A. McKenzie, mine superintendent. Diamond-drilling operations commenced during the latter part of January with an average employment of seven men; this continued for one month, when work was suspended. I found all matters to conform with the requirements of the "Metalliferous Mines Regulation Act."

Bear River Section.

Independence.—Owned by the Independence Gold Mining Company, Limited; S. Fitzgerald, general manager, Stewart. This property did not operate during the year.

Dalhousie.—Owned and operated by the Dalhousie Mining Company, Limited; G. Cameron, superintendent, Stewart. This property did not operate during the year.

A. & T.—Owned by Armour & Tooth, of Stewart. The option on this property by the Consolidated Mining and Smelting Company was dropped at the end of 1929 and, with the exception of some assessment-work done by the owners, the mine has since been idle.

Mountain Boy.—Owned by the Mountain Boy Mining Company, Limited. The property has since been taken under bond during this year by Montreal interests. W. C. Tolan, acting-manager, Stewart; J. M. McDougall, superintendent. At the time of my last inspection there were twelve men employed; the mine closed for the winter at the end of September. I found camp accommodation adequate and sanitary, the timbering of the mine in fair condition, powder properly cared for, and first-aid material provided; the operation in general being within reasonable compliance with the "Metalliferous Mines Regulation Act."

Terminus.—Owned by the Heywood Mining and Development Company; H. A. Heywood, manager. This mine did not operate during the year.

Argenta.—Owned by Erickson & Forest, Stewart. This property is located on the eastern side of the Bear river. The mine was not operated during the year.

Red Top.—Owned by J. J. McNeil and J. Conners, Stewart. This property did not carry on any operations this year.

George Enterprise No. 1.—Owned by the George Enterprise Mining Company, Limited. This mine operated from June to August with four men employed. I found the conditions of camp accommodation adequate and sanitary, the mine furnished with necessary timber, ventilation fair, powder-storage safe, first-aid provisions made, and all other matters in reasonable compliance with the "Metalliferous Mines Regulation Act."

George Enterprise No. 2.—Owned by the George Enterprise Mining Company, Limited. There were six men employed at this mine from January to the middle of August, when the mine closed down for the winter.

George Copper.—Owned by the Consolidated Mining and Smelting Company. A small amount of diamond-drilling was done on this property during the year.

Ore Mountain.—Owned by J. Conway and associates, Prince Rupert. With the exception of some assessment-work done, employing two men, this mine was not operated during the year.

Mayou.—Owned and operated by the Mayou Mining Company, Limited; W. Tompkins, superintendent. Operations at this mine began during the month of June with an average employment of four men. I found the operation from a point of timbering, ventilation, storage of powder, first-aid materials, and camp accommodation in reasonable order and in compliance with the "Metalliferous Mines Regulation Act."

Dunwell.—Owned by the Dunwell Mines, Limited; R. Stewart, president. No work was done on this property during the year.

Emperor.—Owned by the Emperor Mines, Limited; C. Sieforth, manager. This property has not been operated during the year.

Ruth-Francis.—Owned by J. Nesbit and associates, of Stewart. A small amount of work was done during one month of operation.

The *Lakeview* and *L. & L.* mines did not operate during the year.

Albany.—Under option to the Albany Mining Company, Limited. This mine has remained idle throughout the year.

Black Hill.—Owned by the Black Hill Mining Company, Limited; J. Haight, superintendent, Stewart. A small amount of work was done and two men were employed during the month of January. The mine was idle for the remainder of the year.

Silverado.—Owned and operated by the Premier Gold Mining Company, Limited; J. G. Pearcey, superintendent. Operations were suspended in January and resumed in July with an average employment of fourteen men a day; this continued until the month of October, when the mine was closed. During my inspections I found conditions to be in compliance with the "Metalliferous Mines Regulation Act."

Mobile.—Owned by the Argentine Syndicate; C. Porter, manager; D. Murray, superintendent. Work commenced here in the month of June with an average employment of four men and ceased operations at the end of July. I found camp accommodation to be good and sanitary, the mine sufficiently timbered, ventilation fair, and all other matters in good order.

Marmot River Section.

Prosperity.—Owned by the Premier Gold Mining Company, Limited; D. L. Pitt, general manager; B. Smith, assistant manager; G. Anderson, mine superintendent. This property has operated throughout the year with an average employment of eighty-four men, and a considerable tonnage of ore has been shipped during that period. No serious accidents have occurred within

the mine, although the character of the ground is such that it requires extra care in timbering to ensure safety from falling rock. Under very difficult natural conditions, the operation is being handled efficiently. I found general conditions to comply favourably with the requirements of the "Metalliferous Mines Regulation Act."

Porter-Idaho.—Owned by the Premier Gold Mining Company; D. L. Pitt, general manager; B. Smith, assistant manager; Gus Anderson, superintendent. This mine has operated throughout the year; its proximity to the *Prosperity* mine makes it possible for both operations to be cared for by the same superintendent and his assistants. An average of twenty-four men was employed. The ore is transported 5 miles by aerial tram to tide-water. The timbering of the mine, ventilation, first-aid provisions, and proper storage of powder were in good order. Special ambulance cars for use on the aerial tram-line have been designed and are available for immediate use in case of any emergency. It takes about thirty minutes to travel over the tram-line from the mine to tide-water; this has proved to be the safest method of transportation in this area of heavy snowfall, with consequent snow-slides, which makes the use of ordinary trails hazardous in winter. In general, I found conditions to be in compliance with the "Metalliferous Mines Regulation Act."

GEORGIA RIVER SECTION.

Georgia River.—Owned and operated by the Georgia River Gold Mines, Limited; W. Beaton, manager, Vancouver; R. Boscence, mine foreman; F. B. Shearme, superintendent, Stewart. This property is 8 miles from tide-water and worked continuously from January to the end of September; in the middle of January one shift was laid off. The average number of men employed for the period worked was twenty men; no ore was shipped. The ventilation was good and has been further augmented by the completion of a raise between Nos. 2 and 3 tunnels. I had occasion to destroy a quantity of explosives which had been unduly exposed to frost and rain and had improvements made in the general storage of explosives. With the above exceptions, I found general conditions to be in compliance with the provisions of the "Metalliferous Mines Regulation Act."

OMINECA MINING DIVISION.

USK SECTION.

Valhalla and Kleanza.—Operated by the Columario Gold Mines, Limited; J. Willman, superintendent, Usk; J. Bell, mine foreman. Operations for the year began in April and ended in November, with twelve men employed during this period. In my different inspections I found camp accommodation adequate and sanitary, first-aid provisions made, timbering satisfactory, and provisions for ventilation adequate.

Diadem.—Owned by B. Shannon, of Usk, and under option to the American Copper Mining Company; R. E. Doan, managing director; E. J. Eide, superintendent. The mine was operated from May to November, with an average of twelve men being employed. Camp accommodation was ample and sanitary, timbering and ventilation were in good condition, and the general requirements of the "Metalliferous Mines Regulation Act" fully observed.

Mitts.—Owned by E. Mitts, Usk, and under option to the American Copper Mining Company; R. E. Doan, managing director; E. Mitts, superintendent. Operations began in June, employing four men. Camp accommodation is ample, and all other conditions of ventilation, timbering, care of powder, and first-aid provisions complied with the "Metalliferous Mines Regulation Act." Operations ceased for the winter early in the month of November.

Cordillero.—Owned by J. Darby and associates, of Usk, under option to the Cordillero Mining Company; L. H. McQuire, manager; J. Darby, mine foreman. Development-work began here in August with an employment of four men. A raise is being driven to connect the lower level with No. 1 level for the purpose of improving the ventilation. Work was discontinued in the early part of November. During my inspection all matters were found to be within reasonable compliance of the "Metalliferous Mines Regulation Act."

HAZELTON SECTION.

Rocher Deboule.—Owned by the Hazelton Mining Company; D. Harris, manager, New Hazelton. Operations began during the month of February with an average employment of eight men. Recovery of ore in pillars left by the original company was at the time of my visit

being undertaken, but owing to the reduction in the price of copper no shipments were made and the operation shut down in August. I found that the requirements of the "Metalliferous Mines Regulation Act" were fully complied with.

The *M. & M., W.D., Silver Cup,* and the *Mohawk* mines did not operate during the year.

SMITHERS SECTION.

Duthie.—Owned by the Atlas Mining Company, Limited; C. Banks, managing director; A. G. Hattie, superintendent. Operations were continuous during the first quarter of the year with an average employment of eighty men, after which time the mine closed temporarily owing to the fall in the price of silver and other metals. During my different inspections I found the method of operation pursued to be in strict compliance with the "Metalliferous Mines Regulation Act."

BABINE SECTION.

Babine Bonanza.—Under option to the Babine Bonanza Metals, Limited; G. Mahood, manager; C. Chapman, superintendent; G. McBean, mine foreman. Operations were continuous on a small scale during the year, excepting for a shut-down during November. There is a quantity of ore mined ready for shipment, but no ore was shipped during operations. During the year the company installed a tool-sharpener and a compressor of 2-drill capacity. The road to the mine is very poor during the summer months and is best during the winter as a rule; however, owing to unusual weather this year the road has been difficult to travel. During my inspection of the operation I found camp conditions ample and sanitary, mine-workings in safe condition, reasonably ventilated, first-aid material provided, powder-magazine safe, and other conditions of work in compliance with the "Metalliferous Mines Regulation Act."

TOPLEY SECTION.

Topley-Richfield.—This operation closed down near the end of 1929 and since that time the plant and equipment have been partly taken away.

Golden Eagle.—Ceased operation during the year 1929 and the property has reverted to the original owners, Heenan & Matheson, of Topley.

HOUSTON SECTION.

Owen Lake.—Name of the company is Owen Lake Mining and Development Company, Limited; L. Foss, superintendent; D. Dean, mine foreman; C. Cox, mining engineer, Houston. This property is situated 32 miles in a southerly direction from Houston and has a fair road leading to the mine. It was closed in April. The average number of men employed during the time of operation was twelve. No ore was shipped. During my inspections I found operating conditions to be satisfactory and in compliance with the "Metalliferous Mines Regulation Act."

BURNS LAKE SECTION.

The *Taltapin* mine, owned by the Taltapin Mining Company, Limited, and the Silver Island Mining Company, Limited, some 27 miles in a north-easterly direction from Burns Lake, located in the vicinity of the Babine lake, did not operate this year.

SIBOLA SECTION.

Emerald.—Operated by the Consolidated Mining and Smelting Company, Limited; H. R. Hughes, superintendent; J. Cehovin, mine foreman. Operations were continuous throughout the year with an average employment of twenty-five men. In previous reports of the property the location has been given, also some detail as to the form of transportation, which is chiefly over lakes and a long river. This year the road to the mine has been regraded and the transportation of material thus facilitated. The company provided two caterpillar tractors to haul the material to the mine from Ootsa river. Diamond-drilling was carried on at the end of the year. During my last inspection a substantial camp was under construction, first-aid provisions were satisfactory, a first-aid man being provided and a form of transportation for the injured arranged. Conditions in general were found to be in compliance with the "Metalliferous Mines Regulation Act."

Tahtsa Lake.—Owned by the Tahtsa Mining Company, Limited; C. H. Copp, manager. This mine is situated 3 miles in south-easterly direction from the *Emerald* mine. Operations were continuous from January until April with an average employment of six men. During my last visit of inspection a new accommodative camp was built, provisions for first aid made, powder properly cared for, and work in general was under competent hands. All other conditions were found to be in compliance with the "Metalliferous Mines Regulation Act."

SOUTHERN COAST INSPECTION DISTRICT.

REPORT BY JAMES 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; C. V. Brennan, assistant general manager; Ed. Emmons, mines 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 operation 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 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. The total number of shifts worked at the mine during the year was 304,009. The average daily number on the pay-roll was 832. The production per working-day for the mines was 7,100 tons, and per calendar day 6,100 tons, amounting to a yearly output of 2,215,600 tons. The ore broken during the year amounted to 1,820,143 tons.

Development-work during the year consisted of: Drifts, 6,928 feet; crosscuts, 3,845 feet; raises, 10,640 feet; winzes (including No. 4 shaft), 111 feet, making a total footage of 22,849 feet, or 4.32 miles.

The main transportation in this operation is on the 2,700-foot level, 11,222 feet long; near the portal of this level and in the Armour tunnel 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 main living camp is situated near the 2,200-foot tunnel.

Each shift the underground workmen are taken to and brought from the main shaft, situated on the 2,200-foot level, and about a mile away from above level portal, by means of a man-trip. The *Victoria* mine shaft is situated on the same level, but another mile inby the *Fairview* main shaft.

Electric power generated near the tunnel is used to operate all main hoisting-engines as well as some of the smaller type of winches. The open-wire trolley system is used for motor-haulage, there being quite a number of motors employed. Line voltage varies from 250 to 550 volts. Compressed air also is utilized extensively throughout the mines, being used for all forms of drilling holes as well as for operating some of the smaller winches.

The air-compressors are housed in the same building as the electrical-power apparatus. A 12-inch diameter pipe air-line laid in the 2,200-foot level tunnel conveys the air from the compressors to the *Fairview* shaft. From this point pipes of various-sized diameters are utilized to carry the air where the workmen require it.

All the bunk-houses, with the exception of the new unit completed last year, are in operation and filled to capacity. The present state of the copper trade has been responsible for the management having to operate with many less employees. It then became very obvious that the occupation of the new bunk-house was unnecessary. The condition of bunk-houses are quite satisfactory. Fire-escape equipment stills maintains a good standard.

The idea of advancing and promoting the growth of first aid reached a high stage of development this year, so has the idea of accident-prevention.

The second annual indoor first-aid meet was held in the gymnasium, Tunnel camp, on the evening of April 9th. For this event eighteen teams had competed in preliminary and semi-final competitions, leaving six teams for the finals, three in the open and three in the novice competition. The Britannia Mines cup, donated by the company for the best novice team, was won by the Tunnel surface team. This meet was extremely well attended. An exhibit table at one end of the hall displayed several of the safety devices in use in and about the mines. Prizes were donated by the Vancouver Island and Coast District Branch of the British Columbia Mine Safety and First Aid Association. All teams consisted of five men.

In June three five-man first-aid teams competed in Vancouver in a contest staged by the Vancouver Centre of the St. John Ambulance Association. While Britannia teams did not win a prize, it is believed that they conducted themselves with credit. This excursion did much to stimulate interest in first aid.

On December 15th a class competition in first aid was held in the Tunnel camp, all sections of the mine sending teams. Four teams of ladies competed at this event. This is the first time that ladies have entered a first-aid competition at Britannia. In the men's event the team representing the Incline camp won first prize. The Vancouver Island and Coast District Branch of the British Columbia Mine Safety and First Aid Association donated first prize for ladies and first prize for men, and the local branch of the St. John Ambulance Association provided the other prizes.

Victoria mine established a new accident record during the year by working 15,600 shifts without a lost-time accident. On March 29th the company financed a smoker held at *Victoria* camp to commemorate this record. A special feature of the evening was the first-aid contest, in which six five-men teams competed. Each of the five shiftbosses and the surface foreman entered a team.

This record was later broken by the *Barbara-Empress* section, where 18,391 shifts were worked without a lost-time accident. The company showed its recognition by presenting two radio receiving sets, one being placed in the *Barbara* club-room and the other in the *Empress* club-room. The radios were fitted with a suitably engraved plate.

Safety meetings are held at two-week intervals in each section of the mines and for each of the surface departments. In addition to turning in safety inspection reports and making suggestions to promote safety and welfare, all accidents and near accidents which have occurred in the two-week period preceding the meeting are dealt with.

Safety-committee men classify the accident as to cause and make suggestions to prevent similar accidents. An effort is made to definitely place the responsibility for the accident.

For recreation there is a gymnasium, a reading-room, library, tennis-courts, and swimming-pool. The company also maintained 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 sent for treatment to the Vancouver General Hospital.

During the visits of inspection 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 hoist-rope, together with its exact location. The fencing-off of bulldoze chambers was fairly well adhered to. The rules governing the use of safety-ropes in these chambers was well attended to.

Generally speaking, the provisions of the "Metalliferous Mines Regulation Act" were fairly well adhered to during the year.

I regret to report two fatal accidents occurred during the year in these mines—Peter McLaughlin, miner, killed on March 7th, and Victor Ostergood, miner, killed on May 10th, 1930. Particulars to be found in Chief Inspector's report.

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 work done at the Straiton mine during the year has been the extraction of available pillars. It is estimated this mine will be exhausted early in January and permanently closed. There are three small mines at Kilgard—No. 4, No. 5 B North, and Kilgard Fireclay. The Kilgard Fireclay mine was opened this year, a storage-battery locomotive hauling the material from the working-faces to the Kilgard factory. At the top of the hill above the fireclay-deposits the company operates a quarry for the production of shale. The new factory at Kilgard is now practically completed and preparations are being made to move the plant from Clayburn. The mines have worked steadily until the latter part of the year, when the general trade depression affected the output.

The total tonnage of all clays mined underground for the year ended December, 1930, was 32,812 tons, and from open-work, 2,941 tons.

The total number of men employed underground averaged twenty-five. The mines are well timbered and ventilation is good. No serious accident occurred at any of these mines.

NEW WESTMINSTER MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Pitt Lake Mining Co.—Head office, Vancouver. The holdings of this company are situated on the east side of Pitt lake, about 15 miles from Coquitlam. The equipment consists of a small hydro-electric power plant. The water is being supplied from a lake at an elevation of 1,500 feet above the main tunnel and conveyed by flume and wooden pipes to a Pelton wheel at a 600-foot head and directly connected to a generator developing 300 horse-power. A 600-foot compressor and a very complete machine-shop is built near the tunnel. The company is proceeding with the erection of a mill, the mill buildings being almost complete and most of the machinery already on the ground preparatory to erection. Very little work has been done underground this year, with the exception of some further prospecting, as present market prices of copper do not warrant it.

NANAIMO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

PHILLIPS ARM SECTION.

Alexandria Mining Co.—T. S. Davey, mining engineer in charge. This company's property is situated on Phillips arm. Four tunnels have been driven, but only the lower one, just a little above sea-level, is operating. A shaft is sunk from this lower tunnel and is at present down a little over 100 feet, with one level broken away at the 100-foot mark. This year a new 125-horse-power Crossley engine and 150-foot Sullivan compressor were installed. During the latter part of the year development-work was stopped and only two men kept for working the pump, but it is the intention of the company to resume sinking operations early in January. General conditions were found to be satisfactory and the regulations of the "Metalliferous Mines Regulation Act" well adhered to.

Colossus Copper Company, Ltd., Frederick arm, and Caledonia Mines, Limited, Hardy Bay section, have not operated during the year, and Romana Copper Company, Powell lake, did not operate the last six months of the year.

QUATSINO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Coast Copper Co., Ltd.—This company operates the *Old Sport* mine; C. A. Seaton, superintendent. This mine is situated on the south-west shore of Elk lake, in the Quatsino Mining Division.

Some development-work was done on 800-foot North level; on the 1,000-foot South, 1,400-foot South, and 1,600-foot North and South levels, the winze being sunk to just below the 1,600-foot

level. Development footage for the year being 4,543.5 feet; crosscutting, 1,203.5 feet; sinking, 192 feet; and raising, 25 feet; also 2,470 feet of diamond-drilling.

No change took place in surface equipment, but a new recreation-hall was built by the company, thus providing their employees with a reading-room, billiard-room, and a splendid hall suitable for dancing, badminton, etc.

No serious accident occurred at this mine throughout the year. Ventilation was good and the provisions of the "Metalliferous Mines Regulation Act" were strictly adhered to.

June mine, situated near Alice lake and operated by the Consolidated Mining and Smelting Company, was closed down in the latter part of the year. At the time of operation only exploratory work was done, about eleven men being steadily employed. The exploratory work done consisted of 640 feet of drifting and 516 feet of crosscutting.

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, 1930.

Copper Mountain.—R. L. Healey, general superintendent; B. 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. The mine is situated about 14 miles south of Princeton. Including the mill at Allenby, this operation provides employment for fully 500 men and continued to follow an aggressive programme of development during the greater part of the year

The low price of copper caused some curtailment of production in the second half of 1930 and resulted in the suspension of mining in November and December. The method of mining and the nature of the deposit have been described in an exhaustive manner by different officials of the mine and various mining publications; also by the Resident Engineer for the district in previous Annual Reports.

However, I may state that the mine has been developed by six levels, three of which have been driven from the surface and are known as the Nos. 1, 2, and 6 levels, situated at an elevation of 4,073, 3,945, and 3,170 feet respectively. The No. 6 level is the lowest and constitutes the main haulage-level, extending a distance of some 3,000 feet from the portal, and is connected to the surface above by a vertical shaft 900 feet in depth. The intermediate levels, Nos. 3, 4, and 5, are driven from this shaft. To date a large percentage of the ore from this mine has been taken from glory-holes situated near the apex of the mountain. These are connected to the No. 2 level by means of chutes, where the ore is loaded into cars having a capacity of 7 tons and transported by electric-trolley motor-haulage to a spiral ore-chute situated near the shaft. From there the ore is automatically dumped and passes down to the No. 6 level, where it is again loaded into cars and taken out by means of electric motor-haulage to the ore-bins. The coarse-crushing plant is situated near the portal of the No. 6 tunnel.

During the present year the large 3-compartment shaft, situated some 400 feet south-east of the present working-shaft, has been completed to a depth of 600 feet below the No. 6 level. From the different stations in this shaft a considerable amount of lateral work has been accomplished. A large electric hoist has been installed on the No. 5 level and is used for operating a 3-ton automatic-dump skip in this shaft. The ore is discharged into a large pocket between Nos. 5 and 6 levels.

The haulage-roads of this mine are of ample area for the use of the electric-trolley motor system of haulage that is in use throughout, and where more than one motor is in use the block system of signals is applied. I found the chute platforms to be well protected and all dangerous openings throughout the mine fenced off. Blasting in the stopes and levels of the mine is done at specified times, while the stope walls and roofs are in all cases well barred down, after each round of shots have been fired, by experienced men appointed for this purpose.

The camp buildings, offices, machine-shops, blacksmith-shops, steel-sharpening shops, and compressor plant, situated on the same elevation as the No. 2 tunnel, are all modern and well

equipped. A very energetic safety-first committee was organized during the year and met from time to time for the discussion of any matter pertaining to the safety of the operations. A safety-first engineer was also appointed and given every facility for the inspection of the mine. Any suggestions in matters of varying importance in regard to the safety of the operations received immediate attention from the officials in charge.

A well-appointed first-aid room is provided and an efficient first-aid man is in constant attendance. During the year many of the employees attended first-aid classes under the instruction of Dr. Manson and Alfred Gould.

The camp buildings, an excellently managed cook-house with a large seating capacity, and the large bunk-houses, well attended to and provided with steam heat from a central heating plant, all contribute to the comfort of the employees.

I regret to report that there have been six fatal accidents at this mine during the present year, resulting in the same number of fatalities, the causes of which will be found in another section of this report.

Nickel Plate.—Operated by the Hedley Gold Mining Company, Limited; G. P. Jones, general superintendent; W. B. Knowles, mine superintendent. This mine is situated on the Nickel Plate mountain at an elevation of some 5,600 feet and 3,800 feet above the town of Hedley, where the mill and the power plant is located. The ore is transported in 5-ton skips down the side of the mountain by a surface gravity-plane 10,000 feet in length. This plane is operated in two sections controlled by friction-brakes and compressed-air engines.

The mine is situated about 2 miles east of the top terminal of the incline. Transportation is provided for by a light electric railway operated by trolley motors, which enter an adit-drift driven into the side of the mountain to the top of the Dickson slope. This is an 8- by 16-foot 20° slope driven to the 1,500-foot level, with crosscuts driven off from both sides into the ore-bodies, which are found to be lying in large lenticular bodies at a low angle of inclination. The values are associated with the arsenical iron in the andesites, which are of a very hard nature, and as a result very little timber is used in this operation.

The method of work adopted is underhand stoping or working from the upper section of the ore-body towards the floor. The roof is well barred down in the early stages of the mining before the lower part of the ore-body is removed. The ore is loaded into small cars at the foot of the various chutes, trammed by hand to the ore-pockets situated immediately above the slope, and from there it is drawn off into 2-ton skips, then hoisted by a double-drum compressed-air-driven hoist to the top of the slope.

A 2,000-horse-power hydro-electric power plant, situated on the right bank of the Similkameen river, 2 miles below the town of Hedley, provides the chief source of power for this operation, but unfortunately during the dry season the flow of water in the river is not sufficient for power purposes, and as a result a 375-kw. auxiliary steam-driven plant, situated near the mill, is brought into commission and is used for several weeks each year. When the river freezes the operation is generally suspended; this usually occurs in November.

During the present year a vigorous policy of diamond-drilling has been followed in the lower sections of the mine for the purpose of determining the extent of the present ore-bodies and the exploration of further bodies that may exist in this section of the mine.

Sixty per cent. Polar Forcite is used for blasting and all shots in the stopes and levels are fired immediately before the afternoon shift leaves the mine.

During my inspections I found the provisions of the "Metalliferous Mines Regulation Act" well adhered to. About seventy-five men are employed underground and twenty-five on the surface.

Pioneer.—David Sloan, general superintendent; Robert Sloan, mine superintendent. This mine is situated in the Bridge River district, 50 miles north-west of the nearest point on the Pacific Great Eastern Railway, and is accessible by a good wagon-road which passes over Mission mountain from Seton lake and descends on the opposite side to Bridge river, which it follows for some 30 miles to Cadwallader creek, on which the property is situated at an elevation of 4,000 feet. This mine has been the scene of active development, both on the surface and underground, during the present year and may be at present included among the most important gold-mining properties in this Province.

Among the most important developments at this mine during the year has been the sinking of the operating vertical shaft from the 500- to the 1,000-foot level, with four levels driven in the vein on each side of the shaft below the 500-foot level. A raise is at present being driven from below to the 500-foot level which will greatly facilitate the ventilation and further provide a manway or a second opening from below to the surface.

The shaft is 7 by 8 feet and has two compartments, in one of which is operated a steel cage provided with safety-catches, while the opposite side of the shaft is provided with a balance; power is provided by a 10- by 12-inch second-motion Ingersoll-Rand compressed-air hoist.

One of the greatest assets of the *Pioneer* mine is the large amount of power available from the Cadwallader creek, which flows in close proximity to the mine. This power is at present utilized by a 6,000-foot length of 3-foot wood-stave pipe laid along the side of the mountain and produces at the mine a head of 260 feet. This is applied to the driving of four Tuttall water-wheels situated in the mill and connected to the mill machinery by belt-drive, while a 72-inch Pelton wheel direct-connected to a 2-stage Ingersoll-Rand air-compressor, having a capacity of 1,700 cubic feet of free air a minute, provides power for the operation of the mining-machines, pumps, and the mine-hoist. To meet the increasing demand for power, present and future, a 1,000-kw. hydro-electric power plant is in the course of installation on the Hurley river, some 4 miles distant from the mines. A dam has been built in the river and 6,000 feet of 3-foot wood-stave pipe-line has been laid from the dam to the power plant. A high-tension power-line has been completed between the power plant and the mining operations. The above installation was nearing completion during my last inspection in November.

The camp accommodations are fairly well taken care of, consisting of several residences for the employees with families and a double-story bunk-house provided with spray-baths and change-room for the single men. A large double-story office building is located at this camp and provides accommodation for the office staff and officials of the mine.

During my last visit to this mine forty-eight men were employed in and around this mine, forty of whom were employed underground and eight on the surface. The general conditions of the mine were fairly good and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Lorne.—N. H. Atkinson, superintendent. This mine is situated on Cadwallader creek, about 3 miles south of the *Pioneer*. A considerable amount of lateral work has been done from an adit-level driven into the side of the mountain and the vein system has been followed for some considerable distance. Ample power is derived from the creek by means of 6,500 feet of 30-inch wood-stave pipe-line laid along the side of the mountain from the creek above.

There has been very little work done on this property since the early part of the year.

This is a very fine camp-site and living accommodations for the employees have been well attended to by the erection of several houses for families, a large double-story bunk-house for other employees, together with a large dining-hall and kitchen.

Planet.—E. Nelson, mine superintendent. This mine is situated in the Stump Lake district, 30 miles from the city of Merritt, and is in close proximity to the Nicola–Kamloops highway. Active developments have been continued during the whole of the year.

This mine has been developed by a 6- by 7-foot adit-level driven 750 feet, at which point the vein is intersected; this point being some 300 feet below the surface. A fair amount of lateral work has been done on the vein to the north and the south of the adit, while most of the mill-feed has been produced from the stopes formed between this level and the surface. A winze has been sunk near the face of the adit on the vein a distance of some 150 feet. This section of the ore is being developed by means of drifts driven on the vein below the main adit.

The mill continued to operate fairly successfully during the year and its future operation will to a great extent depend upon further developments of the mine to the dip. The concentrates are hauled by motor-trucks from the mine to the railway at Nicola, a distance of some 25 miles.

Camp accommodations were found to be fairly good, consisting of a number of small houses, a one-story bunk-house, and a large dining-hall and kitchen at the mine. During my last visit of inspection there were thirty men employed underground and eight on the surface. Also found working conditions in the mine to be satisfactory and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

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 in the Kootenay-Boundary District during the year 1930, as provided for in section 9 of the "Metalliferous Mines Regulation Act." The Kootenay-Boundary District includes the Ainsworth, Arrow Lakes, Fort Steele, Golden, Grand Forks, Greenwood, Lardeau, Nelson, Revelstoke, Slocan, Slocan City, Trail, Trout Lake, and the Windermere Mining Divisions.

The work of inspection is rather difficult owing to the scattered nature of the district and difficulties of access to many of the smaller mines and prospects. To provide for this, H. H. Johnstone, Inspector, with office in Rossland, carries out the work of inspection in the West Kootenay and Boundary districts, except for the mines situated in and around Kaslo and Sandon, these mines being inspected by H. E. Miard, Inspector of Mines and member of the Board of Examiners for Coal-mine Officials. Mr. Miard also takes in some of the mines in the East Kootenay district, while the writer supervises the whole district.

Our work of inspection could be greatly facilitated if those opening new mines, or reopening old mines, or in the event of closing down, would notify us. Under the blasting regulations, underground storages for explosives and magazines require to be approved in writing by the Inspector, and it would facilitate matters if the parties commencing or closing such operations were to give us notice. The sections relating to those using explosives, requiring to have either provisional or permanent blasters' certificates, is also all too often overlooked.

There has been a considerable falling-off in activity around many of the mines in every district, due to the low prices for the metals, many reducing their forces to a minimum, sufficient to keep them open; in other cases in small operations they have been closed for an indefinite period.

During the year fifty-six mines were visited and 180 inspections made. Many of the larger mines were inspected regularly every month; in some of the smaller operations inspections were less frequent, but the conditions prevailing at the mine generally determined the number of inspections.

In the larger mines the regulations are generally very well complied with; sometimes in the smaller operations we have occasion to call attention to some omissions, and we have found them very ready to comply with our wishes.

AINSWORTH DIVISION.

The number of mines working in this Division were the same as in the previous year—namely, eight, including one under the "Quarry Act" at Marblehead. The working was rather intermittent.

ARROW LAKES DIVISION.

There were no mines actively working in this Division during the year.

FORT STEELE DIVISION.

In this Division eight mines were in operation, six mining lead, zinc, and silver, and two on phosphate. Over 800 men were employed, the greater number of these being in the *Sullivan* mine at Kimberley. A considerable number of these were also employed in developing and prospecting for phosphate at the Crowsnest. The gypsum-quarry at Mayook closed down early in the year and has not resumed operations. No work was done at Moyie by the St. Eugene Extension Company.

GOLDEN DIVISION.

Two mines were in operation in this Division during the year, the *Giant* at Spillimacheen and the *Monarch* at Field. The work at the *Giant* was principally diamond-drilling and after this was completed the mine was closed down. The *Monarch* mine at Field worked continuously during the year, although at the latter end the concentrator was closed down and work confined to development. Both of these operations mine lead and zinc.

GRAND FORKS DIVISION.

Five mines were in operation in this Division during the year, three mining lead and zinc with silver values, one gold, and a quarry at Fife mining limestone. The *Rock Candy* was not in operation during the year, there being small demand for fluorspar.

GREENWOOD DIVISION.

Seven mines were in operation, practically all in the Beaverdell part of the Division, employing about sixty workmen. The low prices for lead, zinc, and silver caused the closing-down temporarily or reduction in the number of men working during the year.

NELSON DIVISION.

In this Division only thirteen mines were in operation, as compared with eighteen in the preceding year, employing about 150 workmen.

REVELSTOKE DIVISION.

Three mines were in operation in this Division, similar to last year, but with reduced forces, only thirty-six workmen being employed.

SLOCAN DIVISION.

This Division, producing principally lead, zinc, and silver, was very hard hit by the low prices for these metals, and the number of mines operating fell from twenty-four last year to twelve, and many of these with reduced forces.

TRAIL DIVISION.

Only five mines were in operation during the year, principally small gold prospects, employing about fourteen workmen, who were leasing.

ACCIDENTS.

Fourteen accidents were reported during the year, as provided for by section 19 of the "Metalliferous Mines Regulation Act"—one under subsection (*a*) and thirteen under subsection (*b*). All of these accidents were investigated, and where possible when an inquest was held this was attended.

One accident only occurred above ground, involving severe burns to a workman who was starting up a tractor in a shed. In some manner not explained the gasoline vapour caught fire. The other thirteen accidents all occurred underground, involving fifteen men, of whom eight were killed, either instantaneously or died from the result of the injuries. Ten of these occurred in the *Sullivan* mine at Kimberley, involving four deaths and six seriously injured.

In the *Monarch* mine at Field two men died as the result of gas-poisoning; the mine manager at the *Bell* mine was killed by a runaway car on the slope, and one man was killed in the *Union* mine near Grand Forks by a piece of rock falling down a chute, at the bottom of which he was loading drills to be hoisted.

In the non-fatal accidents we have rocks rolling off an uper bench accounting for three parties being injured; falling rocks accounts for two; falling off a ladder, one; and being struck by a crowbar while using it in a chute, one.

It seems very difficult to get away from accidents around mines, but both with regard to fatal and non-fatal accidents a little more care on the part of the workmen would go a long way towards reducing the number.

VENTILATION.

In the majority of cases ventilation in metalliferous mines is produced by natural means. The great objection to this method is its uncertainty; on hot days it flows one way and on cold days another. To rectify this many mines are installing positive ventilation, fans being used for this purpose.

A large fan has now been installed at the *Sullivan* mine at Kimberley and has given great satisfaction during the summer months; in winter so far it has not been required. With this

fan exhausting, the smoke and air is drawn out at the top of the mountain instead of hanging in the workings.

It is very satisfactory to have the operators in the metal-mines interest themselves in the question of better ventilation, and I consider it will amply repay all their trouble and expense by providing greater health and efficiency.

Samples of the mine-air have been taken during the year at several of the mines where conditions seemed to indicate that this was not just as good as it should be. In every case the results showed well above 20 per cent. of oxygen and no excessive amount of either dangerous or deleterious gas present.

WELFARE-WORK.

I regret to report that very little interest has been taken either in first aid to the injured, mine-rescue work, or even safety first, except at the *Sullivan* mine at Kimberley.

At the *Sullivan* mine a safety engineer is maintained in charge of this work, with very gratifying results. Large classes have been held in first aid, and practically 95 per cent. of the workmen are trained. In mine-rescue two teams have been trained in the used of self-contained breathing apparatus and a rescue-station second to none in the Province is maintained convenient to the mine. These men are also trained in the use of the all-service mask, as well as the McCaa rescue-machines, and I feel sure will be a great asset in the case of any emergency arising. A constant campaign is maintained in safety first; every accident is investigated with a view to preventing a repetition, and the result is shown in the reduction of the number of smaller accidents.

One feature I would like to emphasize is the work of the safety committee, consisting of the officials and workmen, who regularly meet every two weeks to discuss accidents that have occurred, sources of danger, and suggestions for improving the conditions with regard to safety and health. We feel very much indebted to this committee for their interest in the welfare and safety of the workmen and would like to suggest to other companies the great advantage derived from such work.

