

ANNUAL REPORT
OF THE
MINISTER OF MINES
OF THE PROVINCE OF
BRITISH COLUMBIA
FOR THE
YEAR ENDED 31ST DECEMBER

1932



PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C. :
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1933.

To His Honour J. W. FORDHAM JOHNSON,
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 1932 is herewith respectfully submitted.

W. A. MCKENZIE,
Minister of Mines.

Minister of Mines' Office,
March, 1933.

*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, 1932.

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 1932 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.

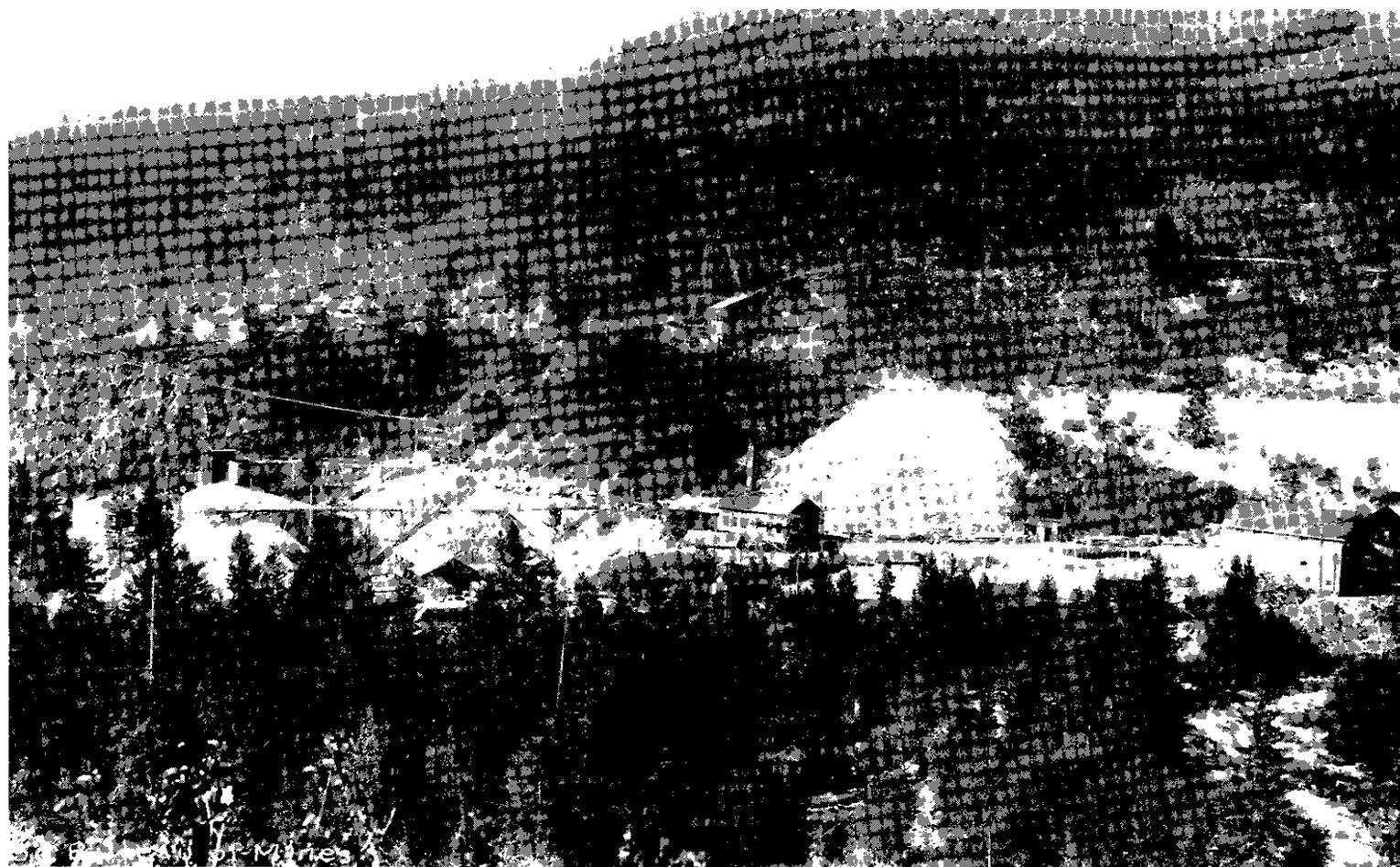
I am,

Yours faithfully,

JOHN D. GALLOWAY,

Provincial Mineralogist.

*Bureau of Mines, Victoria, B.C.,
March, 1933.*



Pioneer Gold Mines of B.C., Ltd., Cadwallader Creek, Lillooet Mining Division, B.C.

STATISTICAL REVIEW OF THE MINERAL INDUSTRY OF BRITISH COLUMBIA IN 1932.

BY JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST.

GENERAL SUMMARY.

The gross value of the mineral production of British Columbia in 1932 was \$28,241,618, a decrease of \$6,641,563, or 19 per cent., as compared with the figure of \$34,883,181 in 1931. This heavy decline was mainly caused by lowered outputs of copper, zinc, and coal and much lower metal prices.

The final figure of mineral production is higher by \$1,566,101 than the preliminary estimate issued in January. The higher figure has resulted mainly by including as mineral production a substantial production of zinc concentrates produced by the *Sullivan* mine, which is in storage and was not turned into refined metal during the year. The practice of the Bureau of Mines is to record as production the actual mineral produced by the mines rather than refinery output of metals, and it is therefore logical to include the total output of zinc concentrates. Other variations in the final figures from the preliminary estimate are relatively small.

The decrease in production value was to be expected owing to lower metal prices, smaller outputs of zinc, copper, and coal, and the falling-off of building and constructional work, materially affecting the value of structural materials produced. On the other hand, a large increase was recorded in gold production and a small increase in lead-output as compared with 1931. Silver production showed only a slight decline in quantity. In the face of unprecedentedly severe economic conditions the industry has been maintained in a satisfactory manner.

The following table shows the increases and decreases in production in the principal components of the mineral industry of the Province:—

Class.	DOLLAR INCREASES AND DECREASES, 1932 PRODUCTION, AS COMPARED WITH 1931.		
	Increase.	Decrease.	Percentage.
Gold (placer and lode).....	789,175	.....	23.91
Silver.....	10,939	.....	0.48
Base metals (copper, lead, and zinc).....	.....	4,088,690	23.65
Coal*.....	.....	1,160,511	15.27
Structural materials.....	.....	1,854,461	52.98
Miscellaneous metals and minerals.....	.....	338,015	41.48
Net decrease.....	.....	6,641,563	

* Quantity decline, 10.1 per cent.

The value of metallic mineral production in 1932 showed a decrease of \$3,288,576 as compared with 1931, or 14.9 per cent. All things considered, this is a very satisfactory record.

The tonnage of metalliferous ores mined in the Province was 4,340,158 tons, as compared with 5,549,103 tons in 1931, a decrease of 21.8 per cent. The average gross value of the ore mined was \$4.32 per ton, as compared with \$4.06 per ton in 1931. The slight increase in gross value reflects the larger percentage of gold ore mined in 1932, which is much higher grade than ore containing base metals, output of which was curtailed.

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 1932 valued at \$19,538,989 (including placer gold). This is followed by coal, with an output of \$6,523,644, and structural materials and miscellaneous metals and minerals, totalling together \$2,178,985.

By value, the various products of the mineral industry produced in 1932 are ranked in the following order: Coal, lead, zinc, gold, copper, silver, structural materials, miscellaneous metals and minerals. Gold this year is fourth in the list as compared with sixth in 1932.

Lode-gold output, valued at \$3,753,261, shows the substantial increase of \$734,367, or 24 per cent., as compared with the production in 1931. The output is higher because of an increased return from the *Pioneer* and a substantial contribution from the *Lorne*—operated by the Bralorne Mines, Limited. The loss of the *Reno* mill by fire in February, 1932, stopped production from this property, but construction and development plans recently completed assure a larger output from this property in 1933 than previously. *Premier* continued as the leading gold-producer at practically the same rate of output as in 1931. Less gold was produced as a by-product of copper-mining owing to curtailment of tonnage treated. Many small gold properties contributed to the total production.

The value of the placer-gold production for the year was \$346,800, an increase of \$54,808, or 19 per cent., as compared with the 1931 figure. The output from the larger operations was, in the aggregate, about the same as in the previous year, so that the winnings of individual and small-scale operations were considerably larger and more numerous than in 1931.

It is believed that this year substantially accurate figures of placer production have been obtained, although it is possible that some small lots of gold were secretly taken out of the country and no record of them obtained. The assistance rendered by branch banks and store-keepers throughout the Province, by making a voluntary monthly return of gold handled by them, either for transmission to branches of the Mint or taken in payment for supplies, has been and is of great help in obtaining a record of the output of placer gold. To these institutions and individuals the thanks of the Bureau of Mines is given.

The silver-output was 7,130,838 oz., valued at \$2,258,453. As compared with 1931, this is a small decrease in quantity, but a slight increase in value, owing to the average silver price for the year being a little higher. The principal producers were the *Sullivan* and *Premier* mines. The Wallace Mountain silver camp, Greenwood Mining Division, maintained profitable production even at present silver prices and development has maintained the usual ore reserves.

The lead-output for the year was 254,488,932 lb., valued at \$5,378,878. This is a small increase in quantity as compared with 1931, but owing to a lower average price for lead a decrease in value of \$1,363,404. The principal producer is the *Sullivan* mine and, in addition, small amounts come from leasing operations and as a by-product from the treatment of other ores.

Zinc-output amounted to 192,120,091 lb., valued at \$4,621,641, a considerable decline as compared with 1931 in quantity and value. The production comes almost entirely from the *Sullivan* mine and output was lessened due to the difficulty of marketing the metal. A part of the zinc concentrates produced by this mine (and recorded as output) was not treated during the year, so that the actual production of zinc metal for the year was lower than the above figure.

The copper-output for the year was 49,841,009 lb., valued at \$3,179,956. As compared with 1931, the decline in quantity was 13,353,290 lb. and in value \$2,109,407. There are now only two important producers of copper in British Columbia—the *Britannia* mine of the Howe Sound Company and the *Hidden Creek* mine of the Granby Consolidated Company. The former curtailed production to less than half that of the preceding year, while the Granby Company made a larger output than in 1931. This company's *Copper Mountain* mine remained closed all year.

The coal-output for the year was 1,534,975 long tons, valued at \$6,523,644, a decline of 10.1 per cent. in tonnage and 15.2 per cent. in value below 1931. For the 1932 statistical figures coal has been valued at \$4.25 per long ton, as compared with \$4.50 in 1931. This is believed to approximate very closely the average return received by the operators, but wide variations in price occur for different kinds, sizes, and grades of coal in the various coal districts of the Province.

The decline in coal-output was general in all the coal districts of the Province, and reflects lessened fuel demands by industries consequent on industrial depression and lowered domestic consumption due to hard times. Importations of coal from outside British Columbia declined 28 per cent. in tonnage, from 206,536 tons to 149,867 tons. From available figures the fuel-oil consumption in the Province declined approximately 12 per cent. in quantity as compared with 1931. It is apparent, therefore, that British Columbia collieries are capturing a larger

share of the available market than in previous years. Lowered prices, better attention to marketing practice, and the "Buy Home Products" campaign are assisting coal production, even though output declined 10 per cent. in 1932. With a return to better times the coal production of the Province should increase.

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

	1929.	1930.	1931.	1932.
Vancouver Island mines .....tons, 2,240 lb.	1,120,805	988,805	831,925	749,006
Nicola-Princeton mines	242,236	208,060	211,844	195,312
Crowsnest mines	886,706	689,236	661,426	587,875
Northern District	1,505	1,029	2,395	2,782
Total quantity of coal mined	2,251,252	1,887,130	1,707,590	1,534,975

The production of structural materials for the year was valued at \$1,698,839, a drastic decline of 52 per cent. from the figure of \$3,553,300 recorded for 1931. This decreased output clearly shows the heavy falling-off in building and constructional work in 1932. A substantial improvement in general business and employment is necessary before increased output of structural materials can be expected.

The output of miscellaneous metals and minerals in 1932 was valued at \$480,146, a decline of \$338,015 from the production in 1931. Lowered outputs of gypsum, cadmium, and bismuth largely account for the decreased production.

The foregoing outline shows that during 1932 a general decline has taken place in the production end of the mineral industry of the Province. This was to be expected, as British Columbia is largely dependent on international markets for the disposal of the base metals produced, and depressed conditions caused lowered consumption of coal and structural materials within the Province. With the exception of gold-mining, further unemployment occurred in the industry owing to curtailed production and the practising of all possible economies in order to lower production costs.

GOLD-MINING.

The feature of mining in British Columbia during 1932 was the extensive revival in gold-mining, both placer and lode. The latent gold possibilities of the widespread mineralized areas of the Province are now receiving belated recognition, and there seems little doubt that several new gold-mines will result from the extensive developments under way and planned for the 1933 season.

The increased output of gold, both placer and lode, during 1932 is only a slight indication of the activity taking place in searching for and developing gold properties. The total gold-output of \$4,100,061, as compared with \$3,310,886 in 1931, is an increase of 24 per cent. The bulk of the gold produced in the Province during 1932 was sold on the basis of payment in American funds. By agreement with the Dominion Bureau of Statistics, gold production in fine ounces is valued in Canadian dollars for statistical purposes, as it is considered standard money rather than a commodity. During the year, the so-called premium or advantage to producers in selling gold on the basis of American funds averaged for the year 13.58 per cent. The premium to British Columbia producers therefore amounted to approximately \$556,000, making the total return to the producers in terms of Canadian funds about \$4,656,000. This is an increase of 40 per cent. over the value in 1931 figured in the same way, as in that year the premium was quite small.

During 1932 much interest was shown in placer-mining, with many more prospectors out than usual. Placer-prospecting was stimulated by the issuance by the Department of Mines of provisional free miners' certificates free of charge, which enabled the holders thereof to locate and record placer claims without cost. By the end of 1932 about 10,000 of these certificates were issued and many tried their luck at small-scale placer-mining. While many were unsuccessful owing to being totally inexperienced, a fair percentage had a satisfactory season, making from \$1 to \$2 a day, and are being trained in this way for future years. Several new placer discoveries were reported, some of which promise to be of importance. Along the Fraser,

Thompson, Similkameen, and other rivers, bars which have been unworked for years have again been attacked, and in the old placer camps many old diggings are being reworked.

Although production is relatively small, it should not be concluded that there is not much interest in the industry. Actually in the last five years much placer-mining has been carried on, but unfortunately in many instances without as yet very tangible production results. Much of this work has consisted of testing placer-ground, and in many instances the testing is not conclusive or completed. In a number of placer-fields of the Province plants for hydraulicking are being constructed, and some of these may be expected to be productive in the future. Much desultory small-scale work has been carried on, partly to recover gold and partly to prove up deposits of placer-gravels.

The outlook is for a rising trend in placer-output for several years. At the same time much extravagant and ill-advised information is being put out about placer-mining possibilities. The popular idea which prevails in some quarters that thousands of men can make wages by placer-mining on a small scale in different parts of the Province is fantastic and erroneous. There is scope in British Columbia for a certain number of placer-miners and prospectors, but in the first place they must have some training and a little experience. Even then the returns to many will be quite small. One to two dollars a day may be recovered by some, and a few will do better than this, while certain important new discoveries may be made. There are at the present time in British Columbia more than enough unemployed men to supply all the placer prospectors needed and men outside the Province should not be advised to come here.

This refers particularly to the unemployed. Trained placer-men or scouting engineers looking for placer-ground for companies will find a fruitful field in British Columbia. The Department of Mines has recently issued Bulletin No. 1, 1933, "Placer-mining in British Columbia," which gives much general information on placer-mining, small-scale methods of working, and definite recommendations by the Resident Mining Engineers of suitable areas for prospecting. This bulletin may be obtained from any office of the Department of Mines, British Columbia, for the sum of 25 cents.

Lode-gold mining and development was vigorously prosecuted in 1932 and a still better year is forecast for 1933. The greatest lode-gold production ever made in British Columbia was in 1913, when \$5,627,490 was the recorded value. Eighty-eight per cent. of this output, or over \$5,000,000, came from mines that are now closed down in Rossland and the Boundary district, most of them permanently abandoned. The principal producers of to-day were then obscure prospects. This illustrates clearly the changing nature of metallic mineral production and gives rise to the hope that in the next twenty years many new gold-producers will be developed in the Province. Indeed, the present intense activity in gold-mining assures an increasing output for several years. A production of \$5,000,000 is likely in 1933, with the addition of \$750,000 to \$1,000,000 in "premium" paid over the official statistical price of \$20.67 an ounce in Canadian funds.

In 1932 forty-six mining companies were incorporated in the Province. Of these, twenty-seven were formed to operate lode-gold properties, thirteen to operate placer-gold properties, and six for other kinds of mineral-deposits. This shows clearly the overwhelming interest now being taken in gold-mining as compared with other metals and minerals. In addition to these new companies formed, the older operating companies have been more than usually active in looking for gold properties. As a result of favourable developments by the Cariboo Gold Quartz Mining Company, a "rush" into this district by the large mining companies took place last fall and winter. Hundreds of claims have been staked and many existing locations optioned. Although the area generally has been for many years recommended by engineers of the Department of Mines, it is only now that it is receiving the attention it deserves. It is probable that the Cariboo lode-gold showings will be quite thoroughly tested and developed in the next year or two, with, in certain instances, promising possibilities. Similarly, the important ore disclosures on the *Pioneer* and *Bralorne* mines have stimulated much activity in the Bridge River district.

Throughout the Province, in old and new gold camps, prospectors and scouting engineers are energetically seeking for gold properties. Details regarding these operations will be found in the Resident Engineers' reports. Apart from increased gold production and payment of dividends, the importance to the Province of gold-mining at the present time is the largely increased employment provided and the distribution of money for supplies and services in connection

with this work. The depressed condition of other mining in the Province is being in part counteracted by the employment provided by gold activities.

It seems advisable, however, to warn the public that the "gold boom," like every other boom, shows signs of being carried too far, with the usual consequent loss to so-called investors, who in many instances are really speculators or gamblers. At the present time many mineral claims are being taken up and companies promoted to develop them which have but a remote chance to develop into mines. Through the operations of the "Securities Act" the public is now assured a more legitimate financial set-up for these companies than prevailed with many in former years; and also adequate provision that a fair percentage of the money raised from the public will be spent in developing the property. This, however, in no way guarantees that the property is a reasonable speculation for development from the mineral view-point, and the public is advised to check this feature by reference to Department of Mines reports or other reliable sources of information regarding the mineralization.

METAL PRICES.

Copper, lead, and zinc prices continued the downward trend of preceding years to make new low records. Silver shows a slight rise in 1932 as compared with 1931, principally due to Canadian money being at a discount with United States money. The following table shows the average yearly prices for silver, copper, lead, and zinc:—

AVERAGE METAL-MARKET PRICES FOR 1930, 1931, AND 1932.

Year.	Silver (New York).	COPPER.		LEAD.		ZINC.	
		London.	New York.	London.	New York.	London.	St. Louis.
	Cents per Oz.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.	Cents per Lb.
1930.....	* 38.154	.....	* 12.982	* 3.9273	5.517	* 3.5999	4.556
1931.....	* 28.700	.....	* 8.116	* 2.7101	4.243	* 2.554	3.640
1932.....	* 31.671	* 6.3802	6.3028	* 2.1136	3.180	* 2.4056	2.876

* Prices used in compiling total metal valuations in 1930, 1931, and 1932 Annual Reports.

For the last three months of 1931 and for 1932 the figures are corrected for Canadian funds at par by applying the average exchange prevailing.

METALLURGICAL FEATURES OF THE YEAR.

The most important addition to milling facilities in the Province in 1932 was the enlargement of the *Pioneer* mill from 100 tons a day to 300 tons. The expanded mill was started in September and will arrive at maximum production in 1933. The Cariboo Gold Quartz Mining Company, Limited, erected a 60-ton-a-day cyanide plant during the year, which is expected to be in steady production in 1933. During the year the 100-ton mill of the Bralorne Mines, Limited, was brought into production in February. The Reno Gold Mines, Limited, acquired the old *Mother-lode* mill and mineral properties. The mill was reconstructed, a tramway connecting with the mine built, and an hydro-electric plant constructed. The mill commenced operations about the end of the year. In the Nelson and Osoyoos Mining Divisions some small mills on gold properties were reconditioned during the year.

Progress was made at the four big mining operations of the Province—Consolidated, Granby, Britannia, and Premier Companies—in improving metallurgical practice, making for greater efficiency and lower costs.

The excellent work being done at the Anyox plant of the Granby Consolidated Company is shown by the following quotation from the company's annual report for 1932:—

"The average net cost per pound of refined copper produced after allowing credits for precious metals and miscellaneous income, but exclusive of depreciation, depletion, and income taxes, was 5.613 cents, as compared with 6.821 cents for the year 1931."

The ore reserves of this company are shown in the following excerpt from the annual report:—

"The ore reserves of each property at the end of the year, compared with the previous year, were as follows:—

	Dec. 31, 1931. Tons.	Dec. 31, 1932. Tons.
Anyox— <i>Hidden Creek</i> mine	4,644,590	3,870,365
Anyox— <i>Bonanza</i> mine	322,180	307,327
Allenby— <i>Copper Mountain</i> mine	9,885,069	9,885,069

"The net decrease in the ore reserves for the year amounted to 789,078 tons. Unless new ore is found, it is estimated that the recoverable ore reserves of the Anyox mines (*Hidden Creek* and *Bonanza*) will be exhausted within the next two or three years, based on the 1932 rate of extraction."

The annual report of the Howe Sound Company, controlling the Britannia Company, gives no information regarding the cost of producing copper, but it is known that remarkable low-cost records have been obtained in mining and milling very low-grade ore.

From the annual report of the Consolidated Mining and Smelting Company the following excerpts have been taken:—

"*The Sullivan Mine.*—The record costs of 1931 have been substantially reduced. The grade of ore mined was slightly higher in lead, zinc, and silver. The tonnage mined was down about 10 per cent.

"*The Kimberley Concentrator.*—Owing to the low price of metals, some changes were made in the metallurgy with a view to sacrificing some recovery to obtain a reduction in costs. A very satisfactory reduction in costs was secured with only a slight loss in recovery. In the latter part of the year, although the costs were still further reduced, the recoveries were brought back to their highest point.

"*The Lead-smelting Plant.*—New low-cost records were established both for smelting a ton of ore and per ton of lead produced, in spite of reduced tonnage. Recoveries were practically the same as the high record of 1931. The fuming-plant costs showed a very satisfactory reduction.

"*The Lead and Silver Refineries.*—There was a slight reduction in refining costs on a lower tonnage than that refined in 1931.

"*The Zinc Plant.*—There was a big reduction in the cost of producing zinc from the zinc fume made by the slag-fuming plant, and a slight reduction in the cost of making zinc from zinc concentrates. This plant was only working at about half capacity, otherwise the reductions would have been much greater.

"*The Fertilizer Group.*—This group started the year with heavy operating losses which were gradually reduced; October, November, and December show a small but increasing operating profit.

"Heavy expenditures were made in connection with the development, manufacture, and servicing of attachments to seeders to apply the fertilizer. The first attachments demonstrated the necessity of changes in the physical properties of the fertilizers and also the need of protection from wind and rain. A new machine has been developed to take care of the troubles experienced last spring. Five hundred new machines have been manufactured and all the first machines have been remodelled.

"Practically all the implement-makers have been convinced of the necessity of developing attachments for their machines, and many new ones will be on the market this year.

"*Sulphuric-acid Plants.*—These plants worked very successfully during the year. Most of the sulphur-dioxide gases from the zinc-plant roasters were converted into sulphuric acid. Costs by the end of the year were much below the estimates. These plants have demonstrated that they can easily exceed their rated capacity. Oleum up to 40 per cent., water-white acid for batteries and milk-testing, and any degree of sulphuric acid can be made at will.

"*The Ammonia Plant.*—This plant has operated successfully; the estimated tonnage and costs were realized before the end of the year.

"*The Phosphoric-acid and Phosphate Plants.*—These plants were built under contract and, though partially successful, failed to fulfil the contract. The contracting company tried diligently, but unsuccessfully, to bring them up to the requirements. Finally an agreement was arrived at which was satisfactory to both companies. By this agreement our company released the contracting company from further responsibility, agreed to finish the plant itself,

and received from certain manufacturing rights, royalty concessions, and a release from making the final payments on the contract.

"While most of the work has been completed, the plants have not been operated extensively owing to the fact that there was enough unsold phosphate products to take care of most of this year's needs. It is confidently expected that the estimated production costs will be realized when the plant can operate at capacity.

"*The Ammonium-sulphate Plant.*—This plant was in operation for the entire year. Costs were steadily reduced, being within a few cents per ton of the estimates by the end of the year and a few cents below the estimate in January, 1933.

"As ammonium sulphate is the only product being made in the fertilizer plant, it has had to carry an excessive amount of overhead. It has been demonstrated that the capacity of this plant is well over its rating. The tonnage of this plant is now limited by the ammonia-supply.

"*The Research Department.*—This department had many problems in connection with the operations of the various plants. A great deal of work has been done on the collection and recovery of sulphur dioxide from gases carrying low concentrations of that gas; a very interesting electrical ore-detecting device has been developed; extensive tests have been made on weed-killing on the railway right-of-way; and many other investigations were made of possible products that might be made from Tadanac by-products."

The annual report of the Premier Gold Mining Company shows that operating costs were lowered from \$3.33 per ton in 1931 to \$3.19 per ton in 1932.

From the annual report of the Pioneer Gold Mines of British Columbia the following information regarding the mill and power plant has been taken:—

"The mill expansion planned in 1931 to increase the capacity of the plant by 200 tons was completed about September, 1932, and was constructed with each individual operation having a larger capacity, so that if required the plant can be made to handle 400 tons per day. The capacity of the plant has not yet been tested out, as the highest average daily capacity of both units was reached in March, 296 tons per day, and the highest individual day 351 tons. The new mill unit, however, is quite an improvement on the old one and increases the extraction from 10 to 20 cents per ton and has brought the average extraction on the whole mill to about 97 per cent., which cannot be improved very much. We expect, in a few months, when the mine is in a position to supply a continuous increased supply of ore, to test the maximum capacity of the plant, and if inadequate to the supply of ore that may reasonably be expected from the present year's developments, plans will be laid for further increase.

"A second generating unit was added to the South Fork power plant to enable us to get the maximum energy out of that plant. This was completed and ready to run by the end of the year, and we think should solve our power problems for some time ahead."

PROSPECTING AND DEVELOPMENT.

A larger number of prospectors were in the hills during 1932 than for several years. Most of this prospecting was directed towards finding gold-deposits, lode and placer. Many unemployed men who were able in some way to arrange a grub-stake tried their luck at prospecting. Some new discoveries which promise to be of importance were reported. These will require development before their real value can be appraised.

Development during the year was confined mainly to gold properties, but in the aggregate the amount carried on probably exceeded that of 1931. It is noteworthy that customs-ore receipts at the Trail smelter in 1932 were nearly three times as large as in the preceding year. This was largely due to the efforts of leasers, small syndicates, and small companies turning their attention to formerly dormant gold properties. A few leasers worked on silver-lead properties in the Slocan district and a start was made on this form of mining in the Stewart camp. It is apparent that present conditions of low metal prices, low wages, etc., are being accepted, and the characteristic energy of British Columbia miners is being directed to again starting up small mineral properties that have been dormant since 1929.

OUTLOOK FOR 1933.

A mineral production equalling or exceeding in value the 1932 output can be expected in 1933. Greater employment, directly and indirectly, will also be provided by the mineral industry. In the aggregate, the mine plants and personnel of the industry are efficient and

ready to take immediate advantage of any upward trend in industry that may result from a general improvement in world trade and industry.

PROFITS OF MINING COMPANIES.

The following table shows the dividends declared by companies engaged in the mineral industry in the Province during 1931 and 1932:—

Company.	1931.	1932.
The Consolidated Mining and Smelting Co. of Canada, Ltd.	\$2,748,421	\$1,480,125
Premier Gold Mining Co., Ltd.	601,828	691,535
Howe Sound Co.*	1,149,572	253,405
Granby Consolidated M.S. and P. Co., Ltd.	674,955	52,949
<i>Bell</i>	4,800	.....
Crow's Nest Pass Coal Co., Ltd.	186,354	248,272
Pioneer Gold Mines of B.C., Ltd.	155,223	210,210
Highland Lass, Ltd.	3,081	9,242
Others	276,195	96,475
Totals	\$5,800,429	\$3,042,213

The Consolidated Company, besides paying the above cash dividend, declared stock dividends totalling one share for each ten shares of stock held.

* The Howe Sound Company is the holding company for the *Britannia* mine in British Columbia and the *El Potosi* and *Catera* 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.

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; and for zinc, the average London metal-market price for the year. Until this year (1932) copper has been always valued at the average New York market price, but this year the average London price has been used. This change has been necessitated because very little Canadian copper is now marketed in the United States. 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. During 1932 considerable fluctuations in metal prices were caused by many countries being off the gold standard. Although Canada is still technically on the gold standard, Canadian money has been at a discount with United States money all year and at a premium with regard to English money. By agreement with the Dominion Bureau of Statistics and the Provincial Statistical Bureaus, the following procedure has been agreed upon for the 1932 production:—

- (a.) Gold to be valued as usual in Canadian funds, without addition of any premium, as it is considered standard money rather than a commodity.
- (b.) Silver to be valued at the average New York price, adjusted to Canadian funds at the average exchange rate.
- (c.) Lead, zinc, and copper to be valued at the London prices, with similar adjustment for exchange.

(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.

From 1918 to 1930 coal production was valued at \$5 per long ton. In 1931 the price used was \$4.50 per long ton. For 1932 slightly lowered prices prevailed and \$4.25 per long ton has been used. In making comparisons with former years the decline in value is accentuated by this lowered price.

STATISTICAL TABLES.

TABLE I.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1932.

Gold, placer	\$79,227,741
Gold, lode	147,640,166
Silver	106,941,014
Copper	274,340,847
Lead	175,738,933
Zinc	97,631,351
Coal and coke	344,501,487
Structural materials	67,790,972
Miscellaneous minerals, etc.	7,160,135
Total	\$1,300,972,646

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1932 (INCLUSIVE).

1852 to 1895 (inclusive).....	\$94,547,241	1915	\$29,447,508
1896	7,507,956	1916	42,290,462
1897	10,455,268	1917	37,010,392
1898	10,906,861	1918	41,782,474
1899	12,393,131	1919	33,296,313
1900	16,344,751	1920	35,543,084
1901	20,086,780	1921	28,066,641
1902	17,486,550	1922	35,158,843
1903	17,495,954	1923	41,304,320
1904	18,977,359	1924	48,704,604
1905	22,461,325	1925	61,492,242
1906	24,980,546	1926	67,188,842
1907	25,882,560	1927	60,729,358
1908	23,851,277	1928	65,372,583
1909	24,443,025	1929	68,245,443
1910	26,377,066	1930	55,391,993
1911	23,499,072	1931	34,883,181
1912	32,440,800	1932	28,241,618
1913	30,296,398		
1914	26,388,825	Total.....	\$1,300,972,646

TABLE III.—QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1930, 1931, AND 1932.