Fire-hazards are eliminated to a great extent in this mine by a rule insisting that not more than one day's supply of timber or other inflammable material be maintained underground, and this applies even to mine timbers, planking, etc. In addition to these precautions, fire-hose and hydrants are installed at all strategic points throughout the mine, while drinking-water is supplied underground, being piped from the surface and periodical tests made as to its purity.

The *Sullivan* mine maintains a very high standard, both with respect to safety and health, and are always very receptive to suggestions both from their employees, their officials, and from our Department.

The reports of Mr. Miard and Mr. Johnstone, Inspectors of Mines, cover the work of inspection in more detail and are attached.

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 a continuation of the same in the year we are now entering on. We realize it is only through such co-operation that we can expect to reduce the number of 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 1930 in the Fort Steele, Ainsworth, and Slocan Mining Divisions. In the course of these inspections 150 certificates of competency as blaster and 132 substitute certificates of the same class were granted. One special prospector's permit and one approval covering an underground storage for explosives were also issued. On February 28th the office building at the upper *Sullivan* mine was destroyed by fire, with the loss of practically the entire contents, including 128 blasters' certificates held by men employed there and filed in that office in compliance with section 21 of the regulations *re* blasting. This fact accounts for the abnormally large number of substitute certificates issued during the year.

FORT STEELE MINING DIVISION.

Sullivan.—Consolidated Mining and Smelting Company of Canada, Limited; general superintendent, E. G. Montgomery; mine superintendent, William Lindsay; assistant mine superintendent, D. L. Thompson. Notwithstanding the very unsatisfactory condition of the metal market that characterized the year just ended, the *Sullivan* mine employed constantly a force of over 600 men, the total varying between 757 during the spring and 601 (410 underground and 191 on the surface) at the present time. Various circumstances contributed to this decrease, including the completion of the construction programme and the continuous and systematic improvement of the methods of handling ore. The concentrator treats 5,540 tons of ore a day, which corresponds to an average daily output of 6,400 tons for the mine.

Mining and Development Work.—The nature of the deposit, the methods of working, the haulage system, and the preliminary treatment of the ore at the mine have been outlined in the Reports of the Minister of Mines for the years 1928 and 1929. The methods described in the comprehensive papers written by members of the mine staff and quoted in the aforementioned reports have been systematically and vigorously followed during the past year; 5,008 feet of new roadways being driven in pursuance of the general scheme of development. Preparations are now well advanced towards starting a slope intended to prove and develop the part of the ore-body extending below the level of the 3,900-foot tunnel. The hoist emplacement and the rope and muck raises have already been driven, and an early start of sinking operations is contemplated. The slope will be driven in a north-easterly direction on the average dip of the ore as ascertained by bore-holes, and will eventually be connected to a shaft of large dimensions, out of which all the ore mined in the section thus opened will be hoisted. This shaft will be much nearer the concentrator than the present main artery of the mine, and it is expected that in time its output may surpass even that of the present operations.

The eventual recovery of the ore left in pillars is still receiving due attention, and various methods of preventing an untimely subsidence during the progress of such operations are being considered. During the year a second concrete pillar, similar to that erected in 1929, has been completed and the construction of a third one is at present well under way. A close study of the various factors susceptible to affect the ultimate strength of this form of artificial roof-supports has led to slight modifications of the original plan; the corners are now made somewhat stronger and massive abutments are added to the low side-wall. It has also been decided that an internal filling of waste did little more than possibly increase the stability of the pillar, for, owing to the unavoidable and progressive settlement undergone by dry stowing of any kind, the concrete walls would eventually have to support the entire weight and the real ultimate efficiency of the pillar depends solely upon their strength. The practicability of filling worked-out areas with suitable material introduced from the surface through bore-holes of large diameter is being studied also.

The mine roadways, which were the object of favourable comment last year, were always found to be in excellent condition. Owing to this fact the enormous daily output of the mine is handled with a minimum of effort and a degree of safety approaching the highest attainable in haulage operations.

Ventilation.—The state of affairs prevailing in this respect throughout the summer of 1930 presented a striking contrast with that existing during the corresponding period of 1929. A 60- by 33-inch Jaffray reversible fan with steel casing and a 50-horse-power a.c. constant-speed motor supplied by the Canadian General Electric Company were installed early in the spring on the top of the ventilating-shaft driven to the surface from the upper mine-workings in 1929. Until then natural ventilation had been relied upon exclusively, with the exception of the early stages of development in the 3,900-foot tunnel-workings, when blowing-fans and large air-pipes were used. This fact was responsible for the greatest difficulty offered by the problem, as no reliable data were available to calculate the equivalent orifice of the mine with anything approaching accuracy. It was known that the resistance offered by the enormous stopes would be small, but experience proved that, even after this had been taken into consideration, the depression required to pass a given volume of air had been overestimated. It was eventually found necessary to modify the transmission in order to bring the work to be performed within the capacity of the motor. The choice and installation of a fan under such circumstances is not an easy matter, particularly where machinery of this kind is but little familiar to all those

immediately concerned. Considerable credit is therefore due to the management, and particularly to Grant Henderson, construction engineer, for the manner in which the difficulties encountered at first were surmounted. The fan has a wide range of efficiency and the volume of air circulating through the mine could be very materially increased, if this became necessary, by installing a stronger motor. During the winter months natural ventilation suffices to meet all the mine's requirements.

Explosives.—Polar Forcite gelatine of 35, 50, and 60 per cent. strength is the only explosive used underground. A great deal of secondary blasting is necessary, but this is done almost universally by "plugging." "Bulldozing" is looked upon with disfavour, on the grounds that the gases produced are frequently apt to be of an objectionable nature and that the quantity of explosive required is several times that needed to obtain the same results by plugging. The manner in which the exlposives are handled and distributed has been described in the report for 1929.

Electric blasting has recently been introduced and for several weeks past has been used experimentally in an important raise with entirely satisfactory results. The current is taken from the a.c. lighting system and by means of a resistance consisting of four 100-watt incandescent lamps the voltage in the firing-circuit is lowered to 140, with a current of 2 amperes. Each round consists of eighteen shots connected in two parallel series of nine. An accidental admission of current to the blasting-circuit is rendered impossible, beside the ordinary opening at the switch, by the removal of the switch-fuses and another break in the lead wires that is not closed until the men have installed their bulkhead and are ready to come down. The same method of firing will be used in the slope to be started shortly, but there a regular blasting-panel, in which the lamp-bank is to be replaced by a resistance-coil, will be installed.

Plans and Model of Workings.—Beside the very complete and frequently extended set of plans kept at the office, an elaborate model of the workings has been built on the scale of 1/480. This has already proved its inestimable value to the management in following the course of the operations and planning future development. More can be learned in a few minutes, concerning the exact configuration of the ore-body or that of the workings in any section of the mine, by studying this three-dimensional representation of actual conditions than could be done by devoting many hours to a thoughtful perusal of maps. All openings are represented by wooden forms supported on a framework of brass rods. The surface and all bore-holes are also accurately shown. The material used is Australian red-gum wood in slabs ¼ inch thick, each one thus corresponding to a vertical height of 10 feet. Each piece is cut separately so as to correspond exactly to the contours established by the engineering staff, and the successive sections are glued together, the final result being an absolutely accurate miniature of the stope or other opening represented. Plastic wood is used for minor changes and additions. Two men are constantly employed in keeping the model up-to-date and they are to be congratulated on having made of it a regular work of art.

Safety and First-aid Work.—The activity of the very energetic safety-first committee, organized three years ago, did not abate in any way during 1930, and ample proofs of a keen and discerning interest in all matters coming within its scope are afforded by the minutes of the regular meetings held. J. M. Wolverton, safety engineer, and H. A. Twells, superintendent of transportation, continued in office as chairman and secretary respectively.

In the matter of first aid the most ambitious programme ever evolved in any mining centre of the Province is on the way to completion. The objective is to have nearly 100 per cent. of the working-force trained and to this end 581 men are undergoing instruction at the present time. Each week Dr. Haszard is giving two lectures and twenty-one practices are held under the supervision of Henry Parsons (at present employed as full-time instructor) and his four assistants, two of whom hold fifth-year and two fourth-year St. John Ambulance certificates. When this season's work is completed 95 per cent. of the employees will have concluded the course and it is thought that 90 per cent. will qualify for their first-year certificates. The result expected is not only a minimizing of the results of accidents, but also a considerable decrease in the number of personal mishaps partly due to carelessness. At the end of 1930 sixty-six men qualified to render first aid were employed in and around the mine.

There are ten fully equipped first-aid boxes underground and ten on the surface, beside the supplies kept in the mine-rescue room and the upper mine office. In addition, four portable first-aid kits are kept underground with five wire stretchers and five blanket boxes. Three

spare wire stretchers are kept on the surface; one of them at the upper mine. There are also five emergency boxes in which tools, ropes, etc., are kept for immediate use in either rescue-work or fire-fighting. All first-aid boxes are inspected every day and replenished, if need be, by men specially appointed for the purpose. The Dodge motor-ambulance at the 3,900-foot tunnel permits the rapid removal of persons injured to the hospital, and a comfortable room is provided at the upper mine to take care of such cases until the ambulance arrives.

Some decisive steps have also been taken in the matter of mine-rescue work. The equipment installed early in the year includes six McCaa 2-hour oxygen breathing apparatus, ten Edison electric lamps, and six Wolf safety-lamps, with the necessary service and repair kits. The whole is stored in the safety engineer's office, a spacious and well-fitted room on the second floor of the warehouse building. In addition to the aforementioned new equipment, there are two H.H. inhalators, one in the mine-rescue room and the other at the upper mine, and ten Burrell all-service masks, four of which are kept in the mine-rescue room, four at the upper mine, and two on the fire-truck. There were originally sixteen of these appliances at the mine, but during the year two were sent to the concentrator, two to the phosphate-mine at Crowsnest, and two were lost in the fire that destroyed the office building at the upper mine in February.

Sixteen of the mine employees are holding certificates of training in mine-rescue and fourteen more are now receiving instruction under the direction of A. Smith, formerly of Cumberland. A team from the *Sullivan* mine took part in the mine-rescue contest held at Fernie on August 2nd and gave an excellent account of itself, although failing to qualify for one of the prizes in competition with the veteran teams of the Crowsnest Pass.

The use of hard-boiled hats by all underground employees has been made compulsory and it is certain that thereby at least one life has already been saved. An examination of the hats worn by James Blackwell and his partner reveals the fact that certainly the former, and probably both, escaped fatal injuries only through the protection afforded by this type of head-covering.

Several types of hard-toed boots have been tried, but none so far has proved itself to be entirely satisfactory. In these tests about sixty pairs have been used, but all were found clumsy and uncomfortable when climbing over muck-piles or on ladders. However, the matter has not been dropped and it is still hoped that a type of boot affording the required protection and, at the same time, comfortable to the wearer and reasonable in price may be found.

All men collaring holes, using pluggers, breaking rocks, or doing any other work where there is risk of injury to the eyes are required to wear goggles. These are supplied free of charge to all miners, timbermen, barmen, or any others whose work may require some form of eye-protection. After it had been claimed by some of the men that the wire-gauze goggles originally issued did not afford the required degree of protection and were in other ways less satisfactory than might be desired, twenty-seven pairs of "Duraglass" goggles were purchased and given out on trial. Some little difficulty was experienced at first, but they proved satisfactory on the whole and 100 more pairs have been ordered. It is the intention to supply all men requiring eye-protection with "Duraglass" goggles eventually.

Accidents.—Four fatal and seven serious accidents were reported from the *Sullivan* mine during the year. While the writer does not admit that any accident may be looked upon as "unavoidable," when the difficulty encountered in gauging accurately the importance of the various factors eventually contributing to such occurrences and the fallibility of human judgment are taken into consideration, some may reasonably be considered as "unpreventable." After all the surrounding circumstances have been duly weighed, we are led to the conclusion that the four fatal and most of the other accidents reported must be classed as such. It seems that three of the fatal occurrences were due to slight and easily explicable errors of judgment on the part of the victims. In the case of the other (that resulting in the death of Edward Kemp) no satisfactory explanation was found.

While on this subject, it might be permissible to call attention to the masterly manner in which the rescue of Frank Pelle was effected. The man had been carried down into a chute with a sliding mass of broken ore and could not be reached safely from above owing to the possibility of more loose material being brought down on him, while a movement of the ore in the chute would almost assuredly have proved fatal. He could be rescued only after an opening had been cut in the chute bulkhead, which meant that, in addition to 6 inches of wood, it was necessary to penetrate a steel plate ¾ inch thick. In a very short time fifty-five men were taking part in the work. Notwithstanding the treatment administered by Dr. Haszard, who had been

summoned immediately and climbed in the chute with the rescuers, and excellent hospital care, the man died from shock the next morning.

The elaborate statistical system in use permits us to form an opinion regarding the number and gravity of all accidents other than fatal. In this respect, when the data for 1930 are compared with those covering the year 1929, it is gratifying to note a very appreciable decline, amounting to about 30 per cent., in the ratio of shifts lost, through personal mishaps of any kind, to each 1,000 shifts worked.

Additions to Plant and Construction-work.—The extensive construction programme of the company was very nearly completed by the end of 1929, and only comparatively minor additions were undertaken during the year. A retaining-wall 64 feet long and 7 feet high was erected at the foot of the bank, above the power-house, for the protection of the air-lines. The office building at the upper mine was rebuilt. A waste crushing and screening plant was erected beside the rock-house to prepare barren rock for use as track ballast, for which purpose this material finds apparently considerable favour with the Canadian Pacific Railway. Coal and coke bins were built at the tunnel and at the McDougall townsite, and the heating-boilers at the latter place were changed from wood to coal burners.

The additions to the equipment were numerous beside the fan already mentioned. An Ingersoll-Rand after-cooler was installed for the two Bellis & Morcom compressors erected last year and has rendered the operation of these two latest units of the power plant absolutely satisfactory. A compressor is now held in reserve and may be started whenever one of the others has to be stopped for an overhaul, thus assuring a regular supply of compressed air at all times. The installation of a Lynch dust-collecting plant in the rock-house was well under way at the end of the year and is expected to eliminate, to a large extent, the fine dust too often carried in suspension by the air in nearly all buildings housing ore-crushing machinery. A number of Knowles oxygen generator cells were added to the electrolytic oxygen plant, which is now able to supply all the requirements of the mine and the concentrator. The results obtained from this plant are remarkably good. For such purposes as hospital-work and mine-rescue training a gas containing 99.6 per cent. of oxygen is supplied. For other uses, such as welding, etc., the proportion of impurities is kept below 3.5 per cent.

Underground, another 300-kw. motor-generator set was installed to take care of the extra load due, principally, to the introduction of the electric drill-heating furnace. The latter has been in operation since the month of May and has fulfilled all expectations. It consists essentially of a rectangular box, built of firebrick within an outer framework of steel, and containing a trough made of a special refractory material known under the trade-name of "Carbofrax." In this trough the graphitic "resistor" is laid. This bed of carbon establishes the connection between the heavy cast-iron electrodes set at each end of the furnace and is brought to a white heat by a current of 600 amperes at 85 volts. The temperature maintained ranges between 1,050° and 1,100° C. The consumption of carbon is very small (about 9 lb. a day) and no trace of any objectionable gas is given off. Some little difficulty was experienced at first owing to the smaller sizes of steel being heated too far, but this was obviated by a slight modification of the shape of the openings. The furnace had to be shut down twice for repairs since it was started. In order to avoid interruptions in the use of this method of heating the steel, two smaller furnaces are now being constructed and are so arranged that one can be moved on the place of the other whenever repairs become necessary. The only drawback seems to be the fact that both the "Carbofrax" brick and the graphite "resistor" have to be obtained from England, which means that a considerable time must perforce elapse between the ordering and the delivery of either material.

A large double-drum hoist has been recently brought over from the *Silver King* and is at present being equipped with a 150-horse-power motor in the mine machine-shop. It is to be installed at the head of the new slope as soon as the work of transforming it from a steam to an electric drive has been completed.

During the summer stout guard-rails were erected at all dangerous points on the one-way road leading from Kimberley to the 3,900-foot tunnel. The company supplied the material and the Provincial Department of Public Works attended to its installation.

Living Accommodation and Welfare-work.—That the interest taken by the company in its employees does not cease at the end of the shift is a well-known fact, and brief descriptions of the excellent living accommodation, recreation-halls, etc., provided both at the McDougall town-

site and at the upper mine can be found in preceding reports. No symptom of any decline is to be observed in this respect, but, on the contrary, some improvement of one kind or another is to be noted at each visit.

Several analyses of drinking-water were made at concentrator's laboratory during the summer months as, owing to the abnormally long periods of drought, some doubts were entertained regarding the quality of the supply. In all cases the water was found to be perfectly pure.

Under the head of welfare-work, attention may properly be called to the group system of life insurance initiated by the company some years ago. Through this arrangement life insurance to the amount of $1,500 is automatically carried by every employee, the company assuming responsibility for the premiums, and an additional $1,000 can be obtained by those desiring it at an extremely advantageous rate. The practical value of such an arrangement can hardly be overestimated.

For the benefit of those unable to speak English, or possessing only a rudimentary knowledge of it, classes were held last winter by a teacher specially appointed by the Department of Education, with an attendance of about 125. That they were by no means barren of results is evident to any one walking around the mine and engaging the men in conversation. A lady resident of the town has volunteered to continue the work during the present winter and is holding classes for those desiring to improve their knowledge of the language still more. This constitutes another important step towards increased safety.

Conclusion.—It is natural to expect that the management of operations as important as those of the Consolidated Mining and Smelting Company at Kimberley could be entrusted only to men well versed in their respective branches and endowed with genuine executive ability. The manner in which the problems arising are attacked and solved proves that all desiderata are fulfilled in this respect. Moreover, it is quite patent that a well-planned system of selection and training, with incidental elimination of the unfit, has resulted in the formation of an extremely efficient and well-disciplined working-force. Intimate co-operation between the various departments, the keen sense of their responsibilities displayed by all officials, and the friendly character of relations between superior and subordinate, from the highest to the lowest rung of the ladder, are all elements contributing largely not only to the economic success of the undertaking, but also to the progress made towards assuring the safety of the operations. For this spirit and for their hearty co-operation during the past year we are thanking all the officials and workmen employed at the *Sullivan* mine.

Phosphate-mines.

Consolidated Mining and Smelting Co. of Canada, Ltd.—The exploratory work begun last year in order to ascertain the extent and value of the phosphate-rock deposits discovered in the district some years ago proceeded actively during 1930. Up to the present time the general trend of the formations carrying this mineral has been studied from the International boundary to the head of the Elk river and considerable work has been done towards ascertaining the importance and quality of the phosphate-bed at several points. The data thus accumulated are being studied at present, and when they have been adequately correlated they will undoubtedly constitute a valuable addition to the sum of information at present available concerning the geology of this part of the Province. Towards the end of the year Leo Telfer succeeded F. B. Fuhr as superintendent of phosphate-mines.

Operations were suspended at the *Lizard* mine early in the spring. The work done, beside some open-cuts, consists of two exploratory drifts, driven in opposite directions, each on one side of a rather picturesque gulch at an elevation of 4,500 feet. The information sought regarding this particular point having been obtained, the camp was closed, the equipment was transferred to the *Crow* mine, and most of the men were employed in prospecting operations in other parts of the district during the summer. When visited in the month of March, the *Lizard* mine employed twenty-one men, eleven of them underground.

Considerable work was done at the *Crow* mine, a force of thirty men (nineteen underground) being employed throughout the year. The main drift has now reached a length of 2,800 feet, following closely the strike of the seam, which is here somewhat contorted. The dip varies between 12° and 25° and averages probably 20°. An incline was driven from the main drift, towards the outcrop, over a distance of about 800 feet and, although operations have been temporarily discontinued at this particular point, will be driven to the surface eventually. The

phosphate rock itself is fairly strong and generally forms a good roof, while the superincumbent shale, although often weaker, lends itself readily to arching. Under these conditions little timber is required.

Mechanical ventilation was necessary until lately. This was provided by a small fan, driven by a Ford motor, and a line of metallic pipes of large diameter. A very ingenious arrangement of registers permitted to change the direction of the air-current almost instantaneously, the fan being made to force or exhaust at will. The former method was always used when the men were at work and the other after blasting. A ventilating-raise was driven through to the surface towards the end of the year and natural ventilation is now sufficient to meet the mine's requirements. This raise is about 400 feet long, the last 50 feet being vertical and the balance having an inclination of somewhat more than 45°. When some 300 feet from the main drift a strong inflow of water was met, which fact did not tend to facilitate operations. However, this has now been turned to advantage by the erection of a small concrete dam from which water is supplied to the drills and will eventually be piped outside for use in the wash-house and for fire-protection. The head available is about 180 feet.

At one time the samples of air from this mine sent to Ottawa showed the presence of a very small, but frequently recurring, percentage of inflammable gases (CO and methane), amounting to about 0.02 per cent. of each. This was somewhat puzzling, but was explained by the fact that, the prevailing wind in the gulch coming from the south, minute quantities of exhaust gases from the gasoline-driven compressors operated some distance away from the tunnel were brought near enough to be drawn into the fan. After the fire which destroyed the blacksmith-shop, wash-house, and compressor-room on November 12th the compressors were reinstalled on the north side of the mine entrance. On different occasions a faint but characteristic smell, perceived at some points in the main drift, led to the suspicion that either hydrogen sulphide or phosphine might be present in very small quantities. As these gases, when highly diluted, are very difficult to detect by the ordinary process of air-analysis, tests were made with acetate of lead and silver nitrate papers, neither of which showed the faintest trace of a reaction.

The use of an underground storage-room for explosives, to hold a supply not exceeding the requirements of the mine for twenty-four hours, was officially authorized, with the stipulation that a portable electric lamp should be provided to obviate the possibility of naked lights being brought within it. This provision has been rigidly observed.

The mechanical equipment consists at present of two 9- by 8-inch Ingersoll-Rand portable gasoline-driven compressors. A wash-house is provided for the men close to the mine entrance, a very convenient arrangement as the living-quarters are some distance away. These are quite comfortable and well kept. The construction of an office building, with living accommodation for the staff and some storage-space for supplies, was rushed during the fall and the building was occupied towards the middle of November. C. White is the engineer in immediate charge of this operation, with Richard Rowe as mine foreman.

At the *Marten* mine, situated on the South fork of Michel creek and close to the track of the E.B.C. Railway, about 5 miles south of McGillivray Station, operations were started in the fall, but rapid progress was made. Two shallow inclined shafts were sunk and two small prospect-tunnels were driven on the outcrop of the phosphate-bed, while a 7- by 8-foot drift has now advanced about 200 feet. The mechanical equipment consists of a 6- by 8-inch Ingersoll-Rand compressor. The living-quarters are of a temporary nature as, when operations were begun, it was already too late to attempt anything in the way of substantial construction. At the time of the last inspection ten men were employed underground and three on the surface, with L. J. Doyle, formerly in charge of the *Lizard* mine, as foreman. The elevation of the workings ranges between 4,350 and 4,600 feet.

Prospecting-parties were at work on Line creek and at the head of Alexander creek throughout the summer, proving outcrops of the phosphate-bed systematically by open-cuts, shallow shafts, and short tunnels. These prospects were all situated at an elevation of about 7,000 feet. In all, five tunnels were driven and thirteen shallow shafts were sunk. Ten men were employed at the Line Creek and eighteen at the Alexander Creek operations. Nothing permanent in the way of construction was done, as the only object, for the present at least, was to secure information.

The *Empire* mine, on Sand creek and about 5 miles by road from the C.P.R. station at Galloway, was operated for some time in the early part of the year by D. V. Parks, of Lethbridge,

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At the time of inspection a winze was being pumped out and repaired and two small bodies of ore were being extracted. This part of the mine, worked for a number of years, is heavily timbered and dry-rot has appeared at many points, although the ventilation is reasonably good. Some repairs to timber and ladders were prescribed. I might state here that the system of leasing in vogue in the Sandon district presents several objectionable features, particularly when applied to moderately large mines. The men work in small groups, independent of each other, and while they usually take reasonable precautions to assure the safety of their individual working-places, no one assumes responsibility for the maintenance of roadways, the ventilating arrangements, or any of the other details to which, under ordinary circumstances, the mine foreman or the superintendent would be expected to give the necessary attention. On the other hand, men gouging out the few stringers of ore left behind in the course of former operations can hardly be expected to undertake very extensive repairs. While it is true that leasers are usually excellent miners, the fact that the conditions outlined above constitute a rather unsatisfactory state of affairs cannot be overlooked.

At the time of the last inspection there were eight men working underground and one on the surface, the latter being in charge of the power plant.

The *Ruth-Hope*, operated by the Ruth-Hope Mining Company, with H. A. Rose as superintendent, employed only four men underground and one on the surface at the time of the last inspection. Two leasers were also working on one of the upper levels. The operations were limited to the extraction of small pillars of ore left at two different points in the workings of the *Blue Grouse* vein. The mine is well kept and the timbering is good. The ventilating arrangements have been improved and the quantity of air supplied is sufficient to meet the requirements of the small force at present employed, although they would be inadequate should operations be resumed on the former scale.

At the *Carnation*, situated at an altitude of 6,500 feet on Tributary creek, the Carnation Silver Lead Mines, Limited, with W. G. Clark as superintendent, did some surface prospecting in the early part of the summer, verifying the results of a Radiore survey made during the previous season. Only seven men were employed and operations were suspended at the end of July. The underground workings were in good condition and particularly well timbered. The practice of peeling the bark of the timber and allowing it to season outside before bringing it in the mine, as followed by Mr. Clark, presents advantages that would justify a far more extensive application of it. The living accommodation is good and the mechanical equipment is sufficient to permit reasonably rapid development when operations are resumed.

At the *Wonderful* two men were engaged in exploratory work throughout the year, being first employed by the Standard Silver Lead Mines, Limited, and afterwards by C. Cunningham, of Alamo. While the operations were limited to the lower level, the ventilation depended upon a rather ingenious contrivance utilizing the water flowing out of the mine, but when, subsequently, one of the upper levels had been cleaned up and the work was carried on in older workings natural ventilation became available. The original buildings at the mine are old and badly dilapidated and the small bunk-house erected last year has not been finished. The men employed are living in Sandon.

At the *Black Colt* exploratory work was carried on throughout the year by the Queen Bess Consolidated Mining Company; Clarence Cunningham and Charles R. Vandergrift succeeding W. L. Bell and Neil McMillan as superintendent and mine foreman respectively. Eight men were employed underground and three on the surface. The combined bunk and cook house is comfortable and well kept. This, beside a blacksmith-shop, a tractor-shed, and a building housing a portable gasoline-driven Ingersoll-Rand compressor, constitute the surface installation at present. The mine is reached from Sandon by a good road, on which a tractor is operated. The mine was well kept and the timbering, consisting principally of drift and crib sets, was very good. A raise intended to connect Nos. 2 and 3 levels was almost through at the time of the last inspection, and this will both improve the natural ventilation and supply the required second exit.

On February 16th Albert Martinson was slightly burned about the hands and face by the inflammation of gasoline vapour while starting the caterpillar tractor in its shed. The immediate cause of ignition could not be ascertained. This calls attention to the need of adequate ventilation for buildings housing internal-combustion engines of this type.

At the *Queen Bess*, Nos. 1 and 5 levels, which were obstructed by falls of rock, have been cleaned up and partially retimbered, and from No. 5 a crosscut was started in order to intersect a vein already proved at a higher elevation. This road had not reached its objective at the time of the last inspection. The mine had been idle for several years when operations were resumed towards the middle of July by the Queen Bess Consolidated Mining Company, with C. Cunningham as superintendent and Angus McGillivray as mine foreman. Ten men are employed, six of them underground. A 9- by 8-inch Ingersoll-Rand compressor, driven at a speed of 300 revolutions a minute by a 25-horse-power internal-combustion engine, has been installed. The combined cook and bunk house is a very good building, but, having remained untenanted for several years, it required some minor repairs, the most important of which were effected at once.

The *Lucky Jim* and *Slocan-Rambler* mines have remained idle since the beginning of the year and very little was done at the *Mary Ryan*. Some prospecting was done on the *Altoona* group by a small force of men under the supervision of A. Murphy, of Sandon.

Polar Forcite gelatine of 35 and 40 per cent. strength is used exclusively for blasting purposes underground in the district. In some cases storage facilities for explosives are only of a temporary nature.

The foregoing comments disclose a considerable decline of the mining activity in the Sandon district, the total number of men employed being little more than a quarter of that reported for 1929. The economic conditions, responsible for the temporary abandonment of several properties, are undoubtedly pressing with equal severity upon those that are still operated with a reduced force. Notwithstanding these unfavourable circumstances, the general condition of the workings inspected was satisfactory on the whole. The officials and workmen seemed to be duly conversant with the respective duties, displayed an earnest desire to comply with all the requirements of the "Metalliferous Mines Regulation Act," and sincerely welcomed any advice tendered them in the interest of safety.

WEST KOOTENAY DISTRICT.

REPORT BY H. H. JOHNSTONE, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines in the West Kootenay and Boundary Districts for the year 1930. This report does not include properties in the Kaslo and Sandon sections, which were inspected from the office in Fernie.

TRAIL CREEK MINING DIVISION.

The free-gold belt on Little Sheep creek was the scene of quite a lot of development-work and the extraction of some ore by small crews of leasers on the different properties.

The *I.X.L.* was operated throughout the year by J. Cullinane and associates. A portable compressor was used. Four men were employed.

The *Midnight* was operated throughout the year by M. Dally and associates. The crew consisted of two men for part of the year and three men for the balance.

The *O.K.* was operated throughout the year by A. Williams and associates. Two men were employed.

The *Snowdrop* was operated by O. Olson and associates. Work was continuous till November, when work was stopped. I have been given to understand that work will be renewed in the near future. Two men were employed.

The *Golden Drip* was worked throughout the year by M. Penny. Two men were employed.

The *Golden Butterfly* was operated by J. Christianson and associates under lease from the owner. Work started in October. Two men were employed.

The work on these different properties has been well done and the requirements of the "Metalliferous Mines Regulation Act" fairly well lived up to.

NELSON MINING DIVISION.

The *Euphrates*, owned and operated by the Euphrates Mining Company (S. Terzian, superintendent) and situated on Elsie mountain between Nelson and Ymir, on the Great Northern Railway, has worked at intervals. The work consisted of tunnels and crosscuts. An aerial

tramway is being installed from the works to the Great Northern Railway tracks. A compressor driven by water-power furnished the air for drilling. An average crew of eleven men has been employed.

The *Golden Age*, owned by the Golden Age Mining Company and situated at Golden Age Siding on the Great Northern Railway, was operated for a short time by leasers. Two men were employed.

The *Reeves-MacDonald*, owned and operated by the Reeves MacDonald Mines, Limited (H. Lakes, superintendent), was worked during the early part of the year. My last inspection was made in March. The work consisted of driving the long tunnel on the *MacDonald* claim ahead to get under the workings of the *Reeves* and running crosscuts from the tunnel. A mechanical mucker was employed for handling the muck. The machinery and buildings are in good condition and the work done in a workmanlike manner. The timbering is of a very substantial character. Thirty-nine men were employed.

The *Reno*, situated on Reno mountain, at an elevation of 6,200 feet, owned and operated by Reno Gold Mines, Limited (R. V. Neily, superintendent), worked throughout the year. The different levels were connected by raises, with the result of a vast improvement in the ventilation of the mine. An addition was made to the compressor plant, giving a much-needed increase in their drilling-power. The bunk-house, cook-house, and mine are kept in a very sanitary condition and the requirements of the Act well carried out. An average crew of twenty-nine men was employed.

The *Iva-Fern*, situated on Cultus creek, was operated for a few months under lease and bond by the Consolidated Mining and Smelting Company. George Terhune was in charge of the work. Sixteen men were employed.

The *Iolanthe*, at Ginol, on Kootenay lake, owned by the Sanca Mines, Limited (W. Frampton, manager), was worked for a short time. The work was in the nature of assessment-work on the numerous claims owned by the company. Five men were employed.

The *Goodenough*, on Ymir creek, in the Ymir camp, was operated during part of the year by the owners. A. McDonald was in charge of the work. Considerable tunnel-work was done and a considerable tonnage of ore was extracted. Some surface work was also done on a new showing. An average crew of eight men was employed.

On the *Shilo*, situated on Bear creek, in the Ymir camp, some work was done by the owner, J. Gill, of Ymir.

The *Porcupine*, situated on Porcupine creek, is owned by N. Peterson, of Ymir, who worked it with another man nearly all summer.

The *Second Relief*, situated on Erie creek, is owned and operated by Relief-Arlington Mines, Limited. P. Oscarson is superintendent. Work was carried on for the greater part of the year and is still continuing. The work consisted of drifting and stoping. A new low-level tunnel has been started just above the level of the mill. Nine men were employed.

The *Molly Gibson*, located on Kokanee creek, is owned and operated by the Consolidated Mining and Smelting Company. Work was started in June and is still continuing. The old workings were at an elevation of 7,100 feet. The new workings, consisting of a crosscut tunnel, are at an elevation of 6,000 feet and will necessitate a long raise to connect the new workings with the old. Conditions in and about the mine are good. An average crew of twenty men was employed.

The *Bayonne*, situated in the Bayonne basin, is the most inaccessible property in the West Kootenay District. It is reached either from Salmo, where two summits are crossed, or from Cultus creek, where a wagon-road was under construction, or from Creston. The Salmo route is available only in the summer months. The Cultus Creek route will be available next year when the road is finished. The Creston route is used in winter and necessitates a three-day trip on snowshoes going in and three days coming out, sleeping at night in trappers' cabins. The property is owned and operated by the Bayonne Gold Mines, Limited. B. N. Sharpe is superintendent. The work is development, consisting of tunnels, crosscuts, and raises. Machinery will be brought in when the road up Cultus creek is completed. Substantial log buildings house the crew, which consists of ten men.

The *Wilcox*, situated on Ymir creek, in the Ymir district, is a gold property that was worked years ago. It is operated by the Ymir-Wilcox Development Company. F. A. Hebbard

is superintendent. Work at the time of inspection consisted of reconditioning the tunnels and working-places. Work has since been suspended for the winter months. New buildings had been erected for the housing of the men and the mill was being overhauled and refitted. Eleven men were employed.

The *California*, on Toad mountain, is another old property that has been revived. It is being operated by the Hillside Mining Company. A. McPherson is in charge of the work, which consists of development. A new bunk-house and cook-house has been erected. Five men were employed.

The *Red Rock*, situated on the Salmo river, north of the *Reeves-MacDonald* property, is a new operation. It was being worked under lease and bond by the Canadian Corporation. C. F. Cockshutt is superintendent. The work was confined to open-cuts and trenches. Eleven men were employed. Work has since been suspended.

The *Queen*, on Sheep creek, in the Salmo district, is another old gold-producer that is being revived. The work at the time of inspection consisted of clearing out old workings, rebuilding the flume, and putting the buildings in shape for the winter. Nine men were employed. H. A. Lavigne is in charge of the work.

The *Humming Bird*, situated on Roaring creek, was operated for a few months by Vancouver interests. E. B. Rowley was in charge of the work. The work consisted of open-cuts and a tunnel. Four men were employed.

SLOCAN (SLOCAN LAKE PROPERTIES).

The *Galena Farm*, at Silverton, is owned and operated by the Galena Farm Consolidated Mines, Limited (W. L. Sheeler, superintendent). It was worked on company account during the early months of the year. Afterwards a group of miners obtained a lease on the mine and mill and operated them for a few months. Later on all work was discontinued. Twenty-one men were employed under the company and seven under the leasers. For the leasers Joe Johnson had charge of the underground work, and Walter Tattrie of the mill.

The *Hewitt* was operated by the Galena Farm Consolidated Mines, Limited. Walter Tattrie was in charge of the work, which consisted of driving the low-level tunnels, one from each side of the mountain. These were to be connected. Some development-work was also done on some of the other levels. Work was discontinued at the same time as the company ceased operations on the *Galena Farm*. Thirty-six men were employed.

The *Van-Roi*, operated by the Van-Roi Mines, Limited (C. Cunningham, superintendent), carried out quite a large amount of development. Work was discontinued in the later part of the year. Fourteen men were employed.

The *Bosun*, between Silverton and New Denver, was worked by leasers, who were drawing the old stopes and treating the muck with jigs. No mining was done. Five men were employed.

The *Mammoth*, owned and operated by the Western Exploration Company (R. W. Grimes, superintendent), did quite a lot of development-work. All company work ceased early in the year, with the exception of the driving of a crosscut tunnel, which was done under contract. Since the completion of the contract all work has ceased and only a watchman remains at the mine. Sixteen men were employed.

AINSWORTH MINING DIVISION.

The *Comfort*, which joins the *Bluebell* on the north, was operated by the Consolidated Mining and Smelting Company under option from S. S. Fowler and B. L. Eastman. A shaft was sunk and levels driven on the vein. B. L. Eastman was in charge of the work. A very heavy flow of water stopped operations at the bottom of the shaft for a time. After a time the water was got under control, the shaft unwatered, and drifting toward the *Bluebell* started from the bottom. Pending the control of the water, a drift was driven toward the *Bluebell* above the water-level. The work was entirely discontinued about the first of November. Twenty-two men were employed.

The *Kootenay Chief*, south of and adjoining the *Bluebell*, was also operated by the Consolidated Mining and Smelting Company under option from Fowler & Eastman. It is situated on the extreme southern end of the *Bluebell* peninsula. A crosscut tunnel was driven and cut a large vein of ore. Drifting was done on the ore and a winze sunk on it. Joe Hawes was in charge of the work. Nine men were employed. Work was also discontinued on this property.

The *Berengaria*, at Deanshaven, on Kootenay lake, about 3 miles south from the *Bluebell*, was operated for a short time by the Base Metals Mining Company. T. Hawes was in charge of the work. Four men were employed.

The *Bell Fraction*, on the South fork of Woodbury creek, was operated for a short time by the Princess Creek Mining Company. E. J. Edwards was in charge of the work, which consisted of open-cuts and a tunnel. Five men were employed.

The *Dyke* option at Kootenay bay, on the east side of the lake, was operated during the greater part of the year by the Consolidated Mining and Smelting Company. This property is supposed to contain platinum in its ore. Five men were employed.

The *Riverside*, situated on the Duncan river at an elevation of 5,500 feet, was operated by the Omo Mines Company (A. Sorenson, superintendent) during the summer months. The work consisted of a tunnel. Six men were employed. Work was discontinued in October.

GREENWOOD MINING DIVISION.

The *Bell* was operated under lease and bond from the late Duncan McIntosh and H. Lee by the Bell Mines, Limited. The work was under the direction of A. J. Finch until his death on May 9th, 1930. He was succeeded by M. S. Hedley. Production has been steady and development kept pace with production. An average crew of fifteen men was employed.

The *Highland Lass*, adjoining the *Bell*, was operated throughout the year by the Highland Lass, Limited. It was under the same management as the *Bell*. Development and extraction of ore was carried on. The compressor was shut down and air taken from the *Bell*. Five men were employed.

The *Sally*, operated by the Sally Mines, Limited, was worked by a group represented by R. H. Stewart. The work was principally development, with a small extraction of ore from the old workings. J. A. Hanna was in charge of the work with an average crew of twelve men.

The *Wellington*, owned and operated by the Beaverdell-Wellington Syndicate (A. J. Morrison, superintendent), was operated throughout the year, with the exception of a short shut-down in the early part of the year. Development-work was carried on, with a small extraction of ore sufficient to pay expenses and a small dividend. An average crew of ten men was employed.

The *Rambler* was operated for a short time. J. A. Rowley was in charge of the work. Five men were employed.

GRAND FORKS MINING DIVISION.

The *Union*, situated in Franklin camp, was operated thoroughout the year by James F. McCarthy. Paul H. Schulz was superintendent. A large amount of development-work was done and a large amount of ore extracted and milled. The concentrates were shipped to the Trail smelter. An average crew of forty-five men was employed.

The *Waterloo*, situated at Lightning peak, on the headwaters of the Kettle river, was operated throughout the year by the Waterloo Consolidated Mines, Limited. R. L. Clothier is superintendent. Six men were employed.

ARROW LAKE MINING DIVISION.

The *Hailstorm*, situated on Canyon creek at an elevation of 7,640 feet, was operated during the summer months by the Consolidated Mining and Smelting Company. Work was discontinued early in the fall. Fifteen men were employed.

REVELSTOKE MINING DIVISION.

The *Snowflake*, located on Woolsey creek at an elevation of 5,550 feet, was operated by the Snowflake Mining Company. E. Larson was in charge of the work. The work consisted entirely of development—drifts and raises. After their own development ceased the crew was kept on to do some development for the Regal Silver Company in *Morton-Woolsey* ground through the *Snowflake* workings. Eleven men were employed.

The *Morton-Woolsey*, situated on Woolsey creek below the *Snowflake*, was operated by the Regal Silver Mines, Limited. J. R. Swanson was in charge of the work, which was limited to development. A connection was made with surface through a drift from the raise from the lower level. This materially improved the ventilation. Eleven men were employed.

The *Wigwam*, situated on Isaac creek at an elevation of 2,100 feet, was operated by the Wigwam Mining Company (W. T. Dumbleton, superintendent). The work consisted entirely of development. A Sullivan compressor of 372 cubic feet capacity, driven by an 80-horse-power gas-driven engine, was installed. Thirteen men were employed.

TROUT LAKE MINING DIVISION.

The *True Fissure*, situated on Great Northern mountain at an elevation of 6,000 feet, is owned and operated by the True Fissure Mining and Milling Company (D. Morgan, superintendent). A sawmill was installed to cut timber for the construction of a mill, flume, and power plant. Six men were employed in the mine, cleaning out old tunnels and renewing timbers where necessary. Quite a large force was employed at the sawmill and on construction.

The *Revenue*, on Ferguson creek, owned by L. Thompson, was worked for part of the summer. Two men were employed driving a tunnel.

The *White Eagle*, located on Cascade creek at an elevation of 6,800 feet, was operated by the Keene Mountain Gold and Silver Mining Company (J. Gallo, superintendent). The work consists of tunnels and crosscuts. Seven men were employed.

The *Boss*, situated on the side-hill behind the town of Poplar, is owned by Roberts & Johnstone. Tunnels and open-cuts constituted the work. Two men were employed.

The *Topsy*, situated on Rapid creek, is owned by A. Hanson, of Poplar. A considerable amount of work had been done some years ago and the old workings are in bad condition owing to the rotting of the timbers. A new tunnel is being driven at a lower elevation.

There were two fatal accidents and one serious one—the small bone of a leg broken—in these districts during the year. One fatal and one serious accident in the *Bell* mine at Beaverdell, in the Greenwood Division, and one fatal accident in the *Union* mine, in the Grand Forks Division.

Conditions in and around the mines have been found to be good and the regulations of the "Metalliferous Mines Regulation Act" well lived up to. Infringements of the Act, either through neglect or ignorance of the provisions of the Act, have been corrected and a desire shown to live up to the requirements.

I wish to express my thanks to the management of the different properties for their hearty co-operation in carrying out the provisions of the Act.

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.

Tables showing coal production and men employed in collieries are shown on pages 320 and 321.

VANCOUVER ISLAND INSPECTION DISTRICT.

THOS. R. JACKSON AND GEO. O'BRIEN, INSPECTORS.

The Canadian Collieries (Dunsmuir), Limited, operated Nos. 4, 5, and 6 mines, Comox Colliery, and Nos. 1, 2, and 5 mines, 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 Nanoose.

Fiddick mine was operated at South Wellington.

Richardson mine was operated at South Wellington.

Little Ash mine was operated at Wellington.

Biggs' mine was operated at Wellington.

Morden mine was operated at Nanaimo.

Little Jingle Pot mine was operated at Wellington.

NORTHERN INSPECTION DISTRICT.

THOMAS J. SHENTON, INSPECTOR.

Bulkley Valley Coal Mines, Limited, operated the Bulkley Valley mine.

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 Nos. 1 and 2 mines.

The Blue Flame Collieries, Limited, operated its No. 1 mine (formerly Lynden Coal Company, Limited).

Pleasant Valley Coal Mining Company operated its Nos. 1 and 2 mines, 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 GEO. O'BRIEN, 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 1930 the Nanaimo Colliery, which consists of No. 1, Reserve, and Wakesiah mines, all situated in the vicinity of the city of Nanaimo. (Reserve mine suspended operations early in the year and Wakesiah was abandoned in January.)

REPORT BY THOS. R. JACKSON, INSPECTOR.

NANAIMO COLLIERY.

No. 1 MINE (SOUTH SIDE).

Arthur Newbury, Manager; John Sutherland, Overman; Alex. Coombs, William Halliday, William Neave, Fred Menzies, Matt Brodick, William Frew, Archie Hannah, Edward Hughes, John Marrs, John Brown, and John McArthur, 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 as a downcast shaft for the ventilation of the South side workings. The screening and preparation plant is located at this shaft.

The men working in the South side portion of the mine and in the close-by workings of the North side are raised and lowered at this shaft. No. 2 shaft, which is situated about 300 feet distant from No. 1 shaft, 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 operate at a lower pressure than the Babcock & Wilcox; the steam from the Babcock & Wilcox passes 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 directly connected to d.c. generators. The ventilating-fan, hoisting and washery engines are steam-driven, as is also the high-speed turbine-pump at the bottom of the shaft.

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 Robb-Armstrong steam-engine. These units supply power to all the electrically driven machinery above ground and underground. 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 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.

All the water-drainage from North and South side mines that reaches the sump at the shaft-bottom is delivered up the shaft by means of pumps (electric and steam-driven) located adjacent to the shaft-bottom. The output of coal, which used to be weighed on scales situated at the pit-head, is now weighed by that means close to the shaft-bottom. Coal is not hoisted at Protection shaft. The output of coal from No. 1 shaft averages about 1,300 tons daily. The mine ran 239 full working-days for the year.

Ventilation.—The ventilation of the mine is produced by a 72-inch by 90-inch double-inlet Sirocco fan, rope-driven, ratio 3.5 to 1, and capable of producing 195,000 cubic feet of air a minute, against a 4-inch water-gauge; this fan is driven by a steam-engine of 350 horse-power. Another fan (Guibal) capable of producing the necessary ventilation of the mine stands ready to substitute should necessity require.

The use of approved safety electric lamps is standard with all men underground, the firebosses using the Wolf flame safety-lamp for gas-testing purposes. Only permitted explosives are used for blasting and all blasting is done by means of approved shot-firing batteries.

The main haulage, by tail-rope, at present extends from the knuckle at the shaft-bottom in the Douglas seam for a distance of nearly 1,700 feet, bearing almost due east. The tonnage produced in the South side is from 600 to 650 tons a day.

Near the bottom of the Main slope the Diagonal slope diverges to the right at an angle of 45° and reaches the Main level parting at a distance of 2,380 feet away. About 100 yards below this point of divergence is located No. 3 Motor level, which, to Puyallup slope, measures 5,630 feet. Below this level about 200 yards is No. 5 North Slope section.

A direct-acting haulage-engine, steam-driven, located at the shaft-bottom, handles the whole of the coal-output from the South side of this mine.

The present working-places at the bottom of Diagonal slope are confined to pillar-extraction. Owing to the small area of pillars being worked, disturbances from spontaneous combustion, with their accompanying hazards, are much reduced and any heated gobs that exist are well under control.

The average thickness of the coal at present worked is about 6 feet. The amount of water encountered is not great and is attended to by means of a compressed-air-driven pump. No electrical equipment is used in the Diagonal slope. The coal in this area is of a friable nature and consequently requires a minimum of explosives.

Diagonal Slope Split.—I examined all the working-places and found the following conditions to prevail therein: The roadways and timbering were in good condition and the ventilation was fairly good. No gas was found. The section is fairly free from coal-dust owing to most of the main roadways being saturated with water, while the roadways nearer the face are rock-dusted. I measured 35,000 cubic feet of air a minute passing down Main slope, part of it going to Diagonal slope and the rest continuing on its way to No. 5 North slope and No. 3 motor-level. At the bottom of the slope 9,240 cubic feet of air a minute was passing into this section for the use of twenty-two men and four horses.

Jackson's Panel Section.—This portion of the mine is located comparatively close to the Main shaft and is in an area which has been unworked for some years.

No. 5 North Section.—This section, which produced coal up to the month of October, is now permanently abandoned. The pillars are now all extracted, rails and other equipment have been removed, and the workings permitted to fill with water to a point up the slope where the management have decided to hold it by means of a pump which will be installed some time in the future when required.

Puyallup Slope Section.—The working-places of this district are reached by a rock slope driven from the Douglas seam to the Newcastle seam. This slope is projected from No. 3 motor-level, approximately 6,000 feet from the Main slope. Puyallup slope is now almost 2,000 feet in length, with an average pitch of 6½°. To the right of the face of this slope a rock tunnel has been projected to cut the Douglas seam for the purpose of extracting some pillars, and at the same time operating any solid coal area left by former workings.

Long-wall methods of working are pursued in the Newcastle seam in conjunction with air-driven coal-cutting machinery and long-wall conveyors. There are two conveyor-walls, each about 250 feet in length. The total coal-output from this district was about 400 tons a day. The loaders on the conveyor-walls are all certificated miners. A few Siskol puncher-type machines are used for working through faults and other seam dislocations.

As these workings are below the abandoned workings of the Douglas seam, which were allowed to fill with water, the Douglas seam workings are dewatered as the lower seam workings advance. This precaution is accomplished by bore-holes drilled upwards from the Newcastle seam. It is expected that within a year the solid coal in the vicinity of Protection coal area will be reached.

The electrical machinery in operation in No. 3 Motor Level district consists of a Jeffrey 6-ton locomotive, a 100-horse-power hoist at the top of Puyallup slope, and a 50-horse-power electric hoist on No. 3 heading. A 100-horse-power motor-driven pump is located at the head of No. 5 North slope for pumping. This controls the water situation of the South side and delivers it to the pumps at the shaft-bottom.

Coal-dust.—This section is much less affected by coal-dust than the average mine district, owing to a prevailing dampness that reaches the point of saturation all the time. The mining-machine cuttings are generally composed of rock or dirt. The combined effect provides a condition that complies favourably with the provisions of the "Coal-mines Regulation Act."

On my inspection in December I measured 17,000 cubic feet of air a minute passing in this slope for the use of forty-six men and four horses.

The ventilation in the South side workings was generally found to be satisfactory; some of the workings in the vicinity of abandoned areas being at times affected by black-damp from such areas.

During my different inspections in the month of December I found no explosive gas and working-places, timbering, and roadways were generally in good condition.

REPORT BY GEO. O'BRIEN, INSPECTOR.

NANAIMO COLLIERY.

No. 1 MINE (NORTH SIDE).

Arthur Newbury, Mine Manager; A. W. Courtney, Overman; T. Woods, A. Bennett, Nat Bevis, and T. Jordan, Shiftbosses; A. Dean, F. Nash, G. Perry, T. Chapman, J. Dean, G. Moore, J. Nicholl, J. Norris, G. Frater, A. Kirkland, F. Cope, Wm. Cass, Wm. Johnson, D. Stobbart, T. McCourt, J. Christie, and Neil McMillan, Firebosses; G. Stewart, Shotlighter.

Practically the whole of the workings on the North side of the mine are submarine areas, having an average cover of 650 feet. The workmen are transported by ferry to Protection island, a distance of about 1¼ miles, where they descend Protection shaft, which is the main intake for the North side. Newcastle shaft, which is situated on Newcastle island, a distance of about 3 miles from No. 1 shaft, is used as the upcast shaft and escape-way. This shaft is provided with a ladder-way which affords a third means of ingress or egress to No. 1 shaft. 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, and with the exception of one small area of pillars in the Douglas seam in No. 10 South district, the whole output from the North side is machine-mined with pan-conveyors in use on the long-wall faces, the length of the conveyors being from 200 to 300 feet.

The only new development-work done in the North side was the sinking of a rock slope from the Douglas to the Newcastle seam, which has opened up a virgin area in the well-known Newcastle seam and is known as No. 7 wall. The thickness of the seam at this point is about 22 inches, but with the modern methods of machine-mining and conveyors a good average output is maintained.

Several improvements in the ventilation were carried out during the year. A rock tunnel from No. 7 Wall district to No. 6 Wall district was driven and connected. Two upraise air-shafts were driven from the Newcastle seam to the Douglas seam in Nos. 5 and 6 walls respectively. The shafts are equipped with ladder-ways and can be used as escape-ways.

During my inspection in the month of December the following conditions prevailed:—

No. 10 South District (Douglas Seam).—Partly pillar-extraction and partly long-wall. The pillar-extraction area is hand-pick mined and loaded by hand. The long-wall area is machine-mined and loaded by hand. Gateway roads are driven about 40 feet apart and the floor is brushed for the purpose of making height for mule-haulage. The ventilation was good and no explosive gas or CH_4 gas-caps were found. The roadways and working-places were well timbered and cogged and the waste well packed. I measured 11,000 cubic feet of air a minute passing into this section for the use of thirty men and five mules. One of the serious accidents reported occurred in this section—to Frank Burke, a miner, who was struck by a piece of falling rock causing injuries to his spine and fracturing a small bone in his right foot.

Protection Pillars (Douglas Seam).—This is a small area of coal left by former operations between the Diagonal slope and the Wilkinson slope. The seam in this area averages about 3½ feet in thickness and is mined on the long-wall system. The miners use the woodpecker machine for mining the coal, which is loaded by hand. The ventilation was good and no explosive gas or CH_4 gas-caps were found. The working-places and roadways were well timbered and cogged and the waste well packed. Only four miners are employed on a single shift in this section.

Ha Ha District (Douglas Seam).—This is an area of approximately 5 acres of good coal situated about 2,000 feet from the bottom of No. 1 shaft. The coal in this section averages about 8 feet in thickness and is of excellent quality. It is machine-mined and worked on the pillar-and-stall system, although in the early part of the year a fine long-wall face equipped with

pan-conveyors was in operation, but is now finished. The roadways and working-places were well timbered and cogged. The ventilation was good and no explosive gas or CH_4 gas-caps were found. I measured 12,000 cubic feet of air a minute passing into the section for the use of thirty-eight men and five mules.

No. 5 Wall District (Newcastle Seam).—This area is entirely machine-mined and worked on the long-wall system. There are several walls in this district, each approximately 300 feet in length and are equipped with pan-conveyors. Two roadways only are necessary for this method of operation, one used as a timber-road on the top end of the wall and the other as a loading-road at the lower end of the wall. This system eliminates the greatest part of the costly brushing in a low coal-seam and is very efficient. The loading-roadway is usually driven ahead in the solid about 100 feet and kept this distance ahead of the face-line for the purpose of storing a trip of cars, which are drawn back under the discharge-end of the conveyors and loaded in trips, which are then hauled to a convenient siding either by mule or mechanical haulage. The roadways and working-places were well timbered and cogged and the waste well packed. The ventilation was good and no explosive gas or CH_4 gas-caps were found. I measured 11,000 cubic feet of air a minute passing into the section for the use of forty-eight men and ten mules. During the year a connection was made between the North-east slope and this section which greatly improved the ventilation. Up to the time of writing the area expected to be developed in the North-east slope has not turned out very well. The coal-seam at this point is very disturbed and faulty and very little progress was made from a development standpoint during the year.

No. 6 Wall District (Newcastle Seam).—This district is entirely machine-mined and worked on the long-wall system, with faces about 300 feet long, equipped with pan-conveyors. The seam in this section is only 22 inches thick and the mining is done in the clays underlying the seam. The coal is very hard and of excellent quality, the recovery being about 90 per cent. lump. Practically the same method is used as in No. 5 Wall district. The roadways and working-places were well timbered and cogged and the waste well packed. The ventilation was good and no explosive gas or CH_4 gas-caps were found.

No. 7 Wall (Newcastle Seam).—This is a new section recently reached by a rock tunnel 400 feet in length and driven at an angle of 7½°. The area is being developed in the same manner as No. 6 wall and is really an extension of this wall. Two walls, each about 200 feet long, have been opened up and equipped with pan-conveyors. Preparations are now being made for two more walls to be opened up. The development of this section will eventually cut off No. 6 wall, and all the output from both walls will be handled from this section as haulage arrangements are much more efficient. It was in No. 6 wall that the fatal accident occurred to Paul Pavlich, a mucker, who was suffocated by being pinned face downwards in the mining-dirt, before he could be extricated, by a thin slab of rock that fell on him. A rock tunnel 80 feet in length was driven from No. 7 wall to No. 6 wall for the purpose of ventilation. This tunnel put the two sections on one split and improved the ventilation of both sections considerably. The roadways and working-places were well timbered and cogged and the waste well packed. The ventilation was good and no explosive gas or CH_4 gas-caps were found. I measured 6,600 cubic feet of air a minute passing through Nos. 6 and 7 walls for the use of twenty-five men and two mules.

There is very little evidence of coal-dust in the workings of the North side. Practically the whole of the machine-mining is done in the dirt-bands in the seam or in the underlying clays. Most of the haulage-roads are damp and in many cases are very wet and muddy. All shot-firing is done by certificated officials using shot-firing batteries and cables. Permitted explosives only are used.

The district known as No. 2 incline in the Douglas seam, which was in operation last year, is now finished and abandoned and all material is withdrawn.

REPORT BY THOS. R. JACKSON, INSPECTOR.

RESERVE MINE.

Robert Laird, Manager; Clifford Dickinson, Overman.

Owing to the coal-trade depression this mine was closed down during the month of March and has not yet resumed mining operations.

The water from the mine-workings is being maintained in the sump at a sufficient level to permit the resumption of coal production immediately. Engineers are employed at No. 2 shaft

for the purpose of dewatering the mine. The water is hoisted in tanks each capable of holding 1,200 gallons. If required, this amount can be hoisted every forty-five seconds.

For further information regarding this colliery and plant equipment *see* former reports.

REPORT BY GEO. O'BRIEN, INSPECTOR.

WAKESIAH MINE.

W. H. Moore, Manager; Nat Bevis, Overman.

The Wakesiah Colliery was closed down and permanently abandoned in the month of January. All material has been withdrawn underground and the shaft is filling up with water.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

F. Perry, President, Montreal, Que.; Lieut.-Col. Chas. W. Villiers, President, Nanaimo, B.C.; H. S. Adlington, Secretary, Montreal, Que.; P. S. Fagan, Assistant Secretary, Nanaimo, B.C.; John Hunt, General Manager, Nanaimo, B.C.

The above company operated the following mines during 1930: 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; and No. 5 mine, situated at South 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, 6, and Scott's slope. No. 6 is a shaft used as a means of drainage and air-intake 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 hydro-electric plant of this company, which has been described in previous reports, has been in constant operation during the year. Sufficient electricity is generated at this plant to supply motive power for all the collieries, the wharf at Union Bay, and for the lighting of Courtenay, Union Bay, Happy Valley, and Cumberland.

No. 4 MINE.

Thomas Scott, Manager; John Williams, Overman, No. 1 Slope; A. W. Watson, Overman, No. 2 Slope; Charles O'Brien, Shiftboss; Jack Devlin, Wm. Devoy, Jack Vaughan, George Harvey, Robert Walker, Thomas Shields, Alf Jones, Wm. Herd, Wm. Keenan, Thos. Eccleston, Robert McNeil, and Sam Harwood, Firebosses.

This mine consists of two slopes with one main entrance. No. 1 slope runs due north and No. 2 slope runs N. 45° E.

The 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.

These slopes diverge at a point about 75 feet from the main portal. The electric haulage-engine, situated a little way beyond the pit-head, is so connected that trips can be run simultaneously on both slopes to a point where they converge to the main entrance.

The lower seam of coal is worked and varies from 3 to 7 feet in thickness. It is classified as good coal, and though containing a small percentage of sulphur is good coking-coal.

Extraction of pillars is common in both slopes, the working areas of which have been considerably reduced during the past few years. The active workings in No. 1 slope are confined to No. 5 West and No. 11 West levels and No. 10 East section. In No. 2 slope the pillars are being extracted from No. 3 East section, No. 6 East level, and Nos. 7, 8, and 8.5 East levels, also No. 4 West section.

A considerable area of solid coal has been reached by means of No. 11 West level, off No. 1 slope. The tonnage from this district will, as soon as the Scott slope is connected, be brought out that way and over a narrow-gauge track which crosses White's bay on trestle-work; thence to the main track at No. 4 Comox mine portal, where it will be picked up by the main haulage-engine, landed at the pit-head, and dumped into the tipple located there.

Several diamond-drill holes have been put up to a seam of coal overlying the Lower seam. The thickness of strata between the two seams is approximately 40 feet. It is yet too early to predict just exactly what will be done to explore this seam. Analysis of the coal found by the drill is being checked up with a view of determining future development-work.

Electric head-lights of the Edison "H" storage-battery type are used by the workmen and the flame safety-lamps of the Wolf type are used by the firebosses for gas-testing purposes.

No. 1 Slope.—The electrical equipment of this slope consists of the following: One 75-horse-power motor-pump at No. 9 West level; three 2,200–440 volt transformers and one 10-horse-power charging-set at No. 11 West level; two 5.5-ton storage-battery locomotives operating on No. 11 West level; three 2,200–440 volt transformers and one 75-horse-power hoist at the top of incline off No. 11 West level.

During my December inspection there was 108,000 cubic feet of air a minute passing into the mine at the main entrance; of this amount, 38,000 cubic feet was passing into No. 1 slope. I also measured 25,000 cubic feet of air a minute entering No. 11 West level split from the Scott slope for the use of forty men and five mules.

The ventilation in all working-parts of No. 5 West, No. 11 West, and No. 10 East levels was found to be generally good. No explosive gas nor gas-caps were found and the roadways and timbering were in good condition. The sections were sufficiently free from coal-dust, owing to heavy dampness and water on roadways, to comply with the requirements of the "Coal-mines Regulation Act" regarding coal-dust.

No. 2 Slope.—The electrical equipment of this slope consists of the following: Three 2,200–440 volt transformers at No. 3 East level; one 35-horse-power hoist at the dip off No. 3 East level; three 2,200–440 volt transformers at No. 6 East level; one 75-horse-power and one 35-horse-power motor-hoist at the top of incline off No. 6 East level; one 200-horse-power pump; two 35-horse-power "booster" pumps, two 150-horse-power pumps, and one 25-horse-power "booster" pump, all at the bottom of Main slope.

During December I examined all working-parts of No. 3 East, Nos. 6, 7, 8, and 8.5 levels, also No. 4 West level and the Main slope to the bottom, where the pumps are situated. The ventilation was found to be fairly good. Owing to the pillars standing in the gob it is a difficult undertaking to ventilate the places thoroughly. No explosive gas nor gas-caps were found. The roadways and timbering were in good condition and the sections were sufficiently free from coal-dust, owing to the heavy dampness and water on roadways, to comply with the requirements of the "Coal-mines Regulation Act" regarding coal-dust.

Where dust samples, taken from susceptible areas in other parts of the mine, were found by analysis to contain less inert matter than the law requires, this area was again treated in such a manner that the dust samples taken from the newly treated areas contained sufficient inert matter to comply with the regulations *re* coal-dust.

Gas committee reports of the conditions of Nos. 1 and 2 slopes have been received at this office every month. These reports were generally of a satisfactory nature. Mine-air samples taken at the fans showed there was no methane in the air.

Scott's Slope (No. 4 Mine).

T. W. Scott, Manager; Charles Parnham, James Quinn, and John Dando, Firebosses.

On account of long haulage and poor ventilation in the section at the top of No. 1 incline, off No. 11 West level, No. 1 slope, it was decided to sink two slopes from the surface to connect

with these workings and overcome the existing difficulties of operation. This section will be the future producer of the mine, being in an area of solid coal.

The workings in this section are about 200 feet below the surface and quite an overburden of gravel is known to exist over the area. A shaft was sunk through the gravel, and sand rock was met at a depth of 24 feet. To connect with the bottom of the shaft a rock-drift was driven, on a pitch of 46°, up from the coal-workings below, 200 feet long and 7 by 9 feet in section. The shaft has a concrete lining 12 inches thick based on a ledge of sand-rock which was trimmed off for this purpose at the bottom after the drift was put through.

The shaft is 8 by 8 feet in the clear. On one side a ladder-way has been made, and this ladder-way is continued to the bottom of the drift, providing a travelling-way for the men working in the section, thereby permitting them to have one hour longer at the face on account of the shorter distance to travel.

Air-measurements show a quantity of 25,000 cubic feet of air a minute passing down this shaft for the use of forty men and five mules at present employed in this section.

The main haulage slope, which will reach the coal-workings within a distance of 650 feet, is now being sunk from the surface. The slope is 7 by 10 feet in the clear, on a pitch of 22 per cent., and at the end of December the slope was down 180 feet, 130 feet having been driven through gravel. In the gravel the sets, consisting of 15-inch diameter timbers, are spaced 2 feet 6 inches centre to centre, placed on 6-inch by 13-inch sills.

The new slope is situated about 1 mile to the north of No. 4 mine tipple, with which it is connected by a narrow-gauge track. The coal will be hauled in trips of thirty mine-cars by a steam dinky locomotive and screened at No. 4 mine-tipple.

No. 5 Mine.

Robert Laird, Manager; Cliff Dickinson, Overman; Sam Jones, J. Brown, J. D. Davies, and Harry Jackson, Firebosses.

The workings of this mine are reached by a shaft 280 feet deep to No. 1 seam. A short distance from the shaft-bottom slopes have been driven down through the measures to No. 2 seam, 115 feet vertically below No. 1 seam. In this seam the slopes have been driven down a distance of 1 mile.

During the first six months of the year operations were practically confined to the extraction of pillars in No. 1 seam and developing of pillar-and-stall work in No. 4 level, No. 2 seam.

In July the Main slope was again started and opened up on the long-wall system. Since that time the slope has advanced 500 feet and the face-line opened up to date is 1,500 feet long. Owing to depression in the coal trade all pillar-and-stall work in No. 2 seam and pillar-extraction in No. 1 seam was stopped in the month of August and the production reduced from 300 tons a day to 250 tons a day, which has been taken entirely from the new long-wall section.

Two of the old-type Sullivan long-wall electric coal-cutters have been refitted with 6-foot jibs and Bowdil chains and are used on the long-wall face with good results. There are also four short-wall electric coal-cutting machines for use in pillar-and-stall work when required.

The underground hoisting equipment consists of one 75-horse-power electric hoist at shaft-bottom, one 150-horse-power electric hoist at the top of the Main slope, and two 30-horse-power electric hoists at the bottom of the slope, with two small Dobson air-hoists near the faces.

The pumping equipment consists of four small air-pumps near the working-places; one 75-horse-power 7-stage electric pump at the bottom of No. 2 slope for delivering to the shaft-bottom and three 75-horse-power 5-stage electric pumps are located at the shaft-bottom to deliver the water to the surface.

Compressed air is supplied by two small 8 by 9 air-compressors driven by 35-horse-power motors. The air is used for pumps, winches, and rock-drills. Small electric drills are being used to drill the coal in addition to hand-drills.

The engine used for hoisting purposes in this shaft is a Wellman-Seaver-Morgan engine, coupled to a 300-horse-power motor. The line unit is 2,200 volts, 3-phase system, 25 cycles. The hoist is equipped with a single drum having two ropes attached, each of which is 1⅛ inches in diameter. An air-brake control is supplied with an overwinding device.

The fan producing ventilation is a 100-horse-power 100-inch double-inlet reversible fan, driven by a motor of 250 horse-power, speed 250 r.p.m. The line is 2,200 volts, 3-phase, 25 cycles.

The quantity of air being produced at the present time is 150,000 cubic feet a minute, with a 6-inch water-gauge. This fan is automatically controlled with temperature relays on all bearings.

During December inspections air measurements on the main intake showed 65,000 cubic feet of air a minute, of which 15,000 cubic feet passed into No. 4 level split. The balance of the air continues down the Main slope and splits right and left at the face. I measured in right split a quantity of 22,000 and in left split 22,000 cubic feet of air a minute passing to ventilate these respective sections. The ventilation, timbering, and roadways were found to be in good condition. No explosive gas nor gas-caps were perceptible when using the Wolf gas-testing flame safety-lamp.

Regarding coal-dust, the Main slope and all roadways leading to the long-wall faces have been treated with lime-rock dust. A water-spray is also used where necessary on the Main slope to reduce the dust content.

A new approved safety-car has been installed on the back end of the man-trip for the purpose of safeguarding the workmen while they are riding up the slope.

Electric head safety-lamps (Model "H" type) are used by all the workmen, and the fire-bosses use the flame safety-lamp of the Wolf type for gas-testing purposes.

Only permitted explosives are used. No blasting is done except by means of cable and battery, and the shots are fired under the supervision of certificated officials.

The gas committee reports submitted to this office each month showed satisfactory conditions to exist.

Mine-air samples show in analysis that new broken ground will give off considerable gas measured in low percentages. One of the mine-air samples taken at the fan showed a reading of 0.45 per cent. methane in 135,000 cubic feet of air a minute passing. 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 face-line of the long-walls to keep the percentage of methane in the air-current at a minimum.

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 regret to have to report that one fatality occurred in this mine during the year.

No. 6 Mine.

This mine is supervised by the officials in charge 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 of water a minute.

During December visit of inspection I measured on the main intake roadway 37,500 cubic feet of air a minute passing inby from the shaft.

The roadways, timber, and ventilation in the stoppings surrounding the abandoned workings in the main heading were in good condition. There are three shifts of hoisting engineers at this shaft and the water is hoisted continuously throughout the twenty-four hours.

Report by Geo. O'Brien, Inspector.

WELLINGTON EXTENSION MINES.

This division of the Canadian Collieries (Dunsmuir), Limited, mining properties comprise Nos. 1 and 2 mines, Extension, and No. 5 mine and the Alexandra mine, South Wellington. Nos. 3, 7, 8, and 9 mines and the Vancouver slope did not operate during the year.

The output of the Extension Colliery is brought to Ladysmith over the Wellington–Extension Colliery Railway, a distance of about 11 miles, which also affords a means of transportation to and from their work for the employees residing at Ladysmith.

Ladysmith.

The general shipping-point for the output of the Extension Colliery is Ladysmith, where the coal is either loaded on vessels or sent to Mainland points in railway-cars by means of transfer-barges. The coal-washing plant is located here, having three washers, each with a capacity of 200 tons in 12 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 power for lighting purposes around the plant and loading-wharves.

EXTENSION COLLIERY.

Thomas M. Wilson, Manager.

The workings of this colliery are situated partly in the Cranberry and partly in the Douglas districts. An excellent description of the geological features of this area was given in the Annual Report for 1929.

The entire output of Nos. 1 and 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 for a distance of 1¼ miles. No. 1 seam is intersected at a distance of three-quarters of a mile from the portal and No. 2 seam at the inner end of the tunnel. Haulage is done by electric locomotives of the overhead-trolley type. The workmen are taken to and from the surface in a man-trip hauled by a 15-ton Baldwin electric locomotive.

Power Plant.—A general description of the power plant is given in the Annual Report for 1929.

The Extension Colliery worked very intermittently during the year owing to the general depression in the coal trade. It is expected that the colliery will be permanently closed down early in 1931.

No. 1 Mine.

Thomas M. Wilson, Mine Manager; Robert Houston, Overman; D. Gordon, A. Orr, and J. Greenhorn, Firebosses.

No development-work was done during the year, the entire output being obtained from pillar-extraction. The pillars are being drawn back very rapidly and mining operations will soon cease in this mine.

During my inspection in December I found the mine well ventilated and clear of explosive gas and CH_4 gas-caps. As a result of pillar-extraction there is a general squeeze in most of the roadways and severe crushing of the timbers is very noticeable. I measured 18,000 cubic feet of air a minute passing into the mine for the use of twenty men and two mules.

No. 2 Mine.

Thomas M. Wilson, Mine Manager; Robert Houston, Overman; J. Wilson, T. Strang, R. N. Hamilton, J. Stewart, H. Yeowart, J. McKinley, Ed. Heyes, J. Gillespie, T. Hunter, C. Cloke, and Ernest Heyes, Firebosses.

No development-work was done in this mine during the year, the entire output being obtained from pillar-extraction. This mine is divided into five sections, as follows: No. 2 Incline, No. 17 Incline, East Incline, Lower Motor Road, and Slope section. The East Incline section was abandoned early in the year. No. 17 Incline section is being rapidly exhausted and the same may be said of the remaining sections. It is expected that by early spring most of the recoverable pillars will have been drawn, and as no development or prospecting has taken place in the last few years there is very little in sight for the future.