Description.	1930.		1931.		1932.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer .....oz.	8,955	\$152,235	17,176	\$291,992	20,400	\$346,800
Gold, lode .....oz.	160,778	3,323,576	146,039	3,018,894	181,564	3,753,261
Silver .....oz.	11,289,171	4,307,270	7,524,320	2,247,514	7,130,838	2,258,453
Copper .....lb.	90,421,545	11,738,525	63,194,299	5,289,363	49,841,009	3,179,956
Lead .....lb.	319,199,752	12,535,931	248,783,508	6,742,282	254,488,952	5,378,878
Zinc .....lb.	250,287,306	9,010,093	205,071,247	5,237,520	192,120,091	4,621,641
Coal .....tons, 2,240 lb.	1,887,130	9,435,650	1,707,590	7,684,155	1,534,975	6,523,644
Structural materials		4,092,568		3,553,300		1,698,839
Miscellaneous metals and minerals		796,145		818,161		480,146
Totals		\$55,391,993		\$34,883,181		\$28,241,618

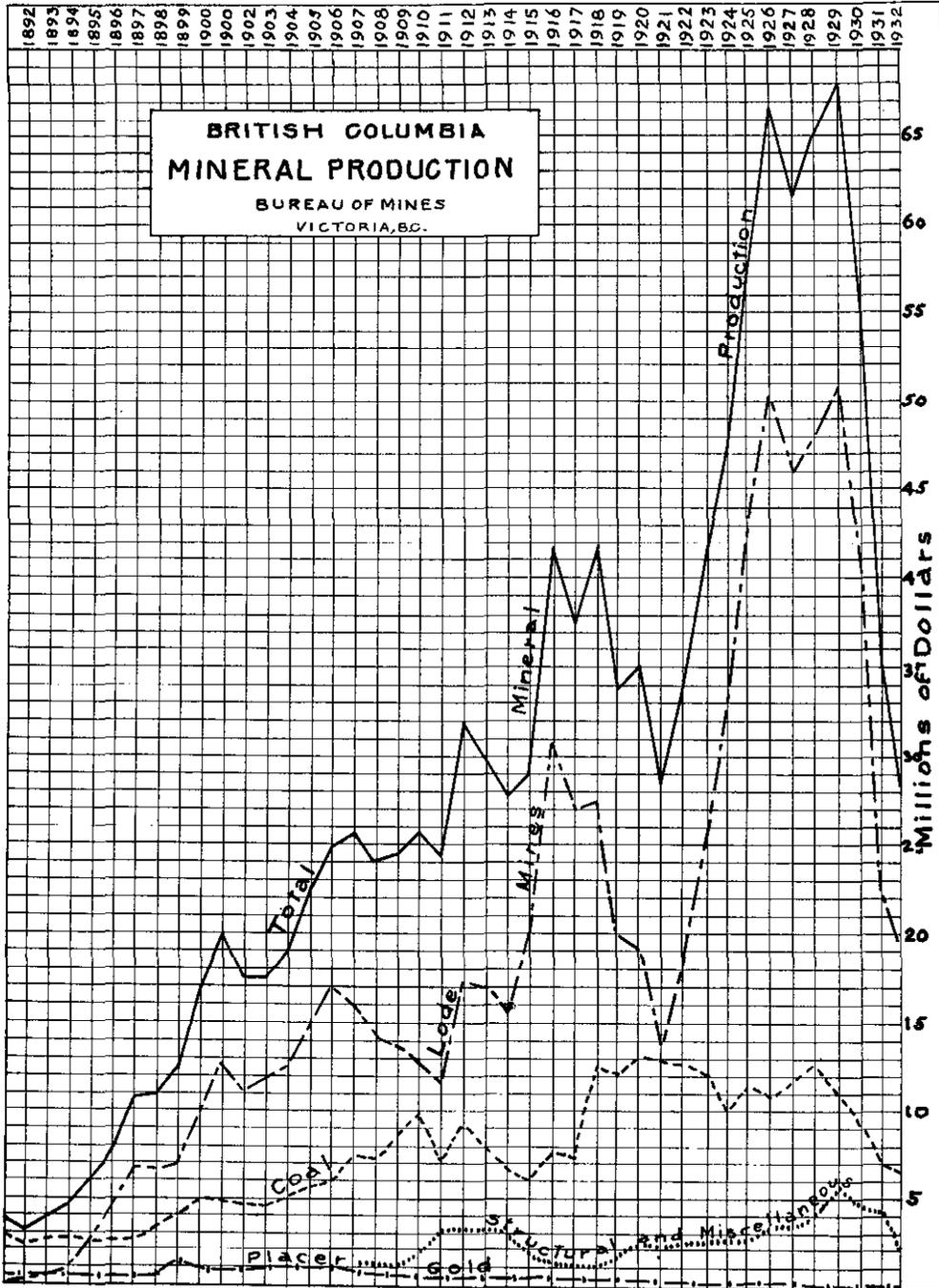


TABLE IV.—OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

Names.	DIVISIONS.			DISTRICTS.		
	1930.	1931.	1932.	1930.	1931.	1932.
North-western District (No. 1).....	\$	\$	\$	\$	\$	\$
Atlin, Stikine, and Liard.....	58,871	177,220	152,944	7,752,006	5,594,130	4,895,770
Nass River.....	4,130,233	3,101,811	2,600,927			
Portland Canal.....	3,502,678	2,233,739	2,098,713			
Skeena, Queen Charlotte, and Bella Coola.....	60,224	81,360	43,186			
North-eastern District (No. 2).....				185,540	165,662	185,595
Cariboo and Quesnel.....	125,563	141,010	147,910			
Omineca and Peace River.....	59,977	24,652	37,685			
Central District (No. 3).....				1,105,913	1,072,034	289,084
Nicola and Vernon.....	341,966	166,605	120,692			
Yale, Ashcroft, and Kamloops	328,142	292,604	156,234			
Lillooet and Clinton*.....	435,805	612,825	12,158			
Southern District (No. 4).....				3,900,183	1,593,272	1,517,603
Grand Forks, Greenwood, and Osoyoos.....	889,300	747,648	759,803			
Similkameen.....	3,010,883	845,624	757,800			
Eastern District (No. 5).....				27,627,947	17,054,049	14,487,063
Fort Steele.....	25,582,617	16,644,950	13,834,116			
Windermere and Golden.....	904,041	8,900	18,323			
Ainsworth.....	26,931	33,647	21,761			
Slocan and Slocan City.....	128,371	35,286	9,883			
Nelson and Arrow Lake.....	256,387	283,115	267,132			
Trail Creek.....	699,253	8,490	303,348			
Revelstoke, Trout Lake, and Lardeau.....	30,347	39,661	32,500			
Western District (No. 6).....				14,820,404	9,404,034	6,866,503
Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria (Vancouver Island).....	7,127,594	5,475,619	4,015,717			
Vancouver, New Westminster, and Lillooet (Mainland).....	7,692,810	3,928,415	2,850,786			
Totals.....	55,391,993	34,883,181	28,241,618	55,391,993	34,883,181	28,241,618

* Lillooet Mining Division included in No. 6 District (Mainland section) from and including 1932.

TABLE V.—YIELD OF PLACER GOLD TO DATE.

1858	\$705,000	1877	\$1,608,182	1896	\$544,026	1915	\$770,000
1859	1,615,070	1878	1,275,204	1897	513,520	1916	580,500
1860	2,228,543	1879	1,290,058	1898	643,346	1917	496,000
1861	2,666,118	1880	1,013,827	1899	1,344,900	1918	320,000
1862	2,656,903	1881	1,046,737	1900	1,278,724	1919	286,500
1863	3,913,563	1882	954,085	1901	970,100	1920	221,600
1864	3,735,850	1883	794,252	1902	1,073,140	1921	233,200
1865	3,491,205	1884	736,165	1903	1,060,420	1922	364,800
1866	2,662,106	1885	713,738	1904	1,115,300	1923	420,000
1867	2,480,868	1886	903,651	1905	969,300	1924	420,750
1868	3,372,972	1887	693,709	1906	948,400	1925	280,092
1869	1,774,978	1888	616,731	1907	828,000	1926	355,503
1870	1,336,956	1889	588,923	1908	647,000	1927	156,247
1871	1,799,440	1890	490,435	1909	477,000	1928	143,208
1872	1,610,972	1891	429,811	1910	540,000	1929	118,711
1873	1,305,749	1892	390,526	1911	426,000	1930	152,235
1874	1,844,618	1893	356,131	1912	555,500	1931	291,992
1875	2,474,004	1894	405,516	1913	510,000	1932	346,800
1876	1,786,648	1895	481,683	1914	565,000		
				Total.....			\$79,227,741

TABLE VI.—PRODUCTION OF LOBE MINES.

Year.	GOLD.		SILVER.		COPPER.		LEAD.		ZINC.		Total Value.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
1887.....		\$		\$		\$		\$		\$	\$
1888.....			17,690	17,331			204,800	9,216			26,547
1889.....			79,780	75,000			674,500	29,813			104,813
1890.....			53,192	47,873			165,100	6,498			54,371
1891.....			70,427	73,948							73,948
1892.....			4,500	4,000							4,000
1893.....			77,160	66,935			808,420	33,064			99,999
1894.....	1,170	23,404	227,000	195,000			2,135,023	78,996			297,400
1895.....	6,252	125,014	746,379	470,219	324,080	16,234	5,662,523	169,875			781,342
1896.....	39,264	785,271	1,496,522	977,229	952,840	47,842	16,475,464	532,255			2,342,397
1897.....	62,259	1,244,180	3,135,343	2,100,689	3,818,556	190,926	24,199,977	721,384			4,257,179
1898.....	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
1899.....	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
1900.....	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
1901.....	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
1902.....	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
1903.....	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
1904.....	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
1905.....	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
1906.....	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
1907.....	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
1908.....	196,179	4,055,020	2,745,448	1,703,825	40,832,720	8,166,544	47,788,703	2,291,458			16,216,847
1909.....	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
1910.....	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
1911.....	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
1912.....	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
1913.....	257,496	5,322,442	3,132,108	1,810,945	51,456,537	8,408,513	44,871,454	1,805,627	5,358,280	316,139	17,662,766
1914.....	272,254	5,627,490	3,465,506	1,968,606	46,460,305	7,094,489	55,364,677	2,175,832	6,758,768	324,421	17,190,838
1915.....	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
1916.....	230,021	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
1917.....	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
1918.....	114,532	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
1919.....	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	27,590,273
1920.....	152,426	3,150,645	3,403,119	3,592,673	42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429	19,750,498
1921.....	120,048	2,481,392	3,377,849	3,235,980	44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,970	19,444,365
1922.....	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
1923.....	197,856	4,088,684	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
1924.....	179,245	3,704,994	6,032,986	3,718,129	57,720,290	8,323,266	96,668,152	6,321,770	58,343,462	3,278,903	25,347,062
1925.....	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	35,588,247
1926.....	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
1927.....	201,427	4,163,850	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
1928.....	178,001	3,679,601	10,470,185	5,902,043	89,292,871	11,235,011	282,996,423	14,874,292	145,225,443	8,996,135	44,977,082
1929.....	188,087	3,888,097	10,627,167	6,182,461	97,998,316	14,265,242	305,140,792	13,964,412	181,763,147	9,984,613	48,281,825
1930.....	145,339	3,004,419	9,913,800	5,256,270	101,483,857	18,373,682	302,346,268	15,269,696	172,096,841	9,268,792	51,174,859
1931.....	160,778	3,323,576	11,289,171	4,307,314	90,421,545	11,738,325	319,199,752	12,535,931	250,287,306	9,010,093	40,915,395
1932.....	146,039	3,018,894	7,524,320	2,247,314	63,194,299	5,289,363	248,783,508	6,742,282	205,071,247	5,237,520	22,545,573
1933.....	181,564	3,753,261	7,130,838	2,258,453	49,841,009	3,179,956	254,488,952	5,378,878	192,120,091	4,621,641	19,192,189
Totals.....	7,153,331	147,640,166	186,131,015	106,941,014	1,773,003,678	274,340,847	3,626,684,551	175,738,933	1,906,759,492	97,631,351	802,292,311

MINERAL PRODUCTION.

TABLE VII.—PRODUCTION IN DETAIL OF THE

DISTRICTS AND DIVISIONS.	YEAR.	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
			\$		\$		\$	
North-western District (No. 1)								
Atlin.....	1931		8,884	142,528				
	1932	30	3,040	136,680	218	4,507	86	27
Stikine.....	1931		11	187				
	1932		37	629				
Liard.....	1931		440	7,480				
	1932		357	6,069				
Nass River.....	1931	1,577,700			3,381	69,891	272,131	81,285
	1932	1,740,300			3,323	68,693	255,940	81,061
Portland Canal.....	1931	271,320			80,883	1,672,000	1,751,894	523,291
	1932	221,828			76,049	1,572,072	1,580,305	600,508
Skeena.....	1931	587	96	1,632	411	8,496	188	56
	1932	6	36	612	3	62	2	1
Queen Charlotte.....	1931		27	459				
	1932		18	306				
Bella Coola.....	1931							
	1932		3	51				
North-eastern District (No. 2)								
Cariboo.....	1931		3,748	63,716				
	1932		4,155	70,635				
Quesnel.....	1931		2,698	45,866				
	1932		3,338	56,746				
Omineca.....	1931		214	3,638				
	1932	8	627	10,659	7	145	3	1
Peace River.....	1931		121	2,057				
	1932		588	9,996				
Central District (No. 3)								
Nicola.....	1931	940			288	5,954	10,498	3,136
	1932							
Vernon.....	1931		18	306				
	1932		55	935				
Yale.....	1931	52	22	374	168	3,473	21	6
	1932	148	224	3,808	344	7,111	79	25
Ashcroft.....	1931		162	2,754				
	1932		128	2,176				
Kamloops.....	1931		130	2,210				
	1932		83	1,411				
Clinton.....	1931		141	2,397				
	1932	25	199	3,383	28	579		
Southern District (No. 4)								
Grand Forks.....	1931	56,764	5	85	16,572	342,574	572,096	170,885
	1932	26,456			19,218	397,271	131,713	41,716
Greenwood.....	1931	3,145	6	102	170	3,514	514,971	158,822
	1932	3,412	180	3,060	414	8,558	595,470	188,595
Osoyoos.....	1931							
	1932	386	2	34	1,367	28,258	203	64
Similkameen.....	1931	70	262	4,454	3	62	4,817	1,439
	1932	529	270	4,590	1	21	14,461	4,580
Eastern District (No. 5)								
Fort Steele.....	1931	1,621,718	181	3,077			4,206,126	1,250,370
	1932	1,440,520	543	9,231			4,418,852	1,399,523
Windermere.....	1931							
	1932							
Golden.....	1931							
	1932		6	102				
Ainsworth.....	1931	12			14	289	254	76
	1932	43	28	476	2	41	8,168	2,587
Slocan.....	1931	2,612			14	289	49,454	14,772
	1932	248			6	124	18,845	5,968
Slocan City.....	1931							
	1932	30			17	351	1,370	434
Nelson.....	1931	13,155	86	1,462	10,383	214,636	4,477	1,337
	1932	13,740	153	2,601	9,631	199,091	33,535	10,621
Arrow Lake.....	1931		2	34				
	1932		4	68				
Trail Creek.....	1931	113	1	17	216	4,465	710	212
	1932	505	7	119	1,489	30,780	641	203
Revelstoke.....	1931		272	4,624				
	1932		908	15,436				
Lardeau.....	1931							
	1932	13	76	1,292	13	269		
Western District (No. 6)								
Nanaimo.....	1931	52			19	393	136	41
	1932	2			8	165	7	2
Alberni.....	1931							
	1932		1	17				
Clayoquot.....	1931		16	272				
	1932	8	18	306	13	269	28	9
Quatsino.....	1931		1	17				
	1932							
Victoria.....	1931		8	136				
	1932		2	34				
Lillooet.....	1931	32,369	100	1,700	28,153	581,974		
	1932	32,657	293	4,981	60,540	1,251,473	11,778	3,730
New Westminster.....	1931		24	408				
	1932		21	357				
Vancouver.....	1931	1,968,494			5,364	110,884	136,547	40,786
	1932	809,264			8,873	183,421	59,352	18,798
Totals.....	1931	5,549,103	17,176	291,992	146,039	3,018,894	7,524,320	2,247,514
	1932	4,340,158	20,400	346,800	181,564	3,753,261	7,130,838	2,258,453

METALLIFEROUS MINES, 1931 AND 1932.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS.		TOTALS FOR DISTRICTS
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1931.	1932.	1932.
	\$		\$		\$	\$	\$	\$
						142,528		4,840,609
						187	141,214	
						7,180	629	
						3,100,422	6,069	
35,235,910	2,949,246					2,233,739	2,592,952	
38,293,437	2,443,198			3,116	80	10,184	2,098,713	
3,671	307	1,404,416	38,061			459	675	
35,933	2,293	1,127,932	23,840				306	
							51	
						63,716	148,182	
						45,866	70,635	
						3,638	56,746	
						2,057	10,805	
							9,996	
5,609	469	87,527	2,372	12,080	309	12,240	19,428	
						306	935	
						3,853	10,944	
						2,754	2,176	
						2,210	1,411	
						2,397	3,962	
							712,449	
13,402	855	61,301	1,661	93,538	2,389	517,594	453,729	
1,349	86	198,956	4,205	402,479	9,682	176,035	217,852	
		290,139	7,863	420,284	10,734		31,137	
		303,950	6,424	462,626	11,129	7,330	9,731	
		131,581	2,781				11,607,183	
		45,460	1,232	5,602	143			
				22,458	540			
		246,228,200	6,673,031	204,252,068	5,216,598	13,149,076	11,301,331	
		251,308,444	5,311,655	190,427,427	4,580,922			
							102	
		4,190	114	1,844	47	526	3,756	
		20,949	443	8,661	209	35,286	9,098	
		492,650	13,351	269,150	6,874		785	
		116,146	2,455	22,892	551	218,249	243,944	
		17,259	488	13,565	346	34	68	
		616,145	13,023	773,548	18,608	4,694	31,102	
						4,624	15,436	
							1,561	
5,083	426					860	2,211,138	
							167	
						272	17	
						17	584	
						136	34	
						593,674	1,260,184	
						408	357	
27,944,024	2,338,915	152,357				2,494,714	949,795	
11,496,888	733,524	604,850	14,052					
63,194,269	5,280,363	248,763,508	6,742,282	205,071,247	5,237,520	22,827,565	19,538,989	19,538,989
49,841,009	3,179,956	254,488,952	5,378,878	192,120,091	4,621,641			

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	1910.....	2,800,046	\$9,800,161
1886.....	326,636	979,908	1911.....	2,193,062	7,675,717
1887.....	413,360	1,240,080	1912.....	2,628,804	9,200,814
1888.....	480,301	1,467,903	1913.....	2,137,483	7,481,190
1889.....	579,830	1,739,490	1914.....	1,810,967	6,338,385
1890.....	678,140	2,034,420	1915.....	1,611,129	5,638,952
1891.....	1,029,097	3,087,291	1916.....	2,084,098	7,294,325
1892.....	826,335	2,479,005	1917.....	2,149,975	7,524,913
1893.....	978,294	2,934,882	1918.....	2,302,245	11,511,225
1894.....	1,012,953	3,038,859	1919.....	2,267,541	11,337,705
1895.....	1,439,654	2,818,962	1920.....	2,595,125	12,975,625
1896.....	896,222	2,688,666	1921.....	2,483,995	12,419,975
1897.....	882,854	2,648,562	1922.....	2,511,843	12,559,215
1898.....	1,135,865	3,407,595	1923.....	2,453,223	12,266,115
1899.....	1,306,324	3,918,972	1924.....	1,939,526	9,697,630
1900.....	1,439,595	4,318,785	1925.....	2,328,522	11,642,610
1901.....	1,460,331	4,380,993	1926.....	2,330,036	11,650,180
1902.....	1,397,394	4,192,182	1927.....	2,453,827	12,269,135
1903.....	1,168,194	3,504,582	1928.....	2,526,702	12,633,510
1904.....	1,253,628	3,760,884	1929.....	2,251,252	11,256,260
1905.....	1,384,312	4,152,936	1930.....	1,887,130	9,435,650
1906.....	1,517,303	4,551,909	1931.....	1,707,590	7,684,155
1907.....	1,800,067	6,300,235	1932.....	1,534,975	6,523,644
1908.....	1,677,849	5,872,472			
1909.....	2,006,476	7,022,666	Totals.....	80,618,116	\$318,827,887

* 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.....	286,945	\$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.....	58,019	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.....	68,005	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, 1931 AND 1932.

Description.	1931.		1932.	
	Quantity.	Value.	Quantity.	Value.
Coal used in making coke, long tons.....	168,722	\$924,279	135,513	\$710,432
Coke made in bee-hive ovens, long tons.....	65,410	\$548,550	29,549	\$247,615
Coke made in by-product ovens, long tons.....	24,751	236,537	22,714	217,221
Coke made in gas plants, long tons.....	37,359	210,470	39,815	236,574
Total coke made, long tons.....	127,520	\$995,557	92,078	\$701,410
Gas produced.....		1,541,454		1,589,663
Tar produced.....		66,506		22,140
Other by-products.....		32,603		37,282
Total production value of coke industry.....		\$2,636,120		\$2,350,495

TABLE XI.—PRODUCTION IN DETAIL OF STRUCTURAL MATERIALS, 1932.

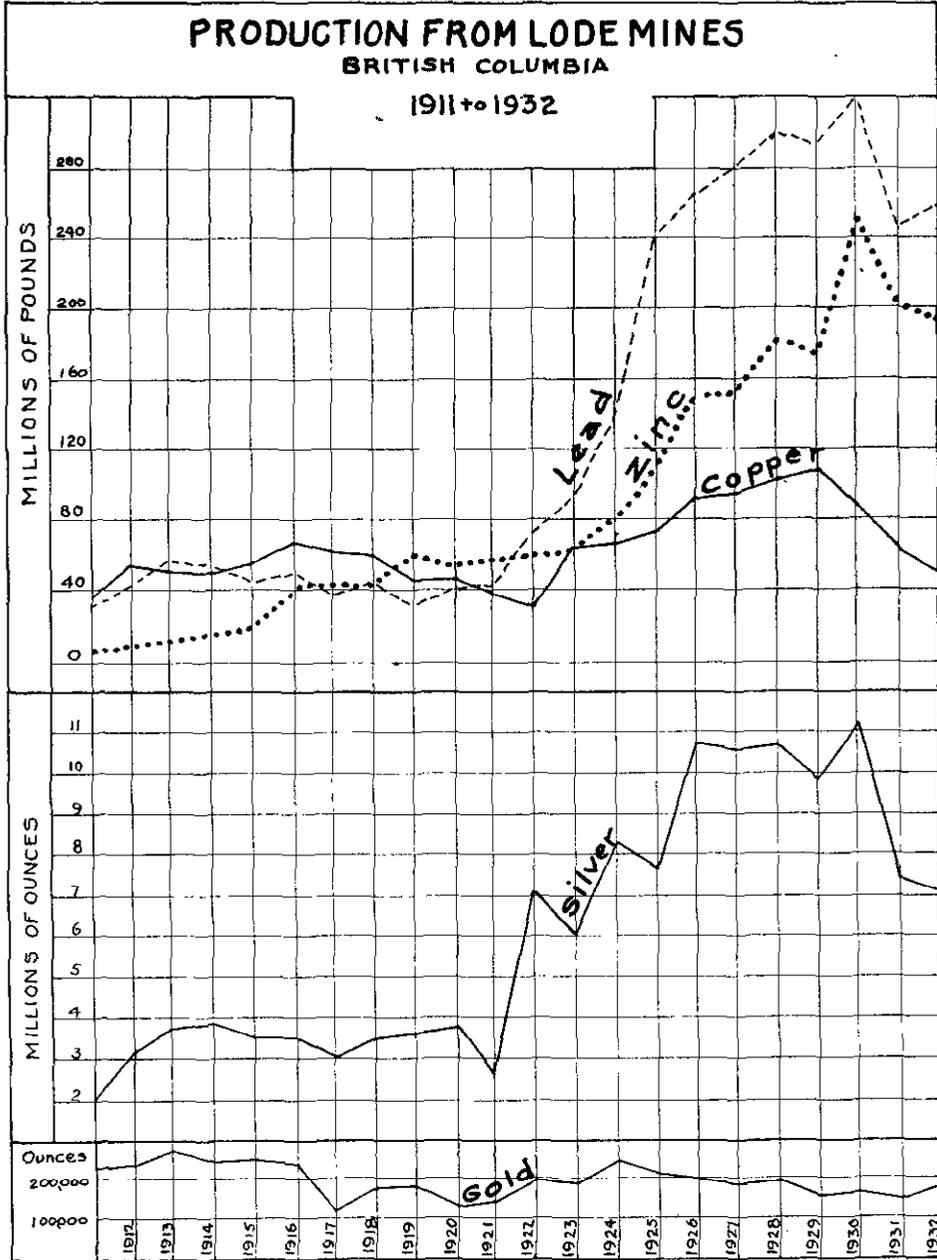
District and Division.	Cement.	Lime and Lime-stone.	Building-stone.	Riprap and Crushed Rock.	Sand and Gravel.	Pottery and Tile.	Clay.	Fire-brick.	Face, Paving, and Sewer Brick.	Red Brick.	Totals, Divisions.	Totals, Districts.
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
North-western District (No. 1).....												47,186
Atlin, Liard, and Stikine.....				400	4,632						5,032	
Nass River.....												
Portland Canal.....												
Skeena and Queen Charlotte.....				565	9,344						9,909	
Bella Coola.....		29,199			3,046						32,245	
North-eastern District (No. 2).....												25,110
Cariboo and Quesnel.....					17,893		2,012	184			20,089	
Omineca and Peace River.....					4,271					750	5,021	
Central District (No. 3).....												85,220
Nicola and Vernon.....			3,200	8,916	13,681	1,096				3,745	31,238	
Yale, Ashcroft, and Kamloops.....				25,644	28,338						53,982	
Clinton.....												24,011
Southern District (No. 4).....												8,368
Grand Forks and Greenwood.....					3,368					5,000	8,368	
Osoyoos.....					10,943						10,943	
Similkameen.....					4,700						4,700	
Eastern District (No. 5).....												115,699
Fort Steele.....			2,000	22,522	9,794						34,316	
Windermere and Golden.....				1,221	17,000						18,221	
Ainsworth.....			3,854	1,236	12,915						18,005	
Slocan and Slocan City.....												
Nelson.....		1,800	7,550	69	13,701						23,120	
Trall Creek.....				4,300	2,234						6,534	
Revelstoke.....				740	14,763						15,503	
Western District (No. 6).....												1,401,613
Nanaimo and Alberni.....		148,191	4,480		22,986					5,860	181,517	
Victoria and Quatsino.....	533,680	9,784		18,591	63,951	7,630				12,736	646,372	
Lillooet.....		100		2,575	36,966						39,641	
Vancouver.....	2,848		26,995	105,050	74,057						208,950	
New Westminster.....				51,034	91,003	89,877	6,326	63,418	11,905	11,570	325,133	
Totals.....	536,528	189,074	48,079	242,863	459,586	99,203	8,338	63,418	12,089	39,661	1,698,339	1,698,339

MINERAL PRODUCTION.

TABLE XII.—PRODUCTION IN DETAIL OF MISCELLANEOUS METALS AND MINERALS, 1932.

District and Division.	Bentonite.	Bismuth.	Cadmium.	Diatomite.	Flux (Lime and Quartz).	Gypsum and Gypsumite.	Iron (Bog).	Mica.	Platinum.	Shale.	Soda.	Sulphur Content of Pyrite and Sulphuric Acid manufactured.	Talc.	Division.	District.
	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢	¢
North-western District (No. 1).....															7,975
Atlin, Liard, and Stikine.....															
Nass River.....					7,975									7,975	
Portland Canal.....															
Skeena and Queen Charlotte.....															
Bella Coola.....															
North-eastern District (No. 2).....															480
Cariboo and Quesnel.....				440										440	
Omineca and Peace River.....								40						40	
Central District (No. 3).....															93,741
Nicola and Vernon.....															
Yale, Ashcroft, and Kamloops.....						84,484					1,061			85,545	
Clinton.....						744					7,452			8,196	
Southern District (No. 4).....															41,762
Grand Forks and Greenwood.....					37,774									37,774	
Osoyoos.....															
Similkameen.....	176					400		1,080	2,332					3,988	
Eastern District (No. 5).....															265,712
Fort Steele.....															
Windermere and Golden.....															
Ainsworth.....															
Slocan and Slocan City.....															
Nelson and Arrow Lake.....															
Trail Creek.....		48	26,824									238,840		265,712	
Revelstoke.....															
Western District (No. 6).....															70,476
Nanaimo.....															
Victoria and Quatsino.....										3,750				3,750	
Lillooet.....													702	702	
Vancouver.....							2,000					64,024		66,024	
New Westminster.....															
Totals.....	176	48	26,824	440	45,749	85,628	2,000	1,080	2,372	3,750	8,513	302,864	702	480,116	480,146

TABLE XIV.



EASTERN DISTRICT (No. 5)—*Continued.*

Mine or Group.	Mining Division.	Locality.	Owner or Agent and Address.	Character of Ore.
Little Daisy.....	Slocan City.....	.....	C. Cleary, Silverton.....	Silver, gold.
Meteor.....	Slocan City.....	.....	Lundstrom & Berquist, Slocan.....	Silver, gold.
Evening Star.....	Trail Creek.....	.....	C. E. Fraser, Rossland.....	Gold, silver.
Gold Drip.....	Trail Creek.....	.....	M. Penny, Rossland.....	Silver, gold.
I.X.L.....	Trail Creek.....	Rossland.....	I.X.L. Syndicate, T. W. Kelly, Rossland	Gold, silver.
Midnight.....	Trail Creek.....	Rossland.....	Midnight Mining Syndicate, Rossland	Gold, silver.
Snowdrop.....	Trail Creek.....	Rossland.....	Snowdrop Syndicate, Rossland.....	Gold, silver.

WESTERN DISTRICT (No. 6).

Tagore.....	Clayoquot.....	.....	A. Bloom, Ceepeece.....	Gold, silver.
Malmberg.....	Clayoquot.....	.....	H. Malmberg, Ceepeece.....	Silver, gold.
Bralorne.....	Lillooet.....	Cadwallader ck....	Bralorne Mines, Ltd., Vancouver.....	Gold, silver.
Pioneer.....	Lillooet.....	Cadwallader ck....	Pioneer Gold Mines of B.C., Ltd., Vancouver	Gold, silver.
Thurlow.....	Nanaimo.....	Thurlow island....	Thurlow Mine, Shoal Bay.....	Gold, silver.
Britannia.....	Vancouver.....	Britannia Beach	Britannia Mining & Smelting Co., Britannia Beach	Copper, silver, gold.
Golden Coin.....	Vancouver.....	.....	K. J. Robinson, Vancouver.....	Gold.

SOUTHERN DISTRICT (No. 4).

Mine or Group.	Mining Division.	Locality.	Owner or Agent and Address.	Character of Ore.
Union.....	Grand Forks....	Granby river.....	Jas. F. McCarthy, Grand Forks.....	Gold, silver, lead, zinc.
Bell.....	Greenwood.....	Beaverdell.....	Bell Mines, Ltd., Creston.....	Silver, gold, lead.
Carmi.....	Greenwood.....	Carmi.....	J. E. Miller, Trustee, Carmi.....	Gold, silver, zinc.
D.A.....	Greenwood.....	Greenwood.....	R. Crowe-Swords, Vancouver.....	Silver, gold.
Dynamo.....	Greenwood.....	Greenwood.....	J. McDonell, Greenwood.....	Gold, silver, lead.
Gold Drop.....	Greenwood.....	Jewel lake.....	R. L. Clothier, Penticton.....	Gold, silver.
Highland Lass.....	Greenwood.....	Beaverdell.....	Highland Lass, Ltd., Kelowna.....	Silver, gold, lead, zinc.
McKinney.....	Greenwood.....	McKinney camp.....	Owen Wheeler, Rock Creek.....	Gold, silver.
North Star.....	Greenwood.....	Jewel lake.....	R. L. Clothier, Penticton.....	Gold, silver, lead.
Stemwinder.....	Greenwood.....	Phoenix.....	R. Forshaw, Greenwood.....	Gold, silver, copper.
Wellington.....	Greenwood.....	Beaverdell.....	Beaverdell-Wellington Syndicate, Ltd., Greenwood	Silver, gold, lead, zinc.
Grandoro.....	Osoyoos.....	Oro Fino mtn.....	Grandoro Mining and Milling Co., Ltd., Vancouver	Gold, silver.
Oliver.....	Osoyoos.....	Fairview.....	P. E. Peterson, Oliver.....	Gold, silver.
Parvenu.....	Osoyoos.....	Oro Fino mtn.....	M. J. St. Clair, Penticton.....	Gold, silver.
Dividend.....	Osoyoos.....	Osoyoos lake.....	Dividend Mining Co., Osoyoos.....	Gold, silver.
Gray and Carmichael	Osoyoos.....		Gray & Carmichael, Osoyoos.....	Gold.
Mountain View	Osoyoos.....		Mountain View Gold Mines, Oliver	Gold, silver.
Silver King	Similkameen.....	Treasure mtn.....	Murray Mining Co., Tulameen.....	Silver, lead, zinc.

EASTERN DISTRICT (No. 5).

Sullivan.....	Fort Steele.....	Kimberley.....	Cons. M. & S. Co. of Canada, Ltd., Trail	Silver, lead, zinc.
Ophir Lade.....	Lardeau.....	Ferguson.....	J. Flagel, Nelson.....	Gold.
Arlington.....	Nelson.....	Erie.....	Relief-Arlington Mines, Ltd., Van- couver	Gold, silver.
Blackcock.....	Nelson.....	Ymir.....	Alf. McMillan, Calgary, Alta.....	Gold, silver, lead, zinc.
Boulder City.....	Nelson.....	Salmo.....	L. R. Clubine, Salmo.....	Gold, silver.
Columbia.....	Nelson.....	Sheep creek.....	J. Sapples, Erie.....	Gold, silver.
Enterprise.....	Nelson.....		Richard Rowe, Nelson.....	Silver, gold, lead, zinc.
Golden Eagle.....	Nelson.....	Sandy creek.....	B. A. Pickering, Nelson.....	Silver, gold.
Gold Hill.....	Nelson.....		Louis Matassa, Erie.....	Gold, silver.
Goodenough.....	Nelson.....	Ymir.....	Alex. McDonald, Ymir.....	Silver, gold, lead, zinc.
Granite- Poorman	Nelson.....	Taghum.....	Livingstone Mining Co., Taghum.....	Gold, silver.
Keystone.....	Nelson.....		S. D. Osborn, Erie.....	Silver, gold.
Kootenay Belle	Nelson.....	Sheep creek.....	Kootenay Belle Syndicate (F. M. Black, Trustee, Vancouver)	Silver, gold.
Nevada.....	Nelson.....		D. H. Norcross, Nelson.....	Gold, silver.
Perrier.....	Nelson.....	Nelson.....	Perrier Gold Mines, Ltd., Nelson.....	Gold, silver.
Queen.....	Nelson.....	Sheep creek.....	C. E. Witter, Salmo.....	Gold, silver.
Reno.....	Nelson.....	Sheep creek.....	Reno Gold Mines, Ltd., Nelson.....	Gold, silver, lead, zinc.
Royal Canadian	Nelson.....		Mrs. E. Bergstrom, Nelson.....	Silver, gold.
Second Chance	Nelson.....		Chas. Petersen and Chas. Mazeroll, Salmo	Gold, silver.
Vancouver.....	Nelson.....	Sheep creek.....	F. Unfried, Nelson.....	Gold, silver.
Venus-Juno.....	Nelson.....	Morning mtn.....	J. C. Allison, Nelson.....	Gold, silver.
Ymir-Wilcox.....	Nelson.....	Ymir.....	Wilcox Mining Syndicate, Rossland	Gold, silver, lead, zinc.
Yankee Girl.....	Nelson.....	Ymir.....	E. P. Crawford, Ymir.....	Silver, gold, lead, zinc.
Bosun.....	Slocan.....	New Denver.....	C. J. Campbell, New Denver.....	Silver, lead, zinc.
Cliff.....	Slocan.....	4-Mile creek.....	Dalzell & McDonell, Silvertown.....	Silver, lead, zinc.
Rio.....	Slocan.....		Sam Marzoli, Retallack.....	Silver, gold, lead, zinc.
Silversmith.....	Slocan.....	Sandon.....	Silversmith Mines, Ltd., Spokane, Wash.	Silver, lead, zinc.
Standard.....	Slocan.....	Sandon.....	Western Exploration Co., Silvertown	Silver, lead, zinc.
Victor.....	Slocan.....		E. Doney & Son, Sandon.....	Silver, gold, lead, zinc.
Chapleau.....	Slocan City.....		John Greenwood, Slocan City.....	Silver, gold.
Gold Viking.....	Slocan City.....	Springer creek.....	R. G. Henderson, Slocan City.....	Silver, gold.
Kho.....	Slocan City.....	Lemon creek.....	Ted Anderson, Silvertown.....	Gold, silver.

TABLE XV.—MEN EMPLOYED IN THE MINERAL INDUSTRY OF BRITISH COLUMBIA, 1932.

District.	Placer-mining.	LODE-MINING.			In Concentrators.	In Smelters.	COAL-MINING.			STRUCTURAL MATERIALS.			Total.
		Under.	Above.	Total.			Under.	Above.	Total.	Quarries.	Plants.	Miscellaneous.	
No. 1.....	190	528	250	778	93	342	.....	.....	.....	18	3	15	1,439
No. 2.....	378	16	37	58	4	.....	19	1	20	16	1	4	476
No. 3.....	78	5	5	10	1	.....	74	27	101	51	4	15	260
No. 4.....	62	115	65	180	11	.....	312	157	469	25	6	8	761
No. 5.....	112	359	262	621	231	1,694	752	249	1,001	89	3	51	3,802
No. 6.....	54	332	281	613	202	.....	1,471	546	2,017	337	312	251	3,786
Totals....	874	1,355	900	2,255	542	2,036	2,628	980	3,608	536	329	344	10,524

TABLE XVI.—TONNAGE, NUMBER OF MINES, AND NET VALUE OF LODE MINERALS, 1932.