During my inspection in December I found the mine generally in a fair working condition. I did find, however, a small quantity of explosive gas in one place in the Lower Motor Road section. The rest of the places were clear of explosive gas and CH_4 gas-caps. I measured 16,200 cubic feet of air a minute passing for the use of sixty-five men and twelve mules. Due to the taking-out of the pillars, as is the case in No. 1 mine, the roadways are getting badly crushed and great care is necessary in this mine to prevent serious accidents.

I regret to report that one fatal and three serious non-fatal accidents occurred in this mine during the year. In each case the injured men were miners. Guiseppe Riceputo, miner, was instantly killed by a fall of top coal and cap-rock in his working-place. No evidence could be found that the top coal was spragged or timbered while the deceased was working underneath it. L. Reneard, miner, was struck by a mine-car in his working-place, caused by the block that was holding the car slipping out and causing the car to run toward him and fracture his left leg. George Fearon, miner, was preparing to put timber under a bad piece of roof when some of the loose rock fell on him and fractured his pelvis. Albert Torkko, miner, was also preparing to put timber under a bad piece of roof when some of the loose rock fell on him and fractured his pelvis.

All shot-firing at this colliery is done by certificated officials with shot-firing battery and cable. Permitted explosives only are used.

The roadways and working-places in this colliery are very damp and there is practically no evidence of dangerous coal-dust accumulations.

REPORT BY GEO. O'BRIEN, INSPECTOR.

WELLINGTON EXTENSION No. 5 MINE, SOUTH WELLINGTON.

Wm. Wilson, Manager.

This colliery, 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 Alexandra mine. The seam is variable in thickness, "pinches" and "wants" being frequently encountered. 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 the railway to the Canadian Collieries shipping centre at Ladysmith. The tipple is provided with a revolving dump capable of handling 500 tons in eight hours, chain car-haul, shaker screens, picking-table, loading-boom, and a scraper conveyor for boiler-fuel. The output is hoisted up the Main slope in No. 5 mine by a first-motion steam-hoist with 18- by 36-inch cylinders.

No. 5 MINE.

Wm. Wilson, Mine Manager; Joseph Wilson, Overman; A. Derbyshire, Ed. Surtees, Dan McMillan, Dan Caldwell, and Joseph Neen, Firebosses.

Considerable development has taken place in this mine during the year, despite the fact that work was very intermittent owing to the general depression in the coal trade. The main development was toward the Old Alexandra mine, which was successfully dewatered during the year, and fine roadways were driven from the No. 5 mine and connected to the Alexandra mine. Some of the coal is machine-mined by compressed-air-driven Siskol mining-machines. The Douglas seam, which is the only seam in operation at this colliery, is 20 feet thick in many places and is fairly friable. The system of working is pillar and stall and some pillar-extraction, the latter being chiefly confined to the removal of the barrier-pillar that formerly separated No. 5 mine workings from the Alexandra workings.

During my inspection of this mine in December I found general working conditions to be good. The roadways and working-places were well timbered, the ventilation was good, and no explosive gas or CH_4 gas-caps were found. I measured 14,000 cubic feet of air a minute passing in the No. 5 mine split for the use of sixty men and three mules.

ALEXANDRA MINE.

Wm. Wilson, Mine Manager; Joseph Wilson, Overman; Hugh Davidson and Ernest Kelly, Firebosses.

This is the Old Alexandra mine formerly operated by the Robert Dunsmuir interests some thirty years ago. The mine was closed down in 1901 and has not been in operation since that time until this year. The dewatering of the Alexandra mine was commenced late in 1929 and was successfully completed toward the end of 1930. There is still a small area to be dewatered near the bottom of the slope, but it will be some time before this will be required. The barrier-pillar was penetrated by careful boring from the No. 5 mine and the water was allowed to drain into the lower workings of No. 5 mine, which formed a large sump for the reception of the water. It is pumped from this sump to the surface by two Allis-Chalmers single-stage centrifugal pumps, each with a capacity of 1,400 gallons a minute. The Main slope was cleaned up and regraded as the water receded. The track has been relayed with 35-lb. steel from top to bottom. The output is hauled up the Main slope by a 90-horse-power 250-volt d.c. electric hoist to a siding near the mouth of the slope. It is then hauled by a steam-locomotive on a narrow-gauge track of 36-inch gauge to the No. 5 mine tipple, a distance of about half a mile. General development is in progress, new roadways are being driven, as well as some of the old ones being cleaned up. The coal is of excellent quality, though fairly friable.

During my inspection in December I found general working conditions to be good. The roadways were well timbered, the ventilation was good, and no explosive gas or CH_4 gas-caps were found. I measured 21,000 cubic feet of air entering the Alexandra split for the use of

forty men and two mules. There is very little evidence of dangerous accumulations of coal-dust in the South Wellington Colliery, as the mine-workings are naturally very damp and in many cases wet and muddy, the haulage-roads being particularly so.

I am pleased to be able to report that no fatal or serious accidents occurred at this colliery during the year.

All shot-firing is done by certificated officials with shot-firing battery and cable, and permitted explosives only are used in the mine.

REPORT BY THOS. R. JACKSON, INSPECTOR.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.

Chas. Bocking, President, Vancouver, B.C.; Miss Harvey, Secretary, New York City; L. R. Thomas, Assistant Treasurer, Vancouver, B.C.; Robert Henderson, Superintendent, Cassidy, B.C.

Nos. 1 AND 2 MINES.

Robert Henderson, Manager; Fritz John, Overman; Tom Bullen, Albert Radford, James McGrath, Alex. McLaughlin, Matthew Meek, and Daniel Morgan, Firebosses.

Granby Colliery, consisting of Nos. 1 and 2 mines, is situated about 9 miles in a southerly direction from Nanaimo. These mines are entered by slopes from the surface. In No. 1 mine 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-inch water-gauge. This fan is driven by a 150-horse-power Westinghouse electric motor. The main hoist is a Vulcan 18- by 26-inch double-drum second-motion hoist. The mine-cars have a carrying capacity of 1.75 tons and mechanical haulage only is used underground. Compressed air is used underground for driving drills, pumps, and winches, and is provided by a Rand cross-compound compressor having a capacity of 2,000 cubic feet of air a minute. Electric power is supplied by an Allis-Chalmers 450-kw. generator, 2,300-volt, 3-phase, 60-cycle, 300 r.p.m., direct-connected to a vertical high-speed Goldie & McCulloch engine. 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, is kept in readiness for emergency.

The chief source of coal-supply is from the extraction of pillars. At No. 2 mine a solid piece of coal was reached and is now about worked out. This mine was started last year and has been producing about 250 tons a day. No. 1 mine produces about 400 tons a day. Towards the end of the year both mines were connected and the ventilation for both is now provided by No. 1 fan.

Now that connection exists between the two mines No. 2 fan has been stopped. The Main slope, which was a return airway, is now an intake.

A large bath-house and change-room is used by the miners for the purpose of changing 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.

All employees underground use approved electric safety cap-lamps and the firebosses use the Wolf flame safety-lamp for gas-testing purposes. Only permitted explosives are used underground.

The ventilation is well maintained and during my last inspection in December no gas was found. Samples of dust taken throughout the year show a satisfactory incombustible content.

REPORT BY GEO. O'BRIEN, INSPECTOR.

FIDDICK MINE, SOUTH WELLINGTON.

Richard Fiddick, Operator; Wm. Roper, Fireboss.

This mine is situated on the site formerly worked by the Pacific Coast Coal Mines, Limited, near the South Wellington Station on the Esquimalt & Nanaimo Railway. The operation consists

entirely of recovering pillars left by the previous operators. A new slope was sunk early in the year and work has been fairly steady on a small scale during the year. During my inspection in December I found general working conditions to be good. The ventilation, which is by natural means, was good and no explosive gas or CH_4 gas-caps were found. The roadways and working-places were well timbered and cogged. The mine is naturally damp and very little evidence of coal-dust could be found. All shot-firing is done by certificated officials with shot-firing battery and cable, and permitted explosives only are used underground. No accidents were reported from this mine during the year.

REPORT BY GEO. O'BRIEN, INSPECTOR.

RICHARDSON MINE, SOUTH WELLINGTON.

Richardson Bros., Operators; Robt. Wright, Fireboss.

This mine is also situated on the site of the Pacic Coast Coal Company's former operations, near the South Wellington Station on the Esquimalt & Nanaimo Railway. The operation consists entirely of recovering pillars left by the former operators. The mine was idle for eight months during the year, there being very little demand for the coal, which is disposed of locally.

During my inspection in December I found the ventilation, which is by natural means, to be good. No explosive gas or CH_4 gas-caps were found. The mine is naturally damp and very little evidence of coal-dust could be found. All shot-firing is done by certificated officials with shot-firing battery and cable, and permitted explosives only are used. No accidents were reported from this mine during the year.

REPORT BY GEO. O'BRIEN, INSPECTOR.

BIGGS' MINE, WELLLINGTON.

James Biggs, Operator; Jas. Rallison, Fireboss.

This mine is situated in Section 1, Range 2, Mountain District, near the Canadian Collieries (Dunsmuir), Limited, No. 9 mine at Wellington. The operation consists entirely of extracting a few pillars left by former operators. The mine closed down in September and has not operated since. There are only a few small pillars left and the present owners expect to recover them when the coal trade picks up.

No explosive gas or CH_4 gas-caps were found during my inspections of this mine. The mine is very damp and very little evidence of coal-dust could be seen. While the mine was in operation all shot-firing was done by certificated officials with shot-firing battery and cable, and permitted explosives only were used. There were no accidents reported from this mine during the year.

REPORT BY GEO. O'BRIEN, INSPECTOR.

LITTLE ASH MINE, WELLINGTON.

R. H. Chambers & Co., Operators; R. H. Chambers and Chas. Webber, Firebosses.

This mine is situated about a mile from the town of Wellington. It was formerly known as the Jordan mine and operated under that name about thirty years ago. A lease of the property was acquired by a few local miners in 1928 and operations have been continuous since that time, chiefly the extraction of the pillars left by the former owners. The seam averages about 6 feet in thickness and is of excellent quality.

During my inspection in December I found general working conditions to be good. The ventilation, which is by natural means, was good and no explosive gas or CH_4 gas-caps were found. The roadways and working-places were well timbered and cogged. The mine is very damp and there are no accumulations of coal-dust. All shot-firing is done by certificated officials with shot-firing battery and cable, and permitted explosives are used. No accidents were reported from this mine during the year.

REPORT BY GEO. O'BRIEN, INSPECTOR.

LITTLE JINGLE POT MINE, EAST WELLINGTON.

Joseph Stewart, Operator; Jos. Thompson, Fireboss.

This mine is situated on the original Jingle Pot mine property at East Wellington. The operation consists of extracting some outcrop pillars that were left by the original owners.

A lease on the property was acquired by two local miners and the old adit-tunnel was reopened and cleaned up. The seam pitches about 50° at this point and the coal is of excellent quality. The entire output is sold locally. There are only a few pillars left that can be recovered, so the life of this operation is very limited.

During my inspection in December I found working conditions to be good. The ventilation, which is by natural means, was good and no explosive gas or CH_4 gas-caps were found. The working-places and roadways were well timbered and cogged. The mine is very damp and there are no accumulations of coal-dust. All shot-firing is done by certificated officials with shot-firing battery and cable, and permitted explosives only are used. No accidents were reported from this mine during the year.

REPORT BY GEO. O'BRIEN, INSPECTOR.

Lantzville Collieries, Ltd., Lantzville.

Henry Shepherd, President, Nanaimo, B.C.; J. E. Ryan, Secretary-Treasurer, Nanaimo, B.C.; J. A. Challoner, Superintendent, Lantzville, B.C.

No. 1 MINE.

Arthur Challoner, Overman and Fireboss.

This mine is situated on Nanoose bay, about 9 miles north of the city of Nanaimo. Part of the output is shipped to Vancouver and the remainder is sold locally. Very little actual development was done during the year, the work being chiefly confined to a small section operated on a semi-long-wall basis. The seam averages about 22 inches in thickness, is very hard and of excellent quality. A fault was encountered at the face of the Main level which completely cut the coal out. A little prospecting was done at this point, but the seam was not located. The same fault extends across the working area of the mine and is gradually cutting off the working-places. There are indications of the seam on the other side of the fault in a bore-hole about 700 feet beyond the face of the Main level, and I am informed that it is the intention of the company to penetrate this fault by driving a rock tunnel through the fault.

During my inspection in December I found general working conditions to be good. The roadways and working-places were well timbered and cogged and the waste well packed. The ventilation was good and no explosive gas or CH_4 gas-caps were found. The mine is very damp and there are no accumulations of coal-dust. All shot-firing is done by certificated officials with shot-firing battery and cable, and permitted explosives are used. I measured 4,500 cubic feet of air a minute passing into the mine for the use of ten men. No accidents were reported from this mine during the year.

REPORT BY GEO. O'BRIEN, INSPECTOR.

Canadian Coal and Iron Co., Ltd.

MORDEN MINE, SOUTH WELLINGTON.

Charles Graham, Mine Manager; Wm. Walker, Peter Carr, and D. McMillan, Firebosses.

The Morden mine was formerly operated by Pacific Coast Coal Mines, Limited, but was closed down in 1921 and remained closed until February, 1930, when the Canadian Coal and Iron Company reopened the Morden shaft and the work of dewatering the mine was commenced. A large amount of work was necessary to repair the caved roadways and the dewatering of the mine was considerably hampered by several large caves on the Main slope. A small quantity of coal was produced the following month, and subsequent months, by skipping the pillars in some of the roadways that were being reopened. A little over 3,000 tons of coal was recovered in this manner during the period of operation. Some prospecting was done on the West side of the shaft, but the seam was not located at this point. A distance of about 700 feet was cleaned up and retimbered on the Main slope, when the mine again closed down in the middle of August and has remained closed up to the time of writing. At the present time only a watchman is employed looking after the plant and equipment.

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 1930.

The coal companies operating in this district during the year were as follows: The Coalmont Collieries, Limited; Middlesboro Collieries, Limited; Pleasant Valley Mining Company, Limited; the Tulameen Coal Mines, Limited; and the Blue Flame Coal Mines, Limited. These companies continued to operate during the whole of the year, with the exception of the Blue Flame Colliery, which suspended operations during the early part of the year, but were reopened again during the month of September by the Economy Coal and Supply Company, Limited, of Vancouver.

There was a small amount of work done at the Normandale mine during the summer, when the slope was dewatered, cleaned out, retimbered, and the face advanced a few feet. There were three men employed underground and after working a short while work was again suspended. The Ashington Coal Company, Limited, did work of an exploratory nature on the "Wilson" coal property in Princeton by driving the main adit-tunnel to a point 700 feet from the portal. A diamond-drill hole was put down 300 feet at this point, after which work was suspended.

ACCIDENTS.

Two fatal accidents and three of a serious nature were reported to this office during the present year, resulting in the death of forty-six men and injury to three others. A fireboss in the No. 2 mine of the Tulameen Coal Company was in the act of firing a shot in the mine on the night of November 23rd when a number of detonators on his person made contact with the battery current and detonated, with fatal results.

I regret to report that a most disastrous explosion occurred in the No. 4 mine, Coalmont Collieries, Limited, on the evening of August 13th, resulting in the death of forty-five men. There were forty-six men on shift at this time in this mine and only one escaped with his life. It is not my intention to attempt to give the cause of this terrible disaster in this report, as the matter may be very well left with the Chief Inspector of Mines and Commissioner Thomas Graham, who was appointed by the Hon. the Minister of Mines to make a searching investigation and if possible report the cause.

The three serious non-fatal accidents happened at the Coalmont Collieries, Limited—two in the No. 4 mine and one in the No. 3 mine, resulting in the injury of the same number of employees.

All the accidents were investigated and where inquests were held I was notified and attended the same. I am very much indebted to the Coroner for his courtesy in giving me every opportunity in questioning the witnesses for the purpose of assisting in solving the cause of the accidents.

INSPECTION ON BEHALF OF THE WORKMEN.

Inspections on behalf of the workmen have been attended to at the larger coal-mining operations in this district during the year, these inspections being made regularly each month. I am pleased to state that a copy of the inspection reports have been mailed to this office regularly and in all cases have been very favourable.

DANGEROUS OCCURRENCES.

Three notices of dangerous occurrences were received at this office during the year and all had reference to heating or fires underground. During the early part of the year heating occurred in the old roads of a small section between the No. 5 and No. 6 levels of the No. 4 mine, Coalmont Collieries, Limited, which was immediately sealed off; and during the month of July heating occurred in an old crosscut off the No. 2 West level of the same mine. This was treated with water and cleaned out. During the month of December there were distinct signs of heating in an abandoned area of the Blue Flame Coal mine near Princeton, which necessitated the sealing-off of this section.

SPONTANEOUS COMBUSTION.

Spontaneous heating is one of the most serious hazards encountered in operating coal-mines in this district, as the seams are of a high volatile nature and very susceptible to spontaneous

combustion, and, viewing the whole history of coal-mining in this district, some system of general application should be observed in coal-mining in this area to give the greatest margin of safety from this danger.

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.; Geo. 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.

Transportation is provided for between the mine and the tipple by an overhead tramway 15,000 feet in length, which passes over the mountain to the mines at Blakeburn. It is here that the mine offices, bunk-house, dining-hall, wash and change rooms, machine-shops, auxiliary steam plant, and a fairly large number of residences, occupied by the employees, are situated.

This company is at present operating the No. 3 and No. 4 mines, which are situated on Blakeburn (North fork of Granite) creek and have been developed by adit-levels driven into the side of the mountain. At present all the operations are to the dip of these adits and in the same seam of coal. The seam has a general pitch south of 20° and has an unusual thickness that may be better described as a number of seams of coal intersected by small bands of shale, fireclay, and inferior coal which have an aggregate thickness of from 80 to 100 feet. The coal is of a high volatile nature and the area has been subjected to a large amount of minor and major faulting. The particular seam being worked is about 12 feet thick and is overlaid by an irregular friable lime rock 2 feet thick and disintegrates and expands when in contact with the atmosphere. Generally 1 or 2 feet of the upper part of the seam is left to form a working-roof. The measures are friable, making the timber costs high and increasing the difficulty in maintaining roadways.

All the work in the mines consists of the extraction of pillars. The No. 3 mine, which has been in operation for some considerable time, is at present somewhat small and the area to be extracted limited. Preparations have been made during the year for the purpose of opening the No. 5 mine, which is situated 3,500 feet west at an elevation of 252 feet above the entrance to the No. 4 mine.

An incline has been graded between No. 5 mine and the present electric-trolley haulage system and a 75-horse-power electric-driven slope-hoist has been installed at the new operation. The new slope has been driven a distance of about 50 feet from the portal and will develop a section of the Coalmont field lying to the west of No. 4 mine.

There has been no change in the power plant or the tramway operations during the year. For description *see* previous reports.

No. 3 MINE.

John Davis, A. M. McDonald, and Robert Barrass, Firebosses.

The entrance to this mine is situated on the same elevation and 1,500 feet north of the top terminal of the aerial tram. The mine was developed by a well-timbered 8 by 12 adit-level from the surface croppings and follows the strike of the seam for a distance of some 3,000 feet, being generally known as the "Wilson tunnel." All the work consists of the extraction of pillars from the Nos. 1 and 2 slopes to the dip of the main haulage-level. During the present year the No. 1 Slope section, which has been sealed up for several years, was again opened up and the slope skipped a distance of some 500 feet below the Main level, where the pillars are at present being split and preparation made for drawing back this section of the mine.

Owing to the friable nature of the coal a very small quantity of explosive is required. The ventilation is produced by a fan 5 feet in diameter, driven by a 30-horse-power induction-motor, situated near the entrance to the counter-level, and during my last visit to this mine ventilation measured showed that 10,800 feet of air a minute was passing into the mine for the use of twenty men. The air was well conducted around the working-faces, the brattice and stoppings being

in good order. The mine is very free from methane and during the present year I have not been able to find any gas in and around the working-faces.

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 and in good condition; analyses of material taken from the roads of this mine, which are well treated with inert dust, show proper compliance with the requirements of the Coal-dust Regulations.

All the coal is mined by hand. When blasting is required it is done under the supervision of certificated officials with permitted explosives and fired by electric detonators.

No. 4 MINE.

Harry Hopkins, Overman; Robert Murray, Thomas Bryden, Archie McWhirter, Frank Bond, Wilfred Valentine, George Walker, and Fred Miller, Firebosses.

This is the largest and the most important operation of the Coalmont Collieries, Limited. It is situated 5,400 feet north of the entrance to the No. 3 mine and is connected to the top terminal of the aerial tramway by a light electric railway, built around the side of the hill from the No. 3 mine. This mine was opened during the year 1924 by an 8 by 10 rock tunnel, known as the No. 4 tunnel, driven into the side of the mountain and cutting through the measures, which were found to be lying at an angle of some 30°, and entered the coal-seam at a distance of 300 feet from the portal. This tunnel is at an elevation of 4,000 feet and is 209 feet above the light railway, and as a result a surface gravity-plane was in use for conveying the coal from the mine to the main haulage below. For the purpose of facilitating the haulage a cross-measure tunnel was driven at the elevation of the electric haulage; this intersected the Main slope and all the output of the mine is hauled through this tunnel, which has a total length of 1,600 feet. This mine was developed by an 18° Main slope to the No. 15 West level, which is reached at a distance of 1,800 feet from the knuckle at the No. 6 level; and the No. 17 East level, which is reached at a distance of 2,000 feet. The workable area on the east side is limited and most of the operations have been on the west side of the slope. For some time No. 15 West level has been the main haulage-level and was driven a distance of some 2,000 feet from the Main slope for the purpose of developing the mine to the dip of this level. Two slopes were driven to the dip and were known as the Nos. 1 and 2 slopes.

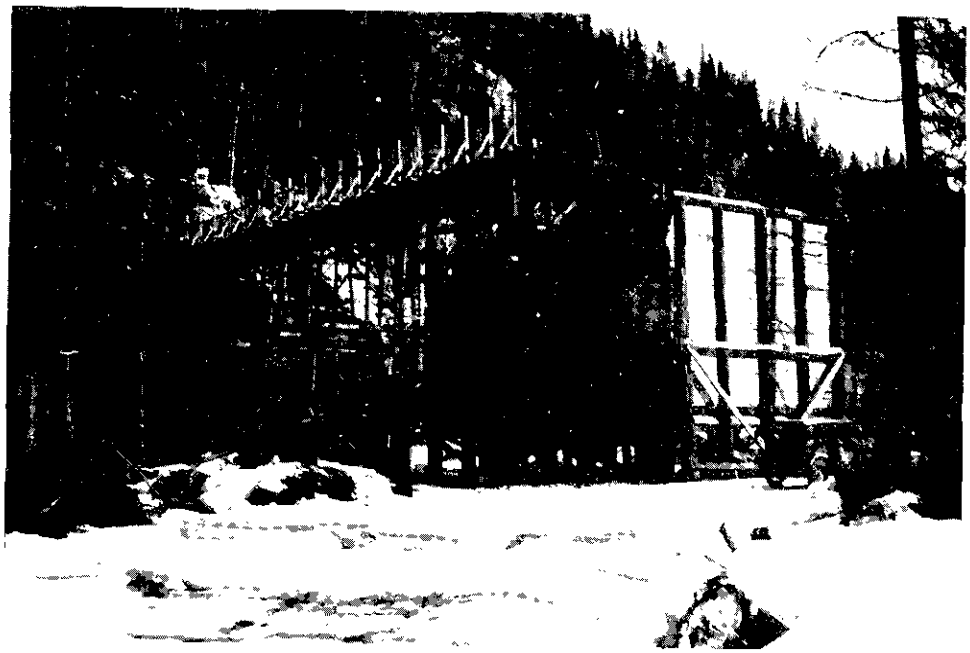
The No. 1 slope was commenced at a distance of 500 feet from the main haulage-slope and driven a distance of 1,000 feet to the dip, while the No. 2 slope area is located 1,000 feet inside of the No. 1 slope and driven a distance of 500 feet to the dip of the No. 15 level. Owing to the depth of the mine and the friable nature of the measures it was hard to maintain roads, with the result that it was considered that this mine had reached its economical limit. During 1930 practically all the work in this mine consisted of extracting pillars, with the result that in the lower section there is a fairly large gob area.

This mine was developed on a modification of the "panel system," and as soon as any section of the mine had reached a limit, which, as a rule, was determined by some major faulting, the extreme pillars were extracted and the areas sealed off with stoppings built with squared timbers and faced with gunite.

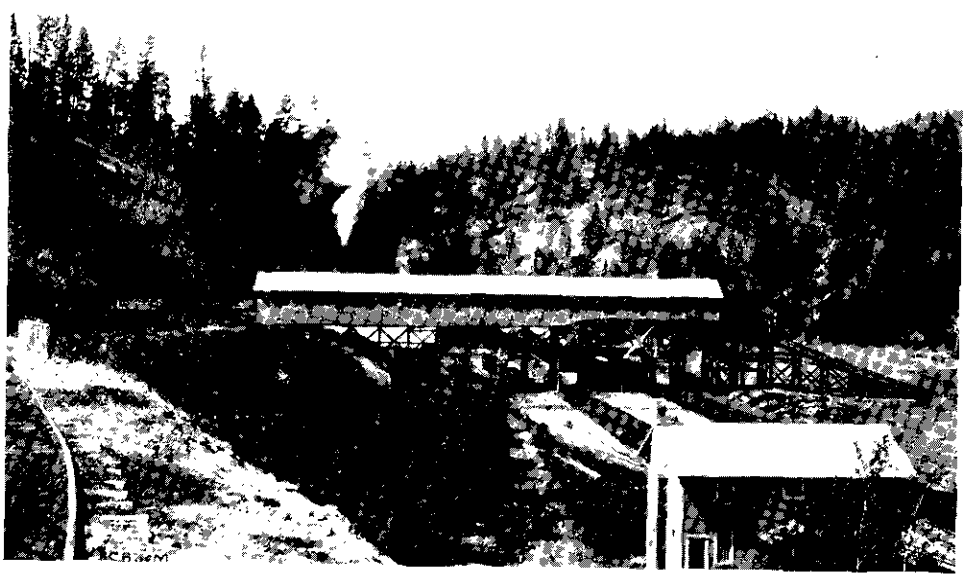
Ventilation is produced by an 84-inch double-inlet belt-driven Sirocco reversible fan, situated near the entrance to the No. 1 counter-heading at the surface croppings some distance above the old No. 4 level, which is operated by a 75-horse-power constant-speed motor, the intake air entering the Main slope and the main haulage-level. The intake current was conducted down the Main slope along the No. 15 West level to the No. 1 slope, where it was split, one part going down to No. 1 Slope workings and thence to the East return, while the other part ventilated the workings in No. 2 slope and passed into the West return.

During my last inspection of this mine in December the ventilation measured showed 28,000 cubic feet of air a minute passing into this mine, and the ventilation measured below the No. 8 West level in the return showed 15,000 cubic feet of air a minute passing for the use of fifty-six men; Burrell gas test was found to be *nil*. The whole of the East side of this mine is at present in the course of being sealed off and as a result the ventilation in this section was somewhat sluggish.

The particular seam mined in No. 4 mine is about 12 feet thick and about 2 feet of this is left next the roof, as there is a very friable rock immediately above the seam.



Duckrill Coal-mine—Bunker on Goat Creek.



Plexsaut Valley Coal Co., Ltd., Princeton.

New Mine-rescue Station at Princeton, B.C.

The quantity of explosives used is small as the coal is easily got.

Following the explosion which occurred in this mine on August 14th, the workings in No. 1 slope were sealed off as a fire precaution and at the end of the year the workings in No. 2 slope were also sealed off on account of heating.

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 most important coal operation in the Nicola-Princeton District and has continued to operate for many years. It is situated 1 mile west of Merritt.

There have been no new developments at this colliery during the year; the operations are confined to the No. 2 East mine, No. 2 North mine, No. 3 North mine, No. 2 South mine, and one small mine that is at present known as the "Prospect" mine. The No. 3 North and the No. 2 South mines are at present by far the most important. The area of any of the mines operated are by no means large and the chief developments are in the No. 2 South mine. The thickness of the different seams of coal averages from 3 to 7 feet of fairly good bituminous coal.

For the purpose of keeping the grade of coal as high as possible the use of explosives is curtailed. All the coal is mined by machines of the post-puncher type, and to further minimize the use of explosives compressed-air picks of the Hardy type have been introduced.

Power Plant.—This plant consists of four return-tubular boilers having an aggregate capacity of 600 horse-power and is used for driving a 2,300-volt alternator coupled direct to a high-speed steam-engine; this provides power for the pumping plant at the Coldwater river, while a smaller d.c. steam-driven generator is in use for lighting purposes at the mines and residences at the Middlesboro townsite.

All the hoists, pumps, and mining-machines at the mines are operated by compressed air provided by a large steam-driven Canadian Rand 2-stage cross-compound air-compressor having a capacity of 2,000 cubic feet of free air a minute.

Approved electric head-lamps are used by all the employees underground, while flame safety-lamps of the Wolf type are used by the officials for inspection purposes. These mines have been well treated with inert dust and samples of material taken from the mines during each month have, on analysis, proved to be in accord with the requirements of the Coal-dust Regulations, while during the whole of the year no explosive gas had been reported to have existed in any of these operations.

The miners have availed themselves of the opportunity provided by section 101, Rule 37, of the "Coal-mines Regulation Act" and appointed representatives to inspect the mines during each month; these reports in each case were found to be very favourable.

No. 2 North Mine.

James Fairfoull, Overman; Lewis Clark, Fireboss.

This mine is situated 300 feet west of the top of the surface incline and at the present time consists of a 30° slope driven to the dip from the surface exposure, a distance of 200 feet. The seam of coal is about 6 feet in thickness and lying at a high angle of inclination. The operation consists of extracting pillars in close proximity to the slope and outcrop.

During my last inspection three men were working in this mine. General conditions regarding ventilation were fairly good, the mine well timbered, and a sufficient supply of suitable timber provided for the use of the miners.

No. 2 South Mine.

James Fairfoull, Overman; Richard Dunnigan, Fireboss.

This mine is situated a short distance west of the entrance to the No. 2 North mine and has been developed by an adit-level driven into the side of the hill from the surface outcrop on the same elevation as the openings into the other mines. This seam of coal varies in thickness from 6 to 8 feet and is highly inclined.

This main adit-level has reached a distance of 1,600 feet from the portal and raises or headings with the necessary crosscuts have been driven to the surface at intervals. An 18° slope was commenced at the surface on the same elevation as the adit-level driven to the dip, a distance of some 600 feet, and continued as the lowest level of the mine, with raises to the adit-level above.

The difference in elevation between the lower level and the surface above is 600 feet. The ventilation is natural and the quantity of air passing through the mine depends a great deal upon the surface temperature. During my last visit to this mine ventilation measured showed 8,000 cubic feet of air a minute passing into this mine for the use of thirty men. The brattice and stoppings 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 also well timbered and in good condition, and being naturally wet were free from dangerous coal-dust. Owing to the high inclination of the seam, which is practically vertical, the method of work adopted follows very much in line with the operations in a metalliferous mine.

No. 3 North Mine.

Alex. Allen, Overman; Garnet S. Corbett and Thomas Rowbottom, Firebosses.

This is the largest and, at present, the most important producing mine of the Middlesboro Collieries, situated a short distance west of the top terminal of the surface incline. It has been developed by an adit-level driven into the side of the hill from the surface outcrop, following the strike of the seam for a distance of some 2,000 feet. Owing to the measures lying in the form of a basin this level followed around the contour and came out in close proximity to its starting-point.

This seam of coal is about 6 feet in thickness and is steeply inclined. Near the entrance to the portal of the level a slope was driven to the dip, a distance of some 700 feet; from this four levels were driven off, which follow the same course as the Main level, but much shorter, the lower level being near the foot of the basin.

The roads are driven 8 feet in width and headings are driven to the rise, with the necessary crosscuts, and are holed through to the surface for ventilation purposes.

Development-work is at present being done to the dip at the foot of the basin. All the work above the main adit-level consists of the extraction of pillars, which have been drawn back to about 500 feet from the entrance.

During my last visit of inspection to the mine ventilation measured showed 16,000 cubic feet of air a minute passing into this mine for the use of thirty-two men. The brattice and stoppings were found to be in fairly good order. There was no trace of methane.

The working-places and roads were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The mine was well treated with inert dust, and analyses of material taken from the same show it to be in accordance with the requirements of the Coal-dust Regulations.

No. 2 East Mine.

William Ewart, Overman; Matthew McKibben, Fireboss.

This is a small mine operated from the surface croppings on the north side of the surface incline. The seam of coal is very irregular in thickness, subject to a great deal of faulting, and lies at a high angle of inclination. Work has generally been of an exploratory nature, but with little success, and as a result work at present consists of the extraction of pillars.

During my last visit of inspection ventilation measured showed 3,000 cubic feet of air a minute passing into this mine for the use of nine men. The air was fairly well conducted around the working-faces and there was no trace of gas in the mine.

The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were also well timbered and in fairly good condition; analyses of material taken from the same were in accordance with the requirements of the Coal-dust Regulations.

Copies of the "Coal-mines Regulation Act" and special rules are well posted near the entrances to these mines.

Tulameen Coal Mines, Ltd.

Robert Dixon, President, Vancouver, B.C.; A. B. Barclay, Secretary-Treasurer, Vancouver, B.C.; John Bennett, Superintendent, Princeton, B.C.

No. 1 MINE.

William Strang, Overman; Thomas Dobie, Robert Gourley, Frank Lester, William Forsyth, David Francis, and Jonathan Pearson, Firebosses.

This mine, situated about 2 miles west of Princeton, is accessible by a good wagon-road following the west bank of the Tulameen river and has been the scene of active developments, both on the surface and underground, during the year.

No. 1 mine, where the underground operations consisted of extracting pillars, was finished during the year and work was concentrated on a new mine known as No. 2; the entrance to this new operation is 800 feet south of the entrance to the No. 1 mine.

Work was commenced at No. 2 mine during January by driving a 20° slope through the measures; this reached the coal-seam about 600 feet from the portal. This is the same seam in which No. 1 mine was operated, but is being mined at a greater depth by the new mine, leaving a barrier-pillar of about 150 feet between the lower operations of No. 1 mine and the developments of the No. 2 mine.

This seam is about 20 feet in thickness and is generally correlated as the No. 1 seam of the Princeton district; the lower section of the seam is intersected with several bands of shale, fireclay, and bone, and as a result the operations are confined to the upper section, which is good clean coal and about 6 feet thick; there is a fairly good shale roof immediately above the seam.

A considerable amount of minor faulting was met in the vicinity where the slope intersected the seam, and this interfered to some extent with the otherwise rapid development of the mine. The faces have advanced with such speed that by the end of the year the workings covered quite a large area and the seam has been found to be less disturbed than was the case where first struck. The roads are driven from 10 to 12 feet in width and the pillars made of a liberal size; owing to the pitch of the seam, chutes are in use for conveying the coal from the face of the headings to the mine-cars.

Shortly after the coal-seam was encountered at the foot of the Main slope, preparations were made to drive a raise on the east side to the surface for the purpose of ventilation; this is now produced by a 5-foot enclosed-type belt-driven fan situated near the entrance to the return airway. During my last visit of inspection ventilation measured showed 12,960 cubic feet of air a minute passing into this mine for the use of thirty men. The air was well conducted around the working-faces, the brattice and stoppings being in fairly good order; Burrell gas test, *nil*.

The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were also well timbered and in fairly good condition; analyses of material taken from the same were shown to be in accordance with the requirements of the Coal-dust Regulations.

All working-places are mined by machines of the post-puncher type and the use of explosives curtailed as much as possible for the purpose of producing the larger sizes of coal for the domestic trade. Permitted explosives are in use and all shots fired electrically by certificated officials appointed for that purpose.

The slope-hoist is a second-motion single-drum engine, the cylinders being 12 by 16 inches. A long trestle was erected from the entrance to the mine slope to the new bunkers and to the screening plant at the railway-siding, where facilities for loading the railway box cars were arranged.