District.	Tonnage.	No. of Shipping Mines, 1932.	No. of Mines shipping over 100 Tons.	Net Value of Lode Minerals produced.
No. 1.....	1,962,164	7	3	\$2,950,120
No. 2.....	8	1	.....	150
No. 3.....	173	3	1	7,165
No. 4.....	30,783	18	8	652,174
No. 5.....	1,455,099	39	14	1,823,317
No. 6.....	891,931	7	3	1,642,467
Totals.....	4,340,158	75	29	\$7,075,393

METALLIFEROUS MINES SHIPPING IN 1932.

NORTH-WESTERN DISTRICT (No. 1).

Mine or Group.	Mining Division.	Locality.	Owner or Agent and Address.	Character of Ore.
Engineer.....	Atlin.....	Windy arm.....	R. H. Brooks, Vancouver.....	Gold.
Bonanza.....	Nass River.....	Anyox.....	Granby Cons. M.S. & P. Co., Vancouver	Copper, silver, gold.
Hidden Creek.....	Nass River.....	Anyox.....	Ditto.....	Copper, silver, gold.
Dunwell.....	Portland Canal	Glacier creek.....	By leasers; Dunwell Mines Ltd., Victoria	Silver, gold, lead.
Silverado.....	Portland Canal	Stewart.....	By leasers; Silverado Mines, Ltd., Victoria	Silver, gold, lead.
Premier.....	Portland Canal	Cascade river.....	Premier Gold Mining Co., Ltd., Premier	Gold, silver, lead.
Holden.....	Skeena.....	Porcher island.....	A. J. Holden, Porcher Island.....	Gold, silver.

NORTH-EASTERN DISTRICT (No. 2).

Hixon Creek.....	Omineca.....	Hixon creek.....	J. H. Johnson, Prince George.....	Gold, silver.
------------------	--------------	------------------	-----------------------------------	---------------

CENTRAL DISTRICT (No. 3).

Aurum.....	Yale.....	Verona.....	Consolidated Underwriters, Ltd., Vancouver	Gold, silver.
Dawson.....	Yale.....	Verona.....	Ditto.....	Gold, silver.
Windfall.....	Clinton.....	Taseko river.....	Taylor Windfall Mining Co., Vancouver	Gold.

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.
 CHAS. GRAHAM, *Dist. Inspector*, Prince Rupert.
 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.
 P. B. FREELAND, { No. 3 District, Penticton.
 { No. 4 District, Penticton.
 B. T. O'GRADY, No. 5 District, Nelson.
 A. M. RICHMOND, Assistant Resident Mining
 Engineer, Victoria.
 GEO. A. CLOTHIER, No. 6 District, Vancouver.

Descriptions of the functions of the Department of Mines and its various branches have been printed in previous Annual Reports and are not repeated in this report. Commencing April 1st, 1932, some changes were made in the Resident Engineers' Districts. Lillooet Mining Division, formerly a part of the Central District (No. 3), was transferred to the Western District (No. 6), which is administered by Geo. A. Clothier, Resident Engineer, with headquarters at Vancouver. The Lillooet Division contains the active Bridge River gold camp.

P. B. Freeland, Resident Engineer of the Southern District (No. 4), was assigned the Central District (No. 3) to look after as well as No. 4 District. His headquarters are now at Penticton. H. G. Nichols, former Resident Engineer of the Central District, was retired from the service. These changes and other economies were necessitated by a greatly reduced appropriation for the Mineral Survey vote.

A. M. Richmond, Assistant Resident Mining Engineer, now has his permanent headquarters in Victoria. In addition to his work in carrying on a survey of non-metallic minerals, he is from time to time engaged in a detailed examination of gold camps and properties. Several reports on non-metallics have been issued as a result of his survey, which are available free of charge on application to the Department of Mines. During 1933 Mr. Richmond will spend most of the field season investigating areas believed to hold latent lode-gold possibilities.

This Annual Report has been condensed as much as was practicable in order to economize on expenditure. In so far as possible, material printed in previous Annual Reports has not been reprinted, but it is believed that the main information desired by the public is contained herein. Any information not included which is available in any branch of the Department will be furnished to those writing for it.

ASSAY OFFICE.

REPORT BY D. E. WHITTAKER, PROVINCIAL ASSAYER.

During the year 1932 there were made by the staff in the Government Assay Office 4,075 assays or quantitative determinations and 301 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	\$116.03
Fees for assaying	30.00
Fees for assayers' examinations	30.00

Total cash receipts	\$176.03
---------------------------	----------

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

Attorney-General's Department	\$128.00
Agricultural Department	1,935.00
Board of Health	740.00
Treasury Department	22.50
Forest Branch	210.00
Other departments	80.00
	\$3,115.50

Value of work done outside of Mines Department work \$3,291.53

The value of gold melted during the year 1932 was \$806.50 in 15 lots, as compared with \$399 in 10 lots in 1931.

FREE DETERMINATIONS.

In addition to the above quantitative work, about 2,475 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.

A meeting of the Board of Examiners was held on May 22nd and December 7th, 1932. No candidates applied for examination on May 22nd. One candidate applied for examination on December 7th and passed the examination on that date. The Board recommended that a certificate be issued to the above-mentioned candidate.

GOLD COMMISSIONERS AND MINING RECORDERS.

The following list shows the Gold Commissioners and Mining Recorders of the Province, revised to April, 1933:—

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.....			J. C. Devlin.
Sub-office.....	Haines (U.S.).....		(Com. for taking Affidavits)	B. A. Barnett.
Sub-office.....	Squaw Cr. via Atlin.....			Mrs. F. Muncaster.
Sub-office.....	Tulsequah.....			H. L. Fraser.
Sub-office.....	Juneau (U.S.).....		(Com. for taking Affidavits)	Harold E. Brown.
Stikine.....	Telegraph Creek.....	J. C. Devlin.....	J. C. Devlin.....	
Sub-office.....	Boundary via Telegraph Creek			W. R. Overend.
Liard.....	Telegraph Creek.....	J. C. Devlin.....	J. C. Devlin.....	
Sub-office.....	Porter Landing.....			W. G. Crisp.
Sub-office.....	McDame Creek.....			L. F. Murphy.
Sub-office.....	Fort St. John.....			F. W. Beaton.
Sub-office.....	Fort Nelson.....			J. S. Clark.

GOLD COMMISSIONERS AND MINING RECORDERS—Continued.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
Skeena.....	Prince Rupert.....	N. A. Watt.....	N. A. Watt.....	
Sub-office.....	Kitimat.....			Chas. E. Moore.
Sub-office.....	Terrace.....			O. T. Sundal.
Sub-office.....	Stewart (Portland Canal)			H. W. Dodd.
Sub-office.....	Kimsquit.....			Percy Gadsden.
Nass River.....	Anyox.....	N. A. Watt.....	E. Ross Oatman.....	
Sub-office.....	Alice Arm.....			Mrs. L. Cummings.
Sub-office.....	Stewart.....			H. W. Dodd.
Portland Canal.....	Stewart.....	N. A. Watt (at Prince Rupert)	H. W. Dodd.....	
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.....			W. T. Reavley.
Sub-office.....	Masset.....			J. C. S. Dunn, M.D.
Sub-office.....	Lockeport.....			
Omineca.....	Smithers.....	H. B. Campbell.....	H. B. Campbell.....	
Sub-office.....	Fort Grahame.....			John Melnyk.
Sub-office.....	Bella Coola.....			C. A. Brynildsen.
Sub-office.....	Finlay Forks.....			A. MacKinnon.
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. Beaton.
Sub-office.....	Whitewater (Finlay River) via Fort Grahame			L. T. Kempple.
Sub-office.....	Cedarvale.....			John Thompson.
Sub-office.....	Terrace.....			O. T. Sundal.
Sub-office.....	Fort Fraser.....			C. S. Foot.
Sub-office.....	Vanderhoof.....			Geo. Ogsdon.
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.
Sub office.....	McConnell Creek.....			H. K. Henry.
Peace River.....	Fort St. John.....	H. B. Campbell (at Smithers)	F. W. Beaton.....	
Sub-office.....	Prince George.....			G. Milburn.
Sub-office.....	Finlay Forks.....			A. MacKinnon.
Sub-office.....	Hudson Hope.....			F. F. Monteith.
Sub-office.....	Pouce Coupe.....			M. S. Morrell.
Cariboo.....	Barkerville.....	J. P. Scarlett.....	J. P. Scarlett.....	
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.....			J. P. Scarlett.
Clinton.....	Clinton.....	R. J. A. Dorrell.....	R. J. A. Dorrell.....	
Sub-office.....	Williams Lake.....			L. C. Maclure.
Sub-office.....	Haylmore via Bralorne..			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.

GOLD COMMISSIONERS AND MINING RECORDERS—Continued.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Deputy Recorder.
Ashcroft.....	Ashcroft.....	E. Fisher (at Kam.)	Henry H. Wood.....	Geo. D. Mead.
Sub-office.....	Lytton.....			A. Dryden.
Nicola.....	Merritt.....	E. Fisher (at Kam.)	A. G. Freeze.....	
Yale.....	Hope.....	E. Fisher (at Kam.)	H. Beech.....	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.....			C. W. Dickson.
Greenwood.....	Greenwood.....	Chas. Nichols.....	Chas. Nichols.....	
Sub-office.....	Rock Creek.....			S. A. H. Brew.
Sub-office.....	Beaverdeil.....			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.....	A. A. Robertson.....	J. E. Kennedy.....	
Sub-office.....	Fernie.....			S. B. Hamilton.
Ainsworth.....	Kaslo.....	Ronald Hewat.....	A. W. Anderson.....	
Sub-office.....	Trout Lake.....			H. Macpherson.
Sub-office.....	Poplar Creek.....			Arthur G. Johnston.
Slocan.....	New Denver.....	Ronald Hewat (at Kaslo)	Frank Broughton.....	
Sub-office.....	Sandon.....			W. J. Parham.
Slocan City.....	Slocan.....	Ronald Hewat.....	T. McNeish.....	
Nelson.....	Nelson.....	J. Cartmel.....	J. Cartmel.....	
Sub-office.....	Creston.....			R. H. Hassard.
Sub-office.....	Ymir.....			Wm. Clark.
Sub-office.....	Salmo.....			M. C. Donaldson.
Arrow Lake.....	Nakusp.....	J. Cartmel (at Nelson)	Walter Scott.....	
Revelstoke.....	Revelstoke.....	Wynfield Maxwell.....	W. Maxwell.....	
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.....	Ditto.....	Ed. Evenson.....	
Victoria.....	Victoria.....	R. J. Steenson.....	R. J. Steenson.....	
New Westminster.....	New Westminster.....	A. P. Grant.....	A. B. Gray.....	
Sub-office.....	Chilliwack.....			Chas. J. Whittaker.
Vancouver.....	Vancouver.....	John Mahony.....	R. A. Burgoyne.....	
Lillooet.....	Lillooet.....	L. J. Price.....	L. J. Price.....	T. B. Williams.
Sub-office.....	Haylmore via Bralorne.....			W. Haylmore.

GOLD COMMISSIONERS' AND MINING RECORDERS' OFFICE STATISTICS, 1932.

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 Reverted Crown-granted Mineral Claims.	Placer Claims recorded.	Placer Leases granted (Bench, Creek, and Drifting).	Certificates of Work, Placer Leases.	Bills of Sale, etc.	Free Miners' Certificates.	General.	Mining Divisions.	Districts.	
North-western District (No. 1)																	\$18,859.35
Atlin.....	341	4	2	19	121	12			6	10	84	48	\$2,059.25	\$6,590.00	\$8,649.25		
Stikine.....													500.00*	760.35*	1,260.35*		
Liard.....													630.00*	2,000.00*	2,630.00*		
Nass River.....	72	1		27	148	2	6						458.00	567.75	1,023.75		
Portland Canal.....	159	2	3	172	362	27							997.00	1,532.00	2,529.00		
Skeena.....	197	1	4	29	62	16	3		24	26	23	6	1,041.25	1,056.00	2,097.25		
Queen Charlotte.....	27	1	9	8	6				1	10	2		237.00	315.75	552.75		
Bella Coola.....	16			2	7								79.50	37.50	117.00		
North-eastern District (No. 2)																36,399.11	
Cariboo.....	241	4		720	149	100		4	132	97	123	110	1,452.50	12,351.00	13,803.50		
Quesnel.....	512	2	2	18	32	8			34	21	199	118	1,761.25	9,853.65	11,614.90		
Omineca.....	648	7	1	187	659	111	12		99	72	64	124	3,403.50	7,549.71	10,953.21		
Peace River.....											1			27.50	27.50		
Central District (No. 3)																14,357.70	
Nicola.....	53	1		31	61	2				11	1	7	289.00	1,066.50	1,355.50		
Vernon.....	134	2		41	36	12			12	5	12		690.00	1,072.80	1,762.80		
Yale.....	233	6		104	224	36			117	57	11	14	1,459.75	1,444.40	2,904.15		
Ashcroft.....	127	1		161	54	7			41	25	6	23	591.00	1,093.50	1,684.50		
Kamloops.....	413	1	1	142	196	20		3	71	8	8	19	1,758.25	1,691.40	3,449.65		
Clinton.....	120			114	70	16	2		101	38	9	103	475.50	2,725.60	3,201.10		
Southern District (No. 4)																11,671.05	
Grand Forks.....	101			46	46	12			17	4			428.50	716.10	1,144.60		
Greenwood.....	169	1	104	76	117	19	2		11	35	30	19	854.50	2,647.25	3,501.75		
Osoyoos.....	158		2	79	47	15			20				832.50	557.40	1,389.90		
Similkameen.....	226	2	216	47	183	14			4	25	53	32	1,279.75	4,355.05	5,634.80		
Eastern District (No. 5)																26,531.45	
Fort Steele.....	364	6		70	96	4			94	170	18	110	1,794.75	8,619.80	10,414.55		
Windermere.....	80	1		48	62	10			18	7	6	8	379.50	904.50	1,284.00		
Golden.....	63	4		10	40		11		3	1	1		526.00	365.75	891.75		
Ainsworth.....	102	4		44	135	22			9	11			961.75	795.00	1,756.75		
Slocan.....	39	1		21	69		1		1				287.25	333.25	620.50		
Slocan City.....	71			23	68	7			30				173.25	247.10	420.35		
Nelson.....	396	12	1	164	282	34	5	31	111	6		1	2,455.00	3,291.55	5,746.55		
Arrow Lake.....	17			5	14								94.50	48.00	142.50		
Trail Creek.....	154	1		10	25	7			4	20			924.75	244.50	1,169.25		
Revelstoke.....	138	4	1	54	69	16	4		2	21	15	20	909.50	1,934.20	2,843.70		
Lardeau.....	60	2		58	161	7			5			9	434.75	806.80	1,241.55		
Western District (No. 6)																28,692.19	
Nanaimo.....	113		46	139	164	43	3		2				451.00	994.50	1,445.50		
Alberni.....	53			9	29	5			3	1			212.25	180.25	392.50		
Clayoquot.....	36			44	20	5			3				143.00	271.25	414.25		
Quatsino.....	20			1	30								91.50	217.50	309.00		
Victoria.....	356	9	1	24	37	1			22	10	6	1	2,433.50	949.33	3,382.83		
Lillooet.....	420	8	1	638	502	220	34		5	39	34	76	2,707.25	9,047.95	11,755.20		
New Westminster.....	202	3		68	76	9			2	31			1,029.75	400.90	1,430.65		
Vancouver.....	1,750	58	3,542	14	96	7	2	10					10,232.76	329.50	10,562.26		
Totals.....	8,411	149	3,935	3,467	4,555	826	84	136	1,113	706	698	809	\$47,518.01	\$89,992.84	\$137,510.85	\$137,510.85	

* Estimated.

REPORTS OF RESIDENT MINING ENGINEERS.

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

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

INTRODUCTION.

The geological, topographical, and other general features of this district are described in detail in former Annual Reports. Greater space than usual has been devoted in this report to descriptions of likely virgin and semi-virgin territory, especially that possessing potentialities for discovery of lode and placer gold. This district contains enormous areas as yet unmapped, untrod, and unscratched by the prospector. Geologically, some of them may be favourable and some not. The Resident Engineer has considered it of outstanding importance to incorporate into his season's field operations the general exploration of as much virgin territory as possible. In this way it is hoped to bring to light promising areas and direct attention of prospectors and exploratory interests to the most likely sections in them.

GENERAL SUMMARY.

During 1932 the mineral industry of this district has not only been sustained in the face of continued adverse general conditions, but constructive and practical policies and methods of adjustment to the change of conditions have been adopted. In the course of these commendable endeavours, technical achievements are being accomplished, opportunities and economic mineral possibilities are being recognized, that perhaps otherwise would not have taken place.

These activities are reflected in:—

- (1.) Continued reduction of costs and introduction of economies and increased efficiency in the producing mines of the Granby Consolidated Mining, Smelting, and Power Company, Limited, and the Premier Gold Mining Company, Limited.
- (2.) Leasing operations by individuals notwithstanding the low silver price.
- (3.) Intensification of search for lode-gold and placer-gold deposits. Increasing activity of individuals in placer-gold mining.
- (4.) Sounder appraisal of applicable placer methods by the large-scale, placer-gold operators and the introduction of modern equipment.
- (5.) More thorough appraisal of lode-deposit potentialities and recognition of possible opportunities for profitable small-scale operations.
- (6.) A clearer insight into and understanding of favourable and unfavourable geological factors governing deposition of ore-bodies.
- (7.) A more co-operative relationship between property-owners and operators.
- (8.) The recognition of virgin territory favourable for deposition of gold ores.
- (9.) Introduction of air-plane transportation and cost co-operation of freighting outfits with the prospector and small operators.

Production shows a decrease in gold and silver quantity output, but an increase in copper. Output value has also been adversely affected by continued low metal prices.

Development and exploration have been quite active. Prospecting has also been very active and more men have been engaged in this pursuit than in 1931, with many new men of the younger generation among them. The increasing demand for the services of the Department of Mines has resulted in the busiest season in the history of this office.

The future of the industry can be faced with well-founded optimism. All signs point to an increased activity during the coming year, especially in the category of gold-mining. Important results in this phase can be anticipated and new operations in lode-gold and placer-gold mining can be expected in 1933.

PRODUCTION.

The following list gives the production from lode mines in No. 1 District during 1932:—

Name.	Ore.	Gold.	Silver.	Copper.	Lead.
	Tons.	Oz.	Oz.	Lb.	Lb.
Atlin Mining Division— Engineer.....	30	218	86	.....	.....
Nass River Mining Division— Bonanza.....	99,232	461	43,144	4,489,948	.....
Hidden Creek.....	1,641,068	2,862	212,706	33,803,489	.....
Portland Canal Mining Division— Dunwell.....	27	23	2,495	221	2,611
Premier.....	221,718	76,010	1,561,484	34,686	1,109,290
Silverado.....	83	16	16,326	1,026	16,931
Skeena Mining Division— Holden, A. J.....	6	3	2	.....	.....
Totals.....	1,962,164	79,593	1,836,333	38,329,370	1,127,932

The placer-gold output from No. 1 District for 1932 was 8,491 oz., valued at \$144,347, as compared with \$152,286 in 1931.

DEVELOPMENT.

Development and exploratory operations have been continued actively at the *Premier* mine and by the Granby Consolidated Company. Energetic exploration of the *Ruffner* property, Atlin, by Buffalo interests continued to about the end of July, when the property was examined by engineers representing European interests. In the same Division the *Whitewater* and the *Smith-Wilms-Bacon* groups in the Taku River area were also intensively explored by company interests. At the close of the season's operations on the *Whitewater* group, the inconclusive results indicated and the failure of the owners to grant an extension of time on option payment caused the dropping of its option on this group by N. A. Timmins, Incorporated. Towards the close of the year the Alaska Juneau Gold Mining Company is reported to have optioned this property with the intention of carrying on further development and exploration. Exploration was actively carried on during the season on the *Skidegate-Sunrise*, in the Queen Charlotte Division; Georgia River Gold Mines, Limited; *Unicorn*, *Kenneth* (Argentine Syndicate), *Ben Bolt*, *Virginia K.* (Excelsior Syndicate), and *Northern* (North-western Aerial Prospectors, Limited) groups, and several other properties in the Portland Canal Division. In the Skeena Division small crews were employed in exploration on the *Hunter* and *Western Copper* groups, Khutze River area, and on the *Surf Point*, Porcher island. It is expected that the latter property will go into small-scale production early in 1933. In the Alice Arm area, Nass River Division, little exploration was undertaken by company interests, but prospectors were fairly active on their claims.

An outstanding and heartening feature is the turning of individuals to opportunities for small leasing operations on high-grade silver deposits and the profitable outcome from such operations. Expansion in this type of operation can be looked for. The trend to this always existing opportunity is pointing the way to possible small-tonnage milling operations, and assisting in the further development of tonnage potentiality in its relation to possible large-scale operations. In the Portland Canal section four individual leasing operations have been successfully carried on during the season, and on at least two of them it is planned to continue through the winter. Placer-gold operations by company interests and individuals have been exceptionally active.

PROSPECTING.

Prospecting has been generally quite active, but chiefly devoted to gold. In the Portland Canal and Alice Arm areas, however, many prospectors owning likely copper and silver-lead properties have carried out more constructive and intelligent work on their showings than perhaps in any other period in recent years. Important new discoveries of silver ores have been made in the American Creek area of the Portland Canal Division and in the Kitsault Valley area of the Alice Arm section.

Although no outstanding discoveries have been made, the lode-gold potentialities of this district have steadily enlarged and the gradually unfolding promise for future production is

stimulating. With the gradual penetration of the vast area of virgin territory in this district, the progressing study of geologically favourable sections, and the direction of the attention of prospectors to these sections, an encouraging future looms in the offing. In the older areas intensification of search and development is also bringing tangible results and indicating dormant possibilities.

The increasing use of aeroplanes in this district has placed distant gold areas within reach of the prospector and companies and is becoming an important factor in the increase and spread of activity. In the Unuk River section important discovery and exploration results were achieved by a party of prospectors transported into that section by aeroplane. Other parties from Stewart and Ketchikan penetrated this area on foot. The results from activities in the Unuk River section added further concrete evidence to that frequently stressed in former Department of Mines reports, which indicates that the gold potentialities of this area are worthy of intensive exploration and warrant mapping by the Geological Survey of Canada, and the supply of initial ingress into the area by trail-construction through the Alaskan Panhandle by the Alaskan Government. The Alaskan road authorities undertook a preliminary reconnaissance along the Unuk river during 1932. Two parties from Stewart were prospecting for placer and lode gold at the head of Bell Irving river.

A noteworthy expedition in search of placer gold was undertaken by George King and Wesley Meyers, of Ketchikan, who flew into the Whiting River area, whence they penetrated on foot to the telegraph-line, which they followed to Telegraph Creek. During this trip interesting indications were found.

From the Taku River region most of the prospectors were engaged by a Detroit syndicate and transported by five aeroplanes to a base headquarters at Atlin for an expedition into the Findlayson River section in Yukon Territory. This somewhat reduced prospecting in the Taku River section. However, much active surface prospecting was undertaken in this area on several groups by the Alaska Juneau Gold Mining Company with encouraging results.

In the Atlin area prospecting for placer gold was very active. Good results, by more intensive prospecting, were achieved on O'Donnell river, Spruce creek, Pine creek, Wright creek, and others, and in the Surprise Lake area. Prospectors were also active in the Consolation Creek section and spread through the Gladys Lake area towards the Yukon boundary at Teslin lake. In this work syndicates made good use of aeroplanes. In the Atlin area attention is also turning to prospecting for lode gold in quartz veins, opportunities for which are stressed in Bulletin No. 1, 1932, and some encouraging results are reported.

In the Rainy Hollow area prospecting was carried out in the area about the valley of the Klehini river. In this area F. R. Patrick and E. C. Michels, prospecting for Juneau interests and going in via Haines, Alaska, carried out energetic work in the St. Elias Range section between longitude 137° and latitude 59°, with the latter part of the season devoted to getting in supplies for an early commencement of prospecting operations in 1933.

A traverse by the Resident Engineer of the virgin area of the extreme north-westerly segment around the headwaters of the Tatshenshini and Kelsall rivers and on into the Squaw Creek area revealed a very promising prospecting section.

On Graham and Moresby islands prospecting for both placer and lode gold is increasing and in the Moore Channel-Kootenay Harbour gold-belt some interesting results have been achieved. In the coastal area bordering the mainland more interest has also materialized in the active prospecting of the likely granitic areas described in Bulletin No. 1, 1932, especially in the Porcher-Pitt Island and Khutze River sections of the Skeena Division, and on Porcher island additional discoveries of gold-bearing pyrite veins have been made.

Prospecting for lode and placer gold has been active in the Kitsumgallum Lake area, and on Douglas creek auriferous deposits have been traced towards the headwaters. Douglas creek was staked almost from end to end.

NEW DISCOVERIES.

Of the many new finds made during 1932, some may prove interesting with further work. Of these may be mentioned:—

Queen Charlotte Division.

Kootenay Group.—Additional showings of free-gold-bearing quartz veins.

Early Bird.—Recognition of gold-bearing possibilities in a wide replacement fracture-zone.

Tanoo.—Extensive deposit of low-grade copper ore with fair gold values, discovered by E. C. Stevens, of Skidegate.

Skidegate-Sunrise Group.—Location of main vein with appreciable widths and some new subsidiary veins on 100-foot level.

Skeena Division.

Surf Point Mine, Porcher Island.—Several new quartz veins with minable lenses of high-grade gold-bearing pyrite.

Eddy Pass, Porcher Island.—Additional quartz veins with high-grade gold-bearing pyrite.

Wren, Porcher Island.—Three quartz veins with gold-bearing pyrite and high-grade float.

Copper Coin, Porcher Island.—Fourteen-foot wide mineralized siliceous replacement-zone.

Douglas Creek, Kitsumgallum Lake.—Extension of placer-gold area.

Nass River Division.

Lucky Strike, Kitsault Valley.—Gold-bearing vein of appreciable width.

Vanguard, Kitsault Valley.—Gold values in newly discovered vein, reported about 15 feet in width.

Moose, Kitsault Valley.—New discovery of small vein carrying about \$8 gold per ton.

Tyee, Kitsault Valley.—Additional discoveries of silver-lead showings of importance.

Last Chance, Kitsault Valley.—Vein 8 feet wide carrying chalcopryrite, galena, and zinc-blende.

Portland Canal Division.

Georgia River Gold Mines, Ltd.—Intersection of south-west vein on *Bullion* tunnel-level with reported good gold values.

Kenneth (Argentine Syndicate).—Important extensions to "D" vein system.

Dunwell.—Disclosures of additional ore possibilities.

Sunbeam.—High-grade silver ore of shipping grade.

Ben Bolt.—Extension of main zone and a new vein of promise.

Northern (North-western Aerial Prospectors, Ltd.).—Discovery of high-grade silver ore on the *Moonlight* and *Northern No. 7* claims.

Edith.—New discovery of high-grade silver-lead-zinc vein.

Unicorn.—Extension of east-west structures with appreciable widths, encouraging gold values, and some native gold.

Salmon Gold.—New discoveries carrying from \$2 to \$16 in gold per ton across widths of 4 to 8 feet.

Unuk River.—Large mineralized gold-bearing replacement-zone.

Liard Division.

Little Muddy River.—Placer-gold discovery and new mining operations.

Atlin Division.

Taku River.—On the *Smith-Wilms-Bacon* and on the *McDougall* group new discoveries of gold-bearing ore under Alaska Juneau Gold Mining Company exploration.

Atlin.—Placer-gold discoveries on Bull and Carval creeks of the O'Donnel River area. Continuation of "Gold run" on Pine creek. Indication of possible continuation of "Blue run" on north side of central Spruce creek. Strong indication of possible old channel on south side of central Spruce creek and south of known "Yellow run" old channel. Practically certain location of McKee Creek old channel on north side of the creek. Extensive interglacial gold-bearing gravel reconcentrations of economic importance on Otter creek.

Atlin Ruffner.—Intersection of mineralized vein-structure by low-level crosscut tunnel at elevation 4,126 feet.

Taku Arm (Lake Tagish).—New discoveries of lode- and placer-gold showings.

LIKELY AREAS FOR PROSPECTING.

Queen Charlotte Division.

Vancouver Harbour and Rennell Sound, Graham Island.—Area of granitic contact with Triassic volcanics. Favourable for lode-gold deposits.

Kootenay Harbour, Moresby Island.—Area of Triassic volcanics about half a mile in from north shore of South arm and lying between limestone-shale area on the south and tuffaceous rocks on the north. This green volcanic belt is about 1 mile wide and strikes north-easterly towards Mitchell inlet. Favourable for lode-gold deposits.

Mitchell Inlet, Moore Channel, Moresby Island.—Low-lying area of possibly Triassic pillow-structured, amygdaloidal, and spherulitic lavas on south side of inlet extending to around the inlet head (Thetis cove).

Douglas Inlet, Moore Channel, Moresby Island.—Low-lying area of similar rocks to those described in Mitchell inlet, occupying the central section of the south side of the inlet. Favourable for lode-gold deposits.

Peel Inlet, Moore Channel, Moresby Island.—Some areas of green andesitic rocks. Favourable for lode-gold deposits.

Cumshewa Inlet, Moresby Island, East Coast.—North side of inlet, in Triassic formation area back from the beach and contiguous to a granitic contact exposed along Cumshewa point.

Skeena Division.

Porcher-Pitt Island belt of quartz diorite close to Triassic rock contact and in the neighbourhood of later granitic injections. Favourable for gold-bearing quartz-pyrite veins.

Khutze Inlet Area.—Same as for Porcher and Pitt islands.

Kitsumgallum Lake.—Granodioritic contact area. Prospect both in the older Triassic rocks and also in the granitic rocks themselves close to the contact. Favourable for gold-bearing mixed sulphides and gold-bearing pyrite respectively.

Nass River Division.

Kitsault River Valley.—West side of the upper valley area. Favourable for gold-bearing sulphides. All pyritized quartzose structures should be sampled.

Portland Canal Division.

Stewart.—The older known areas contiguous to the Salmon and Bear rivers are as yet only very superficially prospected. Many claims still held or abandoned should be reprospected thoroughly. (See Annual Reports, 1929 and 1930, and Bulletin No. 1, 1932, for mineral localization.)

Unuk River.—A large area of the western contact-zone cutting across this trough should be intensively prospected. Favourable for silver-lead-zinc and also lode-gold deposits, possibly also some placer gold in areas protected from too intense glaciation.

Stikine Division.

Barrington River (North Fork of Chutine River).—Areas of young granitic injections into Triassic rocks in the central canyon section of this stream and towards the head. Favourable for lode-gold deposits and also placer gold.

Dease River.—Along the contact areas, both marginal and inclusion, of the Cassiar batholith between Dease lake and Cottonwood river. Favourable for lode-gold deposits. The many quartz-vein-carrying areas of the Dease Lake and Dease River sections should also be thoroughly prospected for lode-gold occurrence. Many likely placer-gold creeks occur in this area, such as those contiguous to the upper drainage area of the Little Muddy river; Walker creek, flowing into Deadwood lake; Spring and French creeks, with their several tributaries, flowing into the west side of Dease river north of McDame creek.

Atlin Mining Division.

Many likely areas are mentioned in Bulletin No. 1, 1931, "Placer-mining in British Columbia," and Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia." The following newly traversed area is, however, mentioned here:—

Tatshenshini River.—Granitic boss and stock contact areas around the headwaters of the Tatshenshini and Kelsall rivers. Favourable for both lode and placer gold and also for silver-lead deposits.

AVIATION.

The use of aeroplanes for exploration, transportation of men, equipment, and supplies into the more remote northern areas showed a marked increase during 1932 and has now proved beyond question the suitability and efficiency of this method of transportation. In several instances of urgency, in connection with accidents and sickness in outlying sections, the aeroplane proved its worth.

During 1932 Canadian Airways, Limited, established a base at Atlin with a W. 34 Junkers freighting-aeroplane in charge of pilot S. R. McMillan and engineer Paul Davis. This plane successfully carried out several extended flights. On occasion the Canadian Airways Super Fokker aeroplane piloted by E. P. Wells, based at Burns Lake, was also flown into this district. This machine and pilot showed great efficiency in a series of flights for Stewart parties into the Unuk River section, involving the landing of men, equipment, and supplies on a lake $3\frac{1}{2}$ miles long and $\frac{1}{2}$ mile wide, located at altitude 3,600 feet. Five small Eastman, open cockpit, 3-passenger aeroplanes flew from Detroit, Michigan, to Atlin in the interests of a Detroit exploration syndicate and, based at Atlin, were active throughout the season, with many extended flights into Yukon Territory and remote sections of the Atlin Division.

GEOLOGICAL SURVEY OF CANADA.

Field-work by the Geological Survey of Canada was continued during 1932, George Hanson being in the Hastings Arm-Portland Canal segment and F. A. Kerr in the Taku River area.

Further detailed work in connection with the genetical and structural aspects of the Salmon River-Cascade Creek area ore-deposits is strongly recommended. The commencement of geological and topographical mapping of the Unuk River section is also recommended. The work of prospectors in this area during 1932 has more than ever proved of importance. The definite knowledge acquired during 1932 that aeroplanes can safely land in a conveniently situated section solves the transportation problem for a season's field-work.

The co-operation of the Geological Survey of Canada staff at Ottawa in the microscopic determination of many rock and mineral specimens submitted during the season has greatly assisted the elucidation of field problems encountered by the Resident Engineer and is appreciated.

ADDRESSES AND PROSPECTORS' CLASSES.

During the year addresses covering various phases of the mining industry in No. 1 District were given at several points. Before the start of the field season a series of classes for prospectors and others interested in the mining industry, involving a week at each locality, with afternoon and evening demonstrations and lectures, were held at Prince Rupert, Terrace, Alice Arm, and Stewart. These were well attended and were received with enthusiasm at each locality. There is no doubt whatever of the practical utility of these studies to the prospector and others connected with the mining industry, and to the progress of the mining industry itself. It would seem that the beneficial effect of these courses and the intelligent absorption of the material submitted is already apparent in the attitude, increasing efficiency, and enthusiasm of the prospectors and in the intelligent prosecution of their work generally.