Two return-tubular boilers provide the necessary power for the surface and underground requirements. Three air-compressors are in use having an aggregate capacity of about 1,500 cubic feet of free air a minute; this is used for operatitng the pumps, underground hoists, and the coal-cutting machines.

Approved Edison head-lamps are in use by the employees underground and safety-lamps of the Wolf type are in use by the officials for inspection purposes.

Copies of the "Coal-mines Regulation Act" and the special rules are posted near the entrance to this mine.

Pleasant Valley Coal Mining Co., Ltd.

W. R. Wilson, President, Vancouver, B.C.; R. R. Wilson, Vice-President, Victoria, B.C.; Margaret Duncan, Secretary-Treasurer, Vancouver, B.C.; C. Stubbs, Superintendent, Princeton, B.C.

This operation commenced during the year 1928 and is situated about 1½ miles west of the town of Princeton, on the south bank of the Tulameen river, and is one of the most important developments in this district.

The surface plant is situated on the river-flats, which provides ample space for the mine-yard, tipple, power plant, and other surface arrangements necessary for the operation of a large colliery; and railway connection with the main line of the Kettle Valley Railway, on the opposite side of the river, was completed during the year.

The measures were found to outcrop on the side of a hill and appear to be fairly uniform over a considerable area, which is somewhat unusual in this district. This company is at present operating two seams of coal, one known as the No. 1 or the Upper seam and the other as No. 2, with approximately 800 feet of measures between.

Work up until the present time has been devoted more to development than production, with the result that this colliery is now capable of producing a fairly large tonnage. For information as to tipple and power plant *see* last year's report.

No. 1 MINE.

Thomas Cunliffe, Overman; Antoni Ambrosi and John Gillham, Firebosses.

This mine is situated on the same elevation, about 900 feet east of the tipple, and has been developed by a pair of 8- by 10-foot adit-drifts cutting across the measures and reaching the seam, which is exposed at a higher elevation, at a distance of 700 feet from the portal. From this point levels have been driven in the seam for a distance of 1,900 feet and pairs of headings have been driven at intervals of 500 feet from the levels towards the outcrop; the No. 1 heading was driven through to the surface and is now used as an airway and timber-road. The different sets of headings will constitute separate panels, which is a wise precaution in a field where the coal-seams are so susceptible to spontaneous combustion.

The pitch of the seam, from 12° to 16°, is not sufficient to allow the use of chutes, and a Meco air-driven conveyor was installed in the No. 1 district during November and is working very efficiently.

The roads are driven from 12 to 14 feet in width, horse-haulage being used on the Main level, and the McGinty system of haulage used in driving the headings.

This is a fairly thick seam of coal and the lower section is intersected with several bands of shale, fireclay, and bone, with the result the operations are at present confined to the upper section, which averages from 3 to 4½ feet in thickness of good clean domestic coal overlaid by a fairly good shale roof.

The mine-fan is installed near the entrance to the main counter-level, but is not at present in use as the difference in elevation between the main adit-levels and the surface opening of No. 1 heading produces satisfactory ventilation, which at my last visit of inspection showed 12,000 cubic feet of air a minute passing through the mine for the use of twenty men. The mine was quite clear of any trace of gas and Burrell gas test was *nil;* the working-places were well ventilated and the brattice and stoppings were in good order. The working-faces were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were well timbered, in good condition, and, being naturally damp, were free from dangerous coal-dust.

No. 2 MINE.

William Harmishaw, Fireboss.

This mine is situated 1,700 feet west of the mine-tipple, about 2,600 feet west of the entrance to the No. 1 mine, and is in the Lower seam.

This mine has been developed from the surface croppings by a pair of 12° slopes, following the pitch of the seam to the south, and have been driven a distance of 900 feet from the portal; eight levels being driven to the west side of the slope and three to the east. The seam is from 3 to 5½ feet in thickness, lying on a sand-rock floor, overlaid by a fairly good shale roof, and is a fairly good domestic coal.

Owing to the hard nature of the coal and, further, for the purpose of producing as large amount of big coal as possible, the working-places are all mined by machines of the post-puncher type and all shots fired by electric batteries by officials appointed for this purpose.

Ventilation is produced by a 4-foot belt-driven enclosed-type fan situated near the entrance to the counter-slope, and during my last visit to this mine measurements showed that 3,600 cubic feet of air a minute was passing into this mine for the use of eight men. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were fairly well timbered, in good condition, and, being naturally wet, were free from dangerous coal-dust.

Edison electric head-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.

Blue Flame Collieries, Ltd.

Geo. E. Hurdle, President, Vancouver, B.C.; Harry L. Heaton, Secretary, Vancouver, B.C.; Robert Alstead, Superintendent, Princeton, B.C.

No. 1 MINE.

Robert Alstead, Overman; Arthur Hilton, Fireboss; Ernest Ward, Shotfirer.

This mine is situated on the right bank of Lamont creek, about 10 miles west of the town of Princeton and 1 mile south of the Hope–Princeton highway, and as a result is accessible by a good road. Large motor-trucks are in use for conveying the coal from the mine to the bunkers, situated near the entrance to the Kettle Valley Railway tunnel, a distance of some 9 miles.

This mine was opened from the surface croppings during the year 1927 by the Lynden Coal Mines, Limited, and has continued to operate in rather an intermittent manner by several interests since that time. This property is held by the Blue Flame Collieries, Limited, and is at present operated by the Economy Coal and Supply Company, Limited, of Vancouver. The mine was idle during the early part of the year, and when operations were resumed the tipple arrangements were improved by the installation of a shaker screen and larger bunkers, while a larger hoist was provided on the Main slope. When the above improvements were completed during September the mine resumed production.

The general conditions of the mine did not warrant any further developments in the Main levels and it was decided to commence the extraction of pillars in the inner area of the mine.

The Main slope has an average pitch of about 13° and follows the pitch of the seam a distance of about 600 feet, where the contour of the seam changes. From there it was continued as a level for a further distance of 750 feet, making a total of some 1,350 feet from the face of the level to the portal of the slope. Headings had been driven to the rise about 450 feet and a limited amount of pillars developed to the dip of the mine. This seam is about 24 feet thick, but the mine was confined to the upper part, which consists of good-quality clean coal about 7 feet thick, which finds a ready market for domestic purposes.

It is the intention to develop this mine to the dip of the main haulage, and as a result, 400 feet from the portal of the mine, slopes are at present being driven to the dip. At the end of the year they had reached a distance of about 400 feet from the Main slope and the indications so far have been favourable to this development.

The power plant consists of a 5.5- by 16-foot return-tubular boiler situated near the entrance to the mine and provides power for a 500-foot single-stage air-compressor, slope-hoist, and the mine-fan.

Ventilation is produced by a 4-foot-diameter high-speed enclosed-type steam-driven fan, and during my last visit of inspection measurements showed 16,800 cubic feet of air a minute passing into this mine for the use of twenty-one men; the brattice and stoppings were in fairly good order and the air well conducted around the working-faces. The mine was free from any trace of methane and a Burrell gas test in the return showed *nil*. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the miners. The roads were well timbered and in good condition and treated with inert dust; analyses of samples taken from the same showed them to be in accordance with the requirements of the Coal-dust Regulations.

During the month of December there were distinct signs of heating taking place in the gob area off the section of the mine in the Main levels, which necessitated sealing off this section by three "beam stoppings." This heating was very successfully dealt with and very little loss to this pillar section of the mine.

Edison electric head-lamps are in use by all the employees underground and facilities for charging the same have been installed at the mine. Flame safety-lamps of the Wolf type are in use by the officials for inspection purposes.

There is a total of thirty men employed in and around this mine. Some reside at the camp, where a bunk-house, kitchen, and a dining-hall is maintained, also a wash and change room provided with spray-baths, while a number of the employees who are in possession of cars travel to and from Princeton.

NORTHERN INSPECTION DISTRICT.

REPORT BY THOS. J. SHENTON, INSPECTOR.

Telkwa Collieries, 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 property operated until the end of March and has been idle since that time. The mine is being allowed to fill with water. During operations eight men were employed.

In my different inspections I found the operations to be carried on in compliance with the "Coal-mines Regulation Act."

Bulkley Valley Coal Mine.

F. Dockrill, Managing Director, Telkwa, B.C.; A. Robinson, Superintendent, Telkwa, B.C.

This property is situated 1 mile south of the Goat Creek coal-mine. Operations began in this mine during the month of November. The coal being mined is 12 feet thick and is known as the Betty seam, which is some 60 feet above the Lower seam which was worked in the Goat Creek mine.

During my different inspections I found the operation to be carried on in compliance 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 1930, 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.

Three collieries were in active operation during the year—namely, Coal Creek and Michel, owned and operated by the Crow's Nest Pass Coal Company, Limited, with head office in Fernie; and the Corbin Colliery, owned and operated by the Corbin Collieries, Limited, with head office in Vancouver.

At two of the collieries, Coal Creek and Michel, a part of the fine coal is used for the manufacture of coke, the demand for which has greatly fallen off in recent years, with the result that over 50 per cent. of the ovens are idle. At both collieries the bee-hive type of oven is in use and no attempt is made to recover any by-products.

There has been no labour trouble during the year and relations between the workmen and the employers have been very good.

Accidents.

Fourteen accidents were reported under section 71 of the "Coal-mines Regulation Act," involving death or serious injury to an equal number of workmen.

Four of these accidents were reported from Coal Creek, five from Michel, and five from Corbin.

Four of the accidents resulted in death, all of which took place in the Michel Colliery.

Five of the accidents occurred to miners, three to drivers, two to timbermen, one to a fireboss, one an engineer, and two to labourers.

Five were due to falls of roof or sides, five due to haulage, and four from miscellaneous causes.

Two of the fatal accidents were the result of falls of coal or rock at the face—one a miner, the other a timberman.

Another fatal accident was the result of a car striking the driver, who fell in front of it, while in the fourth the workman was riding on the car when it got out of control of the hoistman.

At least two of these fatal accidents could have been avoided by a little more care on the part of the deceased.

In the non-fatal accidents there were two men injured by being trampled on by horses and another injured while riding his horse from the mine to the barn.

Many of these accidents could be avoided if a little more care was taken by the workmen themselves.

All of the accidents were investigated and, where death resulted, the inquest was attended; we are very much indebted to the Coroner for his courtesy in allowing us to question witnesses so as to assist in solving the cause of the accident.

Ventilation.

The general conditions with respect to ventilation have been well maintained throughout the year and are dealt with in detail in the report made by John MacDonald.

The Burrell gas-detector has been in use at all the collieries and is very useful in determining lesser quantities of methane than can ordinarily be detected with the Wolf safety-lamp. The percentage of methane in the air-currents varied very much during the year, and is lower than in previous years, owing, I believe, to the irregular workings of the mines.

As usual, No. 1 East mine at Coal Creek provides the highest percentages.

In the No. 1 ventilating-split the percentage was under 1 per cent.; in the other three splits it was over; and in the case of No. 3 split was close to 2 per cent.

No. 3 mine, Coal Creek Colliery, showed in the No. 2 split as high as 1.64 per cent. of methane; while the No. 1 split showed over 1 per cent.

In the other mines at Coal Creek the percentages were very low. In the mines at Michel the average percentage was under 1, and in the case of No. 8 mine as low as 0.2 per cent.

At Corbin Colliery the methane contents of the air-currents on an average was very low, No. 4 mine showing 0.5 per cent. and No. 6 showing less than 0.3 per cent.

Regulations for Precaution against Coal-dust.

The conditions with respect to this danger have been very well carried out during the year, and we consider it is very important that this work should be maintained.

The principal means of dealing with this danger (coal-dust) is to use non-combustible dust, which is finely crushed lime rock secured from the Summit Lime Works, situated east of Crowsnest, in Alberta. This firm makes a specialty of providing rock-dust for coal-mines and supplied a great many of the Alberta mines also.

In any case where the non-combustible contents fell below 50 per cent., these places were re-treated and another test made until such time as they were proved satisfactory.

Inspection on behalf of the Workmen.

These inspections on behalf of the workmen have been carried out every month at all the collieries in the district and is of great value in maintaining safer and healthier conditions in and around the mines.

We are very much indebted to the workmen's committee for their interest in this work of inspection. Conditions were generally found to be fairly good and no reports were received at this office complaining of either dangerous or unhealthy conditions.

Searches for articles contrary to section 101, Rule 9. Under this rule searches were made regularly during the year at all the collieries, and in two cases persons were found with matches in their possession. In each case prosecution followed; the party at Coal Creek was found guilty and fined $5 and costs, and the other party at Michel was found guilty and fined $20 and costs.

Haulage.

Underground haulage is either by horse, compressed-air hoists, locomotives, or by rope-haulage. No electric power is used underground, although in some cases haulage-ropes are operated by electric motors situated outside the mine.

At present electric power is secured for all the collieries from the East Kootenay Power Company, with hydro plants situated at Elko and Bull river, and an auxiliary steam plant situated on Crowsnest lake near Sentinel, in Alberta.

A new steam plant has been installed at Michel during the year, consisting of Babcock & Wilcox boilers, automatic stokers, and chain-grates, effecting greater economy in steam production, and in the near future we expect Michel to provide its own power instead of purchasing it.

Lighting.

Lighting underground is by means of the Edison electric mine safety-lamp, of which three types are in use, each succeeding one being a distinct improvement on the old for illuminating purposes.

The Wolf mine safety-lamp is used by the officials and the bratticemen, so as to be able to make a rapid determination of the air-currents with respect to methane. These lamps are all equipped with magnetic locks and the electric lamps with spring-locks.

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 where necessary.

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 only two kinds of explosives have been in use—one for blasting coal (Monobel), the other for blasting rock (Polar CXL-ite).

Coal-cutting Machinery.

There was no coal produced by coal-cutting machines during the year, pneumatic air-driven picks being in use both at Coal Creek and Michel Collieries.

Rescue Apparatus.

First-aid classes were held during the year at each of the collieries. The rescue apparatus maintained at the collieries is similar to last year, there being six sets at Coal Creek, six sets at Michel, and five sets at Corbin, all of the Gibbs type.

Resuscitation apparatus is maintained in the first-aid rooms of all the collieries; at the Ferni Mine-rescue Station the equipment is similar to the previous year and has been maintained in good condition; this is dealt with in detail in the report of Instructor John Puckey.

Copies of all notices required under the "Coal-mines Regulation Act" have been kept posted at the different mines.

We again wish to thank the workmen, the officials, and the companies for their co-operation and assistance in carrying out our duties during the year and look forward to a continuation of the same in the future.

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—Fernie, B.C.

W. R. Wilson, President, Fernie, B.C.; A. H. McNeill, Vice-President, Vancouver, B.C.; J. S. Irvine, Secretary, Fernie, B.C.; A. A. Klauer, Treasurer, Fernie, B.C.; H. P. Wilson, General Manager, Fernie, B.C.

The above company operated, during 1930, 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 Fernie. Railway connection from the colliery is made with the Canadian Pacific Railway and the Great Northern Railway at Fernie, over the Morrissey, Fernie & 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 Fernie.

COAL CREEK COLLIERY.

B. Caufield, Manager.

This colliery is situated on both sides of Coal Creek and has railway connection with the Canadian Pacific and Great Northern Railways at Fernie by means of a branch line, 5 miles in length, called the Morrissey, Fernie & Michel Railway. The mines operating during the year 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 crew of men has been steadily employed repairing the main roads and airways. Owing to the general depression in trade, active production was suspended in one district in No. 2 mine, one district in No. 3 mine, and practically the whole of No. 1 South mine.

Another new coal-seam has been prospected on the south side of the valley in the vicinity of No. 1 South and a pair of prospect-drifts are being driven on a level grade. This seam is of good quality and averages around 7½ feet in thickness. A new haulage-road was graded along the mountain-side from the portal of No. 1 South mine to the new prospect and laid with 30-lb. steel rails for a distance of 800 feet; the coal from the new seam is hauled by horses to No. 1 South and then lowered by gravity-plane to the tipple level.

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 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 Fernie, 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. Caufield, Overman; E. Morrison, 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 174 r.p.m., produced an average quantity of 173,900 cubic feet of air a minute, under a water-gauge of 3.4 inches. The ventilation is divided into four splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—32,000 cubic feet of air a minute for the use of forty-two men and ten horses. Safety-lamp indicated 0.7 per cent. methane.

No. 2 Split.—24,000 cubic feet of air a minute for the use of forty-two men and six horses. Burrell gas-detector, 0.9 per cent. methane.

No. 3 Split.—19,600 cubic feet of air a minute for the use of twelve men and two horses. Safety-lamp indicated 1.4 per cent. methane.

No. 4 Split.—21,000 cubic feet of air a minute for the use of fourteen men and three horses. Burrell gas-detector, 0.8 per cent. methane.

North Return.—121,500 cubic feet of air a minute for the use of sixty-eight men and eleven horses. Safety-lamp indicated 0.7 per cent. methane.

East side of fan-shaft, 64,000 cubic feet of air a minute; west side of fan-shaft, 129,750 cubic feet of air a minute; total return air, 193,750 cubic feet of air a minute.

While explosive gas has been found a few times in cavities in the roof during the course of our inspections, conditions generally as regards ventilation have been fairly good all over the mine and it is anticipated that further improvement will be noted when the overcast, now under construction over the main haulage-tunnel, is taking care of the ventilation from the Nos. 19 and 20 East Slope districts. Burrell readings taken in the return air-currents have varied from 0.6 per cent. methane in No. 4 split to 2.2 per cent. in No. 3 split.

Roadways and timbering have been kept in a fairly good state of repair, a good supply of timber being provided for the purpose, and the requirements of the various systematic timbering orders fairly well attended to at the working-faces. All roadways and working-places, where required, are treated periodically with crushed limestone-dust and water to reduce the dangers to be apprehended from coal-dust. Four hundred and seven samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, 373 of these being well above the standard set by the above regulation.

The fire area in the vicinity of the main west return airway remains normal; this area is inspected regularly each shift and we have good reason to believe that no more fire exists in these particular roadways. All the old workings in the immediate vicinity were thoroughly cleaned out and retimbered and have an ample supply of air passing at all times.

No. 1 South Mine.

F. Landers, Overman.

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 124,600 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 being operated as a single-inlet unit.

No explosive gas was found during any of our inspections, while the methane content in the return air-current has always been kept under 0.5 per cent. 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 various systematic timbering orders fairly well attended to at the working-faces. All roadways and working-faces, where required, are treated regularly with crushed limestone-dust. One hundred and fifty-two samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were well above the standard set by the above regulation.

While active production of coal was suspended in this mine in March, a crew of men has been kept steadily engaged repairing the main roads and airways, particularly the No. 2 mine main returns, as these pass through the No. 1 South workings.

A fresh outbreak of fire was discovered in the old fire area off No. 4 incline on August 16th; this occurred along the low side of old No. 12 room at a point between two of the fire-breaks or dams which had been filled in with incombustible dust and rock when dealing with the fire that occurred in this same area in April, 1929. A plentiful supply of crushed limestone-dust was immediately distributed all around this area, while additional water-lines were laid so as to cope with any emergency. This seam varies in thickness from 10 to 40 feet, the lower 10 feet only being worked; the remaining 30 feet is intermixed with bands of black shale and sulphur, and when this caves it creates a fire-hazard that has to be carefully guarded against at all times, particularly in old workings. Three fires have now been dealt with in this mine, all of which have been loaded out, as it was considered impractical to try and seal them off under existing conditions. The last outbreak proved to be much smaller than the two former fires and the

work of loading it out was commenced as soon as it was discovered and continued without a halt for forty-five days; during this period over 900 tons of burning and heated material was loaded out.

No. 2 Mine.

C. McNay, Overman; J. Bushell, W. Green, and J. Halle, Firebosses.

This mine is situated on the level of the tipple and operates the upper and western portion of No. 2 seam. It is ventilated by an electrically driven 11- by 7½-foot Sirocco fan, particulars of which are to be found 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.—19,200 cubic feet of air a minute for the use of ten men and three horses. Safety-lamp indicated a very slight trace of methane.

No. 2 Split.—38,080 cubic feet of air a minute for the use of fifty-two men and nine horses. Safety-lamp indicated a slight trace of methane.

Main Return.—76,000 cubic feet of air a minute for the use of sixty-two men and twelve horses.

Explosive gas has been found a number of times in the course of inspection, while Burrell readings taken in the return air-currents have always been well under 0.5 per cent. methane. 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 various systematic timbering orders fairly well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust and sprinkling systems. Two hundred and twenty-nine samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but four of these being well above the standard set by the above regulation.

On June 6th smoke was discovered in the old workings on the north side of No. 4 incline; upon examination being made it was found that an extensive fire was burning along a fault where the seam had met with an overthrust; this practically folded the seam back over and increased the total thickness to 25 feet at this point. In the first working in this portion of the mine 10 feet of coal had been timbered up, which in the course of time caved off the fault-line and eventually caught fire. After consultation it was decided that the best way to deal with the situation was to dig the fire out. This presented a difficult problem, as several heavy caves had to be cleaned up in the old workings, 1,000 feet of track relaid, pipe-lines to put in, and two pumps installed.

The work of loading out the burning material was commenced a few days after the fire was discovered and continued without cessation for a period of eight weeks with a crew of six men and a fireboss on each shift. Large quantities of crushed limestone-dust were constantly distributed in the fire area, pumps were kept going steadily, and an ample supply of water was sprayed on the fire by means of several lines of fire-hose leading from the main water-pipes.

Canaries supplied from the Mine-rescue Station at Fernie were taken into the mine at the beginning of each shift and kept close to the men working on the fire, while the mine-rescue apparatus and H.H. inhalator were kept in readiness for emergencies.

As mentioned above, the thickness of the seam was 25 feet at this point, and it will be readily understood that timbering presented a serious problem as the presence of steam and smoke made it impossible to make a close examination of the roof and sides; after several sets of timber had been displaced, each time with danger to the men, it was decided to build cribs along each side of the roadway as high as the smoke would permit and place heavy timbers across the road from crib to crib. This method proved successful and enabled this exceedingly dangerous operation to be brought to a successful conclusion. The total distance driven was 170 feet in an old roadway 14 feet in width and 25 feet in height. When one considers the dangers connected with an operation such as this, it can be said that the management and men are to be congratulated on the efficient manner in which this highly dangerous undertaking was carried out.

No. 3 Mine.

J. Worthington, Overman; R. Phillips, W. Brown, and E. Caufield, 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 63,900 cubic feet of air a minute, under a water-gauge of 4.6 inches. The ventilation is divided into two splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—9,000 cubic feet of air a minute for the use of eighteen men and four horses. Burrell gas-detector, 0.8 per cent. methane.

No. 2 Split.—24,500 cubic feet of air a minute for the use of forty-two men and ten horses. Burrell gas-detector, 1.1 per cent. methane.

Main Return.—66,000 cubic feet of air a minute for the use of sixty men and fifteen horses. Safety-lamp indicated 1 per cent. methane.

We have not found any explosive gas during the course of inspection, while Burrell readings taken in the return air-currents have varied from 0.8 per cent. methane in No. 1 split to 1.6 per cent. in No. 2 split. Roadways and timbering have been kept in good shape, a good supply of timber being provided for the purpose, and the requirements of the various systematic timbering orders fairly well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust and spraying systems. Three hundred samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were well above the standard set by the above regulation. This is a condition that speaks volumes for the efficient manner in which the roadways of this mine were treated to reduce the dangers to be apprehended from coal-dust.

No. 9 Mine.

R. Fowler, Fireboss.

As in the past years, a small force of men has been engaged during the year continuing with the work of repairing main roads and airways. It is ventilated by a small blower-fan which produced an average quantity of 9,320 cubic feet of air a minute. This mine is all on one split, the quantity passing along the main intake at the last inspection measured as follows:—

Main Intake.—10,000 cubic feet of air a minute for the use of five men and one horse.

No explosive gas was found during any of our inspections and the methane content in the return air-current has always been well under 0.5 per cent. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose. All roads and working-places, where required, are well treated with crushed limestone-dust.

MICHEL COLLIERY.

Robt. Bonar, 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.

A very important addition to the surface plant during the year was the construction of a complete new boiler plant. This consists of two 500-horse-power Babcock & Wilcox patent steel boilers, W.I.F. type, having a working-pressure of 180 lb. a square inch and equipped with superheaters to give 100° to 120° superheat at normal rating. Fuel consists of slack from development-places in the mines and is burned on double B. & W. chain-grate stokers using induced draught. The fuel is fed to these by pipe chutes from overhead bunkers of 200 tons capacity.

Boiler-feed water is supplied by two 7- by 9½- by 21-inch Weir pumps with water from a Cochrane feed-water heater and settling-tanks at a temperature of 215° F. Coal is delivered at present by motor-truck to a hopper at ground-level and is taken from this by a Stephens-Adamson plate conveyor, which discharges into a pivoted bucket-carrier and then delivered to the overhead bunkers. This carrier is arranged to handle ashes also and delivers these to an ash-hopper in line with the above coal-bunkers, all refuse being then delivered direct to motor-trucks from the hopper. A new steam-driven pump and two service-pumps have been installed for fire-protection, also an electrically driven No. 5 D.V. Cameron centrifugal pump for the same purpose.

All of the above equipment is housed in a modern reinforced-concrete building, with ample provision for light provided by the latest type of steel sash. Provision has been made for increasing the capacity of the plant, as in all probability a generator will be installed at some future date to furnish power for the mine-fans. The plant has been arranged so that the firing-floor is on the same level as the power-house; this arrangement permits the engineer in charge of each shift to have all equipment under his direct supervision. Special openings were made in the basement to take in air for combustion, thus eliminating all draughts on the main operating floor. Work was commenced on the construction of this new plant in the latter part of December, 1929, and fully completed by November 15th, 1930.

A new screening plant has been erected for the dual purpose of screening house-coal and supplying slack for the boilers. This is equipped with a car-dump and bucket elevator; the latter appliance raises the coal to a sufficient height to enable a gravity screening plant to be used. The slack will be taken direct to the boilers, while the screened coal will go to supply the household market.

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 report of the conditions prevailing in the various mines throughout the year:—

No. 3 Mine.

C. Stubbs, Overman; R. McFegan, Assistant Overman; J. Strachan, T. Owen, H. Beard, O. Winstanley, and J. Jenkinson, Firebosses; W. Weaver, Shotfirer.

This mine operates the upper 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 123,600 cubic feet of air a minute, under a water-gauge of 2.9 inches. The ventilation is divided into three splits at present, the quantities passing in each at the last inspection measuring as follows:—

No. 9 Incline Split.—15,600 cubic feet of air a minute for the use of forty-five men and ten horses. Safety-lamp indicated 1.3 per cent. methane.

No. 8 Incline Split.—12,000 cubic feet of air a minute for the use of twenty-two men and five horses. Safety-lamp indicated 0.7 per cent. methane.

West Return.—33,600 cubic feet of air a minute for the use of sixty-seven men and fifteen horses. Safety-lamp indicated 0.8 per cent. methane.

No. 5 Split.—24,000 cubic feet of air a minute for the use of thirty men and five horses. Safety-lamp indicated 0.6 per cent. methane.

Main Return.—120,000 cubic feet of air a minute for the use of 103 men and nineteen horses. Safety-lamp indicated a slight trace of methane.

Explosive gas was found a few times in the course of inspection, while Burrell readings taken in the return air-currents have varied from 0.4 per cent. methane in No. 2 split to 1.4 per cent. in No. 9 Incline split. During the latter part of the year a number of permanent stoppings have been erected to reduce the leakage that was prevalent in the West side workings; this work is being continued at the moment of writing. A big improvement was also made in the matter of effectually sealing off the old No. 10 Slope district and arranging for the noxious gases escaping therefrom to be carried direct to No. 9 Incline split return airway.

Roadways and timbering have been kept in good shape, a good supply of timber being provided for the purpose, and the requirements of the systematic timbering orders fairly well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. Seventy-two samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, sixty-five of which were well above the standard set by the above regulation.

A new district has been opened up through the fault in the main West level which has indications of developing into an important and welcome addition to the workings of this mine.

No. 1 Mine.

C. Stubbs, Overman; W. Cartwright, D. James, A. Ball, S. Lazaruk, J. Robson, and W. Gregory, Firebosses.

This mine is reached by a crosscut tunnel from the upper No. 3 seam of No. 3 mine; this tunnel cuts through Nos. 2, 1, A, and B seams, of which only Nos. 1 and B are operating at present. Ventilation is provided by No. 3 East mine-fan; particulars regarding same may be found in the report dealing with No. 3 East. This mine is all on one split, the quantity passing at the last inspection measuring as follows:—

Main Return.—40,000 cubic feet of air a minute for the use of sixty-two men and seven horses. Safety-lamp indicated 0.6 per cent. methane.

Explosive gas was found on only one occasion in the course of inspection, while the methane content in the return air-current has always been kept well under 1 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 various systematic timbering orders well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust and spraying systems. Fifty-two samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but seven of these being well above the standard set by the above regulation.

No. 3 East Mine.

C. Stubbs, Overman; W. Cartwright, D. James, A. Ball, S. Lazurak, J. Robson, and W. Gregory, Firebosses.

This mine 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 72,200 cubic feet of air a minute, under a water-gauge of 2.1 inches. This fan ventilates Nos. 1 and 3 East mines, the quantities passing at the last inspection measuring as follows:—

No. 1 Mine, Main Return.—40,000 cubic feet of air a minute for the use of sixty-two men and seven horses. Safety-lamp indicated 0.6 per cent. methane.

No. 3 East Mine, No. 8 West Return.—32,000 cubic feet of air a minute for the use of three men and one horse. Safety-lamp indicated a trace of methane.

No. 3 East Mine, Main Return.—88,000 cubic feet of air a minute for the use of sixty-five men and eight horses.

No explosive gas was found during the course of inspection and the methane content in the return air-currents has always been kept well under 1 per cent. Roadways and timbering have been kept in a good state of repair and generaly well treated with rock-dust.

Operations during the year have been confined to repairing main roads and airways, and particularly in an effort to seal off some abandoned workings in the lower No. 3 seam, where heating has been evident for a number of years. These old workings are situated about 20 feet below No. 3 East main return airway, to which the heat was making its way through breaks in the floor of the upper No. 3 seam. As it was considered inadvisable to drive a roadway direct into these abandoned works, it was decided to sink several shafts in the bottom coal of the upper seam; when these reached the solid rock, drill-holes were put through at several points into the lower seam, through which a continuous stream of water and incombustible dust was directed in an effort to silt and, if possible, seal off the lower workings. This method has been successful in checking and reducing the heated condition in the immediate vicinity of No. 3 East main return airway and will be continued until all possible danger to this roadway is removed. While this work was being done all precautions were taken to ensure the safety of the men engaged. Telephones were installed from the portal connecting with an established station on No. 3 East return inby the heated area, and no person was allowed to travel that portion of the return that might possibly be affected by dangerous gases given off from the old workings, a guard being stationed at the portal to make certain that no unauthorized persons entered the mine. The mine-rescue apparatus and Burrell all-service masks were kept in readiness for emergency, while canaries were kept beside the men at all times. Large quantities of crushed limestone-dust were constantly distributed in the area affected, while an ample supply of water was always available. At the moment of writing, conditions in this area are much improved and better than they have been for years.

No. 8 Mine.

R. Taylor, Overman; A. Almond, E. Ainsworth, W. McKay, and J. Scales, 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 64,600 cubic feet of air a minute, under a water-gauge of 2.9 inches. The ventilation is divided into three splits, the quantities passing in each at the last inspection measuring as follows:—

No. 1 Split.—15,000 cubic feet of air a minute for the use of thirty men and eight horses.

No. 2 Split.—12,500 cubic feet of air a minute for the use of twenty-six men and seven horses.

No. 3 Split.—9,000 cubic feet of air a minute for the use of twenty men and six horses.

Main Return.—65,000 cubic feet of air a minute for the use of seventy-six men and twenty-one horses.

Explosive gas was found only once during the course of inspection, while the methane content in the return air-currents has always been kept well under 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 various systematic timbering orders well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust and sprinkling systems. Seventy samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were well above the standard set by the above regulation.

Corbin Collieries, Ltd.

E. L. Warburton, Manager; J. Taylor, Assistant 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 previous years, practically the whole of the output came from Nos. 4 and 6 mines, prospecting-work only being done in No. 5 mine, where operations were temporarily suspended in November.

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 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. Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines. Following is a brief report on the conditions prevailing in the various mines throughout the year:—

No. 4 Mine.

W. Commons, Overman; A. Ford and H. Ferryman, 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 96 r.p.m., produced an average quantity of 17,610 cubic feet of air a minute, under a water-gauge of 0.5 inch. The ventilation is all on one split, the quantity passing at the last inspection measuring as follows:—

A Level Return.—16,200 cubic feet of air a minute for the use of twenty-two men and three horses. Safety-lamp indicated 0.8 per cent. methane.

Explosive gas has been found several times in the course of inspection, but only in Nos. 1 and 2 South levels. These roadways are developing a portion of the seam that is much thicker and of a more friable nature than usual, in which gas feeders have been encountered periodically since the month of July. These feeders gave off greater quantities of gas than are usually met with in this seam and it was sometimes necessary to suspend operations in these two levels until such time as the gas had bled off. At the last inspection in December, conditions in these particular places were much improved and we do not anticipate any serious trouble from this cause in the future.

No. 5 Mine.

The principal work done in this mine during the year was the driving of a ventilating-raise from the face of the Main level up to the counter-level, where further prospecting was done in an effort to prove the No. 5 seam. This mine is ventilated by natural means, a sufficient quantity of air circulating for the use of four men engaged in development. With the approach of cold weather, operations were temporarily suspended in November. This working was supervised by the officials of No. 4 mine.

No. 6 Mine.

W. Almond, Overman; J. McKelvie, H. Osborne, B. Cheetham, A. Rear, D. Waddington, and F. Coates, Firebosses.

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 32,100 cubic feet of air a minute, under a water-gauge of 0.5 inch. The ventilation is practically all on one split at the present time, the quantity passing at the last inspection measuring as follows:—

Main Intake.—48,000 cubic feet of air a minute for the use of thirty-three men and three horses.

Explosive gas has been found on one or two occasions in the course of inspection, while the methane content in the return air-current has been kept well under 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 various systematic timbering orders fairly well attended to at the working-faces. While the mines at this colliery are for the most part naturally wet, there are a few roadways that require regular treatment for coal-dust by the application of crushed limestone-dust. Fourteen 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.

QUARRIES.

Quarrying operations in the Province are now subject to provisions of the "Quarries Regulation Act" and regulations thereunder, as follows:—

AN ACT TO REGULATE THE WORKING OF QUARRIES.

(CHAPTER 52, STATUTES OF 1929.)

His Majesty, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, enacts as follows:—

1. This Act may be cited as the "Quarries Regulation Act."

2. In this Act, unless the context otherwise requires:—

"Inspector" means any Inspector appointed under the "Metalliferous Mines Regulation Act" or under the "Coal-mines Regulation Act":

"Minister" means the Minister of Mines:

"Quarry" means any excavation or opening on or under the surface of the ground made or worked for the purpose of obtaining or removing rock, stone, gravel, sand, clay, or earth, which excavation or opening is not a mine within the scope of either the "Coal-mines Regulation Act" or the "Metalliferous Mines Regulation Act"; and includes all machinery, equipment, appliances, and plant used in the working of a quarry.

3. The Inspector from time to time, as occasion may require, or as the Minister may direct, shall inspect any quarry within the Province, and shall report to the Minister respecting the state and condition of the quarry, the safety of the persons employed in or about the quarry, and the observance therein of the provisions of the regulations.

4. Every owner, agent, manager, and every lessee of any quarry shall at all times admit the Inspector to the quarry on the exhibition of his certificate of appointment, for the purpose of any inspection under this Act.

5. Any owner, agent, manager, or lessee who, in contravention of section 4, refuses or neglects to admit the Inspector to the quarry, or who refuses or neglects to render him necessary assistance or facilities for his inspection of the quarry, shall be liable, on summary conviction, to a fine of not less than ten dollars and not more than one hundred dollars.

6. The Lieutenant-Governor in Council may make regulations for the purpose of carrying into effect the provisions of this Act; and for the purpose of ensuring the safety of persons employed in or about any quarry may by the regulations prescribe rules regulating, controlling, or prohibiting the making or working of a quarry; and may by the regulations prescribe penalties for the enforcement of any regulation.

REGULATIONS PURSUANT TO SECTION 6, CHAPTER 52, STATUTES OF BRITISH COLUMBIA, 1929.

His Honour the Lieutenant-Governor in Council has been pleased to approve the following regulations:—

1. No magazine for explosives shall be maintained on any quarry property except with the written permission of the Inspector of Mines. The site of this magazine and the style of structure shall be subject to the approval of the Inspector. Where practicable, the site of the magazine must be distant at least four hundred feet from the quarry or works or any public highway. The magazine shall be constructed of materials and in a manner to ensure safety against explosion from any cause, and shall be either so situated as to interpose a hill or rise of ground higher than the magazine between it and the quarry and works, or an artificial mound of earth as high as the magazine and situate not more than thirty feet from it shall be so interposed.

2. Cases containing explosives shall not be opened in the magazine, and only implements of wood, brass, or copper shall be used in opening the cases. No scraps or broken portions of cartridges shall be placed in or left lying on the floor of the magazine or store.

3. No explosives in excess of a supply for twenty-four hours shall be taken into the operating part of a quarry, and no store, for twenty-four hours' supply, shall be established without the approval in writing of the Inspector of Mines, who shall prescribe such conditions in connection therewith as he may deem necessary. When a quarry is closed down all explosives shall be disposed of and all unused explosives removed from the quarry.

4. No naked light shall be taken into any magazine or place where explosives are kept. No person shall smoke in a magazine or place where explosives are kept or while handling explosives.

5. The superintendent in charge of a quarry or some other responsible person or persons delegated by him shall make a thorough daily inspection of the condition of explosives in or about the same, and shall make an immediate investigation when an act of careless placing or handling of explosives is discovered by or reported to him.

(*a.*) Any employee who commits a careless act with an explosive or where explosives are stored, or who, having discovered it, omits or neglects to report immediately such act to an officer in charge of the quarry, shall be guilty of an offence against this Act, and the officer in charge of the quarry shall immediately report such offence to the Inspector of Mines or to the constable of the county or district in which the quarry is situate.

6. No building for thawing explosives shall be maintained in connection with any quarry except with the written permission of the Inspector of Mines. The site of this building and the style of

structure and equipment shall be subject to the approval of the Inspecor. The building shall be under the direction of the superintendent or some person authorized by him. The quantity of explosives brought into any thawing-house at any one time shall not exceed the requirements of the quarry for a period of twenty-four hours, plus the amount that it may be necessary to have thawing to maintain that supply.

7. In no case shall powder be thawed near an open fire or a steam-boiler or by direct contact with steam or hot water, nor shall any electrical device for generating heat be allowed in the same compartment with explosives.

8. A reliable recording-thermometer shall be kept in the room in which explosives are thawed and the record thereof kept, but in the case of a small quarry the Inspector of Mines may give permission, in writing, to use a maximum and minimum registering-thermometer on condition that a daily record of high and low temperature be made and kept on file.

9. No drilling shall be done in any hole that has been charged or blasted.

10. When a blaster fires a round of holes he shall, where possible, count the number of shots exploding. If there is any report missing, he shall report the same to the quarry foreman or shiftboss. If a missed hole has not been fired at the end of a shift, that fact, together with the location of the hole, shall be reported by the quarry foreman or shiftboss to the quarry foreman or shiftboss in charge of the next relay of workmen before work is commenced by them. In case of a miss-fire shot, or suspected miss-fire shot, no person shall be allowed to return to the place where blasting is being done until the expiry of thirty minutes from the time of lighting the fuse. No fuse shorter than three feet shall be used in any blasting operation.

A charge which has missed fire shall not be withdrawn but shall be blasted, and no drilling shall be done within a distance of three feet of a miss-fire shot or a cut-off hole containing explosive until it has been blasted. Every miss-fire shot shall be marked by the insertion of a wooden marker into the outer end of the hole. The foreman or shiftboss shall be responsible for directing the angle of the hole and depth to which it shall be drilled.

No person other than the holder of a blasting certificate shall remove or attempt to remove the wooden marker with which a miss-fire hole or socket of a hole has been marked.

11. In so far as possible in underground operations no blaster shall be alone when spitting fuse, and in no case shall he spit fuse without having a second light, placed conveniently close. No more than twelve holes shall be spit in any round of shots by one person.

12. The firing of rounds in shafts or winzes shall be done by electric current where such shafts or winzes are deeper than one hundred feet. In winzes or shafts which are sunk at an angle flatter than forty-five degrees electric blasting shall not be compulsory.

13. Every blaster shall, before blasting, give or cause to be given due warning in every direction by shouting "Fire," and shall satisfy himself that all persons have left the vicinity except those required to assist him in blasting.

Every blaster shall, before blasting, cause all entrances to the place or places where such blasting is to be done or where the safety of persons may be endangered by such blasting to be effectively guarded, so as to prevent inadvertent access to such place or places while such charges are being blasted.

A blaster shall not, where blasting takes place by electricity, enter or allow other persons to enter the place or places where the charges have been fired until he has disconnected the cables from the blasting-battery, or has pulled out and locked the switches of the blasting-circuit.

14. No person authorized to travel with explosives and to distribute same shall leave any explosive except in a place provided for storage of explosives. Should no storage-place for explosives be provided, he shall personally deliver the same to another authorized person.

15. All drill-holes, whether sunk by hand or machine-drills, shall be of sufficient size to admit of the free insertion to the bottom of the hole of a stick or cartridge of powder, dynamite, or other explosive, without ramming, pounding, or undue pressure. No explosive shall be removed from its original paper container.

16. No explosive shall be used to blast or break up rock or other material where by reason of its heated condition there is any danger or risk of premature explosion of the charge.

17. No explosive shall be used at any quarry unless there is plainly printed or marked on every original package containing such explosive the name and place of business of the manufacturer and the strength and date of its manufacture. Every case of supposed defective fuse, detonator, or powder shall be reported to the Inspector of Mines, with the name of the manufacturer.

Straight or ordinary dynamite shall not be used underground.

In no case shall detonators be transported in the same conveyance or carried in the same receptacle with any other explosives, safety-fuse excepted. Nor shall detonators be stored in the same building with other explosives.

18. No person shall conduct or be allowed to conduct any blasting operations in or about a quarry unless he holds either a provisional or a permanent blasting certificate. No person who is not the holder of a blasting certificate shall prepare any blast. A blaster may be assisted in preparation and firing of charges by reliable persons who are not the holders of blasting certificates: Provided always that he shall not be so assisted unless such persons are acting under his direct supervision.

No person other than one holding a blasting certificate or permit, or a person authorized by the superintendent in writing, shall in any quarry whatever open or interfere in any manner whatsoever with a box containing explosives.

19. Upon engagement a blaster shall produce his blasting certificate, which shall be retained by the superintendent until the termination of the engagement. Provisional blasting certificates shall be similarly retained by the superintendent. Permanent blasting certificates shall be obtained from an Inspector of Mines. Provisional blasting certificates valid for a period not exceeding ninety days, or

until the first visit of the Inspector of Mines, may be granted by the quarry superintendent, or a qualified person authorized by the quarry superintendent. No more than one provisional blasting certificate shall be granted to one and the same person. Such certificates may be obtained in blank form from the office of the Chief Inspector of Mines. A duplicate of each provisional blasting certificate issued must be forwarded to the office of the Chief Inspector of Mines, Victoria, B.C.

20. An Inspector of Mines may grant permanent blasting certificates to persons who can satisfy him as to their fitness to receive the same. The Inspector of Mines may by an endorsement place any limitation or qualification he may think fit upon the scope of the certificate.

21. A quarry superintendent or a qualified person or persons authorized by the quarry superintendent shall not sign a provisional blasting certificate until he has, or they have, by such means as are available or by inquiry and examination, found that the applicant has a competent knowledge of blasting operations and the rules and regulations referring thereto, and that he is trustworthy and sober.

22. The applicant for a permanent blasting certificate must produce satisfactory porof that he is properly qualified to conduct blasting operations.

23. If at any time the holder of a blasting certificate issued in accordance with these regulations shall, in the opinion of the Inspector of Mines, be guilty of inattention or negligence in execution of his duties, or shall suffer from any physical infirmity likely to be detrimental to efficient discharge of his duties, such Inspector may immediately suspend or cancel such certificate.

24. If at any time the holder of a blasting certificate, whether provisional or permanent, issued in accordance with these regulations shall, in the opinion of the superintendent, be guilty of a breach of any of these regulations, such superintendent may immediately suspend such person from duties of a blaster, and shall forthwith report any such suspension to an Inspector of Mines for such action as he thinks fit.

25. Definite instructions must be given by the foreman or blaster at the beginning of a shift or after blasting, to any person who may be required to enter a quarry or part of a quarry, of any danger which might exist.

After blasting, the blaster shall see that all loose material resulting from the blast is either taken down or otherwise made safe.

26. Where mechanical drills are used in any underground operation the Inspector of Mines may, if he is of the opinion that any dust produced by the drilling operations is injurious to the health or safety of the workmen, order that all such drills shall be equipped with a water jet or spray or other appliance equally efficient to prevent the escape of dust, and of a type approved by the Inspector of Mines.

(*a.*) Where dust is produced in any quarry operation the Inspector of Mines may order satisfactory means of preventing the escape of such dust.

27. All exposed dangerous parts of machinery, equipment, appliances, and plant shall be kept securely fenced to prevent persons from inadvertently coming into contact with same.

The approach to the edge of quarry-workings shall be securely fenced to prevent persons inadvertently falling into such quarry.

28. Where workmen are required to climb or work on the face of a quarry above the ground or bench elevation, safety-ropes shall be provided, and it shall be incumbent on the foreman or superintendent to see that such ropes are supplied and used.

29. Where the conditions are such that the Inspector of Mines is of the opinion that a quarry-face is too high he may order that the operation be carried on in benches or sections, and may order that the face of a quarry be maintained at a certain angle from the horizontal.

30. Where the material being carried is soft or friable the Inspector of Mines may order that stulls or sprags with suitable cap-pieces be used to keep the material in position until such time as it is to be blasted or otherwise removed, and where the operation, or part of the operation, is underground the roof and sides shall be secured, where necessary, by suitable timbering or other efficient means.

31. At every quarry the owner shall provide a good and sufficient supply of "first-aid" material and have at least one employee who is the holder of a certificate or proficiency in rendering first aid.

32. (1.) If an Inspector, upon careful investigation, is of the opinion that a quarry or any part thereof is in any respect dangerous, or that any matter, thing, or practice done, followed, or permitted in, about, or in connection with the quarry constitutes a defect calculated to impair the efficiency of quarrying operations or to endanger the safety of any person in or about the quarry, the Inspector shall give notice thereof in writing to the owner, agent, or manager of the quarry, stating in the notice the grounds for his opinion, and shall, by the notice or otherwise, order that such remedies be applied and such provision be made for the safeguarding of those employed in or about the quarry as he thinks requisite.

(2.) If the Inspector is of the opinion that any delay in remedying such matter would be dangerous, he may order the closing of the quarry or any part thereof, or may order the stopping of all work therein or connected therewith, until the matter complained of be remedied; and in every such case the Inspector shall forthwith transmit to the Minister a copy of the order and a full report of the reasons therefor.

(3.) Any owner, agent, manager, or other person refusing or neglecting to obey any order given by the Inspector under this section shall be guilty of an offence against this Act.

33. (1.) Where in or about any quarry, whether above or underground, loss of life or any serious personal injury to any person employed in or about the quarry occurs by reason of any accident whatever, the owner, agent, or superintendent of the quarry shall forthwith communicate information thereof to the Chief Inspector or Inspector for the district by telephone, telegraph, or messenger, if such means of communication are reasonably available, and in addition shall, within twenty-four hours next after

the accident, send notice in writing thereof, and of the loss of life or personal injury occasioned thereby, to the Inspector of the district on behalf of the Minister, and shall specify in the notice the character of the accident and the number of persons killed and injured respectively.

(2.) In cases where loss of life or serious personal injury has occurred in any quarry, the place of the accident shall remain undisturbed for a period of three days or until the Inspector has inspected the same: Provided that a compliance with this subsection shall not be required if it would seriously interfere with the general operation of the quarry.

34. Every person who is guilty of any offence against this Act shall, if no other penalty is prescribed elsewhere in this Act, be liable to a penalty not exceeding one hundred dollars.

35. Where a person who is an owner, agent, or superintendent of or a person employed in or about a quarry is guilty of any offence against this Act which in the opinion of the Justice who tries the case is one which was reasonably calculated to endanger the safety of the persons employed in or about the quarry, or to cause serious personal injury to any of such persons, or to cause a dangerous accident, and was committed wilfully by the personal act, personal default, or personal negligence of the person accused, such person shall be liable, if the Justice is of the opinion that a pecuniary penalty will not meet the circumstances of the case, to imprisonment, with or without hard labour, for a period not exceeding three months.

36. All offences under this Act and all penalties under this Act, and all money and costs by this Act directed to be recovered as penalties, may be prosecuted and recovered on summary conviction.

37. No prosecution shall be instituted against the owner, agent, or superintendent of a quarry for any offence under this Act which can be prosecuted on summary conviction, except by an Inspector or with the consent in writing of the Minister; and in the case of any offence of which the owner, agent, or superintendent of a quarry is not alleged to be personally the perpetrator, an Inspector shall not institute any prosecution against the owner, agent, or superintendent if satisfied that he had taken reasonable means to prevent the commission of the offence.

The above regulations to come into force on the thirty-first day of January, 1931.

W. A. McKENZIE,
Minister of Mines.

REPORTS OF INSPECTORS OF QUARRIES.

VANCOUVER MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Coast Quarries Co., Ltd.—The operations of this company are situated at Granite falls, 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 and two power-shovels handle the material at the face of the quarry. During my visit in December thirty-six men were employed. Conditions generally were found very satisfactory.

NEW WESTMINSTER DIVISION.

Gilley Bros.' Quarry.—Several visits were made to the plant, where granite is quarried for general construction-work. Several improvements were made this year in the screening and loading equipment, a new conveyor being installed for loading the scows. Every effort is being made to conduct operations in a safe and satisfactory manner.

Port Haney Brick and Tile Co.—Situated at Port Haney. This company operates a clay-bank for the purpose of manufacturing bricks, tiles, etc. One power-shovel handles all the material necessary for the factory.

VICTORIA DIVISION.

B.C. Cement Co., Ltd.—This company operates a large limestone-quarry at Bamberton. Adjacent to the quarry they have a very up-to-date plant for the manufacture of cement. At the quarry power-shovels load the material into cars and gasoline-locomotives transport the material to the bunkers. Every precaution is taken at this plant for the safety of workmen.

Well-organized first-aid classes are conducted and great interest is taken in these classes by both management and workmen. One of the first-aid teams competed at Nanaimo this year and took second place.

About twenty-four men are regularly engaged in the quarrying operations. The entire plant at Bamberton is under the able supervision of H. Anderson, manager.

Rosebank Lime Co.—This company operates a small quarry at Colwood, a few miles from Victoria. Conditions were found to be satisfactory here.

NANAIMO MINING DIVISION.

Texada Island Section.

Pacific Lime Co.—A large limestone-quarry is owned and operated at Blubber bay by this company. About 180 men are employed in the quarry, lime-kilns, and sawmill. Around fifty men are employed in the quarry alone. The material is conveyed to the bunkers from the quarry by an aerial tramway system. Every precaution is taken for the safety of workmen. Although affected by the general trade depression, all the workmen have been kept on by the company. The whole of the operations are under the general supervision of O. N. Walker.

B.C. Cement Co.—This company has a limestone-quarry on the opposite shores of the bay from the Pacific Lime Company. The material is loaded into cars by a 70-horse-power gasoline electric shovel and transported by gasoline-locomotives to the bunkers. The rock after passing through the crushing plant is conveyed to the wharf by a 32-inch conveyor-belt. In all, about fourteen men are regularly employed here and general conditions were found to be very satisfactory. The operations here are under the supervision of R. Hamilton.

Nelson Island Section.

Vancouver Granite Co.—Quarry bay, Nelson island. This is a dimension-stone quarry, the stone being used for building and monumental purposes. A 60-horse-power boiler generates steam to drive a single-stage compressor for the drilling-machines and a 8½ by 10 steam-hoist for the loading-derrick. At the quarry a 25-horse-power boiler supplies steam for a 7 by 10 hoist for the quarry derrick. On my last visit this quarry was not working.

NANAIMO AND ALBERNI MINING DIVISIONS.

Report by Geo. O'Brien, Inspector.

McDonald Cut-stone Operators.—This operation is situated on Newcastle island in the strait of Georgia and was under the direct supervision of Mr. Donahue. Ten men were employed getting out cylindrically cut stone for pulp-grinding mills. The mill stones are from 4 to 5 feet in diameter and from 4 to 5 feet long, being afterwards trimmed to the proper dimensions. The operation appears to be carried on with all due precautions to safety and no accidents were reported during the year.

Gabriola Shale Products, Ltd.—This operation is situated near the southerly end of Gabriola island in the strait of Georgia. Charles F. DeLong was in charge during the year. The method of operation is the open-quarry system. The product is a good grade of shale and is used in the brick-making plant on the property. The overburden averages from 15 to 20 feet in thickness and is stripped by hand. The operation appears to be carried on with all due precautions to safety and no accidents were reported during the year. The quarry and brickmaking plant has been closed down for a few months in the latter end of the year, but I was informed by Mr. DeLong that operations are going to commence early in 1931.

GRAND FORKS MINING DIVISION.

Report by H. H. Johnstone, Inspector.

Fife Quarry.—This quarry is situated at Fife, close to Christina lake, and was worked for the greater part of the year by the Consolidated Mining and Smelting Company, Limited. Ten men were employed.

BELLA COOLA MINING DIVISION.

Report by Thos. J. Shenton, Inspector.

Beale's Lime-quarry.—This property is owned by J. F. Beale, Bella Bella; J. Beale, superintendent; J. Coulter, foreman. The limestone is sold to the Ocean Falls Company and is taken there by scows. During my visit of inspection ten men were employed. Blasting operations were found to be satisfactory and I had the management remove the powder-magazine to a safer location. In general, conditions were found to be in accordance with the "Quarries Regulation Act."

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, and, at Coalmont Colliery, for recovery-work following an explosion. 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.

At the end of the year a new building for the Princeton Rescue Station was nearly completed and the equipment on hand for this station consists of twelve sets of the McCaa two-hour oxygen apparatus; twelve sets of the Burrell all-service gas-masks; one H.H. inhalator and twenty self-rescuers, with adequate supplies to maintain above in service.

A number of calls were received during 1930 for the use of oxygen resuscitation apparatus from different hospitals and medical men. Four stations are established, while the fifth, at Princeton, will be in service early in the year.

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.

Midlesboro.—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 J. 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, 1930.

On January 29th a call was received from the Reserve mine for the oxygen rescue apparatus to deal with a large accumulation of methane gas. Precautionary advance holes had been drilled from the Reserve mine to the abandoned working of No. 5 mine. Some time later these drill-holes passed enough gas in this section to make the atmosphere irrespirable. The apparatus was used to permit the plugging of the above drill-holes. A team consisting of the manager, overman, and several men completed this work safely in a short time.

On the morning of August 14th I received instructions to take part of the rescue equipment to Coalmont Colliery, where an explosion had occurred on the previous night. I reached Coalmont with the apparatus at 6 a.m. on the 15th in company with Inspector of Mines Jackson, and was instructed by the Chief Inspector of Mines to take charge of all the rescue apparatus and equipment of the teams, and attended to this work on the surface and underground until August 27th, when I returned to Nanaimo.

During the year this station received twenty emergency calls from medical practitioners in Nanaimo and district to supply oxygen treatment to patients who were in a serious condition. All above calls were responded to without delay.

During the early part of the year the training of men in the use of mine-rescue apparatus was fairly active and seventeen men were awarded certificates of proficiency. Twelve of the men were employees of the Western Fuel Corporation of Canada, Limited, and five were employees of the Canadian Collieries (Dunsmuir), Limited.

In addition to the above training, two complete teams of six men to a team, employees of the Western Fuel Corporation of Canada, Limited, carried on active training with a full-period practice once each month during the year.

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 fifty-one 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, 1930, 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 certificates of competency.

During the year the Canadian Collieries (Dunsmuir), Limited, has had twenty-four trained men in constant practice twice a month.

The mine-rescue equipment at this station consists of eleven two-hour Paul 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.

Three teams from this district competed at the mine-rescue competition held at Nanaimo on June 14th.

No emergency calls for mine-rescue apparatus were made during the year 1930.

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, 1930.

Instruction in mine-rescue work has been given individually to men who have shown interest.

On August 13th, in response to instructions from Victoria, I took all the rescue apparatus at this station by motor to Coalmont Collieries, where an explosion had occurred; remaining there on recovery-work until August 23rd.

The equipment at this station consists of five sets of Paul two-hour oxygen apparatus; four sets of the Gibbs two-hour oxygen apparatus; and three Burrell all-service gas-masks. 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 as Instructor of the Government Mine-rescue Station, Fernie, for the year ended December 31st, 1930.

In January, 1930, a fire was reported from No. 6 mine, Corbin Colliery, but no calls for equipment were made to this station.

I continued the training of the three teams in mine-rescue work at *Sullivan* mine, Kimberley, and in April the fifteen men came down to Fernie and took their final test at this station; and all passed a very creditable examination and received their Provincial Government mine-rescue certificates of competency.

Three teams from Coal Creek Colliery carried on their monthly training up to September, but owing to some of the team members leaving the district the teams became broken up.

In June a fire was reported in No. 2 mine, Coal Creek Colliery, and some of the apparatus of this station was sent to the mine in case of emergency.

On August 1st the management of Michel Colliery sent in a call for the use of the Burrell all-service gas-masks in dealing with a mine fire. The machines were sent at once.

On August 14th this station was notified by telegram from Victoria to forward six sets of McCaa oxygen apparatus and six sets of Burrell all-service gas-masks and supplies to Coalmont, where an explosion had occurred. This was shipped by the first train going west.

On Saturday, August 16th, I was notified that a fire had broken out in No. 1 South mine, Coal Creek Colliery, and held all apparatus in readiness for immediate dispatch, but the work did not necessitate the use of the apparatus.

The canaries kept at this station were called into service in different mines where the presence of CO from fires was suspected.

The equipment at this station at present consists of six sets of Gibbs apparatus; eleven sets of McCaa apparatus; twelve all-service masks; fifty spare canisters for latter; forty self-rescuers; and a good supply of spare parts for both the Gibbs and McCaa apparatus.

Every machine in this station is tested each week and kept in readiness for any emergency calls.

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, 1930.

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 to 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 amended rules made by the Provincial Board of Examiners and approved by the Minister of Mines on September 28th, 1929.

Two examinations were held in 1930. The first was held on May 21st, 22nd, and 23rd, and the second on November 19th, 20th, and 21st.

The total number of candidates at the examinations were as follows: For First-class Certificates, 4 (1 passed and 3 failed); for Second-class Certificates, 4 (1 passed and 3 failed); for Third-class Certificates, 31 (13 passed and 18 failed); for Mine Surveyors, 9 (4 passed and 5 failed).

The following is a list of the candidates who successfully passed in the various classes:—

First-class Candidates.—William B. Hanson.

Second-class Candidates.—Harry Hopkins.

Third-class Candidates.—Edward Surtees, William Forsyth, Joseph Delprato, Cadwaladr Williams, Francis Kelly, John Yates, Thos. Eccleston, Thos. Brydon, Antonio Ambrosio, Edward R. Hughes, William H. Adams, Joseph Hamer, and Alexander Dunsmore.

Mine Surveyors.—Harold H. Gardner, Charles J. Heaney, Terence C. Holmes, and Robert Pettigrew.

Many of the candidates in their studies are not keeping pace with modern mine practice and consequently their answers are far below the standard required to-day.

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 comptency 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 1930 examinations have been held for candidates for certificates of competency as coal-miners in the various coal-mining districts of the Province.

Two hundred and twenty-three candidates presented themselves for examination; 194 passed and twenty-nine 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 desires 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.
Battey, Richard	May 27, 1913	Graham, Thomas	Nov. 9, 1907
Baxter, Andrew	June 10, 1911	Gray, James	Nov. 27, 1909
Bennett, John	Dec. 30, 1926	Hanson, Wm. B.	Dec. 9, 1930
Biggs, J. G.	July 22, 1908	Henderson, Robert	Nov. 27, 1909
Bonar, Robert	Oct. 28, 1911	Hewlett, Howe	May 27, 1913
Brace, Tom	May 13, 1915	Higgins, Alexander	Dec. 19, 1918
Bridge, Edward	July 22, 1908	Hodge, William K.	June 16, 1925
Brown, David	May 21, 1914	Holden, James	May 1, 1909
Brown, Robert Joyce	May 13, 1915	Howden, Archibald	May 27, 1913
Caufield, Bernard	May 1, 1909	Howells, Nathaniel	Oct. 28, 1911
Church, James A. H.	June 10, 1911	Hughes, John C.	May 17, 1917
Cox, Richard	May 13, 1915	Humphries, Clifford	June 10, 1911
Crowder, James	June 10, 1911	Hunter, Alex. B.	July 8, 1916
Cunningham, John Howard	May 9, 1912	Huntrods, Eustace S. F.	May 19, 1922
D'Altroy, A. C.	Dec. 20, 1928	Jackson, Thos. R.	Nov. 9, 1907
Davidson, W. A.	May 1, 1909	Jaynes, Frank	May 13, 1915
Davies, David	June 10, 1911	Johnston, John	June 30, 1928
Davies, Stephen	Nov. 15, 1917	Kellock, George	June 10, 1911
Davies, Thos. Owen	May 21, 1914	Knox, T. K.	July 27, 1909
de Hart, J. B.	May 17, 1917	Laird, Robert	Nov. 15, 1917
Derbyshire, James	Nov. 9, 1907	Leighton, Henry	May 9, 1912
Devlin, E. H.	Dec. 30, 1926	Littler, James	Dec. 2, 1929
Dickson, James	Oct. 31, 1912	Mackinnon, Hugh G.	May 19, 1922
Elliott, Daniel	Nov. 9, 1907	Macauley, D. A.	June 10, 1911
Elliott, John B.	June 30, 1928	McCulloch, James	Sept. 10, 1910
Emmerson, Joseph	Nov. 9, 1907	McDonald, John	Oct. 3, 1919
Ewart, William	May 19, 1922	McGuckie, Thomas	July 22, 1908
Fairfoull, Robert	June 10, 1911	McKendrick, Andrew	May 27, 1913
Foster, William R.	Dec. 31, 1925	McLean, Michael D.	June 16, 1925
France, Thos.	Nov. 22, 1906	McMillan, J. H.	Sept. 10, 1910
Fraser, Norman	Mar. 4, 1905	McVicar, Samuel	May 1, 1909
Freeman, H. N.	May 1, 1909	Mazey, William John	Oct. 31, 1912
Galloway, C. F. J.	July 22, 1908	Miard, Henry Ernest	May 9, 1912
Garman, Morris W.	Nov. 15, 1917	Millar, John K.	Nov. 22, 1906
Gascoyne, Rowland B.	May 21, 1914	Miller, Andrew Anderson	Oct. 31, 1912
Gillham, John	Jan. 5, 1925	Montgomery, John W.	May 1, 1909
Glover, Francis	Oct. 31, 1912	Moore, Wm. H.	May 17, 1917
Graham, Charles	Nov. 14, 1905	Mordy, Thomas	Sept. 10, 1910

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT," 1904–1911–1919—*Continued.*

Name.	Date.	Name.	Date.
Morrison, Edward	June 24, 1924	Stevens, L. C.	Nov. 27, 1909
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	Wesnedge, 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.	Nev. 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, 1906	Yates, Frank	Dec. 31, 1925

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	Johnston, John	June 10, 1927	B 267
Courtney, A. W.	Oct. 28, 1911	B 138	Jones, Samuel	May 16, 1918	B 221
Cox, Richard	May 9, 1912	B 143	Jones, William T.	July 22, 1908	B 66
Crawford, David	May 1, 1909	B 88	Jordon, Thos.	Nov. 27, 1909	B 104
Cunliffe, Thomas	May 1, 1909	B 78	Kirkwood, John R.	Oct. 31, 1912	B 160
Dando, John	May 27, 1913	B 164	Knowles, James E.	Oct. 28, 1911	B 137
Daniels, David	Nov. 2, 1907	B 53	Laird, Robert	May 17, 1917	B 210
Derbyshire, James	Oct. 23, 1906	B 32	Lander, Frank	May 13, 1915	B 195
Davidson, Hugh	May 27, 1913	B 165	Lane, Joseph	May 9, 1912	B 142
Davies, Stephen	Sept. 10, 1910	B 113	Lee, Robert John	Sept. 10, 1910	B 110
Dennis, Fred. W.	May 21, 1914	B 174	Littler, Jas.	June 10, 1927	B 266
Devlin, Ernest H.	May 21, 1914	B 179	Littler, Matthew	Oct. 31, 1912	B 157
Dewar, Alexander	Oct. 31, 1912	B 162	Luck, George	June 10, 1911	B 128
Dickenson, Clifford	May 13, 1915	B 189	Manifold, Albert	May 9, 1912	B 145
Dunsmuir, John	Nov. 14, 1905	B 26	Marsh, John	Nov. 15, 1917	B 216
Duncan, James	Nov. 21, 1923	B 255	Mason, Joseph	May 13, 1915	B 193
Dykes, J. W.	May 1, 1909	B 77	Massey, H.	Nov. 27, 1909	B 99
Eccleston, Wm.	May 1, 1909	B 87	Mather, Thomas	June 10, 1911	B 127
Fairfoull, James	May 21, 1914	B 186	Matusky, A.	May 1, 1909	B 91
Fairfoull, R.	May 1, 1909	B 83	Mayer, Ralph Waldo	May 9, 1912	B 144
Finlayson, James	July 29, 1905	B 21	Mazay, W. J.	Nov. 27, 1909	B 101
Ford, Allan	May 27, 1913	B 171	Menzies, Fred	Dec. 22, 1921	B 244
Foster, W. R.	Nov. 27, 1909	B 102	Merryfield, William	July 22, 1908	B 61
France, Thos.	May 14, 1905	B 27	Miard, Hy. E.	Sept. 10, 1910	B 107
Francis, David M.	May 21, 1914	B 182	Michek, John	May 17, 1917	B 188
Francis, Enoch	May 1, 1909	B 86	Middleton, Robert	July 22, 1908	B 72
Francis, James	July 22, 1908	B 63	Mitchell, Henry	July 8, 1916	B 201
Frater, George	July 8, 1916	B 204	Monks, James	Nov. 2, 1907	B 55
Freeman, Henry N.	Nov. 2, 1907	B 45	Moore, Wm. H.	May 21, 1914	B 173
Frew, Wm. M.	June 10, 1927	B 269	Morgan, John	Nov. 2, 1907	B 43
Garbett, Richard	Oct. 31, 1912	B 161	Morgan, William	Dec. 19, 1918	B 224
Garman, Morris Wilbur	Oct. 31, 1912	B 155	Morgan, Daniel	Nov. 21, 1923	B 254
Gilham, John	June 21, 1920	B 237	Morris, John	July 22, 1908	B 67
Gillespie, Hugh	July 29, 1905	B 24	Morrison, Edward	Nov. 21, 1923	B 253
Gillespie, John	Oct. 23, 1906	B 36	Morton, Robert W.	July 22, 1908	B 59
Gould, Alfred	May 13, 1915	B 190	Mottishaw, S. K.	Oct. 28, 1911	B 135
Gourlay, Robert	Dec. 19, 1918	B 227	Murray, George	Oct. 3, 1919	B 232
Graham, Chas.	Mar. 4, 1905	B 1	Musgrave, J.	May 1, 1909	B 90
Gray, David	May 1, 1909	B 76	Myers, Peter	May 9, 1912	B 149
Gray, George	July 8, 1916	B 207	MacKinnon, Hugh G.	Dec. 22, 1921	B 243
Greenwell, Archibald	May 16, 1918	B 220	McKay, Walter	June 30, 1926	B 262
Hamilton, Robert N.	May 21, 1914	B 175	McLaughlin, Alex.	May 13, 1915	B 191
Hastings, Andrew P.	Dec. 19, 1918	B 223	McDonald, J. A.	Oct. 28, 1911	B 133
Heathcote, Joseph	July 21, 1929	B 273	McDonald, John	May 27, 1913	B 172
Henderson, Robert	July 22, 1908	B 60	McFegan, W.	Nov. 31, 1909	B 106
Hodge, William K.	Jan. 5, 1925	B 259	McFegan, Robert	May 18, 1922	B 246
Holliday, William	Dec. 19, 1918	B 230	McGarry, Martin	Oct. 31, 1912	B 156
Hopkins, Harry	June 16, 1930	B 276	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

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Parnham, Charles	Nov. 2, 1907	B 49	Stubbs, Clement	May 18, 1922	B 245
Quinn, James	May 21, 1914	B 181	Sutherland, John	May 16, 1918	B 218
Quinn, John	May 9, 1912	B 146	Taylor, James	May 13, 1915	B 194
Ramsay, Peter Millar	May 17, 1917	B 209	Taylor, Robt.	Dec. 30, 1926	B 265
Rankin, Geo.	Nov. 27, 1909	B 103	Taylor, Thomas	July 8, 1916	B 203
Raynes, M. T.	Oct. 28, 1911	B 139	Thomas, J. B.	Nov. 27, 1909	B 105
Reid, Wm.	Oct. 28, 1911	B 132	Thomas, Joseph D.	Oct. 23, 1906	B 38
Renny, James	Oct. 28, 1911	B 140	Thomas, Daniel W.	Nov. 22, 1922	B 249
Richards, Thomas	Nov. 2, 1907	B 57	Thompson, Joseph	Sept. 10, 1910	B 114
Richards, Samuel	May 9, 1912	B 152	Touhey, James	May 9, 1912	B 147
Rigby, John	July 29, 1905	B 29	Touhey, William	July 8, 1916	B 205
Roberts, Ebenezer	Sept. 10, 1910	B 117	Tonge, Thomas	July 22, 1908	B 71
Robinson, William	July 22, 1908	B 69	Tully, Thomas	Nov. 15, 1917	B 214
Rogers, George	May 1, 1909	B 79	Vanhulle, Peter	Nov. 2, 1907	B 54
Roper, William	May 9, 1912	B 141	Virgo, John	May 1, 1909	B 89
Rowbottom, Thomas	May 16, 1918	B 222	Walker, William	May 13, 1915	B 192
Russell, John	Nov. 2, 1907	B 47	Warburton, Ernest L.	May 27, 1913	B 170
Rutherford, Jasper	May 16, 1918	B 219	Watson, Adam G.	Nov. 14, 1905	B 28
Scarpino, Francis	Dec. 19, 1918	B 226	Watson, Arthur W.	May 17, 1917	B 211
Scott, Thomas Wright	June 21, 1921	B 241	Webster, James S.	June 24, 1924	B 258
Shanks, David	Oct. 31, 1912	B 159	Wesnedge, William	Nov. 27, 1909	B 98
Shaw, Thomas John	May 27, 1913	B 166	White, John	Nov. 2, 1907	B 48
Smith, John	Oct. 3, 1919	B 231	Whitehouse, William	Oct. 31, 1912	B 163
Smart, Robert K.	Nov. 22, 1922	B 248	Williams, John Samuel	Nov. 15, 1917	B 215
Somerville, Alex.	Mar. 4, 1905	B 4	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
Stobbart, 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			

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

Name.	Date.	No.	Name.	Date.	No.
Adams, Wm. H.	Dec. 9, 1930	C 845	Barker, Robert	June 10, 1911	C 415
Adamson, Robert	May 1, 1909	C 323	Barlow, B. R.	May 1, 1909	C 337
Adamson, Wm.	Dec. 22, 1921	C 721	Barr, Samuel	June 10, 1927	C 809
Ainsworth, Edward	May 16, 1918	C 674	Barrass, Robt.	June 30, 1926	C 795
Allan, Alexander	Oct. 28, 1911	C 430	Bastian, Albert	May 30, 1923	C 750
Almond, Alex.	Oct. 1, 1907	C 252	Bate, Horace	Dec. 30, 1926	C 802
Almond, Walter	July 22, 1908	C 286	Bateman, Joseph William	Oct. 28, 1913	C 551
Alstead, Robt.	June 21, 1921	C 719	Bauld, Wm.	June 10, 1911	C 422
Ambrosi, Antonio	June 16, 1930	C 843	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 338
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