ACKNOWLEDGMENT.

The Resident Engineer desires to express his thanks to the prospectors, operators, and all those with whom he has come in contact during the conduct of his work.

In the following report details of mining activities and mineral possibilities in the various Divisions of the district are set out.

BELLA COOLA MINING DIVISION.

The Division has been described in previous reports and in Bulletin No. 1, 1932. Its geological characteristics are described and likely areas for prospecting mentioned. During 1932 the Division was comparatively inactive and was not visited.

QUEEN CHARLOTTE MINING DIVISION.

This Division is thoroughly covered in previous reports and in Bulletin No. 1, 1932; its geological aspects and prospecting opportunities are described. Likely prospecting areas are given previously in this report.

GRAHAM ISLAND SECTION.

Black-sand Beach Deposits.

Interest in the possible profitable recovery of gold from the beach-sand concentrates of the east coast has increased very materially. These deposits are described in the Annual Reports for 1929 and 1930 and in Bulletin No. 2, 1930, and Bulletin No. 1, 1931. Considered from the standpoint of individual operations, the character of the material is such that the proposition is not recommended to "greenhorns." However, with ability for continuous work, applied study of the peculiarities of the deposits, and application of details of methods suitable to the recovery of the gold in these deposits, it would be possible for individuals to earn expenses or small wages. It would seem that large-scale operations would be dependent for success, not upon the spasmodic superficial deposition of the high-grade streaks and patches, but upon a sufficient yardage of low-grade, permanently-situated, formerly-deposited sands and the application of a suitable method of concentration and gold-extraction. Such deposits would take the form of buried black-sand concentrate-lenses interbedded with layers of non-pay grey sands, the whole making up a sufficient grade for profitable treatment by the method selected.

The beach and bordering bluffs consist of Pleistocene to Recent superficial deposits of unconsolidated to semi-consolidated sands, clays, sandy clays, gravels, and conglomerates. The basal formation is a blue-grey glacial clay. The black-sand deposits have a lenticular and varying distribution along the base of the bordering bluffs, and have been derived from disintegration of the material constituting these and its reconcentration by wave and possibly wind action.

Concentrate-lenses from 1 to over 6 inches thick are distributed in sections up to 300 or 400 feet long and 40 to 50 feet wide, extending from the base of the bluffs through the high-water drift-log fringe and down the gently sloping beach. The richest lenses are about 5 feet wide and 10 to 50 feet long. A typical characteristic of the deposits is a marked gradation from concentrated magnetite black sand in the upper or high-water fringe, through brownish-red and pink garnetiferous sand, into greenish epidote or peridotite sand, and then into the yellow-sand strip down to the low-tide breaking surf. Although in some of the black-sand patches, particularly those collected behind drift-logs, some fine colours of gold could be recognized with the naked eye or with the aid of the magnifying-glass after gently scraping away the top layer of the damp sand, no free gold was actually recognized in the pinkish garnet or greenish epidote section. In all cases where gold could be recognized, the colours are characteristically fine, probably from 60 to over 100 colours constituting 1 cent.

The best area is apparently a stretch about 3 miles in length locally known as "Bull Swamp," situated about 5 miles south of Cape Fife, commencing at about 1 mile south of Martel creek and extending to the vicinity of Frank Gagner's location, known as Lake creek (about 4 miles south of Martel creek). In this section several small ravines representing the eroded beds of small creeks are noted. These creeks, dependent upon the rainfall for their water-supply and cutting down to the basal clay on the beach, offer an additional means for reconcentration or natural sluicing of the already formed lenses, and in one of them, from which a small amount of water was trickling in veinings across the beach, numerous fine specks of gold could be readily seen.

Methods of Recovery.—Concentration followed by amalgamation in specially constructed machines has heretofore been the most popular method. The flotation process may prove to be successful in the extraction of the fine or flour-gold occurring in these sand-deposits. In this respect the Resident Engineer has been in recent correspondence with A. W. Fahrenwald, Professor of Metallurgy and Ore Dressing, School of Mines, University of Idaho, who has carried out exhaustive experiments in this connection. Regarding the treatment of these sands, Professor Fahrenwald states: "Rather a large number of placer and black-sand samples have come to this laboratory and have been tested for flotation. We have had very good results. Small gold particles float readily, and I have no doubt that the material in which you are interested would respond satisfactorily to the flotation process. It is, of course, a matter of economics. From considerable study of the problem and calculations that I have made, I believe any sand running 50 cents or more a yard can be handled at a profit by the flotation process." One apparent difficulty in connection with gold-recovery from these deposits is the scarcity of water, particularly during the drier summer season.

The hand method that has so far given best results is shovelling into sluice-boxes with the recovery-box carried at a steep grade, say about 18 inches to the 12-foot box, so as not to allow the riffles to become clogged with heavy magnetite, and the gold-saving boxes lined with blankets into which narrow and shallow cleat-riffles are sewn. A combination with this of trap or plate amalgamation might be useful for increased recovery. The necessary grade of the recovery-box would have to be determined by experimentation and panning of the tailings. The sands would be shovelled into a sluice-box without riffles, ahead of the recovery-box. This facilitates an even feed to the recovery-box. By this method probably from 50 to 60 per cent. of the gold values in the sand, and also platinum, could be recovered. It is not known that long-toms have been tried on the Graham Island beaches, but it would seem that this method, using a steep gradient and amalgam-plates, might be applicable to the richer patches. Recovery in rockers adapted to the peculiarities of the sand should also be possible from the rich patches. It is estimated that one man could handle about 3 cubic yards of sand per ten-hour shift in a long-tom or rocker. In considering hand operations by individuals on these beach-sand concentrations, it must be stressed the nature of these deposits would necessitate more or less intermittent operation on small rich lenses with the best periods occurring after storms.

Gold Beach Mines, Ltd.—It is understood that this company has absorbed the assets of the Gold Star Mines, Limited, operating at Cape Fife. During the 1932 season, Norman H. Terry carried out a three-month series of tests on the beach sands in the neighbourhood of Cape Fife. This consisted of test-pitting in an extensive stretch of sands above high-tide mark and the treatment of this material in a Lorentsen centrifugal force amalgamator. In these tests 102 cubic yards of sand are stated by Mr. Terry to have yielded \$291, or \$2.84 per cubic yard. Mr. Terry estimates that much of the yellow sand also contained pay values. It is stated that within a radius of 1,000 feet of the present site there is estimated 54,000 cubic yards of workable sand. The company proposes setting up a plant to treat 500 cubic yards a day. Concentration, magnetic separation, and an amalgamating-machine will be used.

During 1932 the late Frank Gagner, an experienced Yukon miner, operated intermittently about 4 miles south of Martel creek and made expenses by hand-slucing. Several other individuals have also worked during 1932. On Blue Jacket creek, Masset inlet, two men, at first totally inexperienced, are recovering fair wages by shovelling into sluices.

During the season sluicing has been carried out on Blue Jacket creek by two men, at first quite inexperienced, and who have been recovering from 3 to 4 oz. of fine gold per month.

Duncan Lease.—This lease, situated at Lawn Hill and owned by William Duncan, of Lawn Hill, is described on page 51, Bulletin No. 1, 1931. During 1932 some test-pitting and sluicing was carried out on this ground, indicating that wages or expenses could be earned by individual sniping and that the ground may possibly bear investigation for a limited operation by a small syndicate.

Lode Gold.

Skidegate-Sunrise. Work on this property under the supervision of W. G. McMorris was continued by the Kitsault-Eagle Silver Mines, Limited, Standard Bank Building, Vancouver. The ore-deposit and workings have been described in former Annual

Reports, particularly those for the years 1918 to 1931, inclusive. Further description is contained in Bulletin No. 1, 1932. During 1932 surface work was carried out and underground work mainly confined to the 100-foot level. The result of these operations has been the clarification of structure and the location of the Main vein showing good widths on the 100-foot level. Briefly summarized, the deposit is a shear-zone approximately 30 feet wide striking north-westerly and dipping, as far as can be ascertained, steeply south. In this are quartz veins and lenses of varying widths sparsely mineralized with chalcopyrite, pyrite, galena, and zinc-blende, and showing places in the upper horizon between the 50-foot level and surface, erratically distributed fine gold. Some high values have been found in the veins in this horizon and from former individual operations limited amounts of high-grade ore have been extracted. The quartz-development in the shear-zone appears to have taken the form of one main quartz-structure from 8 to over 12 feet in width and several minor quartz-structures from 2 to 4 feet in width striking at an acute angle to and, in some cases, parallel with the main quartz-structure. By some authorities the minor quartz-structures have been interpreted and aligned as one continuous vein and termed the "Sump vein." Paralleling the northerly projection of the Main

vein and offset about 40 feet, surface open-cutting has exposed a quartz-structure up to about 20 feet wide. This has generally been interpreted as a separate vein; recent developments, however, indicate that it is possibly a segment of the Main vein that has been displaced by a major fault striking N. 25° E. (mag.) and dipping 70° E.

Up to a year ago all the work on the 100-foot level was carried out on the hanging-wall or westerly side of the Main vein and was on the minor structures. During this season, however, five crosscuts to the east of these workings have intersected the Main vein on this level, showing widths of from 8 to 10 feet. These crosscuts are all to the south or on the down-throw side of the projected fault, with No. 5 crosscut east appearing to be practically along the drag of this fault. At the points of intersection the vein shows a generally disturbed and crushed condition, which characteristic is common to all the workings on both the 50- and 100-foot levels on the south side of the fault. Grab-samples from the points of intersection do not show commercial values at these intersections. However, the important feature is that the vein has been located on this level with good widths, and on account of the crosscuts being widely spaced the values at the present points of intersection give no definite criterion of what values might be in the vein between the extreme north and south crosscuts. Since the time of examination on June 18th the 100-foot level is reported to have been extended an additional 65 feet north-westerly towards the vertical projection of the northerly segment of the Main vein and two additional easterly crosscuts excavated. The fact that no vein is reported as having been intersected in No. 6 crosscut, which is about 20 feet northerly of No. 5 crosscut, strengthens the assumption of the offsetting of the Main vein by the fault projection between No. 5 and No. 6 crosscuts. A pronounced fault-structure striking north-easterly and dipping easterly is noted about 10 feet north of No. 5 crosscut. In No. 7 crosscut a small minor quartz-structure was encountered.

Further work recommended is the continuation of the 100-foot level westerly to crosscut the northerly segment of the Main vein and determine the values in it by north and south drifts from the points of intersection. It is also recommended to drift north and south on the Main vein from the points of intersection, with the crosscut continued east from the main shaft.

Grab and some channel samples taken by the management in the open-cuts on the northerly segment of the Main vein are reported to have returned values of from \$2.20 to \$58 across widths of from 1 to over 4 feet.

From the surface down to about 65 feet in the upper workings three small ore-shoots have been indicated and estimated by the management to contain 4,750 tons, valued at \$12.30 per ton, with an average width of about 6 feet. The attitude of these shoots in the vein system is not definitely known; they may rake northerly or southerly. With the good widths and definition of vein material exposed on the 100-foot level, coupled with the values existing in the vein between the 50-foot level and surface, it would seem that intensive exploration of the zone on the 100-foot level is certainly warranted in order to determine the possible continuity of the known ore-shoots to this level and the possible occurrence of other ore-shoots at this or other horizons.

In the late fall W. G. Norrie-Lowenthal made a detailed examination of this property, and recommended further work and the possible shipment of some of the high-grade ore occurring in the upper horizon. Work was suspended for a short period towards the close of the season, but will be resumed early in 1933.

Non-metallics.

Graham island contains appreciable areas of clays and clay shales, some of which appear to be good grade, of good plasticity, and probably suitable for brick and tile manufacture. The remarkably fine clay in bedded distribution in the bluffs of the Cape Ball area are mentioned in the preceding description of the east-coast beach.

The occurrence of agate pebbles of many varieties, from carnelian to an opaque and banded matrix variety of buff, brown, and black shades, is noted along the entire stretch of the beach from Cape Fife to Cape Ball. These occur in greatest abundance in the neighbourhood of semi-consolidated conglomerate-beds in the bluffs. An examination of these beds, particularly those constituting the apex of Cape Ball, indicates that the agate pebbles originate from the erosion of these conglomerate-beds in which they are seen to occur in place. It would seem that these stones could find some commercial use in the British Columbia tourist trade or possibly in the Chinese semi-precious-stone trade.

MORESBY ISLAND SECTION.

This section is thoroughly covered in former Annual Reports. In those for 1929 and 1930 and in Bulletin No. 1, 1932, its geological aspects and the opportunities for prospecting are described. Further details of promising localities for prospecting are given previously in this report.

This property consists of the *Early Bird* and is situated on Gold harbour, Mitchell inlet, Moore channel. By water, Gold harbour is 26 miles south of Skidegate point and about 54 miles from Queen Charlotte. The property is owned by J. McLellan, formerly of Queen Charlotte, whose agent is A. J. Gordon, of Skidegate. About \$20,000 worth of gold was recovered from the mining carried on as early as 1851. This was the first lode-gold mine in British Columbia.

A number of years ago the deposit was staked by the present owner, who has spasmodically carried out small-scale selective mining and some leasing on a narrow vein, with gold-recovery in a 3-stamp mill of about $\frac{1}{2}$ -ton capacity. Some nice profits for an individual are reported from these operations. In recent years assessments have been kept up on the property.

The rocks of the area embraced by the *Early Bird* consist of altered lavas of probably the Yakoun formation of middle Jurassic age. Two types of rocks occur in the vicinity of the veins. The main or bulk rock is dense-textured, slightly spherulitic, and amygdaloidal in structure and dark green in colour. In narrow reticulated structure relationship with this rock is a greenish and characteristically spherulitic rock exhibiting decided breccia and amygdaloidal structure in places. Breccia fragments of the associated dense-textured rock indicate the spherulitic rock to be intrusive into the latter. Veinlets and amygdules of calcite and quartz are a marked feature of this rock-type, the quartz amygdules in places being 3 to 6 inches in diameter. Small crystals of pyrite and some small blebs of chalcopyrite occur in the matrix. The matrix tends decidedly to what appears to be serpentine.

On the *Early Bird* the above-described rock association occupies the low-lying area. Near veins and fracturing the rocks have undergone intensive silicification and are featured by numerous small veinlets of quartz. The high ridge to the south is generally composed of a dense-textured greenish lava of andesitic type.

In the low-lying area a fracture-zone about 200 feet wide, striking north-easterly, occurs. This is evident in a series of at least seventeen fractures from $\frac{1}{2}$ to 4 or 5 inches in width, filled with quartz and calcite, that outcrops along the shore, striking generally N. 30° E. (mag.) and dipping from vertical to about 70° west. These small veins are spaced at distances apart varying from about 1 foot to about 40 feet. In one section along the immediate west side of the creek-draw six small veins or stringers are distributed across a width of 30 feet. A network of fine quartz veinlets, varying alteration and partial to, in places, comparatively complete silicification, is characteristic of the country-rock between the veins. Only limited tracing of the veins has been carried out, the bulk of this being on the vein which has been developed. This has been uncovered by intermittent stripping and open-cutting for a distance of about 400 feet, showing a variable strike and varying in width from 1 inch to about 20 inches of compounded stringers. On the high knoll about 800 feet south-westerly from the shore a network of quartz veinlets can be seen.

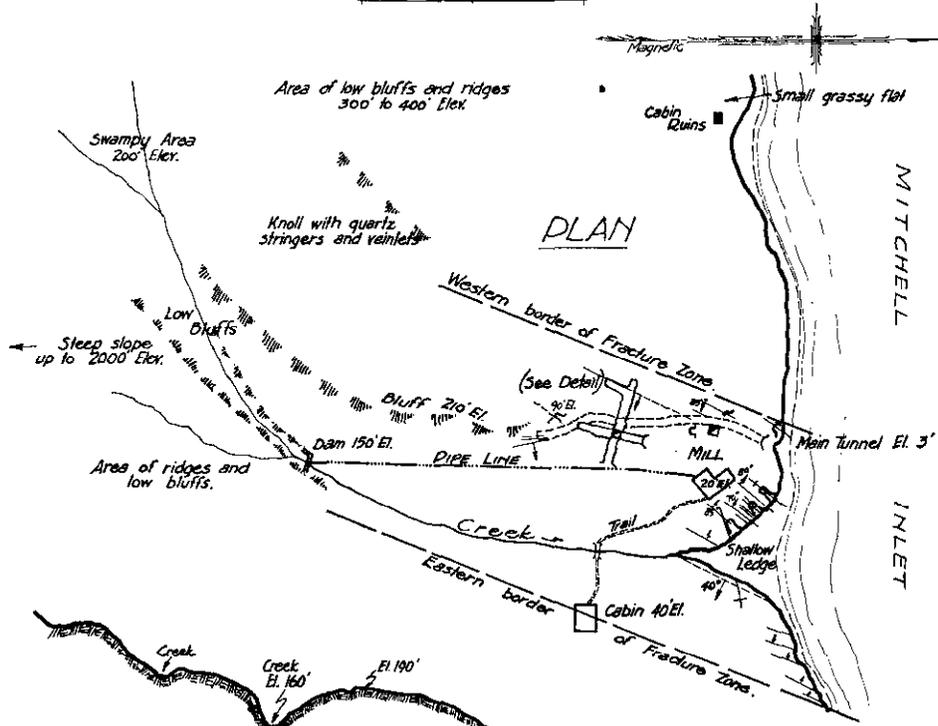
The filling of the veins consists of dense-textured milky quartz with some calcite. In sections where compounding of stringers and veinlets forms the veins, evidence of crushing and breccia-structure can be noted. The veins are generally tightly frozen to the walls, with quartz replacement gradually fading into the wall-rock. A generally sparse mineralization of fine specks of pyrite and chalcopyrite occurs in the veins in places and in the wall-rock contiguous to them. Native gold in comparatively fine and erratic distribution can be seen in places in the vein on which development has been carried out. The characteristics of the occurrence suggest classification as a fracture-zone siliceous replacement.

In 1852 the Hudson's Bay Company excavated an open-cut on one of the veins at just about high-tide mark. At what is presumed to be this point and about 3 feet above high-tide mark, the present owner has driven a tunnel 219 feet on what appears to be related veins which in places pass into the walls. General vein-widths exposed in this working vary from about 4 to 42 inches of compounded stringers. At 57 feet from the portal a winze is sunk 38 feet. This was full of fresh water and could not be examined. It is authoritatively reported, however, that from the bottom of the winze a crosscut was run 10 feet to the vein and the vein drifted on for 70 feet,

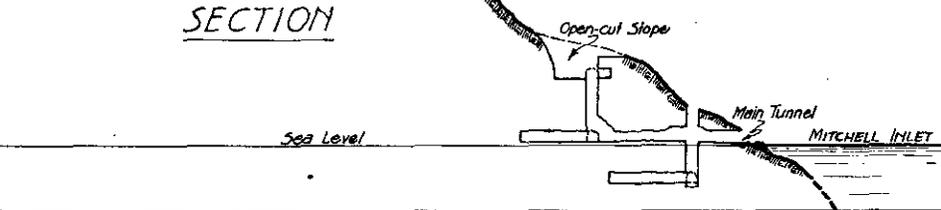
SKETCH PLAN & SECTION OF THE EARLY BIRD GROUP.

MITCHELL INLET, MORESBY ISLAND.
Queen Charlotte Mining Division of B.C.

SCALE 0 50 100 FEET

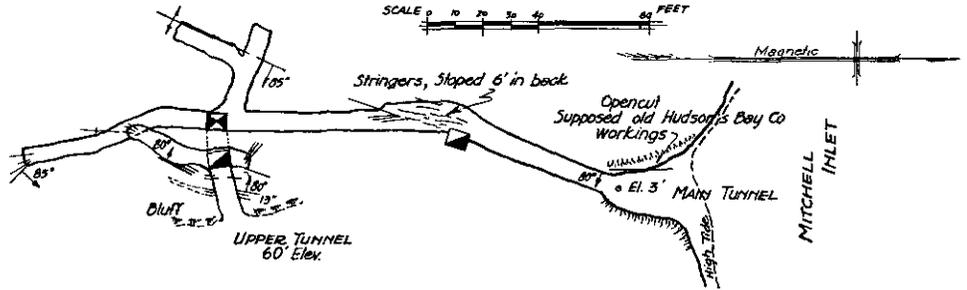


SECTION



PLAN OF TUNNEL WORKINGS

SCALE 0 10 20 30 40 50 FEET



With report of J.T.Mandy, 1932.
Resident Mining Engineer,
Prince Rupert, B.C.
B.C. Bureau of Mines.

A.M.R.

showing good values. This winze is connected with the surface by a shaft 35 feet deep to the main level. At 141 feet from the portal the main level is connected with an upper tunnel by a 50-foot raise. At this point in the main tunnel a crosscut 31 feet to west intersects at 20 feet a vein 4 to 8 inches in width of 1 inch in the face. At both winzes on the main level some limited stoping has been carried out.

At elevation 60 feet, about 150 feet southerly from the portal of the lower tunnel, a 25-foot crosscut has been driven to the vein, the vein drifted on for 44 feet, and stoped out to surface. In this working 13 inches of compound vein-structure and several small isolated stringers are intersected by the crosscut, and in the east wall of the south drift a series of quartz stringers across 3 feet is exposed. In the face of the south drift is a width of 3 to 11 inches of quartz stringers. A cross-structure 12 inches in width cuts across the face of a short north drift on this level. On surface several open-cuts have been excavated. With the exception of four along the shore, these have generally sloughed.

As would be expected, the values are quite variable. Time was not available to the Resident Engineer to carry out as complete sampling with a view to locating possible ore-shoots as was desired. However, in order to procure some evidence of values, the following samples were taken:—

(1.) Across 6 inches and a height of 5 feet of quartz stringers and veinlets $\frac{1}{8}$ to 1 inch wide, main tunnel portal, west side: Gold, 1.20 oz. per ton; silver, 0.1 oz. per ton.

(2.) Composite chip-sample, at intervals of 12 feet, of veins in main tunnel from the portal to the face (exclusive of the two inaccessible stope sections of 40' and 20' feet respectively in the regions of the winze and shaft), representing fourteen sections across vein-widths varying from 1.5 to 42 inches and averaging 12.8 inches: Gold, 0.06 oz. per ton.

(3.) Six inches quartz stringers and crushed country-rock, face main drift: Gold, *nil*; silver, *nil* (12 inches of quartz stringers in the floor on east side of this face were not sampled).

In the upper tunnel-workings the following samples were taken:—

(1.) Three to eleven inches of quartz stringers in face of south drift: Gold, 0.34 oz. per ton; silver, 0.04 oz. per ton.

(2.) Thirteen inches of stringers, north side upper tunnel crosscut: Gold, *nil*; silver, *nil*.

(3.) North drift-face, across 12 inches stringers and veinlets: Gold, 0.1 oz. per ton; silver, 0.01 oz. per ton.

Visible gold was found in many pieces of banded vein-rock lying on the dumps of the main and upper tunnels, and in a small pile lying on the floor of the old mill native gold was seen in every piece examined. Estimated from the openings of the upper tunnel-workings, the dump from these should contain about 200 tons of rock. This dump was not sampled, but, judging from specimens examined and the general characteristics of the material, it is quite possible it might contain good milling values.

Only one small vein or series of adjacent and related small veins have been but partially explored and selectively mined on this property. The workings indicate one high-grade ore-shoot of small to fair length selectively mined from the upper tunnel. In the lower or main tunnel two small shoots are indicated by the limited stope areas neighbouring the winze and raise. A possible third high-grade shoot is indicated at the tunnel portal by the old Hudson's Bay Company open-cut and the value indicated in the vein at this point. The reported values in the drift at the bottom of the winze from the main tunnel indicate the possibility of an ore-shoot also at this point. Although it would seem probable that these ore-shoots rake to the north, it is not considered that the workings have determined this definitely. Nor is it considered that the workings have delimited the extent of these ore-shoots, no matter in what direction they may rake.

It is apparent that the workings have embraced a very limited extent of even the selected portion of the fracture-zone worked. It is not considered that commercial ore possibilities on the horizon of the workings or at other horizons on this selected portion have been by any means exhausted. There is no evident reason why other areas of the 200-foot wide fracture-zone with its seventeen major fractures should not contain values and possibilities similar to those uncovered in the workings. Although small sections of some of these may have been crosscut by the main tunnel (and this is uncertain), it can be taken that the remainder of the zone is entirely unexplored.

The examination indicated that the best values occur where the veins assume a swelled and compounded structure of stringers, veinlets, and interspaced silicification, across widths of 2 to 3.5 feet, giving practical mining widths. Examination of vein material showing this structure from the dumps indicated that whereas the bulk of the visible gold (partly visible to the naked eye, but generally necessitating the use of a glass) occurs in the quartz, some also occurs in the altered and partially silicified interspaced rock. This indicates the possibility for the occurrence of an appreciable tonnage of low-grade milling-ore minable across appreciable width that should warrant definite determination.

Considered from its various indicated aspects, the property presents the following three possibilities warranting definite determination by further exploration:—

(1.) A selective small-tonnage, high-grade operation on isolated veins for individuals or a small syndicate.

(2.) A semi-selective medium-tonnage, medium-grade operation on vein combinations or zone sections.

(3.) An appreciable tonnage low-grade operation involving appreciable sections of the entire zone.

A cabin, in comparative disrepair, for three or four men is located on the property. The buildings housing the mill need considerable repair and partial rebuilding, with renewal of foundation timbers. The 3-stamp, ½-ton-capacity Fraser and Chalmers stamp-mill is in comparatively good shape for rough work. Water-power was furnished from a 15- by 30- by 3-foot dam by an 8-inch wooden pipe-line to a 3-foot Pelton water-wheel under a 100-foot head. The Pelton wheel with shafting and bearings are in good shape and the timbers sound. The complete pipe-line is in place but in need of repairs.

It is considered that this property warrants further exploration to determine the three possibilities enumerated in the body of this report, and especially the appreciable tonnage low-grade aspect cited as (3). During the course of this work possibilities (1) and (2) would also be determined. It is recommended that this be initiated by a complete, careful, and closely spaced sampling of the entire underground workings. Surface-stripping and open-cutting across the zone-width should also be carried out in conjunction with bulk-sampling of the mined material. To determine values accurately bulk-sampling should be carried out through a small pilot-mill and based on recovery and tailings assay. For this preliminary purpose the present mill could be put into shape and a Diesel engine added at small cost.

Dependent on indication from the preliminary exploration, further exploration underground by crosscutting the zone would be determined. In the event of extended operations it is possible that appreciable water-power could be developed from the stream at the head of Mitchell inlet, about 3 miles distant. The location of the property on seaboard and topographical and general conditions suggest a low-cost operation.

This property comprises the *Victoria*, *Skidegate*, *Meaford*, and *Hazelton*, and **Kootenay.** is owned by E. C. Stevens, of Skidegate. It is located on the north shore at the head of the South arm of Kootenay inlet. The property is partly a restaking of ground formerly covered by the old *Blue Mule* group and referred to under that heading in the Annual Reports for the years 1920, 1922, and 1923. In 1922 the old *Blue Mule* owners, after carrying out some stripping and open-cutting, built a 100-foot flume, a 14½-foot water-wheel with 8-foot drive-pulley, four ore-bins, suitable housing, and erected a Ross amalgamating-mill. Some gold was recovered with this equipment, but operations soon ceased.

The South arm of Kootenay harbour is a sheltered deep-water harbour about 30 miles south of the western entrance to Skidegate channel and reached by launch from Queen Charlotte. The launch trip from Queen Charlotte takes from one to two days, dependent on the state of the tide in the narrows.

An alternative route is by launch from Queen Charlotte to the head of Sewell inlet, off Selwyn inlet, a distance of 60 miles, accomplished in one day. A comfortable cabin is located at the head of Sewell inlet. George Newbavery, of Queen Charlotte, conducts an efficient and reasonably priced boat service to any point on the islands. From Sewell inlet there is a good trail to Tasoo harbour, a distance of 5 miles. From Tasoo harbour a trail of varying character and sometimes hard to locate leads to Kootenay harbour, a distance of about 9 miles. Low divides of 75 and 200 feet respectively and extensive swamps are crossed between Selwyn inlet and Tasoo and Tasoo and Kootenay.

The showings are located between elevation 450 and 800 feet and a good cabin is situated at elevation 450 feet, close to the workings, and about 1 mile by good foot-trail from the beach, where there is a poor cabin.

Gently undulating low-lying ridges to about 200 feet elevation, with swamp and muskeg declivities, border the shore-line for a breadth of about half a mile. Northerly of this the mountain-slope gradually steepens to a general slope of about 47°, with intervening bluffs to the crest of the ridge at about 2,500 feet elevation.

The frontal low-lying area is composed of vertical-standing, interbedded, dark-coloured, banded limestones and shales. Abutting on these and occupying the steep mountain-slope is a complex of greenish, probably andesitic, lavas with some purple tuff. At elevation 800 feet a fairly definite band of purple tuffaceous rocks strikes through in a north-easterly direction and is exposed in places as a prominent bluff along its contact with the southerly situated lavas. The showings are confined to the green lava-belt of about half a mile in width lying between the limestones on the south and the purple tuffs on the north. The vein-structures strike north-easterly and parallel with the green lava-belt. This fact is important in indicating favourable ground and rock-type for exploration and the location of additional veins.

The mineral occurrence consists of brecciated and reticulated quartz veins varying in width from 6 inches to over 5 feet. Between the quartz reticulations the included rock has generally been subjected to pronounced siliceous replacement. The veins are sparsely mineralized in places with pyrite and chalcopyrite, with some native gold. The gold is sometimes comparatively coarse and visible, but is generally too fine to be detected by the naked eye. From some sections of the veins where gold is not visible it can be panned from the finely crushed quartz.

Open-cutting and stripping has exposed possibly five parallel main veins striking north-east and dipping steeply south in about a 350-foot breadth of territory. These veins have been traced for distances of from 100 to 400 feet and at their extremities are covered by overburden. Between the main veins two smaller subsidiary veins 12 and 18 inches wide, with relative quartz stringers, are also exposed, but not traced.

At elevation 600 feet, near the west end of the *Meaford*, a sample representing a well-defined quartz vein 12 to 14 inches wide, with sparse specks of chalcopyrite exposed in the face of an old open-cut, assayed: Gold, 0.64 oz. per ton; silver, 0.3 oz. per ton. About 50 feet easterly from this cut, and on the east side of the creek, a sample of an outcrop of quartz with sparse specks of chalcopyrite assayed: Gold, trace; silver, trace.

At elevation 700 feet, and about 400 feet north-easterly, stripping and open-cutting exposes a width of 5.2 feet of reticulated and brecciated quartz, in which two or three fine specks of gold were visible. A chip-sample of this exposure assayed: Gold, 0.44 oz. per ton. Assays of \$39.20 and an average of \$15.20 in gold are stated by the owner to have been procured from a sampling of these exposures. At elevation 800 feet, and about 200 feet north-east of this exposure, some quartz stringers and pyritized semi-silicified sheared material outcrops in an amygdaloidal breccia close to the foot of a falls and adjacent to the contact of purple tuff. Whether or not this represents the continuation of the last exposure is not clear. These exposures line up fairly well with the vein exposed in the old open-cut at elevation 600 feet, and it is possible they are outcroppings of the same vein-structure.

From close to the upper cabin for a distance of about 300 feet north-east to elevation 560 feet a vein is stripped in six places showing a width varying from 12 inches to about 5 feet. The two large cuts at the lower or south-westerly end are the workings from which the ore was drawn for the old mill operation. In the lowest cut at elevation 450 feet a brecciated and reticular quartz-replacement vein-structure 5 feet wide is exposed, striking N. 50° E. (mag.) and dipping 85° south. A sample across 2 feet in this cut assayed: Gold, 0.22 oz. per ton. Assays of \$24 and \$26 in gold are stated by the owner to have been obtained from this cut. Free gold was not observed at this locality, but pannings from finely crushed material from the vein showed colours.

At about 200 feet easterly of this showing and at elevation 525 feet a prominent quartz-outcrop 2 to 4 feet is exposed for 100 feet along the face of a bluff. About 250 feet easterly from this and between elevations 415 and 550 feet three veins from 2 to 3 feet in width are exposed crossing a creek-bed. Continuity of these in both directions on the creek-banks is obscured by deep overburden.

It is considered that this property is decidedly worthy of intensive exploration. The north-easterly-striking belt of green lavas lying between the limestones and the purple tuffs should be intensively prospected downhill towards the limestone-contact, and also towards the north-east as far as it extends, and offers a promising area for further discoveries.

The gold values in the known veins indicated by sampling and panning and the mode of occurrence of the gold are attractive. Should appreciable shoots of pay values be found to occur, the type of mineralization suggests simple and low-cost extraction. The topographical conditions and the attitude of the known veins lend themselves to low-cost mining operations. The easy accessibility of the property is also an attractive feature, and should a permanent operation be warranted water-power could be procured from the harnessing of a river about 3 miles distant. Timber for mining and building purposes is procurable on the ground.

This group comprises the *Cumshewa Nos. 1, 2, and 3* and the *Queen Charlotte, Cumshewa*, owned by E. C. Stevens, of Skidegate. The property is a restaking of ground formerly covered by the old *Homestake* group and is situated about 5 miles west of the entrance to Cumshewa inlet, on the north side. The old workings are located at altitude 300 feet and about 1 mile from the beach. The old *Homestake* group was originally staked in 1907. About 1,200 feet of drifting, 600 feet of crosscutting, and 280 feet of raises and winzes was carried out on the *Homestake* and *Go East* veins by the Queen Charlotte Islands General Development Company, Limited, up to 1913, since when the property has been idle. These old workings are described in the Annual Report for 1913. Exceptionally high gold values were reported from the veins exposed in workings, but there are grounds to believe that on account of the samples being selected, or some other reason, these high values were entirely misleading. Nevertheless, there are points concerning the mineral occurrence on this property which are of interest as indicating that some further exploration under efficient guidance is warranted. When visited by the Resident Engineer in May, 1932, caves in the *Go East* and *Homestake* drifts prevented examination beyond 190 feet and 174 feet respectively from their junction with the main crosscut. The close and badly decayed timbers in the accessible portions of these drifts prevented an examination of the veins in the back and necessitated caution against further caving.

A gently hillock slope of about 20° extends for a mile from the beach to the main tunnel portal at altitude 300 feet. Above this the hill-slope steepens appreciably to the crest of the ridge at about 1,000 feet altitude. The first half-mile of an old wagon-road from the beach has been obliterated by logging operations. A trail through this connects with the remaining portion of the wagon-road, which needs brushing-out and culvert repair. A good trail or road could, however, be easily reconstructed to the workings.

The rocks of the locality consist of Cretaceous sandstones, conglomerates, quartzites, and agglomerates in unconformable contact with probably Triassic to middle Jurassic argillites, limestones, agglomerates, tuffs, and flows. Cumshewa head at the entrance, together with the small contiguous islands and reefs forming the easterly extremity of the north shore of the inlet, is composed of a granitic to dioritic intrusive rock of probably upper Jurassic age. This intrusive exposure occupies an area of about 3 miles square, extending from the head to about half a mile west of the old Indian village. Dark siliceous dykes are seen to be intrusive into this. The rocks immediately contacting with this intrusive to the west are bedded sandstones, quartzites, agglomerates, and tuffs which resemble and can be probably correlated with the middle Jurassic Yakoun formation. West of this for a distance of about 3 miles to the point of the lagoon and about half a mile west of the beach camp the rock-exposures along the beach are gently folded, flatly north-easterly-dipping sandstones, conglomerates, quartzites, shales, agglomerates, and some lenticular limestone areas that can probably be correlated with the upper Cretaceous coal-bearing Haida formation. In places siliceous dykes are seen to be intrusive into this. The Cretaceous rocks occupy a low-lying, gently undulating strip of about half a mile in width bordering the shore. North-easterly of this from about altitude 200 feet are the Triassic-Jurassic sediments and volcanics in which the mineral-showings occur.

The general geology indicates the Cretaceous strip bordering the shore of the immediate locality as being deposited subsequent to the major granitic intrusive, with which the ore occurrences are probably genetically associated and consequently unfavourable for the discovery of such. The higher-elevation area, however, being preintrusive in age, is favourable ground for prospecting and exploration. The contiguity of the granitic intrusive contact about 2½ miles

easterly suggests the possibility of additional discoveries with intensive prospecting and exploration in this Triassic-Jurassic belt.

The *Go East* vein is a pronounced shear along the north side of a basic dyke cutting the argillite, and closely follows the contact of pyritized argillite on the south with the volcanic rocks on the north, striking N. 45° E. (mag.) and dipping steeply north. In an outcrop about 25 feet south of the main tunnel portal what is probably this vein is exposed contiguous to the creek, showing a width of 5 feet of sheared argillite with some quartz. The creek follows approximately the contact of the argillite and volcanics. In the main tunnel-workings this vein is intersected about 40 feet southerly from the end of the main crosscut and followed by the *Go East* drift. In the 125 feet of this drift that is accessible close and badly decayed timbering prevents an examination of the back, but in the crosscut along the north side of the drift and at the caved limit it is seen to be about 5 feet wide, consisting of extremely loose gougy filling, with some fragmental country-rock and quartz stringers. This structure has the characteristics of a fault-shear. On account of the conditions in this drift no sampling was attempted.

At about 100 feet northerly from the tunnel portal and 55 feet higher elevation some stripping has been done by the present owners adjacent to a highly siliceous granitic dyke cutting tuffaceous and brecciated rocks. This exposes a width of about 8 feet of siliceous replacement with pyrite and occasional specks of galena and some branching quartz stringers. This zone strikes N. 50° E. and dips 70° south. A chip-sample of the replacement material with some pyrite assayed: Gold, *nil*; silver, *nil*. At the junction of the *Homestake* drift with the main crosscut what is probably the same replacement-structure is intersected by the *Homestake* drift, showing a width of 50 feet, with appreciable pyrite and some zinc-blende and galena. A grab chip-sample across 40 feet of this intersection assayed: Gold, 0.02 oz. per ton; silver, 0.1 oz. per ton. Although the two samples from this structure showed no commercial gold values, its character, mineralization, attitude, and possible genetical influence is considered important, either in that it may in some place contain commercial shoots or influence enrichment in other veins at or adjacent to its intersection with them. Apparently no attention was paid to it in the old workings, and in an old report the long crosscut north from the end of the main *Go East* drift is mentioned as penetrating "white porphyry" at 154 feet and continuing in this to the face. This is about where this crosscut should intersect this structure.

At elevation 350 feet a small exposure beside the creek shows two quartz veins 12 inches and 2 feet wide mineralized with some pyrite and zinc-blende, striking N. 10° W. (mag.) and dipping 85° E. A combined sample of these assayed: Gold, 0.08 oz. per ton. No tracing has been carried out on these. This is probably the vein opened up in the upper tunnel. At elevation 475 feet there is also a small exposure of a quartz vein with stringers 18 inches wide.

At elevation 375 feet the upper tunnel has been driven for 114 feet on a brecciated quartz vein 8 to 12 inches wide, striking N. 20° E. (mag.) and dipping 85° W., and crosscutting the bedding of pyritized argillite. A sample from the face of 10 to 12 inches of quartz with 14 to 16 inches of quartz and crushed pyritized argillite on the foot-wall assayed: Gold, 0.2 oz. per ton; silver, 4.2 oz. per ton. A general sample of the pyritized foot-wall argillite for the length of the tunnel assayed: Gold, trace; silver, trace. A grab chip-sample of the vein proper, 8 to 12 inches wide, exposed in the 114 feet tunnel-length assayed: Gold, 0.3 oz. per ton; silver, 5.2 oz. per ton.

In the first short crosscut south in the main tunnel, about 300 feet in from the portal and 90 feet west of the raise to the upper tunnel, 3 quartz veins with related stringers in sheared argillite and quartzose agglomerate are intersected at about 10 feet in from the main tunnel. The veins and shearing cover a width of 4.3 feet. A sample representing a width of 20 inches of quartz in this exposure assayed: Gold, 0.1 oz. per ton; silver, 1.1 oz. per ton. A grab-sample from about 1 ton of cobbled ore on the dump near the portal of the main tunnel, carrying a sparse mineralization of pyrite, galena, and zinc-blende, assayed: Gold, 0.24 oz. per ton; silver, 3.7 oz. per ton; copper, *nil*; lead, 0.2 per cent.; zinc, trace.

At elevation 525 feet and about half a mile east of these old workings an old cabin and shaft was located. The shaft is filled with water to within 25 feet of the collar. The few rock-exposures of the vicinity indicate an argillite country-rock. No workings other than the shaft were found in the vicinity. A chip-sample from a small dump of vein-matter lying close to the shaft assayed: Gold, 0.16 oz. per ton; silver, 2.2 oz. per ton. The shaft is probably located

on an old group comprising the *Black Bear, Gold Ore, King George, Gold Stake, and Eagle*, which it is understood were staked in this vicinity some years ago.

Although in the accessible parts of the old workings examined on the *Cumshewa* group no values of commercial grade were found, it is considered that the property has not been sufficiently explored. Surface-stripping and open-cutting is apparently entirely lacking. The significance of the intrusive granitic contact about $1\frac{1}{2}$ miles easterly towards the head of the inlet cannot be overlooked as a favourable influence for gold mineralization; and because appreciable gold values with minor lead, zinc, and iron-sulphide mineralization do occur in places in the veins already exposed is significant and logical verification of this influence. It is considered that further exploration of this mineral occurrence and locality is warranted.

Non-metallics.

Sections of Cretaceous sandstones occupying areas of the north-easterly quadrant of Moresby island from about Cumshewa inlet to Skidegate inlet are seen to possess interesting possibilities for good building and other stones. On the south side of Maude island there is an appreciable area of this material.

On the north side of Cumshewa inlet, and about 5 miles from the head, beds of pure and exceptionally even-grained sandstone up to several feet in thickness that should be excellently suited for the manufacture of grindstones, whetstones, oilstones, etc., were observed. These outcrop just above high-tide mark and dip inland at a flat angle.

SKEENA MINING DIVISION.

Geological characteristics and the occurrence and potentialities of ore-deposits are described in detail in the Annual Reports for 1929 and 1930, and in Bulletin No. 1, 1932, economic geological aspects and likely areas for prospecting are discussed.

COAST SECTION.

Western Copper Venture.—This property is described in previous Annual Reports. In Bulletin No. 1, 1932, a detailed description of the property is given. During 1932 it is understood a limited amount of work with a small crew was carried out.

Hunter. This group of twelve claims, formerly owned by the late C. W. Meldrum and associates, of Vancouver, is situated up the North fork of the Khutze river, about 13 miles from the head of Khutze inlet. The property has been under exploration by Vancouver interests and is described in detail in Bulletin No. 1, 1932. During 1932 it is understood that some further exploration has been carried out, the results of which are not as yet available.

Mineral Hill. This group of four Crown-granted claims is owned by C. W. Moore, of Kitimat. The cabin is at altitude 250 feet, about 5 miles up the valley of the Wedeene river, a tributary of the Kitimat river, at about 15 miles from its mouth. The property is reached in about nine hours by poling up the Kitimat river in an Indian dugout canoe to the mouth of the Wedeene and thence by trail. There is also a trapper's trail along the west side of the Kitimat river which can be used providing water conditions permit the crossing of the intervening side-streams. The type of river-boat with outboard motor in use on the Stikine and Taku rivers would be well adapted to navigating the Kitimat river.

The showing consists of a zone of contact-metamorphic lenticular deposits of magnetite in limestone altered to spessartite (manganese-aluminium garnet), and a quartzitic rock paralleling a granitic contact. Apparently there are two contiguous lens-bearing zones covering a possible width of from 400 to 500 feet striking generally N. 30° E. (mag.) to N. 60° E. (mag.) and on the claims covering a difference in elevation of from 300 to 1,750 feet. It is stated by the owner that the zones can be traced in a north-easterly direction for 2 or 3 miles.

In the zones are numerous magnetite-lenses, some small and others up to about 200 feet in length and about 44 feet in width, of practically solid magnetite. In some places pyrite and chalcopyrite are sparsely admixed with the magnetite, but this condition is not general. Two short tunnels, one at altitude 300 feet on *Mineral Hill No. 1* and the other at altitude 1,700 feet on *Mineral Hill No. 4*, have been excavated; there is also some stripping and open-cutting.

Although as a magnetite proposition the showings are imposing, the remote situation and the occurrence of other more easily accessible magnetite-deposits on seaboard would, it would seem, defer development of this deposit.

Rowe. This property of three claims, owned by C. O. Rowe, of Prince Rupert, and situated on the west slope of Noble mountain, Pitt island, about 40 miles south of Prince Rupert, is described in previous Annual Reports. During 1932 four open-cuts south of the main exposure and distributed along the strike of the vein for about 500 feet were deepened and widened. These show general widths of quartz of from $\frac{1}{2}$ to about 12 inches, with 5 feet of sheared structure in one cut and a local bulge to 8 feet of quartz in another. In these cuts some pyrite is seen in the form of sparse blebs and a few discontinuous streaks constituting a sparse distribution up to about 5 per cent. of the vein material. Sampling of these showings by one of the men carrying on this work for the owner returned high values in gold, reputedly occurring across good widths and indicating to the owner an exaggerated valuation of the showings in the cuts. An examination by the Resident Engineer showed that, as gold values in this deposit are entirely confined to the pyrite, commercial values are not exposed in these cuts. It was further ascertained that the samples were probably taken horizontally along the strike of the vein and possibly were confined to the thin seams and veinlets of pyrite, and so are not representative of the values contained in the veins at these places. This is elaborated to show the misleading nature of such sampling.

At the most northerly exposure on the vein which is described in previous Annual Reports a fair development of pyrite in a good width of vein is exposed, and quite possibly there may be a continuation of this lens, or the occurrence of others, along the northerly extension of the vein-projection from this working. This area is, however, unfortunately covered by slide-rock, but, nevertheless, it is recommended that further work in this direction in an attempt to uncover the vein be undertaken.

Copper Coin. This property is owned by Duncan Kennedy and associates, of Prince Rupert, and is situated about $1\frac{1}{2}$ miles southerly from the *Surf Point* mine on the west side of Porcher island. The showings are described in the 1930 and 1931 Annual Reports and are also referred to in Bulletin No. 1, 1932. During 1932 some stripping and pitting, about 1,000 feet westerly of the trail, uncovered a zone 15 feet wide mineralized with chalcopyrite and pyrite. Another new showing below high-water mark on the shore of the second bay east of the cabin uncovered a siliceous and feldspathic replacement-zone mineralized with pyrite and some chalcopyrite. It strikes N. 45° W. (mag.) and dips 60° E. and would be worth tracing inland. Further possible continuity of the main showing was also uncovered in an open-cut exposing an oxidized width of 9 feet about 200 feet south of the main cut. From a gold aspect the interest of this occurrence is the possible introduction of gold values into these veins and replacements when they approach the vicinity of the underlying diorite.

Surf Point. This property, situated off Welcome harbour, on the westerly slope of Porcher island, and about 25 miles south-easterly of Prince Rupert, is owned by the N. A. Timmins Corporation. In 1932 a small crew was kept active throughout the latter part of the season conducting further exploration, stripping, and hand-mining in preparation for possible production. During the course of this work eighteen veins containing lenses of gold-bearing pyrite of commercial size and grade, including several important new discoveries, have been uncovered, mapped, and appraised. The work in general has been sound and constructive and has been carried out in a highly commendable manner under the supervision of R. E. Legg. As a result of this work it has been possible to lay plans for bringing the property into production on a 20- to 25-ton daily capacity basis early in 1933. It is quite probable that actual mining will lead to extensions of the known lenses and the discovery of new ones both on surface and underground.

The type and geological factors governing this form of deposit are described in previous Annual Reports and also in Bulletin No. 1, 1932, especially from pages 34 to 37, with reference to the similar deposit on the *Hunter* group, Khutze river.

Belmont-Surf Inlet.—This property was taken over some time ago by the N. A. Timmins Corporation interests, but it is understood that no work is intended for the present.

Eddy Pass. This group of five claims is owned by F. T. Patterson, of Prince Rupert, and adjoins the *Surf Point* on the north. Several good lenses of gold-bearing pyrite in a system of quartz veins in quartz diorite similar to those exposed on the *Surf Point* have been uncovered by extensive stripping, sometimes through deep muskeg. The showings are described in previous Annual Reports and reference to the property is also included in Bulletin No. 1, 1932.

During 1932 a new discovery of high-grade gold-bearing pyrite has been stripped for a length of 200 feet. During the latter part of the season work has been undertaken in the extraction of ore by the owner for shipment or for possible treatment in a projected mill on the *Surf Point*.

Eagle. This claim, owned by T. Dawson, of Porcher island, adjoins the *Surf Point* on the west (*see* 1930 Annual Report). On the east side of a defined ravine striking N. 20° E. (mag.) quartz veins with lenses of gold-bearing pyrite cut across the portal of a tunnel with several short crosscuts which have been driven into the side of the ravine. The veins appear to occupy joint-planes striking parallel with and along the east edge of the draw, and these tunnel-workings are consequently on the east side of them. In a north-easterly drift from the end of the main crosscut a slightly sheared structure 12 to 24 inches wide with some disseminated pyrite has been followed for 150 feet in a shallow inclusion in the diorite. At the tunnel portal some pyrite-lenses occupying small, swelled vein sections were extracted. A grab-sample representing about 50 tons of this material on the dump assayed: Gold, 3.5 oz. per ton; silver, 0.9 oz. per ton.

About 100 feet south of the tunnel portal an open-cut has been excavated on a small east-west vein in quartz diorite showing about 2 inches of quartz with some pyrite. About 300 feet east of the main tunnel portal a quartzose shear with some pyrite 12 inches wide striking north-east has been stripped for about 200 feet. During 1932 work has been carried on in a new driven easterly tunnel on the east side of the draw and about 200 feet southerly of the old tunnel portal.

Wren. This group, owned by W. H. Patmore, of Prince Rupert, lies north of the *Eddy Pass*. Prospecting during 1932 was rewarded by the discovery of three veins showing shearing in places and widths of from 2 to 6 feet along distances of from 100 to 200 feet. The veins consist of quartz and crushed greenstone in what is probably a thin covering of greenstone over the underlying diorite. In places the veins are mineralized with small lenses of pyrite, chalcopyrite, and some bornite. Samples of the pure pyrite are stated to have returned values of about \$100 in gold. Extensive trenching has also been undertaken in an effort to locate a vein from which has emanated large pieces of float well mineralized with pyrite and assaying about \$40 in gold per ton.

On several other groups in this area on Porcher island, prospecting has been quite active and some interesting discoveries have been made. In connection with the prospecting of this area, those interested should consult Bulletin No. 1, 1932.

Mica Maid and Mica Boy. These claims are situated on Baker inlet, off Granville channel, about 35 miles south of Prince Rupert, and are owned by Harry Scott, of Prince Rupert. The showings consist of a vein from 1 to 5 feet in width carrying fine white mica in comparatively solid distribution. The vein is situated at about 800 feet distant from the north shore of the inlet, and at an altitude of about 600 feet, and runs parallel with the shore-line. It is reported to have been traced for a distance of about 1,000 feet. The mica is of an exceptionally white and lustrous quality and appears to be of good grade. Tests, however, carried out by the Bureau of Mines show it to contain some very finely distributed silica which, before the mica would be of commercial use in the available market, would have to be eradicated. The easy accessibility of this deposit and the comparative purity of the mica indicates that it may be worth investigation in the event of the broadening of the market for this type of material.

Sadie. This claim, owned by W. Brown, of Prince Rupert, is situated near Cloyah bay, close to the main highway and about 9 miles from Prince Rupert. During the season energetic general prospecting and some open-cutting was carried out by T. Brady and G. Reece, of Prince Rupert, on small shear-zones mineralized with some pyrite, occurring in a hybrid roof-absorption rock close to the granitic contact. Assays of the mineral contents of these zones do not show any tendency to gold or other metal values of any commercial importance.

KITSUMGALLUM LAKE SECTION.

In this area the attention of prospectors is directed to the granitic spur-contact area, the northerly margin of which cuts across Kitsumgallum lake from the west to the east side at Maroon creek. Prospecting for gold-bearing sulphides should be carried out in the marginal rocks and in the granitic rocks themselves close to the contact. In the granitic rocks attention

is particularly directed to the possible occurrence of high-grade gold-bearing pyrite lenses in quartz veins. In Bulletin No. 1, 1932, conditions for these depositions in granitic rocks are elaborated from pages 15 to 21 and also from pages 34 to 37 in the description of the *Hunter* group.

During the 1932 season activity has been mainly devoted to placer gold, with the lode-property assessments and some prospecting carried out in the Maroon Mountain area. The investigation of Maroon and Wesach creeks for placer-gold prospects is also recommended to individuals.

Placer-mining.

Douglas Creek.—This creek flows into the head of Kitsumgallum lake near Rosswood, at elevation 480 feet. It occupies a generally north-easterly-striking trough about $7\frac{1}{2}$ miles in length from elevation 480 feet to about 3,000 feet, and is fed by isolated small glaciers and several small tributaries, particularly on the south side, draining the northerly slopes of Goat mountain. The geology of the area is described in previous Annual Reports and is especially referred to in Bulletin No. 1, 1931. In 1932 activity on this creek steadily increased and at the end of the season twenty-eight individuals were working and the creek was staked practically to the head. Several new cabins were constructed and there are now between eight and ten on this creek. The bulk of the work carried out has been general prospecting, with recoveries varying from promising indications in the gravels above bed-rock to expenses or wages where sluicing is carried out on bed-rock. Heavy rains and high water hampered operations during the summer.

On some sections of the creek small remnants of old-channel ground occur on low bench and bar sections, necessitating drainage-ditch construction. In other sections the best values are found on bed-rock in the present creek-bed and necessitate the construction of wooden flumes for the fluming of the creek-water. The creek-bed and trough is generally narrow, varying from canyon confines through widths of from 100 to 300 feet in the lower area to about 1,000 feet towards the head, with some canyon sections in this area also. The shallowest ground to bed-rock is around the central section of the creek; the area around the mouth and towards the head being comparatively deep. Comparatively large and numerous boulders occur, especially in the canyon sections.

As an indication of what can be accomplished on this creek by hard, systematic, and applied work, the operation of Mr. and Mrs. Nightwine on their leases in the canyon section at altitude 1,000 feet, about 3 miles from the mouth, is an example. These leases have been operated for several years, and during the last two years clean-ups every two days have varied from about \$3 to about \$50 during the work periods, or an average of about \$14 for the two days' shovelling. The biggest nugget discovered on these leases was valued at \$10.13, and several \$1 to \$2 nuggets have been recovered. The total recovery for 1931 amounted to over \$1,000. It is estimated on this operation that two men can shovel from 2 to 3 cubic yards of gravel a day after moving and squaring away the boulders. To handle the largest boulders a geared double-handed hand-winch is used. Included in the equipment is an ingeniously constructed water-driven sawmill.

To facilitate the work appreciable trail-construction in the area was carried out by the Department of Mines.

Lode-mining.

Further prospecting and assessment-work was carried out on the *Wolf, Bear, Hawk, Old Timer, Motherlode*, and other groups on Maroon mountain and some prospecting was also done on the *Maloya*. In the 1930 Annual Report there is a detailed description of recent developments, also in the 1931 Annual Report and in Bulletin No. 1, 1932.

LAKELSE SECTION.

This section is described in detail in the 1930 Annual Report. In Bulletin No. 1, 1932, the lode-gold aspects of its economic geology are illustrated and described, with a tabulation of properties. Those interested are invited to study the introductory sections of the latter report from page 14 to page 20 and the "Classification" reference on page 21.

During 1932 further assessment-work was carried out on the Thornhill Mountain claims, some prospecting in the Williams Creek area, and investigation of marble and limestone deposits

by T. M. Turner in the Thornhill Mountain and Mink Creek areas. On the *St. Paul* group, Thornhill mountain, Michaud Bros., of Terrace, carried out considerable stripping and exposed a width of 5 feet of quartz on the Main vein. This is a gold-bearing vein of merit warranting further exploration and development.

NASS RIVER DIVISION.

This Division is described in Annual Reports from 1928 to 1931, and in Bulletin No. 1, 1932, the lode-gold aspects of the Division are elaborated.

During 1932 more attention by prospectors was given to the west side of the upper Kitsault valley, with some encouraging results. Some interest has also been evinced in prospecting for placer gold in the Cranberry River drainage area of the central Nass River section. As this section lies on the Pacific slope within the area of intense glaciation, it does not characteristically hold much promise for the occurrence of placer-gold deposits of any appreciable extent or importance. Whereas there is known to be in places a wide distribution of fine gold on the river-bars and in some places in high benches, it can be taken generally that these are not of appreciable concentration or extent, but represent a flood-gold derivative from glacial drift. On the other hand, there may occur some restricted drainage-troughs which may have been topographically protected from the generally extreme glaciation and in which small remnant deposits of placer gold may occur such as is instanced on Douglas creek. Generally, however, the area can be taken as unfavourable for the occurrence of appreciable concentrations of placer gold. The Nass river can be ascended by canoe and outboard motor for a distance of about 5 miles above the town of Aiyansh. Beyond this the upper canyon starts, and from this point on even the Indians traverse the territory by trail. Trail conditions are not good, and a journey into the area requires skilled woodcraft and experience and should not be undertaken by the inexperienced.

OBSERVATORY INLET SECTION.

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

Continuous operations have been carried on at Anyox in the *Hidden Creek* and *Bonanza* mines. At *Hidden Creek* exploration by diamond-drilling was curtailed at the end of the third quarter. Milling of about 5,000 tons a day has been maintained, which is about the same as in 1931, involving about the same crew and working twenty-eight days a month. Some exploration was carried out in the areas of No. 7 and No. 8 ore-bodies. The most important development of the year is the cutting of a fine body of ore on the 700-foot level on No. 4 ore-body. Some new ore has also come from lateral extensions of old ore-bodies and from the extraction of pillars and stope-sills. Silica is being mined from a glory-hole on the south end of No. 1 ore-body. Ore reserves have necessarily varied with the fluctuating price of copper. Ore is being pulled from the zero levels and mining has been mostly from between the 150- and 535-foot levels.

Tramming of about 275 tons of ore a day has been maintained from the *Bonanza* mine. On the south side of the creek work on the *Bonanza* ore-body has shown its extension to the south-west.

The United States copper tariff and low copper prices necessitated curtailment of the usual shipments, but metallurgical innovation has made possible the shipment of about 300 tons of high-grade gold-copper blister per month. The usual grade blister-copper is being stored, awaiting an improvement in copper price. Production shows a slight increase in copper and a slight decrease in gold and silver as compared with 1931, but with the bulk of the 1932 production not marketed.

The application of technical skill and efficiency has resulted in remarkably low costs of operation, for which great credit is due the entire staff. The record of this company in the face of extremely adverse economic conditions is a remarkable achievement and a credit to the mining industry of the Dominion. During the course of these operations one objective has been to retain in employment a maximum number of men, which has been an important factor in the alleviation of unemployment.

This group, owned by T. McRostie, of Anyox, consists of the *Sunrise*, **Homestake.** *Homestake*, and *Starlight* Crown-granted claims and the *Homestake Fraction*. The claims were staked in 1910, Crown-granted in 1914, and are situated contiguous to the shore of Granby bay and about 1½ miles southerly from Anyox wharf.

Considerable stripping has been carried out on basic dykes slightly mineralized with pyrite and occasionally some chalcopyrite, cutting the argillite formation. A selected sample of the best mineralization seen assayed: Gold, trace; silver, trace; copper, *nil*.

This group comprises the three Crown-granted claims *Red Wing*, *Red Fraction*, and *Red Jacket*, owned by interests associated with G. Bower, 320 Fifteenth Avenue West, Vancouver. The property is situated at the head of Glacier creek, about 2½ miles from its outlet into Granby bay, 1½ miles south of Bonanza creek, and about 4 miles south of the town of Anyox.

The claims were staked many years ago and in 1911 some work was done on them by the Pacific Metals Company. This consisted of a limited amount of tunnelling and three flat diamond-drill holes reported to have been located about 150 feet south-easterly and at 125 feet lower elevation. These drill-holes were not seen and no information is available concerning results from them. Judging from their described location and the structural attitude of the ore-deposit, it is quite probable they were of little use in the exploration of the main zone.

The area is extremely rugged and precipitous and the claims are not easy of access. The section is entirely denuded of green timber, and heavy talus, timber-snags, and slide-rock covers the valley-bottom and steep slopes to precipitous rock bluffs bordering the valley on both sides. It is indicated that snow and rock slides of appreciable extent are of frequent occurrence in the winter and early spring. The property can best be reached from Bonanza creek by crossing the divide to Glacier creek and following the line of least resistance. With the exception of a few logs, the old camp at elevation 1,800 feet has been entirely obliterated.

The rocks of the area consist of argillites of the Goose Bay formation of Jurassic age, so-called greenstones which are in the main metamorphosed rocks comprising mica and hornblende schists of probably Jurassic age, and intrusive into these two formations is granodiorite of the Coast Range batholith. A generally conformable contact between the argillite and the underlying greenstone parallel to the bedding of the argillite, even where steeply tilted, is a remarkable structural feature, but one or two small sections suggest the greenstones as intrusive into the argillite. The age relationship of these two rocks is consequently not definitely clarified. Numerous dykes of felsitic and lamprophyric type are intrusive into both the argillite and greenstone.

Towards the head, Glacier creek occupies the eroded apex of a comparatively gentle anticline, but at the head in the vicinity of a granitic contact the argillites display steep tilting, with the greenstone-argillite contact conforming. The geology and structure is remarkably similar to that associated with the neighbouring *Hidden Creek* ore-deposits operated by the Granby Company. As structure has proved to be a major factor controlling the *Hidden Creek* ore-bodies, with favourable conditions where folding has occurred, this feature should be given prime consideration in any exploration relative to the *Red Wing* property.

The ore occurrence consists of a replacement-body in mica-schist, mineralized with pyrite, pyrrhotite, and chalcopyrite, with some sparsely disseminated zinc-blende in places. The zone strikes N. 35° W. (mag.) and dips about 60° east, forming a prominent oxidized outcrop about 50 feet wide on the face of the steep bluff about 300 feet high on the north side of the creek at its head. Mineralization is comparatively lightly disseminated on the foot-wall side, but increases in intensity towards the hanging-wall, and in the tunnel-workings a well-mineralized zone or band about 14 feet wide containing massive sulphides in places is indicated. In places quartz stringers occur in the zone. The continuity of this replacement-zone from the top of the bluff towards the north has not been determined. That section, however, is not very easily accessible, but, nevertheless, tracing in this direction could be carried out with little difficulty and would be productive of valuable information. At its south end the zone is cut by a dyke about 10 feet wide, and only sparse mineralization is evident in the rock outcropping south, or on the down-bluff side of this dyke.

The zone occurs about 400 feet northerly of a narrow spur projection from the main granitic intrusive and about 600 feet westerly of the locally steeply tilted greenstone-argillite contact. The attitude of the zone would appear to be possibly conformable to the locally tilted structural attitude of the greenstone-argillite contact, which condition experience in the *Hidden Creek* copper-belt has shown to be favourable for the deposition of this type of ore-body.

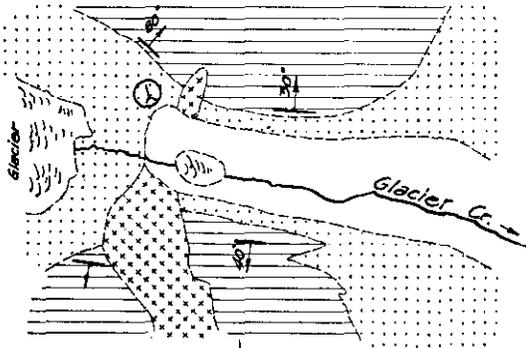
About 400 feet westerly of this zone a prominent oxidation streak in the face of the bluff suggests the possible occurrence of another similar zone of appreciable width. No work has

MAP OF THE RED WING GROUP.

Ness River Mining Division.
North-western Mineral Survey District (No.1).

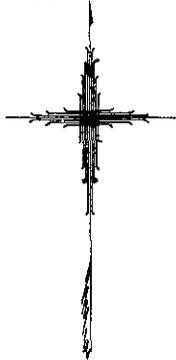
SKETCH MAP SHOWING THE LOCATION AND GEOLOGY.

Scale 0 1000' 2000 4000 Feet



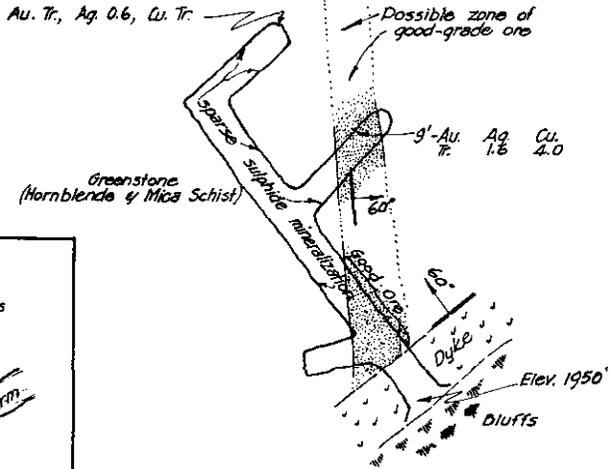
LEGEND

-  Greenstone
-  Argillite
-  Granodiorite
-  Slide Talus
-  Geological Boundary
-  Tunnel & Ore-zone
-  Argillite strike & dip



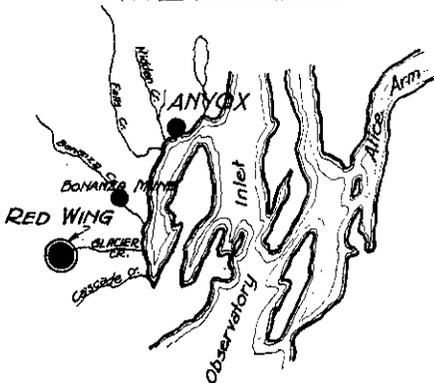
TUNNEL WORKINGS

Scale 0 10' 20' 40 Feet



KEY MAP

Scale 0 1 2 3 4 Miles



With report of J.T. Mandy, 1932.
Resident Mining Engineer,
Prince Rupert, B.C.
B.C. Bureau of Mines

been done on this, as it would appear that at the time of the previous work on these claims that section was covered by glacier which has now receded. This probable zone should also be explored.

Adjacent to the greenstone-argillite contact, about 600 feet easterly of the tunnel, a prominent area of oxidation about 200 feet wide with large cavernous openings suggestive of the leaching of massive sulphides is exposed. This was inaccessible for examination, but its appearance suggests that it may be a silicified mineralized area in the argillite carrying low copper values, such as occurs in the Hidden Creek belt, and it should consequently receive exploratory attention.

The character of the economic geology and of the ore-body that has been partially explored suggests the occurrence of replacement-zones of irregular shape and more or less conforming to the irregularities of the greenstone-argillite contact, and containing lenticular sulphide mineralization of varying intensity, such as are typified in the Hidden Creek deposits. Limitation of surface outcrop should consequently not be taken as a definitely governing criterion of depth-continuity which would be dependent on contact and plunge structural attitude. Exposed dimensions of the *Red Wing* ore-deposit are small in comparison to the *Hidden Creek* ore-bodies and further information regarding this important feature can only be achieved by further exploration.

At elevation 1,950 feet near the head of the valley a tunnel has been driven into the side of a draw in the face of the steep bluff and about 100 feet up from its foot. The tunnel is driven for about 70 feet, bearing N. 65° W. (mag), starting near the foot-wall of the zone and in the crosscutting dyke, and penetrates more and more into the foot-wall country-rock as it approaches the face. At 10 feet from the portal good sulphide mineralization, massive in places, is exposed and continues for 17 feet along the east side; 10 feet of this section should assay at least 4 per cent. copper. Beyond this the tunnel enters sparsely mineralized greenstone, in which material it continues to the face.

At 14 feet in from the portal a crosscut to the west has been driven for 10 feet, showing good mineralization for about 2 feet in from its intersection with the main crosscut, but penetrating the sparsely mineralized foot-wall country-rock from there to the face. Forty feet in from the portal a crosscut 22 feet long to the east shows generally good mineralization of pyrite, chalcopyrite, and pyrrhotite along its entire length, with about 9 feet of the central portion containing appreciable massive sulphides showing relict structure and carrying some sparsely disseminated zinc-blende. A chip-sample of this 9-foot central section assayed: Gold, trace; silver, 1.6 oz. per ton; copper, 4 per cent.

At the face of the main crosscut, a crosscut 15 feet long to the east is in the sparsely mineralized foot-wall country-rock, with, however, the mineralization appearing to increase towards the face. A chip-sample of the face of this crosscut assayed: Gold, trace; silver, 0.6 oz. per ton; copper, trace. This crosscut would have to be extended about 10 feet to penetrate the projection of the ore exposed in the first crosscut east and near the portal of the tunnel.