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Blewett, Ernest	July 22, 1908	C 298	Cooke, Joseph	Mar. 4, 1905	C 209
Blinkhorn, Thomas	Dec. 19, 1918	C 681	Coomb, Alexander	May 27, 1913	C 533
Bond, Frank	June 30, 1926	C 797	Cooper, John Andrew	Dec. 19, 1918	C 689
Bradley, William	July 22, 1908	C 291	Cope, Frank	Oct. 28, 1913	C 549
Bradley, Wilfred	May 17, 1922	C 733	Corbett, Garnet S.	Dec. 23, 1927	C 812
Bridge, Edward	July 29, 1905	C 223	Coulthard, James	June 10, 1911	C 407
Briscoe, F.	July 22, 1908	C 309	Crawford, David	Mar. 4, 1905	C 208
Broderick, Matthew	Jan. 21, 1913	C 525	Cullen, Alex.	July 21, 1929	C 824
Brown, Arthur A.	Oct. 14, 1914	C 596	Cunningham, G. F.	Nov. 11, 1905	C 229
Brown, David	Nov. 1, 1909	C 348	Cunliffe, Thos.	Oct. 1, 1907	C 265
Brown, George	July 8, 1916	C 626	Cuthell, George W.	Dec. 2, 1929	C 832
Brown, George A.	Dec. 14, 1920	C 706	Dabb, Owen	May 21, 1914	C 578
Brown, James	Sept. 10, 1910	C 364	Dando, John	May 9, 1912	C 465
Brown, James	June 10, 1911	C 412	Davey, George	June 21, 1921	C 718
Brown, James	July 8, 1916	C 625	Davidson, Hugh	May 9, 1919	C 464
Brown, Jas. Millie	May 13, 1915	C 615	Davies, Alfred	Oct. 3, 1912	C 691
Brown, John	Sept. 10, 1910	C 392	Davies, Evan Thomas	May 9, 1912	C 463
Brown, Robert	Oct. 28, 1911	C 451	Davies, John H. C.	May 17, 1922	C 729
Brown, Robert D.	June 10, 1911	C 423	Davis, John David	May 16, 1918	C 669
Brown, Robert S.	June 10, 1911	C 408	Davis, William	May 1, 1909	C 339
Brown, Wm. A.	May 21, 1914	C 576	Dean, Andrew	Dec. 19, 1918	C 688
Brown, William Gold	July 8, 1916	C 629	Dean, Joseph	May 13, 1915	C 611
Bruce, Preston	Dec. 14, 1920	C 712	Delprato, Joseph	June 16, 1930	C 837
Bryden, Thomas	June 16, 1930	C 842	Derbyshire, A.	June 10, 1911	C 401
Bullen, Thomas	Sept. 10, 1910	C 379	Dewar, Alex.	Sept. 10, 1910	C 369
Bushell, Jas. P.	Oct. 1, 1907	C 264	Devlin, Edward	Oct. 23, 1906	C 241
Bysouth, Thomas	May 16, 1918	C 673	Devlin, Ernest Henry	May 27, 1913	C 538
Cairns, Andrew	June 10, 1911	C 420	Devlin, John	Oct. 3, 1919	C 693
Cairns, Robert	May 27, 1913	C 539	Devoy, William	May 17, 1917	C 638
Caldwell, Daniel	May 17, 1917	C 639	Dickenson, Clifford	May 27, 1917	C 532
Caldwell, Peter	June 21, 1921	C 715	Dickie, Leslie	Nov. 20, 1923	C 762
Calverly, Joseph	Sept. 10, 1910	C 375	Dingsdale, Geo.	Oct. 28, 1911	C 459
Camamile, Hollis	Oct. 28, 1911	C 443	Dobie, Thomas	Dec. 22, 1921	C 726
Campbell, Samuel	Nov. 15, 1917	C 662	Doherty, J. J.	May 1, 1909	C 340
Campbell, Andrew	Nov. 27, 1917	C 651	Doney, John	Mar. 4, 1905	C 211
Carroll, George	Nov. 21, 1922	C 746	Donnachie, John	June 10, 1911	C 425
Carr, Peter	Oct. 31, 1912	C 497	Doodson, Robert	Oct. 28, 1911	C 455
Carson, George	Mar. 17, 1917	C 663	Dorrance, Orlin William	Jan. 21, 1913	C 517
Cartwright, Wm. H.	June 24, 1924	C 768	Douglas, D. B.	Oct. 23, 1906	C 235
Cass, Wm.	Dec. 30, 1926	C 800	Dow, And. Y.	May 21, 1914	C 587
Catchpole, Charles	July 29, 1905	C 227	Drybrough, Robert	June 21, 1920	C 701
Caufield, Edward	May 16, 1918	C 670	Dunn, James	July 21, 1929	C 821
Caufield, John	May 1, 1909	C 321	Dunn, Wm.	Oct. 14, 1914	C 606
Challoner, Arthur	Oct. 28, 1911	C 433	Dunnigan, Richard	June 21, 1921	C 716
Chambers, Ralph H.	Dec. 14, 1920	C 709	Dunsmore, Alexander	Dec. 9, 1930	C 847
Chapman, Wm.	Dec. 22, 1921	C 720	Dykes, Isaac	June 10, 1911	C 409
Chapman, John	May 30, 1923	C 753	Dykes, Joseph W.	Oct. 1, 1907	C 248
Chapman, Thomas H.	Jan. 5, 1925	C 779	Eccleston, Thomas	May 17, 1917	C 482
Charnock, John	Nov. 15, 1917	C 653	Eccleston, Thomas	June 16, 1930	C 841
Cheetham, Ben	July 22, 1908	C 311	Eccleston, John I.	May 30, 1923	C 757
Chester, John	Oct. 28, 1911	C 440	Edwards, John	May 27, 1913	C 542
Christie, John	Dec. 20, 1928	C 820	Elliott, John	May 27, 1913	C 541
Clare, Albert	Dec. 20, 1928	C 819	Elliott, John B.	Dec. 23, 1927	C 811
Clark, Lewis	June 10, 1911	C 405	Elmes, George	Oct. 31, 1912	C 511
Clark, Walter Pattison	May 9, 1912	C 480	Evans, D.	July 22, 1908	C 284
Clarkson, Robert	June 21, 1920	C 696	Ewing, Robert	May 13, 1915	C 608
Clarkstone, Wm. W.	Oct. 28, 1911	C 431	Fairfoull, James	Oct. 28, 1911	C 453
Clarkstone, Hugh	May 17, 1922	C 736	Farrow, John William	Dec. 19, 1918	C 683
Cleaves, Walter	May 9, 1912	C 475	Ferryman, Henry	June 21, 1920	C 697
Clifford, William	July 22, 1908	C 313	Fitzpatrick, T. J.	Oct. 2, 1911	C 452
Cloke, Chas. E.	June 16, 1925	C 782	Flockart, David	Jan. 21, 1913	C 531
Coates, Frank	June 16, 1925	C 789	Ford, Allen	Oct. 28, 1911	C 445
Colgrove, Charles Henry	Dec. 19, 1918	C 679	Forsyth, William	June 16, 1930	C 836
Commons, William	July 22, 1908	C 304	Fowler, Robert	Oct. 31, 1912	C 495
Coupland, David	June 21, 1921	C 713	Francis, David Morgan	Oct. 28, 1913	C 558

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Francis, James	Oct. 1, 1907	C 250	Howells, Nathaniel	May 1, 1909	C 316
Frater, George	May 13, 1915	C 616	Hughes, Edward R.	Dec. 9, 1930	C 844
Frater, Joseph	July 21, 1929	C 828	Hunter, Peter M.	June 30, 1926	C 798
Freeman, H. N.	Nov. 14, 1905	C 230	Hunter, Thomas	June 16, 1925	C 786
Frew, William M.	May 30, 1923	C 752	Hutchison, Ben	Nov. 14, 1905	C 232
Frew, Andrew	Nov. 27, 1909	C 360	Hutchison, Fred	Nov. 27, 1909	C 358
Frodsham, Vincent	July 22, 1908	C 282	Hynd, John	Dec. 14, 1920	C 707
Furbow, John	Jan. 21, 1913	C 528	Hynds, William	July 8, 1916	C 632
Gabriel, Ernest P.	May 17, 1922	C 739	Ireson, John	Oct. 31, 1912	C 507
Garbett, Richard	Sept. 10, 1910	C 377	Irvine, David	June 10, 1911	C 413
Gascoyne, Rowland B.	Jan. 21, 1913	C 513	Jack, John	May 21, 1914	C 582
Geater, Jas. Gordon	May 21, 1914	C 573	Jackson, Harry	June 24, 1924	C 776
Gemmell, James	Oct. 31, 1912	C 505	James, Thos.	May 21, 1914	C 588
Gillham, John	May 13, 1915	C 623	Jardine, Geo. Edward	Jan. 21, 1913	C 521
Gillies, William	May 16, 1918	C 668	Jarrett, Fred. J.	Oct. 1, 1907	C 256
Glenn, James	Oct. 28, 1911	C 435	Jaynes, Frank	July 22, 1908	C 277
Gordon, Davis John	May 9, 1912	C 474	Jenkins, John	Sept. 10, 1910	C 390
Gourley, Robert	May 9, 1912	C 470	Jenkinson, Jonathan	Dec. 23, 1927	C 813
Gray, George	May 9, 1912	C 467	John, Howel	July 22, 1908	C 305
Gregory, William	May 30, 1923	C 756	Johnson, Moses	Oct. 1, 1907	C 258
Gregson, John B.	Dec. 31, 1925	C 790	Johnston, Fred	Dec. 30, 1926	C 803
Green, William	Nov. 15, 1917	C 659	Johnston, Robert	May 9, 1912	C 479
Greenhorn, John	May 21, 1914	C 575	Jones, Alf. Geo.	May 21, 1914	C 584
Groat, Ed. Murray	Nov. 20, 1923	C 764	Jones, Samuel	May 27, 1913	C 518
Griffiths, Edward	Oct. 31, 1914	C 508	Jones, William C.	Jan. 21, 1913	C 556
Gunniss, Matthew	May 9, 1912	C 460	Jones, William Ernest	Oct. 28, 1913	C 221
Haile, Joseph G.	May 17, 1922	C 731	Jones, W. T.	Mar. 4, 1905	C 544
Hallinan, William	May 1, 1909	C 343	Judge, Peter	Sept. 10, 1910	C 391
Hall, Joseph	May 17, 1922	C 742	Keenan, Wm. James	June 10, 1911	C 426
Halsall, J.	July 22, 1908	C 307	Kelly, Ernest	May 17, 1917	C 646
Hamer, Joseph	Dec. 9, 1930	C 846	Kelly, Francis	June 16, 1930	C 839
Hamilton, John	Oct. 28, 1911	C 444	Kemp, Wm.	Oct. 14, 1914	C 594
Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550	Kirkham, Alfred	Oct. 28, 1913	C 559
Hampton, Samuel	Nov. 15, 1917	C 650	Kirkeberg, H. S.	Nov. 27, 1909	C 350
Hancock, Arthur	Nov. 15, 1917	C 656	Klejko, Steve	Dec. 14, 1920	C 703
Hannah, Archibald	Dec. 2, 1929	C 834	Lane, Joseph	Oct. 1, 1907	C 254
Hardy, Edward	June 21, 1920	C 694	Lavin, Joseph	June 21, 1920	C 700
Hartley, Thomas	Oct. 31, 1912	C 510	Lazaruk, Steve	June 30, 1928	C 815
Hart, Daniel M.	May 17, 1922	C 730	Leeman, T.	May 1, 1909	C 345
Harwood, Fred	Sept. 10, 1910	C 384	Lester, Frank	May 17, 1922	C 734
Harvey, Thomas	May 9, 1912	C 466	Lewis, Benj. J.	Sept. 10, 1910	C 386
Harvie, George	Sept. 10, 1910	C 378	Leynard, Paul	May. 17, 1917	C 637
Heaps, Robert	Sept. 10, 1910	C 373	Liddle, John	July 29, 1905	C 228
Hemer, Herbert	Oct. 14, 1914	C 595	Lindsay, William	May 17, 1917	C 642
Henney, Jonathan	June 10, 1911	C 424	Linn, George Y.	May 17, 1922	C 737
Hendry, James	May 9, 1912	C 471	Litherland, David	June 30, 1928	C 816
Herd, William	Dec. 19, 1918	C 682	Littler, James	June 30, 1926	C 792
Hetherington, Geo.	July 21, 1929	C 825	Littler, John	June 10, 1911	C 410
Heyes, Edward	May 1, 1909	C 320	Littler, Matthew	June 10, 1911	C 417
Heyes, Ernest	Dec. 2, 1929	C 830	Littler, Robert	June 10, 1911	C 418
Hilton, Arthur	Dec. 2, 1929	C 831	Livingstone, Alex	Oct. 28, 1911	C 436
Hilton, Mathias	Dec. 19, 1918	C 677	Loxton, George	June 10, 1911	C 428
Hilton, R. G.	Sept. 10, 1910	C 376	Loxton, John	June 10, 1911	C 416
Hindmarsh, John G.	June 30, 1926	C 799	Lloyd, Thomas	May 17, 1922	C 740
Hindmarsh, Peter	May 30, 1923	C 755	Luck, George	May 1, 1909	C 318
Hodson, R. H.	Mar. 4, 1905	C 216	Lynch, Stewart	Oct. 28, 1911	C 432
Hodge, William K.	Nov. 20, 1923	C 761	Mackie, John	June 10, 1911	C 421
Holdsworth, William	May 16, 1918	C 671	Makin, J. Wm.	Sept. 10, 1910	C 385
Holliday, William	July 8, 1916	C 634	Malone, John	May 21, 1914	C 585
Hopkins, Harry	Dec. 31, 1925	C 791	Maltman, James	Oct. 31, 1912	C 501
Horbury, Joseph W.	June 10, 1911	C 406	Mansfield, A.	May 1, 1909	C 336
Horrocks, A. G.	May 1, 1909	C 324	Marrs, John	May 17, 1917	C 640
Horwood, S.	July 22, 1908	C 312	Marsh, Daniel Parks	May 27, 1913	C 543
Houston, Robert	July 8, 1916	C 631	Marsh, John	Oct. 1, 1907	C 270

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Martin, James	June 10, 1911	C 398	Mottishaw, Samuel K.	Oct. 23, 1906	C 237
Mason, Joseph	July 22, 1908	C 297	Murdock, Jno. Y.	May 21, 1914	C 564
Massey, Henry	May 1, 1909	C 317	Murray, Robt.	June 30, 1926	C 796
Mather, Thomas	July 22, 1908	C 293	Myers, Peter	Oct. 28, 1911	C 446
Matusky, Andrew	Oct. 1, 1907	C 259	Nanson, T. H.	July 22, 1908	C 280
Mawson, J. T.	Nov. 27, 1909	C 359	Nash, George William	May 17, 1917	C 565
Maxwell, Geo.	May 21, 1914	C 571	Nash, George F.	Dec. 22, 1921	C 727
McAlpine, John	Mar. 4, 1905	C 217	Nee, Wm. R.	Dec. 22, 1921	C 724
McArthur, John Malcolm	May 17, 1917	C 648	Neen, Joseph	Nov. 27, 1909	C 352
McArthur, Robert	Dec. 22, 1921	C 723	Nelson, Horatio	Oct. 1, 1907	C 263
McBroom, Al.	July 2, 1908	C 287	Neilson, William	May 9, 1912	C 481
McCourt, John	Oct. 14, 1914	C 605	Newman, John	Oct. 14, 1914	C 603
McCourt, Thos.	Dec. 30, 1926	C 805	Nicholson, James	May 9, 1912	C 469
McCulloch, James	May 1, 1909	C 315	Nimmo, James	May 9, 1912	C 461
McDonald, Allen	June 30, 1928	C 817	Norris, Joshua	Oct. 28, 1913	C 557
McDonald, John	Oct. 28, 1911	C 448	Nuttall, Wm.	June 16, 1925	C 780
McFagen, Alexander	May 9, 1912	C 490	Oakes, Robert	Oct. 31, 1912	C 498
McFegan, Robert	June 21, 1920	C 698	O'Brien, Charles	Nov. 27, 1909	C 349
McFegan, W.	May 1, 1909	C 319	Odgers, Eli	Jan. 21, 1913	C 523
McGarry, Martin	May 1, 1909	C 326	Orr, Alexander	Oct. 28, 1911	C 434
McGrath, James	July 8, 1916	C 630	Osborne, Hugh	Oct. 28, 1913	C 555
McGuckie, Jno. M.	May 21, 1914	C 562	Oswald, Geo. L.	Sept. 10, 1910	C 370
McGuckie, Thomas	July 29, 1905	C 226	Owen, Thomas	May 1, 1909	C 347
McGuire, Thomas	Oct. 28, 1913	C 553	Park, William	Dec. 19, 1918	C 684
McIntyre, Neil	May 21, 1914	C 574	Parks, Alexander	Jan. 21, 1913	C 519
McKay, Walter	Nov. 20, 1923	C 763	Parker, L.	May 1, 1909	C 341
McKelvie, J.	July 22, 1908	C 285	Parkinson, James Wm.	Nov. 15, 1917	C 655
McKenzie, Peter	June 10, 1911	C 427	Parkinson, T.	July 22, 1908	C 289
McKibben, Matthew	May 21, 1914	C 580	Parkinson, Thomas	June 24, 1924	C 769
McKinley, John	Oct. 28, 1914	C 442	Parrott, Jas. E.	May 21, 1914	C 590
McLaren, John	May 30, 1923	C 754	Parson, Herbert	May 13, 1915	C 621
McLaughlin, James	May 9, 1912	C 485	Parsons, Albert	June 10, 1927	C 808
McLachlan, Alex.	June 10, 1912	C 419	Pearson, Jonathan	May 9, 1912	C 473
McLean, M. D.	Sept. 10, 1910	C 389	Penman, Hugh	Oct. 28, 1913	C 552
McLellan, William	Mar. 4, 1905	C 219	Perry, Geo. Harewood	May 17, 1917	C 643
McLeod, James	July 22, 1908	C 296	Phillips, Richard S.	May 17, 1917	C 620
McLeod, John	May 13, 1915	C 609	Phillips, James	Nov. 21, 1922	C 749
McMeakin, James	May 13, 1915	C 612	Pickup, A.	July 22, 1908	C 310
McMillan, D.	Sept. 10, 1910	C 363	Picton, W.	May 1, 1909	C 333
McMillan, Edward	Oct. 31, 1912	C 493	Plank, Samuel	Nov. 14, 1905	C 233
McMillan, Neil	Nov. 15, 1917	C 654	Pollock, John	May 30, 1923	C 760
McNay, Carmichael	July 22, 1908	C 306	Poole, Samuel	May 27, 1913	C 536
McNeill, Adam L.	July 22, 1908	C 281	Price, Walter	Sept. 10, 1910	C 371
McNeill, Robert	Sept. 10, 1910	C 387	Puckey, John Thomas	Dec. 19, 1918	C 687
McWhirter, Archibald	June 30, 1926	C 794	Quayle, Alex. B.	Jan. 5, 1925	C 778
Meek, Matthew	May 9, 1912	C 484	Quinn, James	Oct. 28, 1911	C 441
Meikle, Harry Alexander	July 8, 1916	C 627	Quinn, John	Oct. 28, 1911	C 429
Menzies, Frederick	Dec. 14, 1920	C 704	Radford, Albert	May 21, 1914	C 579
Merrifield, George	Oct. 23, 1906	C 239	Rallison, R.	July 22, 1908	C 279
Merrifield, William	Oct. 23, 1906	C 236	Rallison, James	May 30, 1923	C 759
Michek, John	May 21, 1914	C 563	Rankin, George	July 22, 1908	C 275
Miles, John	June 10, 1911	C 414	Rankin, Wm. Shaw	May 9, 1912	C 489
Miller, Frederick	July 21, 1929	C 823	Raynor, Fred	Oct. 1, 1907	C 257
Mitchell, Charles	May 1, 1909	C 322	Rear, Albert E.	June 10, 1927	C 807
Mitchell, Henry	Sept. 10, 1910	C 366	Reid, Robert	Sept. 10, 1910	C 383
Monks, James	Nov. 14, 1905	C 234	Reid, Thos.	May 21, 1914	C 592
Moore, George	Oct. 23, 1906	C 242	Reid, Wm.	June 10, 1911	C 403
Moore, John	May 1, 1909	C 335	Reilly, Thomas	July 22, 1908	C 303
Moreland, Thomas	July 22, 1908	C 299	Renney, Jas.	Nov. 27, 1909	C 354
Morgan, John	July 29, 1905	C 224	Richards, James	Nov. 1, 1907	C 249
Morgan, William	May 17, 1917	C 636	Richards, Samuel	Oct. 23, 1906	C 244
Morgan, Cornelius	Dec. 22, 1921	C 725	Richardson, J. H.	Oct. 28, 1911	C 458
Morgan, John	June 24, 1924	C 773	Rigby, John	July 29, 1905	C 225
Morris, David	May 9, 1912	C 472	Roberts, Arthur	June 24, 1924	C 772

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Roberts, Ebenezer	May 1, 1909	C 327	Strang, Wm.	June 10, 1911	C 395
Robinson, Michael	May 1, 1909	C 332	Strang, William L.	Jan. 5, 1925	C 777
Robinson, Asa	June 16, 1925	C 787	Surtees, Edward	June 16, 1930	C 835
Robson, James	June 16, 1925	C 788	Sutherland, John	May 27, 1913	C 545
Robson, Thomas	May 21, 1914	C 566	Sweeney, John	May 17, 1922	C 735
Rogers, Ellis	May 13, 1915	C 624	Taylor, Charles M.	Mar. 4, 1905	C 213
Roper, William	July 22, 1908	C 274	Taylor, Henry	Dec. 20, 1928	C 818
Rowan, John	Oct. 14, 1914	C 602	Taylor, Hugh	Jan. 21, 1913	C 530
Rowbottom, Thomas	Oct. 31, 1914	C 492	Taylor, James	May 21, 1914	C 567
Royle, Edward	Oct. 31, 1912	C 506	Taylor, Jonathan	Dec. 19, 1918	C 680
Russell, Robert	Nov. 27, 1909	C 351	Taylor, J. T.	Oct. 28, 1911	C 447
Rutherford, Jasper	May 17, 1917	C 644	Taylor, Leroy	Sept. 10, 1910	C 381
Rutledge, Edwin	July 22, 1908	C 302	Taylor, Robert	June 21, 1920	C 695
Scales, Joseph	May 17, 1922	C 738	Taylor, Thomas	May 21, 1914	C 577
Scott, Henry	July 22, 1908	C 294	Tennant, Joseph	June 24, 1924	C 770
Saunders, Eustace L.	Jan. 21, 1913	C 520	Thacker, Geo.	May 27, 1913	C 537
Scarpino, Francis	May 17, 1917	C 649	Thomas, Thomas	Sept 10, 1910	C 365
Seddon, James	Oct. 3, 1919	C 692	Thomas, John B.	Nov. 14, 1905	C 231
Shanks, David	Sept. 10, 1910	C 372	Thomas, Joseph	Mar. 4, 1905	C 220
Sharp, James	May 1, 1909	C 325	Thomas, Warriett	Oct. 1, 1907	C 273
Sharpe, Henry	June 16, 1925	C 783	Thomason, Charles	Nov. 15, 1917	C 657
Sharples, J. T.	Sept. 10, 1910	C 380	Thompson, Charles	June 24, 1924	C 765
Shea, Thomas J.	Dec. 22, 1921	C 722	Thompson, Thomas	Oct. 1, 1917	C 267
Shearer, L.	May 1, 1909	C 330	Thompson, John	Oct. 31, 1912	C 509
Shields, Thomas	May 16, 1918	C 667	Thompson, Joseph	Oct. 1, 1907	C 269
Shipley, John W.	Oct. 28, 1911	C 456	Thomson, Duncan	Mar. 4, 1905	C 218
Shooter, Joseph	Oct. 1, 1907	C 261	Tolley, John	Dec. 19, 1918	C 678
Shortman, J.	May 1, 1909	C 331	Touhey, William	May 27, 1913	C 547
Simister, J. H.	Nov. 27, 1909	C 353	Travis, Joseph	June 21, 1920	C 699
Simister, W.	May 1, 1909	C 334	Tully, Thomas	May 9, 1912	C 468
Sim, James	Dec. 14, 1920	C 711	Tune, Elijah	May 9, 1912	C 476
Simms, Hubert Allan	Jan. 21, 1913	C 526	Unsworth, John	June 16, 1925	C 784
Sinclair, William	Jan. 21, 1913	C 527	Valentine, Wilfrid	July 21, 1929	C 826
Skelton, Thos.	May 1, 1909	C 344	Vardy, Robt.	May 21, 1914	C 570
Slee, Thomas	June 30, 1926	C 793	Vaughan, John Henry	Oct. 28, 1913	C 560
Smellie, John	May 29, 1923	C 755	Vincent, Thomas C.	Nov. 21, 1922	C 745
Smith, A. E.	Sept. 10, 1910	C 367	Waddington, D. M.	June 10, 1927	C 806
Smith, John Watterson	May 16, 1918	C 665	Walker, George	July 8, 1916	C 633
Smith, Joseph	Mar. 4, 1905	C 207	Walker, Jas. Alexander	Oct. 31, 1912	C 496
Smith, Richard Beveridge	Oct. 28, 1913	C 561	Walker, Robert C.	May 17, 1922	C 728
Smith, Thomas	Dec. 30, 1926	C 804	Walker, Wm.	May 21, 1914	C 586
Smith, Thos. J.	Oct. 1, 1907	C 271	Wallace, Fred	Oct. 1, 1907	C 260
Smith, Thomas	May 9, 1912	C 486	Walls, John	Dec. 14, 1920	C 710
Smith, Thomas	Dec. 14, 1920	C 705	Warburton, Ernest L.	June 10, 1911	C 399
Snow, Aubrey	June 15, 1918	C 675	Ward, Ernest Hedley	May 17, 1917	C 641
Sopwith, Reginald Scott	Jan. 21, 1913	C 512	Wardrop, James	Oct. 31, 1912	C 504
* Sparks, Edward	Oct. 1, 1907	C 255	Watson, Adam G.	Mar. 4, 1905	C 212
Spencer, G.	May 1, 1909	C 329	Watson, Arthur W.	May 27, 1913	C 535
Spruston, Thomas A.	Mar. 4, 1905	C 206	Watson, George	July 22, 1908	C 288
Stafford, M.	Sept. 10, 1910	C 382	Watson, Joseph	Jan. 21, 1913	C 515
Starr, Wallace	May 9, 1912	C 488	Watson, William	Oct. 22, 1906	C 246
Staton, Edward	May 21, 1914	C 581	Watson, William	May 17, 1917	C 645
Steele, Walter,	Oct. 28, 1911	C 439	Watson, John	May 17, 1922	C 743
Stewart, George	May 27, 1913	C 534	Weaver, William	Nov. 17, 1922	C 748
Stewart, James M.	Oct. 23, 1906	C 240	Webb, Herbert	Oct. 28, 1911	C 457
Stewart, James B.	June 16, 1925	C 785	Webster, James Stewart	Dec. 19, 1918	C 685
Stewart, John	Dec. 30, 1926	C 801	Weeks, John	Mar. 4, 1905	C 214
Stobbart, David	June 16, 1925	C 781	West, James Gloag	May 16, 1918	C 676
Stockwell, William	Oct. 23, 1906	C 238	Whalley, William	Dec. 19, 1918	C 686
Stone, Wm. C.	June 21, 1921	C 714	White, James	Oct. 31, 1912	C 499
Strachan, John	Oct. 14, 1914	C 604	White, John	Oct. 22, 1906	C 245
Strang, James	May 13, 1915	C 614	Wicks, Roy	July 21, 1929	C 827
Strang, Thomas	June 10, 1911	C 400	Wilkinson, Edward	Oct. 28, 1911	C 438

* C 314 issued in lieu of C 255 destroyed by Fernie fire.

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Williams, Cadwaladr	June 16, 1930	C 838	Wintle, Thomas A.	July 29, 1905	C 222
Williams, John Sam.	June 10, 1911	C 404	Witherington, George	Oct. 28, 1913	C 554
Williams, Watkin	June 22, 1908	C 301	Wood, Thos. James	Oct. 31, 1912	C 491
Wilson, Joseph	June 24, 1924	C 767	Worthington, J.	July 22, 1908	C 295
Wilson, Joseph	June 30, 1928	C 814	Wright, John	May 21, 1914	C 593
Wilson, Robinson	June 10, 1911	C 397	Wright, Robert	May 21, 1914	C 589
Wilson, Thomas M.	Oct. 1, 1907	C 272	Wright, William	Jan. 21, 1913	C 522
Wilson, William	Oct. 1, 1907	C 262	Yates, Frank	May 17, 1922	C 732
Wilson, William	May 17, 1917	C 674	Yates, John	June 16, 1930	C 840
Winstanley, Robert	Nov. 21, 1922	C 747	Yeowart, Hudson	June 24, 1924	C 771
Winstanley, Oliver	May 17, 1922	C 741	Young, Alexander	May 16, 1918	C 666
Winstanley, H.	July 22, 1908	C 283			

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	Green, Francis	Oct. 11, 1904	C 38
Addison, Thos.	Dec. 10, 1904	C 52	Handlen, Jas.	June 16, 1904	C 122
Aitken, James	Oct. 24, 1904	C 44	Harmison, Wm.	Feb. 3, 1905	C 65
Allsop, Harry	Oct. 11, 1904	C 34	Hescott, John	Jan. 16, 1905	C 62
Ashman, Jabez	Feb. 5, 1907	C 131	Hoggan, Wm.	June 6, 1911	C 134
Auchinvole, Alex	Mar. 29, 1905	C 89	John, David	Nov. 8, 1904	C 49
Barclay, Andrew	April 27, 1904	C 19	* John, Evan	July 25, 1916	C 140
Barclay, James	*April 27, 1904*	C 20	*Johnson, Geo.*	*May 9, 1904*	C 124
Barclay, John	April 17, 1905	C 111	Johnson, Wm. R.	Mar. 1, 1905	C 75
Bickle, Thos.	Oct. 11, 1904	C 37	Jones, Evan	April 30, 1913	C 136
Bowie, James	May 13, 1905	C 116	Lander, Frank	Jan. 9, 1905	C 61
Briscoe, Edward	Oct. 10, 1906	C 129	Lanfear, Herbert	Jan. 27, 1905	C 63
Campbell, Dan	Mar. 29, 1905	C 93	Lewis, Thos.	Oct. 11, 1904	C 35
Carr, Jos. E.	Oct. 11, 1904	C 36	Marsden, John	May 3, 1904	C 21
Carroll, Harry	Mar. 29, 1905	C 98	Miard, Harry E.	Mar. 3, 1905	C 76
Clarkson, Alexander	April 27, 1904	C 18	Middleton, Robt.	Feb. 11, 1905	C 71
Collishaw, John	Feb. 7, 1905	C 68	Miller, Thos. K.	Feb. 21, 1905	C 74
Comb, John	Mar. 23, 1904	C 2	McKenzie, John R.	Oct. 12, 1904	C 40
Courtney, A. W.	Nov. 2, 1904	C 45	McKinnon, Arch'd	April 3, 1905	C 102
Crawford, Frank	April 6, 1904	C 7	McMillan, Peter	Mar. 29, 1905	C 94
Daniels, David	April 27, 1904	C 12	McMurtrie, John	Mar. 29, 1905	C 96
Davidson, David	April 3, 1905	C 106	Moore, Wm. H.	June 17, 1905	C 119
Davidson, John	Mar. 29, 1905	C 87	Morris, John	Dec. 27, 1904	C 57
Dobbie, John	Nov. 27, 1905	C 126	Myles, Walter	April 3, 1905	C 100
Dudley, James	Mar. 22, 1905	C 114	Nash, Isaac	June 1, 1904	C 120
Duncan, Thomas	Aug. 29, 1906	C 128	Neave, Wm.	Oct. 12, 1904	C 43
Dunlap, Henry	Nov. 21, 1904	C 51	Nelson, James	April 27, 1904	C 16
Dunn, Geo.	Dec. 19, 1904	C 56	Nimmo, Richard E.	April 18, 1911	C 133
Dunsmuir, John	Mar. 29, 1905	C 90	O'Brien, Geo.	Feb. 6, 1905	C 66
Eccleston, Wm.	Mar. 15, 1905	C 80	Pearse, Thomas W. H.	April 14, 1916	C 138
Fagan, David	April 6, 1905	C 109	Power, John	Sept. 8, 1920	C 142
Farquharson, John	April 27, 1904	C 17	Price, Jas.	Nov. 8, 1904	C 50
Findlayson, James	June 6, 1904	C 25	Rafter, Wm.	Mar. 29, 1905	C 95
Fulton, Hugh T.	April 3, 1905	C 105	Reid, James	Mar. 23, 1904	C 1
Gibson, Edward	May 30, 1905	C 118	Richards, Thos.	April 27, 1904	C 14
Gilchrist, Wm.	Mar. 29, 1905	C 85	Roughead, George	Jan. 30, 1907	C 130
Gillespie, Hugh	April 6, 1904	C 8	Ryan, John	Dec. 28, 1904	C 59
Gillespie, John	April 6, 1904	C 5	Sanders, John W.	April 3, 1905	C 107
Gould, Alfred	April 17, 1906	C 112	Shenton, Thos. J.	July 25, 1904	C 30

* Issued in lieu of No. C 132, lost.

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

Name.	Date.	No.	Name.	Date.	No.
Shepherd, Henry	June 13, 1904	C 26	Strang, James	April 27, 1904	C 10
Smith, Geo.	Mar. 29, 1905	C 84	Sullivan, John	July 4, 1916	C 139
Somerville, Alex.	Mar. 24, 1904	C 3	Summers, Joseph	May 17, 1920	C 141
Stauss, Chas. F.	Feb. 9, 1905	C 69	Thomas, John	Mar. 29, 1905	C 97
Steele, Jas.	Mar. 29, 1905	C 92	Vass, Robt.	Dec. 12, 1904	C 53
Steele, John	June 4, 1913	C 4	Vater, Charles.	April 6, 1904	C 66
Stewart, Duncan H.	Mar. 28, 1904	C 137	Webber, Chas.	Sept. 13, 1904	C 32
Stewart, John	April 3, 1904	C 104	Whiting, Geo.	May 29, 1905	C 117
Stewart, Daniel W.	May 16, 1904	C 23	Wilson, Austin	Feb. 7, 1905	C 67
Stoddart, Jacob	Feb. 21, 1905	C 73	Wilson, Thos.	April 27, 1904	C 11
Strachan, Robt.	April 27, 1904	C 15	Woodburn, Moses	Mar. 29, 1905	C 83

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	Lymn, Albert Crompton	Oct. 3, 1919	17
Baile, Wynne Jeffreys	Oct. 3, 1919	16	MacDonald, John	May 19, 1922	46
Bonar, Robert B.	Dec. 30, 1926	64	McKenzie, Frank	June 10, 1927	66
Bowerman, Everard S.	Dec. 14, 1920	39	Miard, Harry Ernest	Oct. 3, 1919	2
Boyce, Joseph Patrick	Oct. 3, 1919	5	McCulloch, Robert	Oct. 3, 1919	6
Caufield, Bernard	May 19, 1922	54	Owen, Wm. Arthur	Oct. 3, 1919	10
Corbett, Garnett S.	May 19, 1922	49	Pettigrew, Robt.	Dec. 9, 1930	75
Cox, Richard	May 19, 1922	57	Priest, Elijah	May 19, 1922	53
Crosscombe, James S.	May 31, 1923	60	Rafter, Wm.	May 19, 1922	51
D'Altroy, A. C.	July 21, 1929	68	Reger, Frederick Wm.	Oct. 3, 1919	7
Daniell, Geo. W. B.	Oct. 3, 1919	29	Richards, Chas. Clifton	Oct. 3, 1919	19
Davis, Gerald D.	Oct. 3, 1919	28	Ridley, James	Oct. 3, 1919	18
Delaney, James	Oct. 3, 1919	21	Roaf, Jos. R.	Oct. 3, 1919	14
Dickson, James	Oct. 3, 1919	3	Richards, James A.	Oct. 3, 1919	15
Drewry, Wm. Stewart	May 19, 1922	56	Rutherford, John A.	Dec. 2, 1929	70
Edwards, Jas.	June 10, 1927	65	Schjelderup, Vilhelm	July 21, 1929	69
Freeman, Harry N.	May 19, 1922	47	Scott, Thos. Wright	Oct. 3, 1919	4
Gardner, Harold H.	June 16, 1930	72	Strachan, Robert	June 21, 1920	36
Garman, Maurice W.	Oct. 3, 1919	11	Spruston, Thos. A.	May 19, 1922	52
Gregory, P. W.	Nov. 17, 1919	32	Strachan, Robert	May 19, 1922	45
Graham, Charles	May 19, 1922	50	Sandland, Joseph	May 31, 1923	61
George, Frank J.	May 19, 1922	48	Stewart, R. T.	Nov. 17, 1923	62
Hargreaves, James	Nov. 29, 1920	33	Townsend, Neville F.	Nov. 17, 1919	31
Heaney, Chas. J.	June 16, 1930	73	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
Holmes, Terence C.	June 16, 1930	74	Wark, Samuel David	Oct. 3, 1919	20
Hughes, Edward	Dec. 14, 1920	38	White, Harold	Oct. 3, 1919	25
Hunter, George	Oct. 3, 1919	30	Williams, Paul E. R.	Dec. 2, 1929	71
Howden, Archibald	May 19, 1922	55	Wilson, R. Robinson	Oct. 3, 1919	12
Jackson, Thos. R.	May 19, 1922	43	Wilson, Arthur Rupert	Oct. 3, 1919	13
King, Alfred Geo.	Oct. 3, 1919	27	Wilson, Chas. Jas.	Oct. 3, 1919	22
Kneen, Percy	Dec. 20, 1928	67	Wilson, Hartley Paul	Oct. 3, 1919	24
Lancaster, Peter	Oct. 3, 1919	23	Wilton, Douglas D.	May 19, 1922	59
Lauderbach, Wilfrid P.	June 16, 1925	63	Wilkie, Octavius B. N.	Oct. 3, 1919	26
Lindoe, Luke	June 21, 1921	41	Wright, Austin	Dec. 14, 1920	40

PROSECUTIONS.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Mine and Date.	Occupation of Defendant.	Offence charged.	Judgment.
Canadian Collieries (D.), Ltd.—			
South Wellington, October 14th	Fireboss	Having more than one shot-hole charged at one time in a coal-face	$10 and costs.
Extension Colliery, October 14th	Fireboss	Same offence as above	$10 and costs.
Extension Colliery, October 14th	Fireboss	Same offence as above	$10 and costs.
Comox Colliery, October 21st	Manager	For running percussive drills without being equipped with water-jet	$200 and costs.
Richardson Mine, December 17th	Fireboss	Permitting the use of unlocked flame safety-lamps in the mine	$100 and costs.
Tulameen Valley Coal Mining Co.—			
No. 1 mine, January 28th	Miner's helper	Had matches in his pocket underground	$5 and costs.
No. 1 mine, October 3rd	Miner	Going into a fenced-off area	$10 and costs.
Crow's Nest Pass Coal Co., Ltd.—			
Coal Creek Colliery, February 7th	Miner	Had matches in his possession	$5 and costs.
Michel Colliery, February 7th	Miner	Same offence as above	$20 and costs.

PROSECUTIONS UNDER "METALLIFEROUS MINES REGULATION ACT."

Granby Consolidated M.S. & P. Co., Bonanza Mine, September 24th	Miner	Illegally riding on skip	$10 and costs.

METALLIFEROUS MINES SHIPPING IN 1930.

NORTH-WESTERN DISTRICT (No. 1).

Portland Canal Mining Division.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Kenneth	Glacier creek	Argentine Syndicate, Stewart	Silver, lead.
Black Hill	Bear river	Black Hill Mining Co., Ltd., Stewart	Silver, lead.
Dunwell	Glacier creek	Dunwell Mines, Ltd., Victoria	Gold, silver, lead.
Marmot Metals	Marmot river	Marmot Metals Mining Co., Ltd., Stewart	Silver, lead.
Northern Metals		Northern Metals Holdings Synd., Stewart	Silver, lead.
Porter-Idaho	Glacier creek	Porter-Idaho Mining Co., Ltd., Premier	Silver, gold, lead.
Premier	Cascade river	Premier Gold Mining Co., Ltd., Vancouver	Gold, silver, lead.
Prosperity	Marmot river	Premier Gold Mining Co., Ltd., Vancouver	Silver, lead, gold.

Nass River Mining Division.

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.

NORTH-EASTERN DISTRICT (No. 2).

Omineca Mining Division.

Duthie	Hudson Bay mt.	Duthie Mines, Ltd., Vancouver	Silver, lead, gold.
Silver Cup	9-Mile mountain	Duke Mining Co., Vancouver	Silver, lead.

CENTRAL DISTRICT (No. 3).

Kamloops Mining Division.

Ford	Meadow creek	Meadow Creek Mines, Kamloops	Copper, silver.

Lillooet Mining Division.

Pioneer	Cadwallader creek	Pioneer Gold Mines of B.C., Ltd., Vancouver	Gold.

Nicola Mining Division.

Planet	Stump lake	Planet Mines & Reduction Co. of Nicola, Ltd., Vancouver	Lead, gold, silver.
Green, L. F.		L. F. Green, Merritt	Copper, silver.

Yale Mining Division.

Aurum	Verona	Aurum Mines, Ltd., Vancouver	Gold, silver.
Dawson	Verona	Dawson Gold Mines, Ltd., Vancouver	Gold, silver.

SOUTHERN DISTRICT (No. 4).

Greenwood Mining Division.

Mine or Group.	Locality.	Owner or Agent and Address.	Character of Ore.
Bell	Beaverdell	McIntosh & Lee, Beaverdell	Silver, gold, lead.
Bell	Beaverdell	Bell Mine, Ltd., Creston	Silver, gold, lead.
Bounty	Beaverdell	Philip B. S. Stanhope, Beaverdell	Silver, lead.
Duncan	Wallace mt.	T. T. Henderson, Beaverdell	Silver, lead.
Highland Lass	Beaverdell	Highland Lass, Ltd., Kelowna	Silver, gold, lead.
Sally	Beaverdell	Sally Mines, Ltd., Penticton	Silver, lead.
Waterloo	Lightning-peak	Waterloo Cons. Mines, Ltd., Penticton	Silver, lead.
Wellington	Beaverdell	Beaverdell-Wellington Synd., Ltd., Greenwood	Silver, gold, lead.

Grand Forks Mining Division.

Lightning Peak	Lightning peak	Lightning Peak Mining Co., Trail	Silver, lead.
Union	Granby river	James F. McCarthy, Grand Forks	Gold, silver, lead.
Yankee Girl	Hardy mountain	Boundary-Republic Mines, Ltd., Montreal	Gold, silver.

Osoyoos Mining Division.

B.E.	Olalla	B.E. Mining Co., Leavenworth, Wash.	Gold, silver, lead.
Golconda	Olalla	D. McEachern, Olalla	Copper, silver.
Hedley	Hedley	Hedley Gold Mining Co., Hedley	Gold, silver, arsenic.

Similkameen Mining Division.

Copper Mountain	Allenby	Granby Cons. M.S. & P. Co., Vancouver	Copper, Silver, gold.
Mary E	Treasure mountain	W. B. Dornberg, Vancouver	Silver, lead.

EASTERN DISTRICT (No. 5).

Slocan Mining Division.

Black Colt and Palmita	Sandon	Cunningham Mines, Ltd., Alamo	Silver, lead, zinc.
Bosun	Sandon	C. J. Campbell, New Denver	Silver, lead, zinc.
Canadian Group	Sandon	J. Brandon, New Denver	Silver, lead.
Elkhorn	Sandon	Geo. T. Gormley, Nelson	Silver, lead, zinc.
Galena Farm	Silverton	Galena Farm Cons. Mines, Ltd., Vancouver	Silver, lead, zinc.
Great Western	Sandon	R. B. Kirk, New Denver	Silver, lead, zinc.
Lucky Thought	Silverton	F. W. McDougal, Dewis, *et al.*, Silverton	Silver, lead, zinc.
Mary Ryan	McGuigan basin	Roy C. Wolthausen, Supt., Sandon	Silver, lead, zinc.
Noble Five	Cody	Noble Five Mines, Ltd., Nelson	Silver, lead, zinc.
Ruth-Hope	Sandon	Ruth-Hope Mining Co., Ltd., Vancouver	Silver, gold, lead, zinc.
Silversmith	Sandon	A. K. Olsen *et al.*, Sandon	Silver, gold, lead.
Slocan King	Sandon	Slocan King Mines, Ltd., Spokane, Wash.	Silver, lead.
Slocan Rambler	New Denver	Slocan Rambler Mines, Ltd., Rambler	Silver, lead, zinc.
Sovereign	New Denver	Bank of Montreal, New Denver	Silver, lead, zinc.
Standard	Sandon	Western Exploration Co., Ltd., Silverton	Silver, zinc, lead.

Slocan City Mining Division.

Treasure Chest		Miss Vallia Zimmerman, Slocan City	Silver, lead.

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.
Whitewater	Whitewater	S. N. Ross, Retallack	Silver, lead, zinc.

REVELSTOKE MINING DIVISION.

Regal	Albert Canyon	Regal Silver Mines, Ltd., Vancouver	Silver, lead.

LARDEAU MINING DIVISION.

Lead Star	Beaton	Globe Mining Co., Ltd., Beaton	Silver, gold, lead.

FORT STEELE MINING DIVISION.

Sullivan	Kimberley	Cons. M. & S. Co. of Canada, Ltd., Trail	Silver, lead, zinc.

GOLDEN MINING DIVISION.

Monarch	Field	Base Metals Mining Corporation, Ltd., Field	Silver, lead, zinc.
Ruth Vermont	Vermont creek	The Galena Synd., Ltd., London, England	Silver, gold, lead, zinc.

NELSON MINING DIVISION.

California	Giveout creek	A. T. Harbour, Nelson	Silver, gold, lead.
Goodenough	Ymir	Alex. McDonald, Ymir	Gold, silver, lead.
Reno	Sheep creek	Reno Gold Mines, Ltd., Salmo	Gold, silver, lead.
Second Relief	Erie	Relief-Arlington Mines, Ltd., Erie	Gold, silver.

TRAIL CREEK MINING DIVISION.

Gold Drip	Rossland	J. Schmidt and M. Penney, Rossland	Gold, silver.
I.X.L.	Rossland	J. J. Cullinane, *et al.*, Rossland	Gold, silver.
Midnight	Rossland	Midnight Synd., Ltd., C. Dally, Rossland	Gold, silver.

WESTERN DISTRICT (No. 6).

VANCOUVER MINING DIVISION.

Britannia	Britannia beach	Britannia Mining & Smelting Co., Britannia Beach	Copper, silver, gold.

CLAYOQUOT MINING DIVISION.

Tagore	Zeballos river	Pacific Mines Pet. & Dev. Co., Vancouver	Gold, silver, copper.

LIST OF CROWN-GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1930.

North-western District (No. 1).

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Atlin—			
Smith Fraction	Engineer Gold Mines, Ltd.; Feb. 5	4658	1.27
Nass River—			
Basin	Charles Leopold Munro, administrator of the Estate of Angus McLeod, deceased; July 8	1096	51.65
Basin No. 1	Ditto	1097	51.65
Basin No. 2	„	1098	44.25
Basin No. 3	„	1099	51.65
B.J. No. 2	Beverley Earl Jones; Dec. 24	5516	35.29
B.J. No. 3	Beverley Earl Jones; Dec. 24	5517	48.50
B.J. No. 4	Beverley Earl Jones; Dec. 24	5518	43.45
Black Bear	Ralph Young Ingraham; Sept. 19	3338	37.60
Camp Bird	Albert Benjamin Shanbeck; Dec. 22	932	40.51
Easterly	Thomas W. Shackleton and Olier Besner; Dec. 27	5509	44.95
Moose No. 1	Miles Donald and John Walford Strombeck; March 17	1241	42.48
Moose No. 2	Miles Donald and John Walford Strombeck; March 17	1242	45.26
Moose No. 5	Miles Donald and John Walford Strombeck; March 17	1244	47.50
Moose No. 6	Miles Donald and John Walford Strombeck; March 17	1243	41.60
New World No. 3	Beverley Earl Jones; Dec. 24	5515	51.65
Silver Bow	Thomas W. Shackleton and Olier Besner; Dec. 27	5510	44.95
Summit No. 23	Albert Benjamin Shanbeck; Dec. 22	933	51.65
Portland Canal—			
Alameda	Joseph Raymond Kennedy and Peter Westman; Sept. 30	5124	51.64
Bayview No. 1	Bayview Mining Company, Ltd.; April 16	4182	29.67
Bayview No. 2	Bayview Mining Company, Ltd.; April 16	4181	36.78
Bean Fraction	Alaska Canadian Consolidated Gold Mines, Ltd.; April 16	5522	21.10
Bear No. 1	George Gold Copper Mines, Ltd.; May 12	5332	42.16
Bear No. 2	George Gold Copper Mines, Ltd.; May 12	5333	47.62
Bear No. 3	George Gold Copper Mines, Ltd.; May 12	5334	47.03
Bear No. 4	George Gold Copper Mines, Ltd.; May 12	5335	43.89
Bear No. 5	George Gold Copper Mines, Ltd.; May 12	5336	29.18
Bear No. 6	George Gold Copper Mines, Ltd.; May 12	5337	40.66
Bear No. 7	George Gold Copper Mines, Ltd.; May 12	5338	35.75
Bear No. 8	George Gold Copper Mines, Ltd.; May 12	5339	44.26
Bear No. 9	George Gold Copper Mines, Ltd.; May 12	5340	48.62
Big Four	George Gold Copper Mines, Ltd.; May 12	5391	35.67
Big Four Fraction	George Gold Copper Mines, Ltd.; May 12	5393	25.90
Big Four No. 1	George Gold Copper Mines, Ltd.; May 12	5392	51.59
Big Four No. 1 Fraction	George Gold Copper Mines, Ltd.; May 12	5394	41.59
Boise	Lester Edward Bigham and Silver Range Consolidated Mines, Ltd.; May 28	5109	47.82
Boston Fraction	Alaska Canadian Consolidated Gold Mines, Ltd.; April 16	5521	40.83
Boston Fraction No. 2	Alaska Canadian Consolidated Gold Mines, Ltd.; April 16	5523	49.53
Bush No. 1	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5196	42.29
Bush No. 2	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5197	48.26
Bush No. 3	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5198	42.39
Bush No. 4	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5199	44.92
Cambria	Silver Range Consolidated Mines, Ltd.; May 28	5119	18.75
Cardena	Joseph Raymond Kennedy and Peter Westman; Sept. 30	5128	51.65
Chinook	Lester Edward Bigham and Silver Range Consolidated Mines, Ltd.; May 28	5108	32.33

NORTH-WESTERN DISTRICT (No. 1)—*Continued.*

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Portland Canal—*Contd.*			
Chris	Mountain Boy Mining Co., Ltd.; Dec. 18	4965	49.13
Copper King	Francis Scott; Dec. 22	1864	47.14
Cotton Top	Mountain Boy Mining Co., Ltd.; Dec. 18	4694	21.46
Danny Fraction	Georgia River Gold Mines, Ltd.; Oct. 2	5163	7.73
Day Fraction	Dorothy Ada Cameron and Petrie Shannan Jack; June 5	4132	46.72
Day No. 1	Dorothy Ada Cameron and Petrie Shannan Jack; June 5	4127	27.62
Day No. 2	Dorothy Ada Cameron and Petrie Shannan Jack; June 5	4129	51.37
Day No. 3	Dorothy Ada Cameron and Petrie Shannan Jack; June 5	4130	22.22
Day No. 4	Dorothy Ada Cameron and Petrie Shannan Jack; June 5	4131	48.52
Exchange Fraction	Dalby Brooks Morkill; Oct. 16	1848	0.34
Extra	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5193	18.56
Five Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5192	28.14
Five Fraction	George Gold Copper Mines, Ltd.; May 12	5395	40.43
Foothill Fraction	George Gold Copper Mines, Ltd.; May 10	4941	44.95
Four Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5191	51.35
Fox	Mountain Boy Mining Co., Ltd.; Dec. 18	4963	28.80
Gem	Georgia River Gold Mines, Ltd.; Oct. 2	5150	38.46
Gem Fraction	Georgia River Gold Mines, Ltd.; Oct. 2	5165	48.24
Gem No. 1	Georgia River Gold Mines, Ltd.; Oct. 2	5151	23.19
Goldfields	Georgia River Gold Mines, Ltd.; Oct. 2	5152	51.65
Goldfields No. 1	Georgia River Gold Mines, Ltd.; Oct. 2	5153	43.18
Goldfields No. 2	Georgia River Gold Mines, Ltd.; Oct. 2	5154	43.73
Goldfields No. 3	Georgia River Gold Mines, Ltd.; Oct. 2	5155	47.35
Goldfields No. 4	Georgia River Gold Mines, Ltd.; Oct. 2	5156	44.39
Goldfields No. 5	Georgia River Gold Mines, Ltd.; Oct. 2	5157	47.97
Goldfields No. 6	Georgia River Gold Mines, Ltd.; Oct. 2	5158	50.56
Gold Fraction	Georgia River Gold Mines, Ltd.; Oct. 2	5166	46.64
Grand Ridge	Lester Edward Bigham and Silver Range Consolidated Mines, Ltd.; May 28	5110	44.87
Guard	Silver Range Consolidated Mines, Ltd.; May 28	5120	7.50
Ice Worm Fraction	George Gold Copper Mines, Ltd.; May 10	4943	50.17
Ice Worm No. 1	George Gold Copper Mines, Ltd.; May 10	4942	51.51
Ice Worm No. 2	George Gold Copper Mines, Ltd.; May 10	4944	51.64
Jitney	Georgia River Gold Mines, Ltd.; Oct. 2	5159	11.54
June	Georgia River Gold Mines, Ltd.; Oct. 2	5167	40.94
June Fraction	Georgia River Gold Mines, Ltd.; Oct. 2	5178	40.62
June No. 1	Georgia River Gold Mines, Ltd.; Oct. 2	5168	25.50
June No. 2	Georgia River Gold Mines, Ltd.; Oct. 2	5169	35.17
June No. 3	Georgia River Gold Mines, Ltd.; Oct. 2	5170	38.57
June No. 4	Georgia River Gold Mines, Ltd.; Oct. 2	5171	51.65
June No. 5	Georgia River Gold Mines, Ltd.; Oct. 2	5172	34.44
June No. 6	Georgia River Gold Mines, Ltd.; Oct. 2	5179	28.58
June No. 7	Georgia River Gold Mines, Ltd.; Oct. 2	5174	37.34
June No. 8	Georgia River Gold Mines, Ltd.; Oct. 2	5175	12.38
June No. 9	Georgia River Gold Mines, Ltd.; Oct. 2	5176	38.62
June No. 10	Georgia River Gold Mines, Ltd.; Oct. 2	5177	1.83
Key Fraction	Silver Range Consolidated Mines, Ltd.; May 28	5113	18.35
Lucky Strike	Joseph Raymond Kennedy and Peter Westman; Sept. 23	5123	43.18
Millie	Lester Edward Bigham and Silver Range Consolidated Mines, Ltd.; May 28	5111	50.19
M.L. Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	4452	23.02
Moonshine	Joseph Raymond Kennedy and Peter Westman; Sept. 30	5126	51.65
Mountain Boy Extension	Mountain Boy Mining Co., Ltd.; Dec. 18	4961	8.83
Mountain Boy Extension No. 1	Mountain Boy Mining Co., Ltd.; Dec. 18	4962	45.37
Munro	Thomas J. Wellman and Martin Francis Sullivan; Feb. 24	5382	51.65
Munro No. 2	Thomas J. Wellman and Martin Francis Sullivan; Feb. 24	5383	51.65
O.B.	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5214	0.43
O.B. Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5219	43.78
O.B. No. 1	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5215	32.24
O.B. No. 2	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5216	17.28
O.B. No. 4	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5217	33.69
O.B. No. 1 Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5220	44.81

NORTH-WESTERN DISTRICT (No. 1)—*Continued.*

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Portland Canal—*Contd.*			
O.B. No. 2 Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5223	15.07
One Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5190	21.55
Packer's Fraction	Margaret Caldwell Tobin; Feb. 21	3540	51.64
Radio	Radio-Stewart Mines, Ltd.; Jan. 8	4571	51.60
Radio Fraction	Radio-Stewart Mines, Ltd.; Jan. 8	4575	23.77
Radio No. 1	Radio-Stewart Mines, Ltd.; Jan. 8	4572	47.04
Radio No. 2	Radio-Stewart Mines, Ltd.; Jan. 8	4573	42.16
Radio No. 3	Radio-Stewart Mines, Ltd.; Jan. 8	4574	34.61
September Fraction	Georgia River Gold Mines, Ltd.; Oct. 2	5084	19.62
Sigrid	Mountain Boy Mining Co., Ltd.; Dec. 18	4959	10.08
Sigrid No. 1	Mountain Boy Mining Co., Ltd.; Dec. 18	4960	45.81
Silver Key No. 4	Silver Range Consolidated Mines, Ltd.; May 28	5115	3.92
Silver Key No. 5	Silver Range Consolidated Mines, Ltd.; May 28	5116	24.05
Silver Key No. 6	Silver Range Consolidated Mines, Ltd.; May 28	5117	1.23
Silver Key No. 7	Silver Range Consolidated Mines, Ltd.; May 28	5118	8.79
Snoqualmie	Lester Edward Bigham and Silver Range Consolidated Mines, Ltd.; May 28	5112	51.65
Sovereign	Georgia River Gold Mines, Ltd.; Oct. 2	5160	51.01
Sovereign Fraction	Georgia River Gold Mines, Ltd.; Oct. 2	5173	8.40
Sovereign No. 1	Georgia River Gold Mines, Ltd.; Oct. 2	5161	35.85
Sovereign No. 2	Georgia River Gold Mines, Ltd.; Oct. 2	5162	50.83
Speculator No. 2	Bear Valley Mines, Ltd.; Dec. 22	4887	51.47
Stand Pat	Thos. J. Wellman and Martin Francis Sullivan; Feb. 24	5384	34.29
Star	Joseph Raymond Kennedy and Peter Westman; Sept. 30	5127	31.65
Star Extension	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5211	51.20
Star Extension No. 1	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5212	51.51
Start Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5222	44.77
Start No. 2	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5206	51.39
Start No. 3	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5207	34.66
Start No. 5	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5209	37.82
Start No. 6 Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5210	36.70
Tacoma	Lester Edward Bigham and Silver Range Consolidated Mines, Ltd.; May 28	5107	50.68
Three	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5188	44.41
Three Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5189	12.19
Top Fraction	Georgia River Gold Mines, Ltd.; Oct. 2	5164	26.46
Velvet	Joseph Raymond Kennedy and Peter Westman; Sept. 30	5125	51.65
Warden	Silver Range Consolidated Mines, Ltd.; May 28	5121	0.09
X 10 U 8	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5180	28.09
X 10 U 8 Fraction	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5195	46.74
X 10 U 8 No. 2	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5181	39.45
X 10 U 8 No. 3	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5182	36.53
X 10 U 8 No. 4	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5183	45.27
X 10 U 8 No. 5	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5184	42.57
X 10 U 8 No. 6	Bush Consolidated Gold Mines, Ltd.; Oct. 16	5185	36.03
Skeena—			
H.E.D. Fraction	Harold E. Denison; Aug. 1	7188	7.03
I.X.L.	Harold E. Denison, Gordon C. Denison, and Dora Louise Wright; Oct. 1	6517	51.58
I.X.L. Fraction	Ditto	6518	50.04
Klim	„	6519	51.65
Starlight	Harold E. Denison; Sept. 24	7189	51.65

NORTH-EASTERN DISTRICT (No. 2).

Omineca—			
American Citizen	Charles W. Mitchell and Ira Chas. Mitchell; Aug. 7	7238	31.89
Canadian Citizen	Charles W. Mitchell and Ira Chas. Mitchell; Aug. 7	7171	36.43
Lily Fraction	Peter Schufer; Nov. 11	7245	48.99
Lower	George Dungate; Feb. 4	6477	42.65
Maisie	George Dungate; Feb. 4	7254	30.48

Central District (No. 3).

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Clinton—			
Blue No. 1	Soda Mining Products, Ltd.; Feb. 6	5423	47.94
Oro	William Calvert; Oct. 14	968	42.96
Lillooet—			
Argon	Wayside Consolidated Gold Mines, Ltd.; Dec. 19	3037	49.86
Helium	Wayside Consolidated Gold Mines, Ltd.; Dec. 19	3039	51.63
Queen City Fraction	Wayside Consolidated Gold Mines, Ltd.; Dec. 19	3040	8.27
Radium	Wayside Consolidated Gold Mines, Ltd.; Dec. 19	3038	39.00
Wayside	Wayside Consolidated Gold Mines, Ltd.; Dec. 19	3036	51.65
Nicola—			
Day Star	Planet Mines and Reduction Co. of Nicola, Ltd.; April 25	4111	51.64
Entente Cordiale	Planet Mines and Reduction Co. of Nicola, Ltd.; April 2	4110	51.65
New Emblem	Planet Mines and Reduction Co. of Nicola, Ltd.; April 2	4109	51.65
New Star No. 1 Fraction	Planet Mines and Reduction Co. of Nicola, Ltd.; April 2	4105	42.79
New Star No. 2 Fraction	Planet Mines and Reduction Co. of Nicola, Ltd.; April 2	4106	26.95
Planet Extension	Planet Mines and Reduction Co. of Nicola, Ltd.; April 2	4108	50.73
Planet No. 1	Planet Mines and Reduction Co. of Nicola, Ltd.; April 25	4102	51.65
Silver King Extension	Planet Mines and Reduction Co. of Nicola, Ltd.; April 2	4107	51.64
Silver King No. 2	Planet Mines and Reduction Co. of Nicola, Ltd.; April 2	4103	51.28
Silver Star	Planet Mines and Reduction Co. of Nicola, Ltd.; April 2	4104	44.91
Vernon—			
Independence	John Bryce Shearer; No. 11	4705	32.40
Yale—			
Aurum No. 1	Albert Edward Raab; March 27	1236	47.01
Aurum No. 2	Albert Edward Raab; March 27	1237	38.99
Aurum No. 3	Albert Edward Raab; March 27	1238	42.48
Aurum No. 4	Albert Edward Raab; March 27	1239	47.42
Aurum No. 5	Albert Edward Raab; March 27	1240	17.99
Aurum No. 6	Albert Edward Raab; March 27	1241	35.63
Idaho	Antonio DeAngelis and Albert Edward Raab; March 27	1234	40.75
Raymond	William Edward Manning; Dec. 21	1299	45.89
Sunshine	William Edward Manning; Dec. 29	1300	51.41
Tramway	Antonio DeAngelis; March 27	1235	51.15

Southern District (No. 4).

Greenwood—			
City of Montreal	Napoleon Peter Casorso; Feb. 21	2225	30.58
Glory	Emile Etchepare and Martin Doyharcabol; July 15	3074s	51.65
Gold Pick Fraction	James Drum; Jan. 10	1092	17.50
Homestake Fraction	George Herbert Cropley; Oct. 17	1094s	25.26
Ideal	Emile Etchepare and Martin Doyharcabol; July 15	3075s	39.97
Lucky Boy	Emile Etchepare and Martin Doyharcabol; July 15	3073s	45.91
Mount Pleasant Fraction	Ellen Hallett; April 16	1091s	43.80
Tie	Emile Etchepare and Martin Doyharcabol; July 15	3071s	51.57
Similkameen—			
Lakeview	Bessie Tibbs; March 28	1215	50.50
Whynot Fraction	Bessie Tibbs; March 28	1209	33.95
Whynot No. 2 Fraction	Bessie Tibbs; March 28	1216	33.45

Eastern District (No. 5).

Fort Steele—			
Annie Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 10	14282	49.96
Annex Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 10	13949	45.43
Badger	Colin Cameron; Sept. 12	10107	47.26
Betty	John F. Hobkirk; Oct. 14	9530	50.26
Bisbee	Consolidated Mining and Smelting Co., Ltd.; Dec. 6	13819	51.65
Buick	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13970	51.65
Bunker Hill	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13807	51.65
Cadillac	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13959	51.65

EASTERN DISTRICT (No. 5)—*Continued.*

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Fort Steele—*Continued.*			
Canada	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13793	51.49
Centipede Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13822	19.49
Chandler	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13967	51.65
Chevrolet	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13963	51.65
Chrysler	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13965	51.65
Clark	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13792	51.65
Dan Patch	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13814	51.65
Dodge	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13973	51.65
Durant	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13972	51.65
Essex	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13974	51.65
Fillin Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 10	14283	1.11
Firpo Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13800	16.28
Flapper	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13815	51.65
Flat	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13976	49.63
Flaw	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13977	15.24
Flax	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13978	51.65
Flay	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14258	51.65
Flea	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14259	51.65
Fleece	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	14260	51.65
Fleet	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	14261	51.65
Flight	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14262	51.65
Flint	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14263	51.65
Flit	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	14264	51.65
Flop	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	14265	51.65
Floral	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14266	51.65
Fluff	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14267	51.65
Flute	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	14268	51.65
Flux	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	14269	51.65
Fly	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	14270	51.65
Foam	Consolidated Mining and Smelting Co., Ltd.; Dec. 9	14277	51.62
Fodder	Consolidated Mining and Smelting Co., Ltd.; Dec. 9	14275	51.65
Fog	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	14271	51.65
Foker Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 9	14276	43.94
Fold	Consolidated Mining and Smelting Co., Ltd.; Dec. 9	14272	51.65
Folder	Consolidated Mining and Smelting Co., Ltd.; Dec. 9	14273	51.65
Foot	Consolidated Mining and Smelting Co., Ltd.; Dec. 9	14274	51.65
Ford	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13971	51.65
Frederick	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13810	51.65
Helen	J. F. Hobkirk, Oct. 14	9529	51.65
Hudson	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13968	51.65
Hupp	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13952	51.65
I.M.A. Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14279	0.07
Jean	H. W. Herchmer, Sept. 18	10221	46.34
Jerry	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13818	51.65
Jumbo	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	13824	51.65
Kitty	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13817	51.65
La Salle	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13969	51.65
Lincoln	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13958	51.65
Lone Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 10	13948	43.55
Lou Wilkes Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13813	13.49
Maud	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13801	51.65
Mayook	Thomas Gray Cameron; Sept. 18	10213	50.13
Mohawk	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	13825	51.65
Moon	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13957	51.65
Nash	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13953	51.65
Nellie	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	13823	51.65
Oakland	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13961	51.65
Olds	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13954	51.65
Overland	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13964	51.65
Oxford Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13799	38.89
Packard	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13966	51.65
Primrose	E. A. Hill; Sept. 18	10219	48.32
Prince	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13820	51.47
Princess	Consolidated Mining and Smelting Co., Ltd.; Dec. 10	14285	51.65

EASTERN DISTRICT (No. 5)—*Continued.*

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
Fort Steele—*Continued.*			
Rattlesnake Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13821	28.16
Renfrew	Elizabeth Cameron; Sept. 18	10212	47.54
Reo	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13795	51.65
Roughneck	Neill Cameron; Sept. 18	10220	50.39
Sheba	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13816	51.61
Sheeny	Henry William Herchmer; Sept. 18	10211	50.36
Sir Donald Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13812	11.84
Sir John	J. F. Hobkirk; Oct. 14	9534	48.18
Sir William	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13811	49.93
Somia Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14278	1.20
Spring	Consolidated Mining and Smelting Co., Ltd.; Dec. 8	13826	51.61
Star	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13962	51.65
Starr Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13798	32.16
Stewart	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13790	51.65
Studebaker	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13960	51.65
Stutz	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13956	39.50
Thompson	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	13791	51.65
Tram Fraction	Consolidated Mining and Smelting Co., Ltd.; Dec. 3	14280	0.014
Trent	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13808	51.65
Velie	Consolidated Mining and Smelting Co., Ltd.; Dec. 11	13955	50.75
Victoria	Consolidated Mining and Smelting Co., Ltd.; Dec. 10	14284	51.65
Weeks	Consolidated Mining and Smelting Co., Ltd.; Dec. 4	13809	51.65
Golden—			
New Crown Point	Witwatersrand Syndicate, Ltd.; Dec. 15	11630	46.37
New Midas	Witwatersrand Syndicate, Ltd.; Dec. 15	11635	38.15
Regina	Witwatersrand Syndicate, Ltd.; Dec. 15	11631	42.71
Rialto	Witwatersrand Syndicate, Ltd.; Dec. 15	11632	22.95
Royal Sovereign	Witwatersrand Syndicate, Ltd.; Dec. 15	11634	51.61
Nelson—			
Dempsey	Smith Ameraux Curwen; Sept. 17	14432	17.26
Dewey	Smith Ameraux Curwen; Sept. 17	14431	29.98
Molly	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14232	32.70
Molly No. 1	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14233	51.65
Molly No. 2	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14234	51.65
Molly No. 3	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14235	51.65
Molly No. 4	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14236	51.65
Molly No. 5	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14237	16.35
Molly No. 6	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14238	35.33
Molly No. 7	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14239	48.41
Molly No. 8	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14240	49.87
Molly No. 9	Consolidated Mining and Smelting Co., Ltd.; Jan. 8	14241	49.87
Tyne	Smith Ameraux Curwen; Sept. 18	14433	38.14
Revelstoke—			
Alice	Emily Woolsey; Oct. 28	14183	26.08
Annie	Emily Woolsey; Oct. 28	14189	30.65
Bee	Emily Woolsey; Oct. 28	14185	50.49
Big Ledge No. 2	Emily Woolsey; Oct. 28	14193	30.52
Bonanza King	Fred Shelton Selwood; April 9	14178	46.24
Butt	Fred Shelton Selwood; April 9	14082	49.59
Butt Fraction No. 1	Fred Shelton Selwood; April 9	14176	49.76
Butt Fraction No. 2	Fred Shelton Selwood; April 9	14177	44.39
Cora	Emily Woolsey; Oct. 28	14187	48.22
Emily	Emily Woolsey; Oct. 28	14188	21.44
Francis	Emily Woolsey; Oct. 28	14191	14.09
Gallant Boy	Fred Shelton Selwood; April 9	14179	46.47
Harlock	Fred Shelton Selwood; April 9	14180	46.56
Helena	Emily Woolsey; Oct. 28	14184	26.99
Hilda	Emily Woolsey; Oct. 28	14192	28.81
Joy	Emily Woolsey; Oct. 28	14182	15.70
May	Emily Woolsey; Oct. 28	14186	35.13
Nestoria	Emily Woolsey; Oct. 28	14190	17.57
Slocan—			
Blue Fraction	Wellington Mines, Ltd.; March 12	14224	1.95
Red Fraction	Wellington Mines, Ltd.; March 12	14223	1.41

WESTERN DISTRICT (No. 6).

Mining Division and Claim.	Grantee and Date.	Lot.	Acres.
New Westminster—			
Delta Fraction	Albert Hopgood Sperry and Edward Frank White; Dec. 12	1000	3.89
Epsilon Fraction	Albert Hopgood Sperry and Edward Frank White; Dec. 12	991	28.80
Gamma Fraction	Albert Hopgood Sperry and Edward Frank White; Dec. 12	998	20.07
Merry Widow	Albert Hopgood Sperry and Edward Frank White; Dec. 12	1094	51.08
Pi Fraction	Albert Hopgood Sperry and Edward Frank White; Dec. 12	988	40.61
Phee Fraction	Albert Hopgood Sperry and Edward Frank White; Dec. 12	1002	7.19
Henriette	Gorden Park Stirrett; Sept. 27	5681	28.24

OMITTED FROM 1929 LIST—SOUTHERN DISTRICT (No. 4).

Greenwood—			
Sunset	Harriett Partlow; Nov. 6, 1929	788	20.20

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