Geological and structural conditions are remarkably similar to those associated with the *Hidden Creek* ore-deposits and are favourable for ore-deposition. Although a lenticular and varying intensity of sulphide mineralization can be expected as characteristic of this type of ore-body, the degree and character of mineralization in the *Red Wing* exposures is attractive and certainly warrants intensive exploration to determine continuity, widths, and potential tonnage. The smelter at Anyox, about 3½ miles distant, offers a convenient outlet for ore. The construction of an aerial tramway, although entailing a comparatively high cost of construction, offers no insurmountable engineering difficulties.

KITSALUT RIVER SECTION.

The mineral-deposits and economic geologic aspects are elaborated in the 1929 and 1930 Annual Reports, and in Bulletin No. 1, 1932, the lode-gold aspects in particular are discussed. In these and previous reports detailed descriptions of the main properties will be found, with the more recent developments detailed in the 1931 Annual Report.

The prolonged stagnation in the silver, lead, and zinc markets has continued to retard and postpone development and production from the promising ore-deposits of this type existing in this section of the eastern contact margin. During 1932 some very constructive work was

carried out by Alice Arm prospectors on their claims, and more attention was paid to the possible gold possibilities of the west side of the upper Kitsault valley, with encouraging results. There are at least three or four properties in this section on which individual selective operations by leasers have a good chance for success. Such operations would not only have a good moral effect on the whole camp, but would help to further develop such properties.

Some stripping has been carried out on the *Alice* claims of the Esperanza Mines, Limited. On the *Summit* and *Wildcat* groups, stripping and tunnelling has been carried out by A. Davidson, of Alice Arm. Encouraging widths of chalcopryite ore with appreciable gold values in places have been uncovered on the *Wildcat*, and crosscutting on this property will be continued during the winter. On the *Vanguard*, stripping and open-cutting by M. Petersen, of Alice Arm, have uncovered a width of 15 feet of vein-matter with bunchy mineralization of chalcopryite, galena, pyrite, and grey copper carrying good silver values with an appreciable gold content. On the *Lucky Strike*, J. Hauber, of Alice Arm, is reported to have uncovered a width of 17 feet of vein-structure carrying from \$1.20 to \$3 in gold per ton in places in a surface crosscut. On the *Tyce* group, A. McPhail, of Alice Arm, has carried out extensive stripping and some open-cutting and thereby appreciably extended continuity, widths, and mineralization of the promising silver-lead-zinc showings on this property. On the *Last Chance*, A. McPhail has also stripped and traced a new discovery of a vein about 8 feet wide, well mineralized with chalcopryite, galena, and zinc-blende. On the *Moose* group, J. Strombeck, of Alice Arm, has advanced the lower tunnel 80 feet on a siliceous replacement-zone carrying sulphide mineralization with silver values along parallel cross-fractures, and has also discovered a small quartz vein carrying \$3 in gold per ton.

(See also Annual Report for 1927.) This group is owned by A. Davidson and partners, of Alice Arm. The ore-deposit is a replacement zone or zones which, exhibiting no particularly defined structure, seems to be confined to beds or layers of a bedded andesitic lava and tuff formation crosscut by basic dykes. It is possible that the various showings so far uncovered may be contained in different parallel lava or tuff beds striking north-westerly and dipping about 45° north, with the slope of the hill. Appreciably more surface-stripping is required and urgently recommended. In places the showings are well mineralized with disseminations, blebs, patches, and streaks of chalcopryite, accompanied by pyrite, across widths up to 5 or 6 feet that seem to be best developed along parallel cross-fractures. From the best development of ore the mineralization grades quickly into the sparsely mineralized andesitic country-rock.

In the lower tunnel, driven for 246 feet bearing S. 6° W. (mag.) at elevation 1,900 feet, some very sparsely disseminated chalcopryite occurs in places in a finely pyritized tuff for a distance of 118 feet in from the portal. At this point is a "slip" probably along a bed-plane, and from there to the face the tunnel enters dark tenacious andesite with some pyrite. West of this tunnel and at about 60 feet higher elevation an open-cut exposes good chalcopryite mineralization in streaks and disseminations across about 4 feet along vertical cross-fractures in a bedded-andesitic formation. A sample of this showing assayed: Gold, trace; silver, 1.6 oz. per ton; copper, 2.2 per cent. The main tunnel, about 200 feet above the cabin, consists of over 400 feet of drifting and crosscutting. Near the portal some streaks of chalcopryite can be seen, but in the rest of the workings only very sparse mineralization can be seen in places. The upper tunnel, situated about 70 feet east of the main tunnel and at about 75 feet higher elevation, has been driven for 19 feet bearing S. 10° E. It crosscuts patches of chalcopryite at the portal with a low-grade dissemination to the face which shows a more intensive mineralization. A sample of the face assayed: Gold, 0.2 oz. per ton; silver, 2 oz. per ton; copper, 2.1 per cent. Twenty feet southerly from this tunnel and at 20 feet higher elevation an open-cut exposes good chalcopryite mineralization across about 5 feet in a bedded formation. The showings so far uncovered have promise and warrant further systematic exploration.

PORTLAND CANAL MINING DIVISION.

The economic geologic features of this Division have been covered in previous Annual Reports, especially in 1929 and 1930, and in Bulletin No. 1, 1932, the lode-gold aspects of the Division are fully described. The feature of 1932 has been the undertaking of leasing operations by individuals on high-grade silver-showings, and in one instance on a high-grade gold-showing, and the success achieved in these operations.

During the year prospecting has been particularly active in the American Creek section and some important discoveries of high-grade silver ore have been made. It is again urged that the older areas and properties in the vicinity of the Bear and Salmon River valleys be further prospected in detail, with the promise of additional discoveries and possibly more important ones than those on which work has already been expended. In the Unuk River area a noteworthy prospecting expedition by Stewart parties was carried out with the aid of aeroplane transportation, and resulted in an important discovery of a large gold-bearing replacement-zone which further accentuates the possibilities of this section of the eastern contact belt.

GEORGIA RIVER SECTION.

(See previous Annual Reports.) A detailed description of the more recent **Georgia River Gold Mines, Ltd.** workings was also given in Bulletin No. 1, 1932. During 1932 the crosscut from the *Bullion* tunnel is reported to have intersected the South-west vein, and drifting on it north and south for distances of 180 and 130 feet respectively has been carried out. The management reports that in this work the vein varies in width from a few inches to nearly a full face and is mineralized with chalcopyrite, pyrite, galena, and zinc-blende. A sample submitted from the vein where it was first intersected, showing a width of 2 feet and carrying the typical mineralization described, assayed: Gold, 2 oz. per ton; silver, 4 oz. per ton; lead, trace; zinc, 4.4 per cent. Work ceased on the property on November 30th. It is understood work will be continued as early in 1933 as weather permits, and will be devoted to further drifting and the excavation of a raise to explore the attitude and continuity of the indicated ore-shoot towards the upper tunnel.

In this area further work was also carried out on claims adjoining the Georgia River Gold Mines, Limited, property, and also on the *Montrose* and *Monday* groups respectively, situated towards the mouth of the Georgia river and in the Bulldog Creek area, and referred to in the 1931 Annual Report.

MARMOT RIVER SECTION.

Prosperity and Porter-Idaho.—These properties are described in previous Annual Reports and more especially in that for 1930. No mining was undertaken during 1932, but repairs to the aerial-tramway towers, damaged by slides during the preceding winter months, were carried out.

The showings are described in the 1926, 1927, and 1930 Annual Reports. **Marmot Engineer Syndicate.** During 1932 George Bunn advanced the tunnel on the *Engineer Fraction* 6 feet and also carried out tracing, stripping, and open-cutting on a lead-zinc showing. On the *Engineer* claim a large open-cut showing crushed quartzose vein-matter, mineralized with chalcopyrite and pyrite, was squared up for tunnelling, which it is intended to carry out at this point in the future. A sample of ore from this locality submitted by G. Bunn, showing disseminated pyrite and pyrrhotite in a quartz gangue, assayed: Gold, 0.20 oz. per ton; silver, 2.2 oz. per ton. Another submitted sample from the lower showing mineralized with chalcopyrite and galena in a quartz gangue with some barite assayed: Gold, trace; silver, 13 oz. per ton.

BEAR RIVER SECTION.

Leasing operations have been carried out on this property by John Haahti, of Stewart, and a crew of three men. This work has been conducted from the upper tunnel at 3,688 feet and in the precipitous and dangerous terrain at 3,750 feet just below the glacier, where a small tunnel has been driven from the collar of a raise from the lower tunnel. In this tunnel a very fine showing 12 to 24 inches in width of solid galena, with much ruby silver, was exposed for a distance of 22 feet to the face and with a back of 20 feet. As this work is so close to the glacier, with continuously sloughing ice, the stopping of the ore-shoot to surface cannot be carried out without involving extreme risks. In the conduct of the work the high-grade ore was packed in sacks from the locality to the lower tunnel and the medium-grade ore dumped through the raise. At the portal of the lower tunnel necessary cobbing was undertaken and the sacked ore transported across the canyon by jig-back tram with a 700-foot span, from where it was taken down the hill by pack-train to seaboard. Two lots of 32 and 52 tons of high-grade silver ore had been shipped and about 50 tons, estimated to assay 300 oz. silver per ton, has been packed to seaboard. Due to adverse weather conditions and consequent hazard, operations closed for the season at the end of October.

**Argentine
Syndicate.**

A general description of this property is contained in the 1929, 1930, and 1931 Annual Reports. During 1932 very constructive work was carried out by Clay Porter and one assistant. This was devoted mainly to the extension of the "D" tunnel at elevation 3,720 feet across the "D" shear-zone, which shows a width of 19 feet carrying fair mineralization of silver, lead, and zinc where crosscut. "E" tunnel at elevation 3,890 feet and 500 feet south-easterly was also started and advanced 20 feet on the foot-wall side of this zone, which at this point is very much decomposed and sheared. At elevation 4,040 feet and 250 feet south-easterly of "E" tunnel an open-cut has been excavated on "D" zone showing 3.5 feet of decomposed gougy material on the hanging-wall side, 18 inches in the centre, mineralized with pyrite, zinc-blende, galena, grey copper, and stibnite, then 3 feet of siliceous argillite mineralized with pyrite, and 4 feet of sheared and highly oxidized material on the foot-wall side. Along the strike this zone occupies a well-defined gulch to elevation 4,200 feet, followed by a gradual slope for 1,000 feet to a hillock plateau at 5,000 feet. The zone appears to be contiguous to and parallel with a dioritic intrusive rock on the west side, with spurs of this rock in places projecting across the line of strike.

Open-cutting has also been carried out on a replacement-zone in dioritic rock lying 700 feet westerly of the southerly projection of "D" zone, which outcrops in places between elevation 4,100 and 4,300 feet along a distance of about 2,300 feet. An open-cut at elevation 4,100 feet on this replacement-zone shows a width of 10 feet mineralized with pyrrhotite in siliceous and semi-absorbed argillite. Another open-cut at 4,150 feet shows 8.5 feet mineralized with pyrrhotite, mispickel, stibnite, and zinc-blende.

A sample representative of the pyrrhotite phase exposed in these cuts assayed: Gold, trace; silver, trace. A sample of the mispickel phase with some pyrrhotite in these cuts assayed: Gold, 0.4 oz. per ton; silver, 1 oz. per ton.

Further tracing by open-cutting has been carried out on the easterly shear-zone, continuity of which has now been extended in a south-easterly direction along the plateau and to the edge of the bluff sloping to Glacier creek, a total distance of about 1,900 feet from "A" tunnel. Altogether the result of the work carried out is that further intensive development seems to be advisable.

(See previous Annual Reports.) The property operated by this company has **Dunwell Mines, Ltd.** been closed since 1928. During 1932 leasing operations by individuals have been undertaken on the *Sunbeam* and *Ben Ali* veins. An examination of the old *Dunwell* workings, particularly No. 3 tunnel, indicates that certain possibilities exist for the development of further ore or extensions of shoots stoped out. During 1932 part of the *Dunwell* mill machinery was shipped to the *Bralorne* in the Bridge River area, but there is still remaining sufficient equipment to form the nucleus of a small mill.

Leasing operations on the *Sunbeam* claim of the *Dunwell* property are being carried on by W. Younkin and O. McFadden from open-cuts. This work has been very commendably and intelligently conducted and shows the vein to be following a felsitic dyke striking N. 30° W. (mag.) and dipping about 60° W., with ore on both sides of the dyke up to a width of 8 feet. Mineralization consists of pyrite, some galena, mispickel, ruby silver, and, in places, native silver. The vein has a brecciated and reticulated structure, with the high-grade ore occurring in nests and lenses. The work being conducted by these lessees is of value to the *Dunwell* Company, in that it is resulting in further tracing of the vein and the indication of further ore possibilities in it. From these operations the lessees shipped 12 tons of ore in August and received the following returns: Gold, \$5.32 per ton; silver, 176.69 oz. per ton. A subsequent shipment of 15.76 tons returned values of \$4.40 gold per ton and 128.43 oz. silver per ton. From these operations it is estimated that 75 tons of second-grade ore is piled on the dump that is estimated to assay \$2.50 in gold per ton and 100 oz. silver per ton. It is also estimated that there is in sight about 20 tons of shipping-grade ore. Operations were carried on until early in December, when the heavy snowfall necessitated closing down.

Work has also been carried on under a lease on the *Ben Ali* by Pete Svedburg and C. G. Jackson. This is a quartz vein from 8 to 12 feet in width, with about 2 feet in the centre containing high gold values, occurring in a granitic rock. From open-cutting on this vein the lessees made an initial shipment of ore which returned: Gold, 1.93 oz. per ton; silver, 30 oz. per ton. Thirty tons was ready for shipment in December.

Ben Bolt Mining Co. During 1932 open-cutting, stripping, and general prospecting was carried out by W. Hobill, of Stewart, which has increased the possibilities of the main zone. This work was mainly carried out in a deep draw extending south-easterly from the *Jumbo* through the *Alice No. 2*. Five cuts were excavated along a distance of about 600 feet between elevations 2,825 and 2,930 feet, showing widths of 8 to 10 feet of brecciated quartzose vein-matter, carrying sparse mineralization of pyrite, pyrrhotite, mispickel, some galena and zinc-blende, and extending the tracing of the zone for a distance of about 1,200 feet south-easterly from the upper tunnel on the *Jumbo*.

Near the easterly boundary of the *Alice*, at elevation 3,000 feet, trenching has uncovered for 21 feet a new vein 4 to 18 inches wide, well mineralized with pyrite, pyrrhotite, zinc-blende, galena, mispickel, and some chalcopyrite, occurring near the contact of an augite-porphyrty intrusive into argillite. A representative sample of the exposure in this trench assayed: Gold, 0.12 oz. per ton; silver, 5.5 oz. per ton; copper, 0.7 per cent.; zinc, 8.7 per cent. Further trenching on the projection of this vein at elevation 3,125 feet has uncovered a width of 10 feet of quartz stringers. This vein strikes at an angle of about 40° to the main zone and should junction with its projection in the draw at about 1,000 feet south-easterly of the last trench on the main zone. The vein is well mineralized and carries interesting gold values.

L.L. and H. This group, originally owned by the Bitter Creek Mines, Limited, was staked during 1931 by J. S. Harkley, of Stewart, who carried out further exploration during that year. The property, which is described in the 1929 Annual Report, is situated at elevation 3,425 to 4,000 feet in Harkley gulch. During 1932 work in the upper tunnel and in open-cutting and stripping was continued. In the 1931-32 work the upper tunnel had been extended 60 feet and penetrates the dyke for 14 feet. The owner reports this tunnel now crosscuts a total width of about 40 feet of mineralization divided into two sections of 30 and 10 feet respectively, separated by a slightly mineralized crushed zone 20 feet in width. It is estimated that about 40 feet of dyke remains to be penetrated from the face of the tunnel to reach a mineralized zone on the other side of it. The ore of this deposit contains interesting gold values and the exposed widths of mineralization are attractive. It is recommended to examining engineers.

In this area further work was carried out on the *Lucky Date* near the head of the North fork of Bitter creek and on the *Ore Mountain* and *Little Wonder*.

AMERICAN CREEK SECTION.

(See Annual Reports for the years 1929, 1930, and 1931.) During 1932 extensive open-cutting and tracing of the vein systems was done on the *Virginia K.* and *Virginia K. Extension*, consisting of eleven claims and eight fractions on the east side of American creek. The formation in this area consists of argillites, sandy argillites, sandstones, conglomerates, tuffs, and breccias, gently folded and occurring near the boundary between the underlying Bitter Creek and the overlying Bear River series. Where the formation has not been subjected to acute folding it has a general easterly dip of from 15° to 20°. The sedimentaries in this section are generally gently, in some places acutely, folded and are intruded by tongues of a porphyritic andesite lava. Three types of ore-deposit are represented:—

- (1.) Replacement shear-zone in argillite.
- (2.) Bed-veins between interbedded sandstone, sandy argillite, and tuffs occurring near the top of the Bitter Creek series.
- (3.) Fracture-zone consisting of quartz veins and veinlets in reticulated structure.

On the replacement-zone on *Virginia K. No. 3* eight open-cuts have been excavated between elevations 3,500 and 3,740 feet, along a distance of about 1,000 feet. The zone strikes N. 50° E. (mag.) and dips 77° W., with widths exposed in the cuts of from 10 to over 20 feet of severely crushed, decomposed, and highly manganeseiferous vein-matter. In places appreciable horizons of country-rock occur in the structure. In some of the cuts seams of unoxidized ore in a quartz gangue carrying a mineralization of galena, zinc-blende, and pyrite can be seen. As sampling of the oxidized portions of the structure would give no information regarding values that might be contained in the sulphide ore, this was not sampled. However, representative samples of the exposed unoxidized ore were taken, and assayed as follows:—

No. 1 cut: Gold, trace; silver, 3 oz. per ton; lead, *nil*; zinc, 4.1 per cent.

No. 4 cut, elevation 3,640 feet: Gold, trace; silver, 2 oz. per ton; lead, *nil*; zinc, 11.8 per cent.

Slightly westerly of the replacement-zone on *Virginia K. No. 5*, open-cuts have been excavated on bed-veins, exposing widths of from 3 to 4 feet of highly oxidized vein-matter striking N. 50° W. (mag.) and dipping about 15° E., conformable to the formation. It would seem fairly certain that these structures do not represent, as they were formerly thought to, the continuation of the replacement-zone, but are entirely unassociated from this structure. They occur in what appears to be a gradation of sedimentary and tuffaceous rocks on the border between the Bitter Creek and Bear River series.

Near the south-east corner of *Virginia K. Extension No. 2* some work has been done on a fracture-zone or small stockwork about 20 feet in width occurring in tuff. This consists of quartz stringers from ½ to 1 inch in width, fairly well mineralized with pyrite, galena, chalcopryite, and some zinc-blende.

**North-western
Aerial Pros-
pectors, Ltd.**

This company controls a group of fifteen claims situated about 4 miles north of American Creek glacier, on the west side of American creek and about 17 miles from the end of the Bear River road. The first discoveries are described in the 1931 Annual Report. During 1932 open-cutting and stripping is reported to have resulted in the discovery of a small vein on the *Moonlight*, from which assays of 1,501.68 oz. and 434.06 oz. silver per ton are reported from selected samples of a black sulphide and a black oxide respectively. It is planned to extract some of this high-grade ore in the 1933 season for shipment. The main *Moonlight* showing has been stripped an additional 80 feet and the vein reported to show a width of 14 feet, from which samples of 4 to 18 inches of the hanging-wall side are reported to assay from 224.73 to 244.4 oz. silver per ton, and a selected sample of grey copper 1,450 oz. silver per ton. A good grade of silver-lead-zinc ore across widths of from 2 to 10 feet is also reported from four new cuts on the *Northern No. 7* claim.

Edith.

This group is owned by K. McLeod, of Stewart, and adjoins the North-western Aerial Prospectors' property on the west. During 1932 the owner carried out intensive prospecting and uncovered a promising showing, from which a submitted sample assayed: Gold, 0.1 oz. per ton; silver, 120 oz. per ton; copper, 1.2 per cent.; lead, 12.6 per cent.; zinc, 19.2 per cent. The trail was extended into this area with assistance from the Department of Mines. The head of American creek can now be reached with pack-horses from the end of the Bear River road.

SALMON RIVER SECTION.

This company has continued in active operation on about the same basis of production as in 1931. Diamond-drilling exploration of the foot-wall side of **Premier Gold Mining Co., Ltd.** the north-east zone between No. 2 and No. 3 levels has been continued. Drilling on No. 6 level located a structure indicating a commercial grade of ore, but the exploration of this by crosscutting to the west and drifting is reported to have been disappointing, with no commercial ore located. On the aerial tramway, tower-repair, cable replacement, and maintenance-work has been carried out. Plans have also been formulated for the discontinuance of direct shipments of crude ore to the smelter and the consequent milling of the entire output at the mine. This is a natural outcome of the gradually decreasing grade of the ore as development on this ore occurrence proceeds at the lower levels. Considering the low price of silver, the year has been a fairly good one, with the profits probably about equal to those of the preceding year and broken ore reserves comparatively well sustained. Tonnage to the mill has been kept up at about the rate of 450 tons a day.

This property is described in the 1930 Annual Report and is also referred to in Bulletin No. 1, 1932. During 1932 further prospecting was carried out by Ted Morris, of Stewart, who reports several new discoveries carrying from \$2 to \$16 in gold per ton across widths of from 4 to 8 feet. It is understood that these discoveries have been made in the areas both north and south of the original showings.

Unicorn.

This property is described in former Annual Reports. John Hovland, with one miner, worked throughout 1932. Surface-trenching on the east-west structures has exposed appreciable widths of silicification carrying values up to \$4 in gold per ton, with specks of free gold showing in a few places. Crosscutting to the west from No. 3 tunnel to explore these structures is proceeding.

The surface work undertaken during this season has done much to clarify the structural conditions pertaining on the *Unicorn*, particularly those relative to the east-west cross-structures, and will greatly facilitate the exploration of these in the underground work. A new tunnel, No. 4, started on "E" vein at an elevation of about 250 feet above No. 3 tunnel, was advanced about 40 feet and exposes a vein about 18 inches in width mineralized with pyrite, zinc-blende, galena, and a little chalcopyrite. Visible native gold is also reported to have been found.

In the latter part of the season crosscutting to the west, off No. 3 tunnel, was continuing. Three hundred and seventy feet north of the portal the west crosscut had been extended 15 feet, embracing a total of 50 feet and exposing a siliceous replacement-zone with many quartz stringers in porphyry, and carrying a fair mineralization of pyrite, sphalerite, and galena. It is reported that fine specks of visible gold have also been found in the quartz stringers in this crosscut. Generally, the work on this property has been quite encouraging, and further surface exploration of the cross-fracture area and a continuance of the exploration of the "Unity" or main north-south zone is planned.

Big Missouri.—This property and its ore occurrence is described in detail in former Annual Reports. During 1932 no operations were carried out.

UNUK RIVER SECTION.

A detailed citation of all the available information concerning this area is contained in the 1929 Annual Report. It is also referred to in the 1930 and 1931 Annual Reports. During 1932 a very creditable prospecting expedition into this area with the aid of aeroplane transportation was undertaken by T. S. MacKay, A. H. Melville, and W. A. Prout, of Premier. Through the courtesy of these men details of this expedition, the area covered by them, and a geological map embracing this area have been made available to the Department of Mines. The prospecting resulted in the discovery of a large pyritized quartz replacement-zone carrying encouraging gold values in places and warranting further detailed exploration. For the information of those who might wish to avail themselves of aeroplane transportation into this section, the MacKay expedition has definitely established the fact that aeroplanes can land on and take off from a lake $3\frac{1}{2}$ miles long and $\frac{1}{2}$ mile wide, situated near the headwaters of Sulphurets creek on the west side at altitude 3,600 feet. Climatic conditions are reported as approximately the same as in the Portland Canal section.

Some prospecting for placer gold was also carried out on Sulphurets creek and the South fork by T. J. MacQuillan, of Ketchikan. On Sulphurets creek these prospectors report old-timers' workings and also the discovery of some coarse gold. At the junction of Sulphur and Sulphurets creeks a cable crossing with a span of 185 feet was erected. These men have also constructed cabins at the cable crossing Glacier creek and the boundary and have brushed out the trail to the boundary and along Sulphurets creek. During the season the Alaskan Forest Service carried out a road and trail reconnaissance to the boundary.

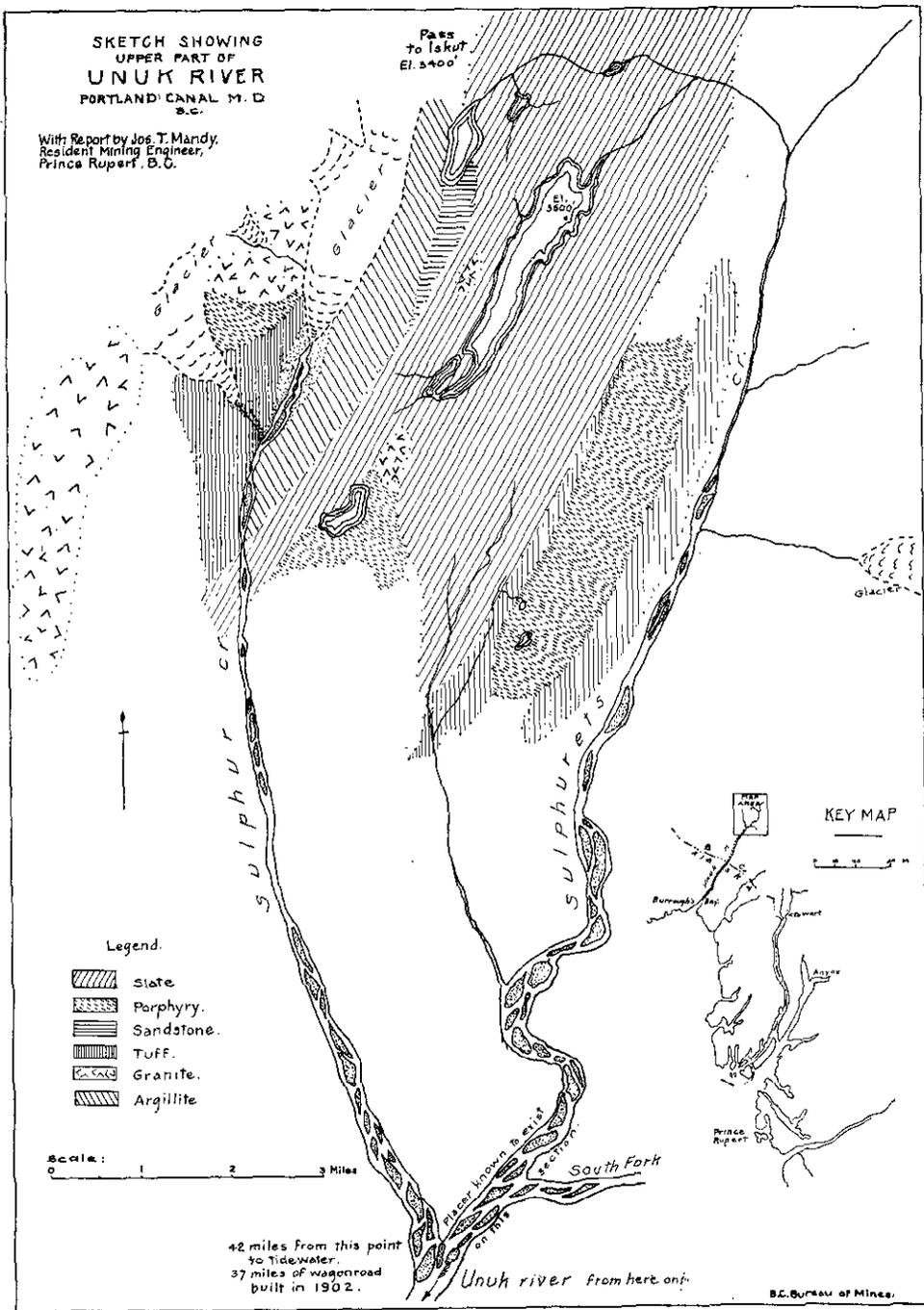
STIKINE MINING DIVISION.

LODE-MINING.

Further work consisting of general prospecting, stripping, and open-cutting was carried out on the *Lucky Strike*, *Jackson*, and *Lady Jane* groups in the Chutine River area, and on the *Peach* and *Apricot* on Devils Elbow mountain. In the Ealue Lake area J. G. Hope, of Telegraph Creek, has further prospected the copper-bearing zone on the *Klapan* group. These groups are all described in the 1929, 1930, and 1931 Annual Reports and in Bulletin No. 1, 1932.

PLACER-MINING.

Barrington Leases.—These leases are situated on Barrington river, about 12 miles by wagon-road from the Stikine river. During 1932 the dredge installed in the preceding year was put into operation. It was soon discovered that boulder conditions were more acute than had been expected and operations ceased after about thirty days' digging with no recovery. In all, an area about 200 feet long and 80 feet wide, with the end about 13 feet down, was dug. This more or less obsolete dredge design was not adapted to efficiently dig this type of ground. It would seem that this ground could be efficiently dug by a modern close-connected bucket-line such as is successfully used in Yukon and Alaskan operations.



Individual Workings.—Seven individuals carried on rocking and sluicing in the lower section of Barrington river and were making recoveries of from \$2 to \$6 a day. The ground worked consists of about 12 inches of gravel occurring above a clay bed-rock along the banks of the river and down to which the river has cut its channel. In some patches this can be easily worked with up to a maximum of about 4 feet of stripping along a narrow strip of the bank. At low water shallow bars on this clay bed-rock form good "sniping" ground. This condition should be found in places for a considerable distance up Barrington river, offering very likely "sniping" ground.

LIARD MINING DIVISION.

Placer-gold operations constituted the bulk of the activity and showed a reported output of 357 oz. of gold, a decrease from that recorded in 1931, with the main activity on Gold Pan, Dease, and Mosquito creeks, and in the Little Muddy and McDame Creek areas.

Many inquiries for likely placer areas in this Division have been received by this office. As has been stressed in former reports, it is considered that the lava-buried gravels occurring along the banks of the Stikine river in the region around Telegraph creek warrant investigation. Some of the depression and trough areas on the east side of Dease lake should also be explored.

Considering the extensive area of auriferous country in the Cassiar region, it would appear that, apart from the immediate vicinity of the well-known productive creeks, the country has been very imperfectly prospected and that a great part of the area has been merely run over in search of rich diggings. It is not improbable that additional rich creeks may be discovered elsewhere. It can also be concluded that there should be appreciable areas of low-grade deposits that should pay to work and return wages or better. The country is far more easily accessible now than it was at the time of the rich discoveries by the old-timers, and values that at that time may not have been considered interesting under conditions prevailing then could be viewed in an entirely different light under present conditions.

For prospecting the area of the Dease river, headquarters could be established at McDame's Post, where supplies can be readily had. From this point a large area of promising territory could be easily reached by river or trail. Likely sections include the McDame Creek area, Spring creek and tributaries, about 25 miles below McDame's Post, and French creek, about 25 miles below Spring creek. In the Spring-French Creek section, Rosella, Patterson, and Dennis creeks are mentioned in an old report by J. M. Dawson as having yielded about \$6 a day to old-timers prospecting that section in the early eighties. The headwaters area and many side-creeks of the Muddy and Little Muddy rivers are also recommended. In the Annual Report for 1931 a detailed description of the Dease River area as far as McDame creek and also of McDame creek will be found.

As an appreciable quantity of the placer gold of the area has undoubtedly resulted from the erosion of gold-bearing quartz veins, it is suggested that this phase should not be overlooked by any one prospecting in that area.

(See former Annual Reports.) This company continued hydraulicking on Dease creek and recovered 173 oz. of gold during the 1932 season. The clean-up was disappointing and the work was closed down on October 10th. Whether values that can be recovered at a profit actually exist in the ground being worked by the Cassiar Hydraulic Mines, Limited, is not definitely known, as the work was undertaken on the strength of what was known of the ground from old-timers' workings. If, however, values occur such as were indicated in neighbouring ground, and the clay layers do not offer too much resistance to hydraulicking, it is possible that with the large amount of ground of this type which is probably available a profit might be derived from the operation. The property is well equipped with a sawmill, good camp accommodation, and extensive ditching for water-supply, and operating costs are estimated at about 9 cents per cubic yard of gravel moved.

The Mosquito Creek Hydraulic Association continued operations during 1932 under the direction of J. R. Gibson and J. H. Searfoss, of Seattle. During 1932 work was confined to ground-sluicing. The first reef which crossed the channel just ahead of the old Adsit tunnel has been passed through and bed-rock cleaned to beyond the end of the tunnel, with some gold-recovery. At this point, however, it is reported that another reef shows up with a very uneven bed-rock and a narrow gut through it just below the sawmill. Topographical correlation would indicate that this is

probably the end of the canyon which features the lower area of Mosquito creek down to its junction with Thibert creek. The drill-holes on which these operations are based are located beyond this second reef. During the season 51 oz. of gold was recovered from ground-slucing and the cleaning of bed-rock with an 8-inch hose.

GOLD PAN CREEK.

A. M. Vickary has continued his work on Gold Pan creek more intensively and recovered about 80 oz. of gold. Several others worked on this creek, all making some gold-recovery.

LITTLE MUDDY RIVER.

In this section Messrs. Faulkner, Blick, and several others have been quite active in preparatory work, with some gold-recovery on a new discovery made towards the end of 1931. During the winter of 1931-32 pipe was hauled in from Dease lake with dogs and a hydraulicking operation started on a small scale during the 1932 season. On the strength of this discovery several individuals went into this territory to prospect, and it is understood that additional showings have been discovered.

MCDAME CREEK.

A detailed description of this creek is contained in the 1931 Annual Report. During 1932 exploratory work was continued on several leases. This included work on the *Viking* lease by Frank Crawford, of McDame, and on the *Centreville Hydraulic*, *Princess Edith*, and *Buccaneer* by G. A. Brown and associates, of Victoria. The results reported from this work do not as yet show anything conclusive, but would seem to be sufficiently encouraging to warrant further exploration.

On the *Viking* lease one shaft was sunk 37 feet and cut into an old tunnel. Another shaft penetrated glacial clay for 12 feet, where water prevented its further sinking. On the *Princess Edith* lease three shallow pits were excavated to water.

On the *Centreville Hydraulic* lease nine shafts of from 6 to 19 feet in depth were excavated. Bed-rock was struck in one shaft at 19 feet and fair values reported. Fifty-four cubic yards of muck from the 1931 tunnel-work was sluiced and is reported to have returned \$9, including one 89-cent nugget. One open-cut was excavated 4½ feet to bed-rock and some values recovered. On this lease three shafts were also sunk on the third bench to depths of from 12 to 16 feet, but water came in in each case. On the left bank below the canyon, at a point where the probable high old channel is indicated as crossing to the right bank, 300 cubic yards of muck was excavated but not sluiced. Several other pits were also excavated on this lease, a total of twenty-one.

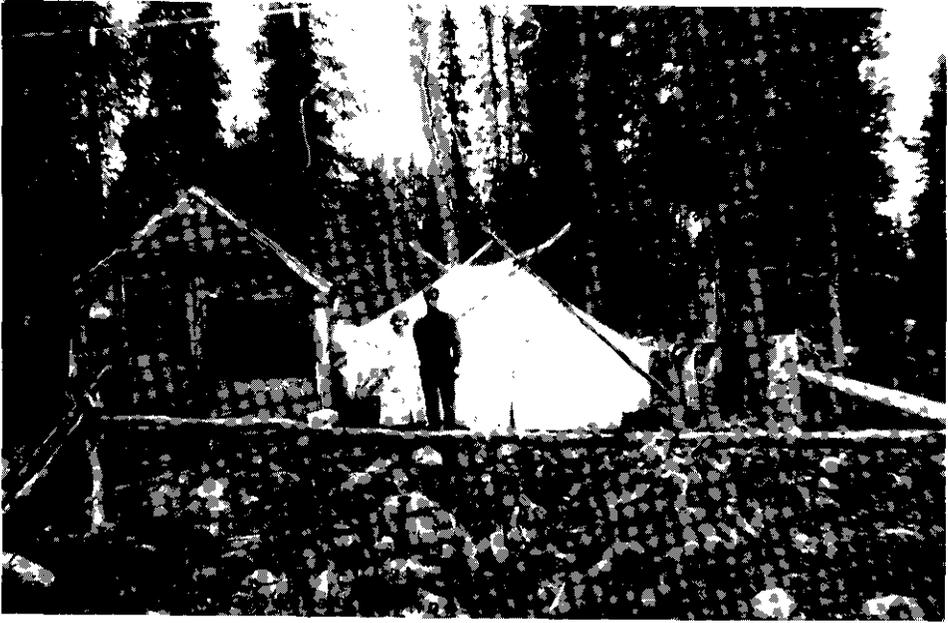
Quartz Creek.—David Wing, who owns three creek leases and a bench lease in this area, carried on construction-work.

ATLIN MINING DIVISION.

Activity in both lode and placer operations has been pronounced and much progress achieved. There is here a very extensive area of likely virgin territory with lode-gold and base-metal potentialities. The use of the aeroplane has greatly improved transportation. In Bulletin No. 1, 1932, the lode-gold possibilities are described in detail, illustrated, and tabulated. In the body of the present report further information is given regarding the older areas of the Division and likely new areas.

TAKU RIVER SECTION.

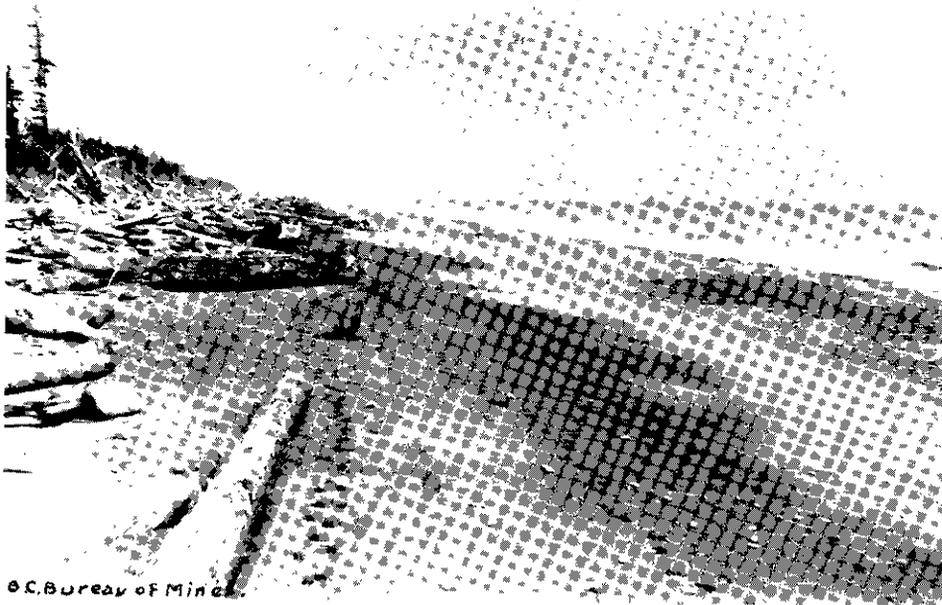
This group is described in the 1929, 1930, and 1931 Annual Reports; Bulletin No. 1, 1930, "Taku River Area"; and Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia." During 1932 active operations were carried on by the N. A. Timmins Corporation, of Montreal, under the supervision of R. E. Legg. This work resulted in the discovery of several new showings, some of them quite wide, well mineralized, and carrying good gold values on surface. These conditions, however, showed a strong tendency to depreciation with depth, which condition was also evident in the diamond-drilling carried out during the previous season. The whole condition indicates the occurrence of lenticularly distributed gold values in extremely erratic and restricted replacement-zones. Were this deposit more easily accessible it is quite possible that on account of the number of lenses that have been discovered some profitable mining could be carried out.



Squaw Creek, Atlin—Deputy Mining Recorder's Office.

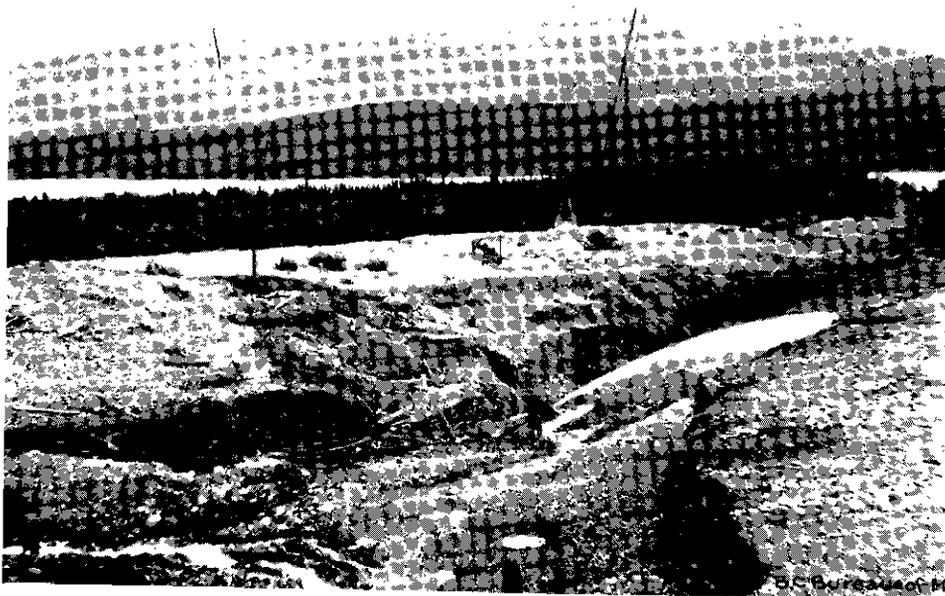


Squaw Creek, Atlin—Canyon on Lower Section.



U.S. Bureau of Mines

Beach Places, East Coast of Graham Island.



Boulder Creek, Atlin. Note Aerial Boulder Conveyor above Monitor.

Through failure of the owners to grant an extension of time, the option held by the N. A. Timmins Corporation was dropped and operations ceased at the end of August. At the close of the year, however, it was reported that the Alaska-Juneau Gold Mining Company had procured an option and intended to carry out some further exploration.

Smith, Wilms, Bacon, and McDougall.—The Alaska-Juneau Gold Mining Company carried out extensive exploratory stripping and open-cutting on these groups. These operations are reported as being in some instances encouraging, but as yet are not conclusive and the company intends to continue with similar work during the 1933 season. The occurrences on these groups are similar to those on the *Whitewater* group.

ATLIN LAKE SECTION.

Engineer. During the season some selective mining was undertaken in the known rich areas of the small veins on this property by Reginald Brooks and some gold was extracted. This property is described in former Annual Reports and referred to in Bulletin No. 1, 1932, on page 24, under "Belt (D), Sub-belt (1)." In this it is stressed that the possibility of a mill-grade ore potentiality of this property from the large replaced shear-zones known to occur on the ground remains to be proved and has not yet been adequately explored.

(Refer to former Annual Reports.) This property is now being operated by **Atlin Ruffner Lead-Silver Mines, Ltd.** Buffalo interests. During 1932 No. 2 vein was intersected by the low-level crosscut and was drifted on for about 330 feet to the west and about 350 feet to the east, with several crosscuts across the vein in each drift showing widths of from 12 to 15 feet and 12 to 20 feet respectively, with lead-zinc mineralization in places. From this intersection the main crosscut was continued for an additional distance of about 1,200 feet, intersecting several minor structures, and three diamond-drill holes were put in from the face.

These drill-holes were aligned as follows: (1) Horizontal hole aligned with the tunnel on a bearing of S. 83° E. (mag.) for 500 feet; (2) horizontal hole to the right of the tunnel bearing S. 52° E. (mag.) for 1,500 feet; (3) hole aligned with the tunnel bearing S. 83° E. (mag.) at minus 50° for 500 feet. The results of these holes are not available.

PLACER-MINING.

The Atlin Division produced, during 1932, 8,040 oz. of gold valued at \$136,680, as compared with 8,384 oz. of gold valued at \$142,528 for 1931. Placer operations by company interests and individuals have been exceptionally active in this Division, and increasing interest is evinced not only in the presently worked creeks in the older areas, but is spreading to virgin territory. Engineers representing large interests have been active in this field and numerous inquiries from operators in distant fields augur a sound future expansion.

In connection with the Atlin area it can be said that mining in the past has been mainly devoted to exceptionally high-grade gravels, and the introduction of some system for treating low-grade gravels will not only greatly increase gold production, but will bring within the scope of mining much ground that has been left unproductive.

At the time of examination of this area in August some litigation on one of the main drifting operations on Spruce creek and a sectional depreciation of values on two of the main drift operations on Ruby creek was temporarily affecting production. However, with the generally good results being encountered on the main operations elsewhere and the increased activity of individuals, it is seen that these conditions have not materially affected production from the section.

O'Donnel River.

Prospecting in this area has been very active and many new leases have been taken up and several new operations started. Nathan Murphy (assisted by Mrs. Murphy) and Melvin Beckman have continued active drifting on their bench lease. At the time of examination a wide heading bearing N. 18° W. (mag.) on flat bed-rock was being excavated. It is understood the ground being worked was returning \$2.50 in gold to the car or about \$5 to the yard. An appreciable area of this type of ground had been blocked out on four sides and an additional area ahead of the workings was in process of being blocked.

Marco Pini and six men, working on a "lay" on a portion of Nathan Murphy's ground in the low area adjacent to the river, were sinking a shaft to reach bed-rock. At the time of examination a depth of 22 feet had been achieved and a pump was being installed to handle the water. It is expected that an additional 10 feet of sinking would reach bed-rock. This outfit was also engaged in driving a tunnel bearing N. 78° W. (mag.) on bed-rock on the right bank of the O'Donnell river above and adjoining Nathan Murphy's work. The tunnel had advanced a few feet into the bank and preparations for sluicing were under way.

Tom Prpich, working above Murphy's ground, drove a tunnel for 142 feet in the bed-rock exposed on the right bank, but at this distance had not reached gravel. From the end of this tunnel a raise for 13 feet entered gravel at about the level of an upper old tunnel. This work indicates that the top of the raise is on the rim-slope of the old channel and that the lower tunnel will have to be advanced a considerable distance before it will enter bed-rock gravels of the channel.

Marco Viola and partners, working on a "lay" on a portion of the Prpich ground, were facing-up a tunnel into the bank at the bottom of the bluff and about 200 feet north of Prpich's tunnel. It is intended to continue this to cut through rim into the bed-rock gravel. These operators were also shovelling on hard-pan in a pit about 6 feet deep on the river-level and recovering some gold.

On Carvel creek Creighton Elliott and Ed. Drexler have been carrying out prospecting on old bar ground along the left bank. In this area the ground is shallow, there being about 5 feet of gravel to bed-rock, and in some sections there are signs of old-timers' workings. An examination of the territory showed several old bars in shallow ground that would offer likely ground for individuals, and on the left bank at the canyon, at about 200 feet below the Elliott and Drexler workings, there is a possible stretch of old channel about 200 feet long that should be prospected by cutting into it from the creek.

On Bull creek four leases have been taken up by Portland interests. Below these leases wages are being made by an individual, stripping the rim of the trough and chuting the dirt down to the creek for sluicing.

McKee Creek.

Good clean-ups have been made on this creek by George Adams. Cutting into the right bank of this creek has practically proved that the old channel is located under this bank running parallel with the present creek-bed. The superficial attitude of rim-rock exposed in the initial work carried out by Mr. Adams certainly indicated the possibility that this channel extends up-stream about three-quarters of a mile above the bridge. At a point just below the pressure-box at about 300 feet below the junction of Eldorado creek with McKee creek, an exposure of rim-rock further strengthens this conclusion and indicates that at this point the old channel lies on the north side of this rim and swings at about N. 20° E. (mag.) in approximate conformity with the swing of McKee creek above Eldorado. Up-stream from this point it may be possible that the old channel swings back into the present site of McKee creek, which condition would account for the presence of good gold values recovered from the present bed of the creek in the lower area.

The superficial attitude of rim-rock indicates a strip of about 2 miles accessible to the present installation, in which the old channel is indicated as being buried beneath the debris covering the right or north bank. It would seem that gold recovered from earlier operations on the south side in this area of the creek originated from a slop-over from the main old channel from the north side, or possibly from gold carried down from farther up where the main old channel may have crossed or come into contiguity with the present creek.

At the time of the examination in August the rim-rock conditions exposed in both pits practically confirmed the location of the old channel on the north side. In the lower pit rim-rock was exposed striking about N. 40° E. and dipping about 5° W.; lying above this was 12 feet of river-wash which looked likely for "pay," and above this about 140 feet of glacial debris, composed of fine sand and gravel with some lenses of interglacial wash-gravel which might contain some values.

In the upper cut, located about 1,200 feet up-stream from the lower, rim-rock was exposed striking about N. 50° E. and dipping 8° W. Lying above this was 12 feet of stratified coarse gravel, then 10 feet of stratified fine gravel, then about 100 feet of glacial sand and gravel. The lower layers and gravel-wash looked very likely for pay values.

The conditions exposed during 1932 are encouraging. The loose character of the overburden is such that it should be quickly and cheaply stripped with a high-duty per miner's inch of water. It is planned to devote an entire season to stripping off the overburden; with the character of this material this should give three or four seasons of straight sluicing of pay-dirt at a general cost of 9 cents per cubic yard of dirt moved. Of this it is estimated that $\frac{1}{4}$ cent would be on account of overburden-stripping. During the present operation piping alternates in each pit with the blasting of bed rock, necessitated by its soft nature and its tendency to hold gold. A crew of fourteen men is employed in two shifts.

Spruce Creek.

On this creek several new leases have been taken up by outside company interests and by local individuals. In the vicinity of Little Spruce creek several individuals are attempting to reach the old channel, which strikes in behind high rim exposed in the bend of the creek. Judging from the attitude of this exposed rim, it would seem that the old channel, deeply buried by glacial debris, strikes through the high bench of the left bank several hundred feet southerly of the exposed rim and forms an approximate triangle with the present bed of the creek. The south-easterly end probably emerges into alignment with the present bed of Spruce creek and the north-westerly end emerges at approximately the site of the old hydraulic pit.

At the north-westerly end of this triangular section D. K. Faulkner, who owns one bench lease and seven creek claims, has been carrying on drifting and crosscutting, recovering approximately \$2 a day from the gravels on rim or above bed-rock. The tunnel portal is about 20 feet above the creek-level and the workings gradually angle across on the north rim towards the centre line of the channel, with the intention of picking up bed-rock. Work has been carried on in two faces, a south drift bearing S. 20° E. (mag.) and the north drift bearing S. 60° E. (mag.). These workings show 6 to 7 feet of gravel under glacial clay. The back of glacial debris above the face of the south drift would be about 250 feet to surface.

At about 120 feet from the south-easterly end of the exposed rim-rock beyond the bend of the creek, C. McKinnon is driving a crosscut tunnel towards the projection of the old channel in the area of its convergence towards the present bed of Spruce creek. At the time of examination this tunnel had advanced 50 feet. Morris Bride has been shovelling tailings from Spruce creek and making fair recoveries. John Tintinger, operating on the *Gladstone* bench lease, has been driving a drainage-tunnel.

James Nedved is driving a tunnel to connect with a shaft on the left bank. The shaft, which is about 44 feet deep, will be used for hoisting, and tramping will be carried out through the tunnel. At the time of examination the crosscut had about 4 feet farther to go to connect with the shaft. When this is completed the shaft will be continued to bed-rock. Below this ground are two claims which are not being worked. It would appear that in this section the old channel follows the low ground of the left bank close to the creek and converges with the creek in the vicinity of McKinnon's operation.

Stephen Elieff and two partners are working on a "lay" of 600 feet acquired from I. Matthews. This work is mainly on the *Ajax* lease, which adjoins the *Poker* lease, on which extensive previous work has been carried out. The operation embodies careful square-setting and cribbing of extensive old and caved workings that have to be penetrated, and is being carried out very expertly by Elieff. At the time of examination a drive heading N. 75° E. (mag.) was being excavated. The face of this drive was 4 feet into rim-rock, with 2 feet of gravel on top, with the rim dipping about 10° towards S. 65° E. (mag.). At the time of examination sections of the ground were stated to run about 2 oz. of gold to the set, and about 30 oz. had so far been recovered. The tunnel had advanced about 300 feet, of which 100 feet was in virgin ground, chiefly composed of pillars left from old workings. It was estimated that about 75 feet farther advance would penetrate virgin ground, and a turn to the right of about 35° would tap a block of virgin ground left in the old workings. A crew of three men is employed in this work.

Joe Clay was still carrying out shovelling in the creek-bed in a patch of virgin ground and is reported to be making fair gold-recoveries.

Otto Miller & Sons are shovelling old tailings from the creek and report making expenses. During the 1932 season \$6 per day is reported as the poorest recovery. During the previous two years miners are reported to have recovered an average of about \$10 a day during the periods of operation.

Herman Miller, working on the *Peterborough* lease on a "lay" from Otto Miller, has sunk an incline shaft 40 feet and is drifting up-stream with the intention of getting into the "Blue run" old channel.

J. E. Smith has been carrying out successful rocking operations of old tailings, earning from \$7 to \$10 a day, and is now shovelling and sluicing from fairly appreciable old tailings-piles of yellow clayey gravel in the creek-bed. It is anticipated that good recoveries will be made from this material, as this yellow clay in rolling through the sluice-boxes on old workings picked up much gold, thereby robbing them of values.

I. Matthews is drifting on the left bank from an inclined shaft sunk 50 feet at an angle of 15° and equipped with a Fairbanks gasoline-engine and geared hoist. Two drifts are being carried, one up-stream and one down-stream. In the up-stream drift, bearing N. 75° E. (mag.), the heading is being carried seven sets wide on flat bed-rock. About 2½ feet of bed-rock is being taken and 4 feet of gravel. Some fairly large boulders are evident in the gravel above bed-rock. It is reported that good values are being recovered. The drive down-stream (south) has encountered an interesting condition, indicating a possible lateral channel lying southerly of the "Yellow channel," on which the north heading is advancing. The south heading is a crosscut along which a flat rim is encountered dipping slightly south. In the face rim-rock is dipping away from the heading. A crew of five men is being employed, two in each heading and one on the hoist. The work is being carried out in two shifts, with an output of about fifty cars of dirt a day.

Axel Nelson and two partners are working on a "lay" from L. Schulz and latterly, it is understood, in association with San Francisco interests. A drainage-tunnel is being driven to operate three creek claims and six fractions below Matthews's ground. This tunnel is being driven through about 1,000 feet of ground owned by I. Matthews. The tunnel is started just above the creek-level and has been driven for 600 feet to an old shaft (27 feet deep), and is solidly timbered with square sets and lagging for this distance, which presumably is in the old "Blue channel" area, lying about 4 feet lower than the "Yellow channel," which the workings are intended to penetrate. It would seem that in this section the "Blue" and "Yellow" channels converge, with the "Yellow channel" of the upper Spruce Creek area lying on the left or south side of the "Blue channel," which quite possibly may be found to continue into the upper Spruce Creek area on the right or north side of the known "Yellow channel" and at a slightly lower elevation.

At the time of examination the tunnel had advanced about 100 feet beyond the old shaft, and it is estimated that an additional 300 feet would penetrate the ground it is intended to work, and at which point it is estimated there will be about 7 feet of bed-rock in the face of the tunnel. This should allow efficient drainage-grade and a good safety margin for the working of the bed-rock area ahead. About eighteen to twenty cars of dirt is being excavated per one-shift day, equivalent to an advance of about 4 feet a day. The old channel in this section appears to strike about S. 50° E. (mag.). This would indicate a sharp bend across the creek to the north to connect up with its position in the Morse & Company's workings.

Bratt, Morse & Company have broken through to their drift-workings with the drainage-tunnel. At the time of examination drifting north on the rim of the old channel about 300 feet north of the shaft was being carried out. The rim at this point is comparatively hard, but the face pans well and good values should be encountered when the bed-rock channel, which at this point lies slightly to the north of the workings, is reached. The bearing of the heading in the workings at the time of examination was N. 75° E. (mag.), which is about the direction of the channel at this point. Ahead of this, however, it would seem the channel crosses under the creek and an increased volume of water may possibly be encountered.

McPherson and Buchanan have continued operations on the *Clydesdale* bench lease. Since the last report on this property in Bulletin No. 1, 1931, extensive drifting and crosscutting has been carried out both east and west of the shaft. It would seem that in relation to this ground the old "Yellow channel," extending from the Morse ground, runs practically parallel with and slightly south of the *Clydesdale* southerly boundary, and may possibly enter this lease and strike through it for a short distance close to the south-easterly corner. An examination of the workings showed the west working to have entered high rim probably an appreciable distance north of the old-channel line. The east workings, with the exception of the first crosscut south and the drift-face, had also been carried in the rim north of the channel. In this section the

face of the first crosscut south shows the rim exposed about 4 feet from the floor and dipping about 5° S. This face is practically on the Morse & Company boundary-line and consequently cannot be extended farther south towards the channel. It is quite possible that a drift north from this face as close to the boundary-line as possible would encounter fair values. In the face of the north drift the rim is exposed close to the roof, dipping south. This point is also very close to the Morse & Company boundary-line, but it is recommended that the drift be carried north as close to the line as possible, as it would seem, from a correlation of the channel between the Morse and the Beaton leases, that the channel would gradually converge towards the Clydesdale ground and possibly cut across a small section of the south-easterly corner.

The Beaton lease, owned by Messrs. Beaton and McPherson and formerly operated on a "lay" by Marco Pini & Company, is involved in a change of control. It is understood the latter sold its "lay" interest to L. Schulz, of Atlin, who in turn transferred this interest to the Scheeler & Colpe Investment Company, of San Francisco. These latter interests inaugurated plans for the operation of the ground on a larger scale than had hitherto been done. This included the installation of modern equipment, including improved hoisting and pumping, fan-blower and galvanized-pipe air-line, with a Petter semi-Diesel power plant. Mining operations are planned for increased yardage production with the inauguration of probably a long-wall retreating system of mining. At the time of examination a cave had occurred in the old workings and work was being carried out to circumvent this and get into solid ground. To facilitate the drainage to the shaft-sump the main crosscut had also been deepened and the track raised. Shovelling and sluicing of clayey tailings from previous work was also being carried out and good clean-ups from this material were being made. As an indication of the values in the lower-grade type of gravel in this ground it is interesting to note that 350 cars of the caved material in the drift were sluiced and returned over 24 oz. of gold, equivalent to about \$1.10 a car or about \$2.20 per cubic yard. As this represents material probably coming from the roof of the drift, these values are indicative of what might be achieved in expansion of the workings to include lower-grade material than has hitherto been mined.

Up-stream from the Beaton ground, on the right bank of Spruce creek and beyond the junction of Dominion and Spruce creeks, five leases have been staked by Portland, Oregon, interests and extensive exploration is planned on these for the 1933 season.

At the mouth of Dominion creek George Noland, in association with Juneau, Alaska, interests, owns two leases covering a section of Spruce creek and Dominion creek. For the purpose of exploring the possible continuation of the old Spruce Creek channel up the Dominion Creek trough, a shaft is being sunk in the attempt to reach bed-rock, which at this point is deeply buried.

In the upper Dominion Creek area four leases have also been staked by Portland, Oregon, interests for the purpose of exploring a possible continuation of the old Spruce Creek channel in the upper section of the Dominion Creek trough. Extensive exploration of this ground by pitting, drilling, and sinking is planned for the 1933 season. Several years ago some superficial work in this area gave interesting indications that show the ground to be worthy of intensive exploration.

In the upper Spruce Creek area several individuals have been carrying out shovelling and sluicing, and several leases have also been taken up by Portland, Oregon, interests, on which extensive exploration during the 1933 season is planned to prove potential hydraulicking or dredging possibilities.

Pine Creek.

(See Annual Report for 1930.) Perhaps the most constructive development during the season in the Atlin section, and one which might lead to far-reaching results in the future, is what appears to be the location of the continuation of "Gold run." This has resulted from the hydraulicking operations carried out during the season by Fred Helm & Company of five men working on a "lay" from Walter Rasmussen, of Atlin, on bench leases on the left bank of Pine creek, about 1 mile below the bridge. At the time of examination the face of the pit in these workings showed a top layer of 10 feet of interstratified interglacial gravel, sand, and clay. Below this is a coarse unstratified glacial gravel with boulders, then about 30 inches of hard-pan and coarse wash-gravel on bed-rock. It would appear that the best values are contained in this lower layer, the tenacity of which requires blasting at times, with the best values on an uneven weathered bed-rock of the somewhat schistose rocks of the Gold series. In the

operation two monitors are in use, one stacking and sluicing tails and the other cutting. Up to the time of examination at the end of July clean-ups of 40, 60, 142, and 190 oz. of gold were being made about every two weeks. From the attitude of rim-rock on the east side, which here strikes about N. 45° E. (mag.), skirting a flat bench about 15 feet above the creek, there appeared to be at the time of examination about 400 feet of good ground ahead of the workings up-stream to at least as far as a reef which cuts across. At this point it may be found that the channel may either cut through this reef in a narrow gut, or circumvent it in alignment with the present creek-channel and again assume its general north-easterly strike under the left bench towards and easterly of Ole Lovgren's workings about 400 feet below the bridge. In this latter section the attitude of rim-rock indicates that the old channel may possibly cross under the road and the present channel of Pine creek at a point about 300 feet northerly of the bridge and approximately about half-way between the site of the old dredge and Pine creek. Should this be the case the continuation of the old "Gold run," as indicated by the attitude of rim-rock northerly of the bridge, would be on the right or west side of Pine creek, heading towards Birch Creek flats. This assumption offers a likely and interesting venture for exploration by drilling.

Just below the bridge Ole Lovgren, crosscutting north-easterly towards the possible location of the old "Gold run" channel on the south side of the road, is recovering some values as the work progresses.

Birch Creek.

(See Annual Report for 1930.) Joe Yonaites, operating on one bench and one creek lease at the lower end of Birch creek, has been shovelling-in on the left bank of the creek on the rim of ground that was ground-sluiced during the previous season. A description of the location of the old channel in this area will be found in Bulletin No. 1, 1931. The operator has carried a cut for 70 feet north and will then drift into the hill on the left bank diagonally across the presumed location of the old channel to cut the left rim. By carrying drainage-grade along the cut it is computed that at the projected tunnel portal there will be a safety margin of about 4.6 feet of rim. Some indicative values and coarse gold have been recovered during these operations.

Billy McDonald, owning two creek leases at altitude 3,800 feet and about 2 miles up Birch creek from Joe Yonaites's ground, is shovelling on the right bank of the creek in about 5 feet of gravel on clay hard-pan. Actual bed-rock is estimated at this point to be about 50 feet below the creek-bed. Some fine gold has been recovered in these operations and below them a patch of virgin ground above the H. P. Pearce lease should be worth attention by an individual.

Boulder Creek.

(See Annual Report for 1930.) The Consolidated Mining and Smelting Company has continued hydraulicking operations on this creek in the attempt to get into "pay." Cutting during the 1932 season has veered to the south to try and hit the rim on that side in order to get some additional point of correlation with the assumed old channel. Water-pressure has been improved by the construction of a new dam giving a head of about 180 feet at the monitor. To remove the largest boulders and increase the sluice capacity a cable has been suspended across the cut with a span of 650 feet and is equipped with a 16-horse-power gasoline Novo engine, hoist, haul-back, and platform-skip. The stacking-cutting system of hydraulicking has been adopted with two monitors in operation. With these improvements the sluicing capacity and cutting efficiency are very much increased and the advance of the cut towards the objective will be accelerated accordingly. The operations are in charge of McLeod White, superintendent, with a crew of about fifteen men.

Ruby Creek.

(See Annual Report for 1930.) On the Manson and Schulz "lay," towards the mouth of this creek, operations have been carried on with one shift and a crew of five men. Two pits are being carried across the channel-width, which is split by a central hump of about 15 feet in width, with two channel sections of about 50 feet on each side. Fair clean-ups have been achieved during the season. The bed-rock in this locality is a blocky granite with pronounced parallel fracturing striking at right angles across the channel, which at this point strikes N. 30° W. (mag.) and conforms to the present creek-bed and necessitates the sluicing of a quantity of old tailings. At the time of examination preparations were being made for the commence-

ment of a new pit on a small benched area of virgin ground on the right rim. A new flume-intake has been installed giving a head of about 180 feet, an increase of 80 feet over that formerly available.

Emil Tornquist and two men have been continuing drifting operations above the Manson-Schulz ground. At the time of examination the channel was showing an impoverishment with a northerly swing farther into the hill. At the point of the present heading the old channel appears to strike N. 30° W. (mag.) and excessively large boulders and smooth bed-rock indicate a sharp turn, steep grade, and rapidly flowing water, which conditions would be conducive to excessive slippage of values. It is quite possible that when this condition is passed through and the old channel again aligns itself to its general line of strike the values will improve.

McKay, Johnson, and Morrison have continued their drifting above the Emil Tornquist ground. At the time of examination the drift-face was about 160 feet under the hill, with a back of about 140 feet. The character of the ground in the present working area indicates a canyon and swift-water condition of the old channel, with big boulders and two narrow guts at a probable bend in the direction of the channel that would cause slippage of values. Fair clean-ups were being made, but it is quite probable that an improvement in values will be found as the workings progress to a more stable condition of the channel beyond this section.

Arno Krumbeigel has installed a pump and continued the sinking of his shaft above the McKay-Morrison ground, in order to penetrate the lava in the attempt to reach bed-rock and the old channel.

Otter Creek.

(See 1930 and 1931 Annual Reports.) The Compagnie Francaise des Mines d'Or du Canada vigorously continued hydrauliclicking under the management of J. E. Moran with a crew of nineteen men. At the end of July piping was being carried on in a pit averaging 50 feet deep, 150 feet long, and 120 feet wide. The bank was made up of interstratified gravels, clays, and sands constituting a post- or inter-glacial morainal reconcentration about 45 feet thick overlain by about 60 feet of fine glacial debris. Bed-rock had not been reached, but the attitude of rims and the character of the material at the bottom of the pit indicated that it was probably close. A thickness of 25 feet of the bank composed of stratified coarse gravel and boulders with interstratified streaks of sand and clay showed good values on panning. Piping and sluicing of the top section is reported to have produced \$4,000 and it is estimated a like amount still remained in the bottom section. The previous clean-up of between one and two weeks produced about \$2,000, with several coarse nuggets, including one of about 7 oz., and indications of value increase with the approach of the cut towards bed-rock. In a computation of about 170,000 cubic yards of gravel moved during 1931, it is estimated that total costs amount to about 9 cents per cubic yard, with between 7 to 8 cents per cubic yard for actual hydrauliclicking.

During the winter prospecting in a shaft and tunnel was carried on. The management reports drifting disclosed a rim-shelf about 15 feet below the end of the pole sluice and dipping north. A winze was sunk 5 feet at the end of the drift, but excessive water prevented its continuance to bed-rock. It is stated that the gravel prospected by this drifting and winzing was estimated to contain from \$2 to \$5 in gold to the car. As this material is still above bed-rock, it is quite possible that exceptionally high values will be found on bed-rock in this section. As bed-rock in this section is well below the hydrauliclicking tailings sluice-grade, another method such as possibly the hydraulic lift will have to be resorted to for the recovery of the values.

Wright Creek.

(See Annual Report for 1930.) The hydrauliclicking operations of Moran and Hodges have been continued on this creek throughout the season. At the time of examination at the beginning of August piping was being carried out in the second pit from that described in last year's report. The cut was advancing up the creek, with a bank-face of about 25 feet in height composed of glacial debris with a few interglacial stratified streaks. It is estimated that bed-rock lies possibly at a depth from 3 to 4 feet below the pit-mouth. To facilitate the work, ground-sluicing is also being carried out with water from the lower dam, which runs for about forty minutes and takes about one hour to refill.

Frank Brown and Vic. Lindahl, operating a bench lease on the right bank, are ground-sluicing through glacial muck on a high, steeply sloping rim. The first cut gave no returns, and the second cut, about 20 feet away, does not look particularly promising.

Jim Marshall, operating a bench lease on the left bank, has been carrying out open-cutting in glacial gravel on the high bench. The attitude of rim in this section of the creek indicates that these workings are not on the old channel, which at this section is indicated as being below and aligned with the present creek-bed.

The Nord Bros. have continued their ground-sluicing in two pits on the left bank of upper Wright creek. About 1,200 feet of new ditch has been completed, with a by-pass to the upper pit. This pit shows a top layer of about 12 feet of hard-pan, sandy clay, and boulders, with about 3 feet of stratified gravel on bed-rock. The lower pit is about 10 feet deep, with more clay and larger boulders in the top layer, and about the same amount of stratified gravel on bed-rock as in the upper pit. In connection with this operation it is still contended by the owners that the gold occurs in the top surface muck. Some nice coarse gold is being recovered and two cascaders of the type described in Bulletin No. 1, 1931, are in operation, one in each pit.

Cracker Creek.

This creek flows into the northerly end of Surprise lake on the west side and is the next large creek on this side of Surprise lake above Ruby creek. The creek has a steep gradient from Surprise lake at elevation 3,025 feet to the top of the canyon at elevation 3,500 feet, about 2 miles above Surprise lake. Beyond this point the creek-trough shows a flatter gradient, with a bend south, and has its source in several tributaries draining from small lakes on the divide between the Surprise Lake valley and Fourth of July creek. In the lower area high benches to about 3,500 feet elevation flank both banks. The attitude of the granite-rim at the top end of the canyon indicates the possibility of an old channel behind and south-easterly of this rim, skirting and possibly paralleling the canyon-rock on that side. At the top end of the canyon an old drainage-tunnel was excavated in an attempt to crosscut towards the presumed old channel. This work was, however, not successfully completed.

At the lower or north-easterly end of the canyon three men working on a "lay" from Paul Eggert, of Atlin, are continuing an old tunnel located on the right bank in an attempt to tap the old channel south of the canyon. The camp is situated at elevation 3,250 feet and the portal of the tunnel at about elevation 3,200 feet. Over 400 feet of tunnelling has been carried out, and at the time of examination in the beginning of August the face being worked was heading S. 45° E. (mag.) in a high rim. It would seem that the bearing of this face is considerably too far east and to the left of the projection of the probable old channel. The ground consists of interstratified fine sands and gravels, with some clay layers representing probably interglacial water action of moderate flowage. The ground appears to be well worth thorough prospecting.

Lincoln Creek.

This creek flows into Gladys lake (2,915 feet elevation) on the south side and on old maps is sometimes referred to as Monro creek. It has its source in an extensive divide area drained by several long tributaries emptying into Vance lake at elevation 4,500 feet on the south-west side of Brown dome. The area is reached by auto-road from Atlin to Surprise lake, a distance of 12 miles, then 18 miles by small boat up Surprise lake, from the northerly end of which a trail 10 miles in length leads to Lincoln creek, a total distance of 40 miles from the town of Atlin. The rocks of the area are composed of greenstones, serpentine, peridotites, and slates of the Gold series. The creek has a steep gradient and a large volume of water.

In 1898, during the discovery days of Atlin, some cursory prospecting was carried out on it. In 1910 the "Gierkie" shaft, about 100 feet east of the creek-bed, was sunk through 6 feet of top soil, 6 feet of top gravel, and 28 feet of glacial clay. A churn-drill from the bottom of the shaft to a depth of 21 feet did not penetrate bed-rock. The caving of this shaft prevented further work. It is stated that all samples of the drill-sludge showed colours of gold. In 1911 the "B. & B." tunnel was excavated to prospect the easterly upper bench. No data are available concerning the results from the tunnel. In 1912 the "Johnson" tunnel was excavated 300 feet on the easterly side of the creek, but disagreement with the owners arose and it was abandoned. In the latter part of 1912 the "Hill" tunnel was excavated on the easterly side, but began caving and was abandoned. A drill-hole was also put down in 1912 to a depth of 60 feet. It was stated that this reached bed-rock and that some coarse gold was found in the core-barrel with material estimated to carry about \$1 per cubic yard. In 1919 the "Fisher" shaft was sunk through 6 feet of top soil, 6 feet of top gravel, and 50 feet of glacial clay. It

is stated that the bottom of the shaft had penetrated gold-bearing gravel overlying the clay, but before this could be explored the shaft caved and was abandoned.

This work was all carried out on ten leases covering 311 acres of ground along 4 miles of the creek from Vance lake down. The available information on this work indicates a covering of interglacial deposits containing possibly concentrated or semi-concentrated stratified streaks which may contain values sufficient for hydraulicking. The section covers a restriction of the bench area along the creek which is generally characteristic of concentrated values on gold-bearing creeks.

During 1927 a weir was constructed to measure the water-flowage and it is estimated that sufficient is available for the sluicing of approximately 100,000 cubic yards of gravel per month. An aerial survey of the region, undertaken by the Resident Engineer during the 1932 season, indicated an extensive drainage area feeding Lincoln creek and an exceptional water-supply and efficient head for the undertaking of extensive hydraulicking operations. Transportation into the section can be accomplished by connecting with the Fourth of July road across a comparatively flat jack-pine area extending to within a few miles of the creek. This would entail the construction of about 26 miles of new road, which could be accomplished with a comparatively small cost, for the accommodation of caterpillar tractors. The general conditions of this area are such as to suggest that extensive exploratory operations entailing preliminary Keystone-drilling are certainly warranted with the objective of bringing in an extensive hydraulicking operation. In the event of sufficient values being proved to warrant an operation it is computed that efficient hydraulicking could be carried out for between four and five months of the year.

Consolation Creek.

Consolation creek rises in a low divide (3,300 feet) between Fourth of July creek and the Gladys Lake drainage-basin and flows into the north-westerly end of Gladys lake. Traversing up Fourth of July creek across the divide shows the upper area of Fourth of July and Consolation creeks to Gladys lake to be heavily drift-filled with a pronounced morainal topography in the upper sections of both creeks, particularly that of the former. Upper Consolation creek for a distance of about 7 miles to about opposite Boyd creek on the Surprise Lake side occupies a flat gradient in a wide drift-filled valley flanked by morainal and escarp topography. It is possible that this section, which has been partially planated, may contain low gold values in inter- or post-glacial concentrations which may be amenable to extraction by dredging. It is recommended that this section of the creek be investigated with this objective.

About half-way up the South branch of Consolation creek some work had been carried out during recent years by the late J. C. Walters. This area is about 35 miles from the town of Atlin and is reached either via Fourth of July creek or by trail from the north end of Surprise lake. The cabin is situated about 2 miles up the South branch from its junction with the main trough of Consolation creek and at about altitude 3,600 feet. A water-driven sawmill is constructed about a quarter of a mile below the cabin, with the workings about a quarter of a mile above the cabin and about an eighth of a mile above the canyon in which the left rim-rock is exposed. In the workings on a flat bar on the left side of the creek steep rim shows in one place. Parallel to this rim a cut and short tunnel have been excavated for 80 feet through ground constituted partly by old river-bar and partly by glacial debris, and at the face breaks through to surface, with a back of about 6 feet. Beyond the tunnel water from the creek is cascaded down to the portal for sluicing. It is not evident in these workings that bed-rock has been reached or approached. Large boulders feature the creek-bed and it is probable that operations in this creek would be encumbered by the handling of these. It would seem, however, from the general location and the lay of the creek, that it is worthy of prospecting.

Volcanic Creek.

This creek flows into the northerly end of Fourth of July creek from the west side. Operations were carried out on a "lay" on two leases from P. L. Eggert, of Atlin. The cabin is situated about 2 miles up the creek at elevation 3,625 feet. A tunnel has been driven 60 feet through glacial debris into the left bank and at the end of this distance penetrates lava. Outcroppings of lava can be seen on the hill-slope between the tunnel and the cabin. About 1,000 feet below the cabin a granite bluff constitutes the steep right bank of the creek. About 100 feet above the cabin a test-pit has been excavated through glacial debris for 10 feet. Panning of the material from this pit showed colours. About 500 feet beyond this is a steep

glacial debris-bank about 40 feet high, with boulders up to about 3 feet in diameter. The creek has a gradient of between 8 and 9 per cent. and is featured by large boulders. As this creek heads into the divide to Ruby creek, it is quite possible that the lava-flow which features the latter creek may also extend into Volcanic creek. Whether this has covered and preserved an old creek-channel, as is the case in Ruby creek, is still to be determined. It would seem that the ground could best be prospected by preliminary drilling, followed, if warranted, by a drainage-tunnel started below the present tunnel-site to determine the attitude of possible rims, and a drift up-stream between them to bed-rock. The assumption of gold values being present in this creek, which drains from the divide to Ruby creek, is mainly based on the occurrence of gold in the latter creek.

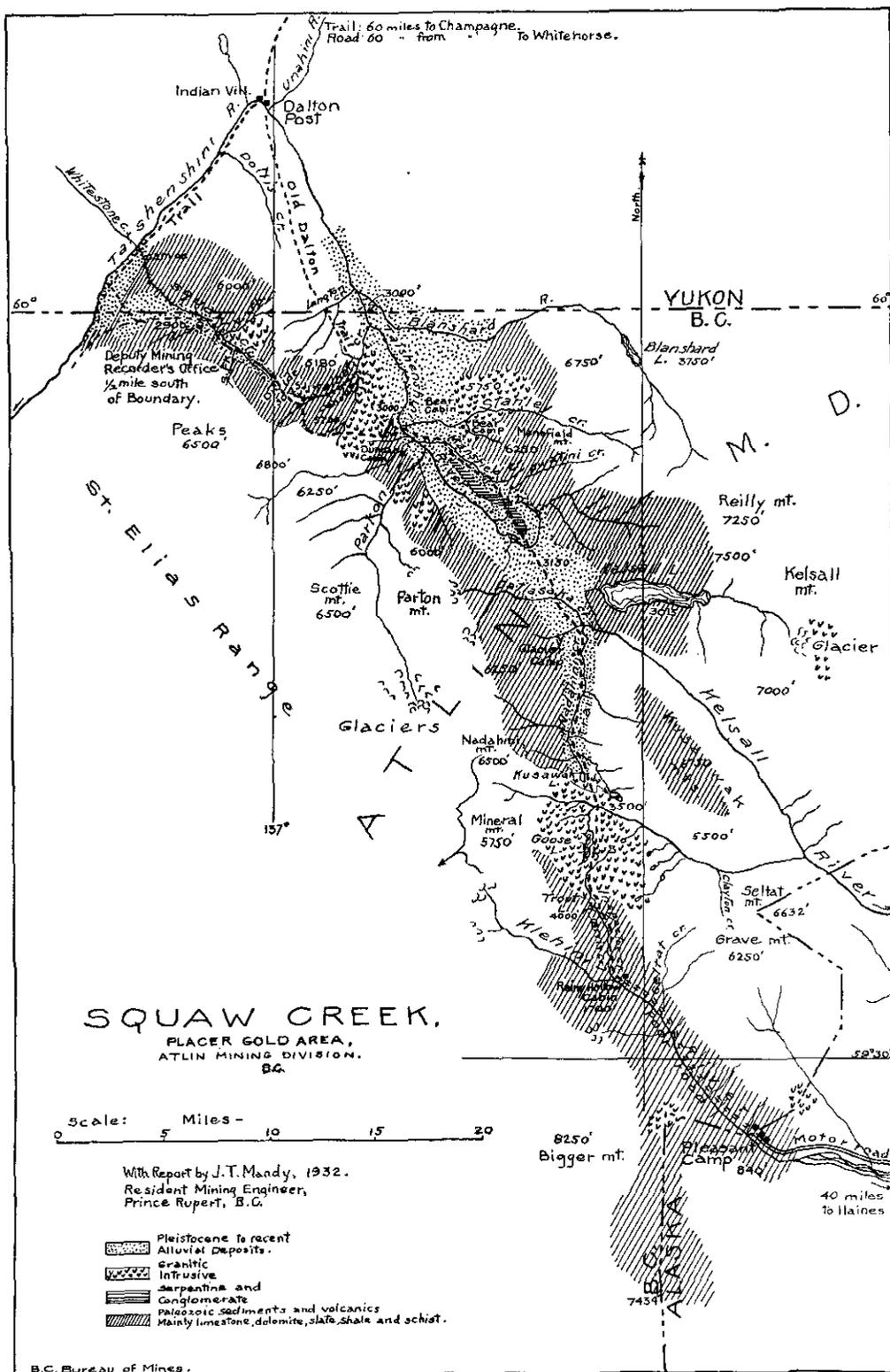
TATSHENSHINI RIVER SECTION.

The following is a condensed description of this section: During 1932 a general reconnaissance of the section lying between Rainy Hollow and the Yukon boundary, including the headwaters of the Kelsall and Tatshenshini rivers, was carried out by the Resident Engineer. The objective of this journey was Squaw creek, which rises in British Columbia and flows into the Tatshenshini river in Yukon Territory. In this reconnaissance, practically entirely through virgin territory, geological conditions indicating a very likely prospecting area for lode and placer gold as well as base metals were noted.

The section is accessible from Haines, Alaska, whence there is a motor-road for 42 miles to Pleasant Camp, on the Alaska-British Columbia boundary, at elevation of 840 feet. From Pleasant Camp an old wagon-road in bad condition leads up the Klehini River valley for about 11 miles to Rainy Hollow Cabin at elevation 1,700 feet. From the cabin the old *Maid of Erin* wagon-road is followed to about the old tunnel on the *Victoria* claim at elevation 2,700 feet, whence the valley of Inspector (Jarvis) creek is followed to the crest of the St. Elias Range divide at about Trout lakes, elevation 4,000 feet. From the *Victoria* tunnel to Squaw creek there is no well-marked trail, but occasionally sections of the old Dalton trail or scattered recent hoof-marks of pack-trains can be picked up. From Rainy Hollow the route follows Inspector creek, skirts the eastern side of Goose lakes (source of Stonehouse creek), crosses Stonehouse creek at the western edge of the Interior plateau at elevation 3,500 feet, and follows Nadahini creek to the headwaters of the Kelsall river. The low divide to the headwaters of the Tatshenshini river is then crossed at elevation 3,150 feet and Mansfield creek is followed to the crossing of the Tatshenshini river at elevation 3,000 feet. From the west side of this river the old Dalton trail is followed for about $1\frac{1}{2}$ miles. Here the route to Squaw creek branches off to the west and skirts the south-west slope of a high peak lying between it and Talbot Creek canyon. It then descends to the headwaters section of Talbot creek, which is crossed at altitude 4,025 feet, and the North branch followed to the divide to Squaw creek at altitude 5,025 feet. Squaw creek is descended for about 4 miles to F. Muncaster's (Deputy Mining Recorder) cabin at altitude 2,900 feet and about $\frac{1}{2}$ mile south of the Yukon boundary. From the range to Squaw creek is about 60 miles through open timberless country, which could be negotiated for practically the whole distance by a tractor.

From Skagway to Haines a boat plies twice a week. Between Haines and Pleasant Camp, Erik Oslund, of Haines, Alaska, conducts an automobile freighting service. Passenger-cars cost about \$15 between these two points and the freighting charge quoted is 1 cent per pound. Erik Oslund also owns two horses and for limited loads arrangements for the use of these from Pleasant Camp could possibly be made at a cost of about \$5 per day per horse and \$6 per day for packer and guide. F. Muncaster, of Squaw creek, operates a pack-train, and it is understood that packing charges from Pleasant Camp to Squaw creek are about 20 cents per pound. The Kane Bros., Klukshu Indians, also operate a pack-train into Squaw creek, and it is possible that connections with this at Pleasant Camp could be made. It is, however, suggested that those planning to go into the area communicate with Erik Oslund, Haines, Alaska, who may possibly be able to make all arrangements and give information regarding seasonal snow and weather conditions. Operations may be carried on from May to the end of September.

An alternative route is via the White Pass & Yukon Railway from Skagway to Whitehorse, thence via Champagne, the Dezadeash river, Unahini river, and Dalton Post to Squaw creek, a total distance of about 150 miles. The route via Haines is, however, recommended as providing accessibility through an extensive promising area in British Columbia. From Vancouver to Squaw creek a cost of between \$75 and \$100 per man would be entailed.



Topography.—North of the range from the headwaters of Nadahini creek to Squaw creek the topography assumes the characteristics common to an elevated planated to peneplanated upland plateau with a general elevation of about 3,200 feet. Bordering the wide valley-plains, mountains-peaks from 6,000 to 7,000 feet elevation, with steep, bare, and talus-covered slopes, are a prominent feature. In the Coastal Range area constituted by the Datlaska mountains extensive glacier-fields can be seen. East of Kelsall lake and the Kelsall river remnants of glacier-fields can also be seen. No glaciers were observed in the interior upland area lying easterly of the range.

Geology.—The superficial deposits of the valley-plains show them to have been filled with glacial drift and morainal deposits which have been planated during post-Glacial times. The geology of the Coastal Range area around the Rainy Hollow section is characteristic of the granodiorite batholith eastern contact-belt illustrated on page 19, Bulletin No. 1, 1932. The roof-rocks consist mainly of limestones and schists, but extensive areas of the intrusive granitic rocks are exposed in places. A wide exposure of the latter extends between the head of Inspector creek and the head of Nadahini creek, a cross-section of about 5 miles. This Coastal Range section is featured by the occurrence of copper-ore deposits.

At about the head of Nadahini creek the batholith plunges easterly beneath a roof of limestone, schists, argillites, serpentine, and peridotite of probably Carboniferous to Triassic age. Beyond this to the Yukon boundary stocks and bosses of granitic rocks representing cupola projections and satellites of the underlying batholith outcrop through or along the base of the older roof-rocks. These are particularly evident on the west side of the valley between Datlaska creek and the Parton river, around the mouth of Stanley creek on the north side of Mount Mansfield, and on the north side of the Blanchard river. West of the point at which the Tatshenshini river is forded a granitic stock about 4 miles in width extends from about the Parton river to at least as far as, and possibly beyond, Talbot creek. This is roofed over in the canyon area of the latter creek, but outcrops again in places on the north side of the North branch of Talbot creek towards the divide to Squaw creek, and occupies the easterly side of the headwaters of Squaw creek to as far as Squaw creek North fork, at which point it again plunges beneath the limestones, dolomites, shales, and schists of that area. Outcrops of coal can be seen in the upper Talbot Creek section. This upland area falls within the Interior Satellite Belt (D), Sub-belts 1 and 2, illustrated on page 19, Bulletin No. 1, 1932, and mineral occurrences in it would be relative to the corresponding genetic and structural control.

Possibilities.—It is suggested that the contact areas of these granitic stocks and bosses be prospected for lode-gold deposits, with the gold possibly occurring both in the free state and in association with pyrite or mispickel. It would seem that some sections of the roof-rocks contiguous to these contact areas would also be favourable for base-metal ore-deposits. Creeks occupying a trough contiguous to these granitic stock and boss contact areas should also be thoroughly prospected for placer gold. Squaw creek, the trough of the upper part of which occupies such a contact area, has been found to be gold-bearing, and it is suggested that creeks such as Stanley creek and those in the vicinity of the Parton river be thoroughly prospected for placer gold.

Erosional conditions of the wide peneplanated valleys with their flat gradients and meandering streams suggest the occurrence of low-grade placer-gold values which might be amenable to dredging. As is described, these areas are quite extensive. Placer-gold values in these would result from an inter- and post-glacial concentration on a clay bed-rock of gold pre-existent in the glacial moraines and drift. Values would of course be dependent upon the degree and extent of reconcentration, and whether they do occur or not is unknown. However, the geologic and erosional conditions point to this possibility. Preliminary prospecting and exploration for this objective should be undertaken by means of initial surface-prospecting and test-pitting, to be followed, if warranted, by systematic Keystone-drilling. It is calculated that if gold values of from 30 to 40 cents per cubic yard could be proved over an appreciable area in this section, and if the ground could be proved suitable, profitable dredging operations of appreciable extent would be possible. It must be stressed that the promise of this region, which, with the exception of Squaw creek, is in a virgin condition, is based entirely upon geologic inference. Evidence, however, points to the section being a very likely area for detailed prospecting by individuals and for initial exploratory operations by large financial interests. By referring to the diagram on page 19, Bulletin No. 1, 1932, it is seen that the genetical and structural aspects of the Interior Satellite Contact Belt (D), Sub-belts 1 and 2, are controlling factors in this area.

Squaw Creek.

This creek is about 8 miles long and flows into the Tatshenshini river on the south side. The lower half of the creek is in Yukon territory and the upper section is in British Columbia. The creek rises in the divide of Talbot creek at altitude 5,025 feet and flows with a comparatively steep gradient in a north-westerly direction. The headwaters are fed by a North and South fork and the stream contains an appreciable volume of water. The geology of the area is featured by granitic rocks occupying the north-east side of the creek from the divide of the main trough to as far as the North fork. The upper part of the main trough lies practically on the contact between this granitic stock on the north-east and the Paleozoic rocks of the south-west and entire lower section. The creek is featured by a spectacular and deeply eroded canyon about 2 miles in length extending from just beyond the Yukon boundary to near the mouth. The attitude of the bordering rim-rocks in correlation with the topography of the encompassing mountains suggests a cross-moving glacier during glacial times, emanating from the region of the source of the North fork and moving westerly across the creek towards the lower section of the Tatshenshini River valley. Although the region shows the effect of comparatively intensive glaciation, it is probable that the direction of moving ice during glacial times, *diagonally across the Squaw Creek valley*, may have to some extent mitigated its effect on placer deposits.

The creek is featured by heavy wash and excessively large boulders, particularly in the upper section. In the outwash area, extending westerly from about the Yukon boundary across the Squaw Creek trough and towards the lower Tatshenshini river, excessively large boulders are not quite so prominent, and it is possible that this section would contain placer-gold values resultant from inter- and post-glacial concentration that would be amenable to hydraulicking. With the exception of a small part of the bench area on the east side of the creek contiguous to the Yukon boundary, this outwash area is entirely unprospected.

Coarse gold was discovered in Squaw creek in 1927 by Paddy Duncan, a Klukshu Indian, and, with the exception of Mr. and Mrs. Muncaster and a few whites who came in during the 1932 season, has been mined in a comparatively haphazard manner practically entirely by Indians. The gold is generally coarse and the majority of it featured by an admixture of quartz. It would appear that two varieties of gold occur, that probably transported from a considerable distance and that which probably has its origin in the vicinity of the creek itself. The largest nugget found on the creek was valued at \$216, found on No. 4 above "Discovery" in 1931. During the 1932 season the largest nugget reported up to the end of August was one valued at \$130 from No. 3 above "Discovery." During this season several from \$20 to \$75 in value were also found. Amongst the Indian miners there is much competition in the discovery of big nuggets and methodical mining suffers accordingly. The creek area and especially the bed of the creek itself is featured by quartz veins and quartzose zones, in part heavily mineralized with fine disseminated pyrite, striking generally parallel with the creek or at an acute angle across it. It is suggested that these should be thoroughly prospected and tested for the occurrence of lode-gold values. The rocks composing the creek-bed are generally soft and schistose, in places featured by wide gouge-zones and fairly well weathered, making a condition that would be conducive to the penetration of placer gold. In former operations it is understood that the bed-rock was left practically intact, but during the 1932 season attention has been directed to the possibility of gold being retained in this, and from 1 to 2 feet of bed-rock is now being cleaned up. In former operations the competition for big nuggets also resulted in the covering of possibly good ground with boulder-piles and tailings from indiscriminate cutting and pitting. *In panning the clean-ups the Indian miners generally pay little attention to the saving of fine gold in the black sand, which is panned out into the creek, leaving only the coarse nuggets in the pan.* In this way much fine gold is lost.

When gold was first discovered the creek was staked by Indians practically from its mouth to its source. At the time of examination about the middle of August, 1932, however, it was only being worked from No. 1 below "Discovery" to No. 6 above. It was understood that Nos. 7 and 8 above "Discovery" were at that time being held and that a half-mile lease, including No. 9 to No. 20 above, was applied for on June 9th. It should be noted that from the boundary to the North fork is about thirty-two claim-lengths, including "Discovery" claim. No ground is held on either the North or South forks. "Discovery" claim is located about three-quarters of a mile above the Yukon boundary.

During the examination fifteen Indian men, four Indian women, six white men, and two white women were on the creek. Daily clean-ups have varied from about \$5 to about \$20 per man; with two or three men working, some daily clean-ups up to \$60 and \$70 for the outfit have been made. The depth of gravel to bed-rock varies from about 8 feet on *No. 1 below* "Discovery" to about 4 feet at *No. 6 above*. Down-stream from *No. 1 below* to the canyon in Yukon territory depth to bed-rock increases as the morainal outwash area extending to the west is crossed. Up-stream from about *No. 7 above* "Discovery" depth to bed-rock also increases. From *No. 1 above* "Discovery" towards the source the creek occupies a comparatively narrow trough varying from about 80 to 300 feet at its base between the confining rims. Narrow strips of low benches or bars 20 to 100 feet wide skirt the creek-bed at intervals along either bank. As most of the work has been confined to the creek-bed itself, the majority of these bars are still unprospected. The wide bar and outwash area extending across the creek-trough towards the west, just above the Yukon boundary, has already been referred to.

No. 2 below "Discovery."—This covers a bar area about 1,500 feet wide on the right bank. It is not being worked, but from the creek to about 100 feet in, several old cuts and pits about 10 feet deep in heavy ground are seen.

No. 1 below "Discovery."—The creek at this point undergoes a short sharp bend to south and skirts the westerly edge of a bar from 200 to 1,000 feet wide. In accordance with the attitude of exposed rims it is quite probable that an old buried compound channel may be located on the bar. J. Robertson is carrying two crosscuts towards the east about 7 feet deep to bed-rock. The ground is heavy, with boulders up to about 4 feet in diameter. Bed-rock is flat and composed of sericite-schist, carbonaceous schist, numerous quartz veins, gouge-seams, and wide quartzose zones in places heavily impregnated with fine pyrite. From the north cut about \$5 in comparatively fine gold was being recovered per sluicing-day at the time of examination.

"Discovery."—On the lower half of this claim "Big Jim" Fred with "Casey" Fred is cutting into a bar 40 feet wide on the left bank on rim sloping flatly towards the steep rim on the west. It is possible that a narrow gut-channel may border the confining steep rim. This working is on the extreme upper end of "Big Jim's" apportionment of ground, but as the bar is about 80 feet wide at the lower end the operator is advised to start there and work systematically up-stream. This will also avoid the covering of good ground with tailings and boulder-piles. Bed-rock is rough and consists of green mica-schist and is not being cleaned. Four feet of gravel with boulders up to 5 feet in diameter cover bed-rock.

On the upper half of "Discovery" Paddy Duncan and three men were shovelling-in on the left side of the creek in ground from 3 to 4 feet deep to bed-rock. The creek-trough in this section narrows to about 100 feet between confining high rims, and many large boulders are in evidence, with some up to about 10 feet in diameter. Bed-rock is soft and consists of sericite-schist with wide kaolin gouge-seams, black carbonaceous limestone, and a brown carbonate rock. The schistosity strikes at an acute angle across the creek. About 12 inches of bed-rock is being taken up. At the time of examination two men shovelling for about two hours recovered about \$10. Up to the time of examination about \$600 in gold had been cleaned up during the season. On the right bank a bar about 100 feet wide should also be prospected.

No. 1 above.—Considerable work had been done on this claim, but at the time of examination it was not being worked. On the right bank a bar about 100 feet wide extending the total length of the claim, and on the left bank a strip about 100 feet long and 20 feet wide, have not been prospected. It is quite probable that boulder-piles cover virgin patches.

No. 2 above.—The creek-bed on this claim has been practically worked out, but some patches still remain under boulder-piles. Jimmy Kudwat, Harry Joe, and Drury Crow were cutting in on gently rising mica-schist bed-rock on the left bank. Bed-rock is soft but is not being taken up. On the day of examination about \$20 in gold, including an \$8 and a \$5 nugget, was cleaned up by two men. Several big nuggets have been found on this claim during the season and on one day a clean-up of \$291.90 is reported.

No. 3 above.—On this claim the creek-bed has been practically worked out by the Kane Bros. One or two virgin patches still remain, however, under boulder-piles and tailings. A bar on the right bank and a strip along the edge of steep rim on the left bank are still unworked. During the season one nugget valued at \$162 and several valued at about \$30 have been found. Bed-rock is composed of the usual soft schistose rocks and is featured by numerous quartz veins and pyrite.

No. 4 above.—Alec Davis and partners (white men) are working this claim on a "lay" from Johnny Fraser. Three men are shovelling from bed-rock towards the right bank of the creek. The ground is heavy and includes boulders up to 7 feet in diameter. Bed-rock is composed of vertical-standing schistose rocks with numerous conformable quartz veins, veinlets, and lenses striking at an acute angle across the creek. Some nice coarse gold was being recovered.

No. 5 above.—Mr. and Mrs. F. Muncaster are working this claim on a "lay" from James Shorty. The creek has been turned to the right bank and shovelling is being carried on from about the centre of the creek-bed in about 4 feet of gravel to bed-rock, which consists of soft carbonaceous shale with numerous quartz veins and lenses. A hand-winch has been rigged up to handle the many big boulders. The attitude of rim suggests that an old channel may be buried under a slide on the right bank, in which case the best values may be found on this side of the creek bordering the slide. At the time of examination about \$6 was cleaned up in two hours' shovelling.

No. 6 above.—This claim is being worked by O. D. Frith and A. B. Mitchel, of Victoria, on a "lay" from Field Johnson. Preparatory work was started comparatively late in the season, involving the turning of the creek to the right side and excavating a drain towards bed-rock to tap a patch of virgin ground in the centre of the creek. The ground is heavy and many boulders up to 4 feet in diameter occur. Some coarse gold was being recovered and this cut will be continued towards the slide on the right bank.

Nos. 7 and 8 above.—At the time of examination no work was being carried out above *No. 6 above* "Discovery." These two claims had, however, been staked by Karl E. Ashenbrenner and Olaf Christenson. On *No. 7* two old cuts about 9 feet deep to bed-rock are reported to have produced about \$2 per cubic yard. One old pit 11 feet deep to bed-rock and another 10 feet deep that did not strike bed rock are reported to have shown colours.

Nos. 9 to 20 above.—No operations were being carried out on this ground at the time of examination at the end of August. An application by Karl Ashenbrenner and Olaf Christenson for a half-mile lease including this ground was made on June 9th. A small amount of desultory work was, however, carried out by prospectors on some of the ground in 1929. On *Nos. 11, 12, and 13* some fairly extensive old workings are seen, and in 1929 Vass and McAuley are reported to have recovered \$600 from *No. 12* and \$900 from *No. 13*. A nugget valued at \$50 is also reported to have been found in this section. On *Nos. 15 and 16* Scotty Howe (white man) is reported to have recovered about \$50 in prospecting. On *No. 17* some gold-recovery is reported to have been made by Frank Smith, and from *Nos. 26, 27, and 28* a comparatively appreciable recovery is reported to have been made by Albert Atlin in the seasons immediately following the discovery of the creek. Heavy boulders and ground 10 or 12 feet deep features the upper area of the creek and may have discouraged the Indian prospectors. In this upper section to the North fork and beyond, the creek-bed is about 200 feet wide, with debris-banks 10 to 15 feet high bordered by rock-rim sloping 45° to 60°, and should be well worth prospecting. It is also suggested that both the North and South forks should receive attention. Around the mouth of the South fork there is much quartz float in evidence.

NORTH-EASTERN MINERAL SURVEY DISTRICT (No. 2).

REPORT BY DOUGLAS LAY, RESIDENT MINING ENGINEER (HEADQUARTERS, HAZELTON).

INTRODUCTION.

The general features of the North-eastern Mineral Survey District have been described at length in previous Annual Reports, to which the reader is referred. Bibliographic references will be found in the Annual Reports for the years 1927 to 1930 (inclusive). In view of the interest which focuses at the present time on lode-gold and placer deposits, attention is drawn to the following recent publications of this Department: "Lode-gold Deposits of British Columbia," Bulletin No. 1, 1932; "Lode-gold Developments in British Columbia during 1932," Bulletin No. 3, 1932; and "McConnell Creek Placer Area," Bulletin No. 2, 1932.

Geologic features are fully discussed in previous Annual Reports, and a résumé of essentials will be found in Bulletin No. 1, 1932. It might be added that during the present year outcrops of the Cassiar-Omineca batholith were discovered on the McLeod river, and of the Central batholith on the Horsefly river, as to both of which further mention will be found in the body of this report.

In connection with geologic features, it seems important to draw attention to the fact that, with one important exception, the age of mineralization throughout this district, like that throughout the remainder of the Province, is Jura-Cretaceous, even extending into Tertiary. The important exception is the pre-Mississippian mineralization of the Barkerville area (including Stanley and Yanks peak), where such noteworthy success has recently been achieved by the Cariboo Gold Quartz Mining Company, Limited. This fact lends much additional interest to development in the area mentioned, but it is especially to be noted that in the Cariboo and Quesnel Mining Divisions the richest placer deposits are, with the single exception of Cedar creek, associated with, and originate from, the pre-Mississippian veins, although many veins of Jura-Cretaceous age also occur in these regions, and have also originated placer deposits, of commercial value, although not as rich.

Only passing reference will be made in this report to lode-gold developments during the year, such being chronicled in Bulletin No. 3, "Lode-gold Developments in British Columbia during 1932."

GENERAL SUMMARY.

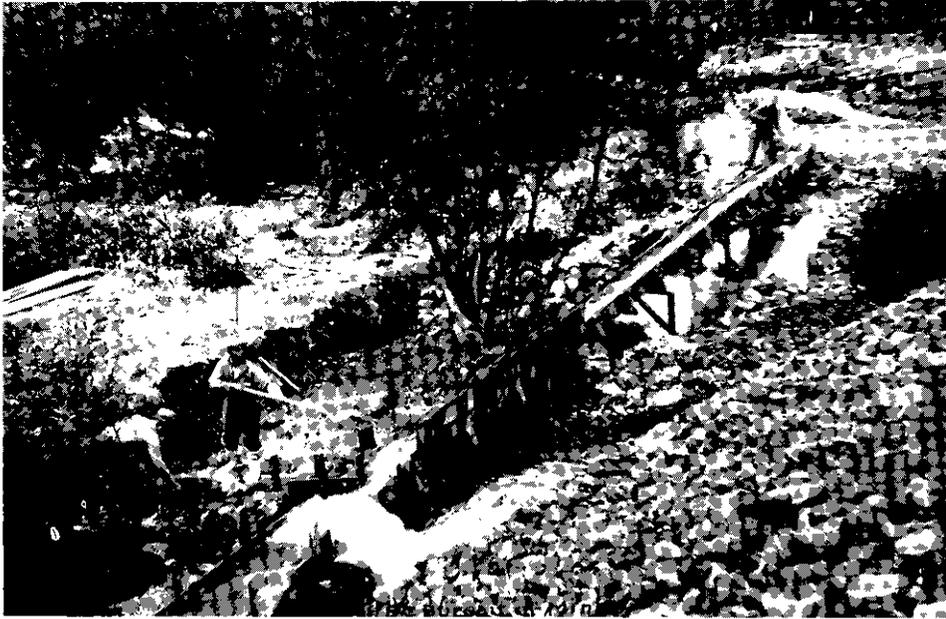
LODE-MINING.

Activities during the year focused almost entirely on lode-gold properties, and base-metal properties remained inactive, save as to individual efforts of prospectors in certain cases.

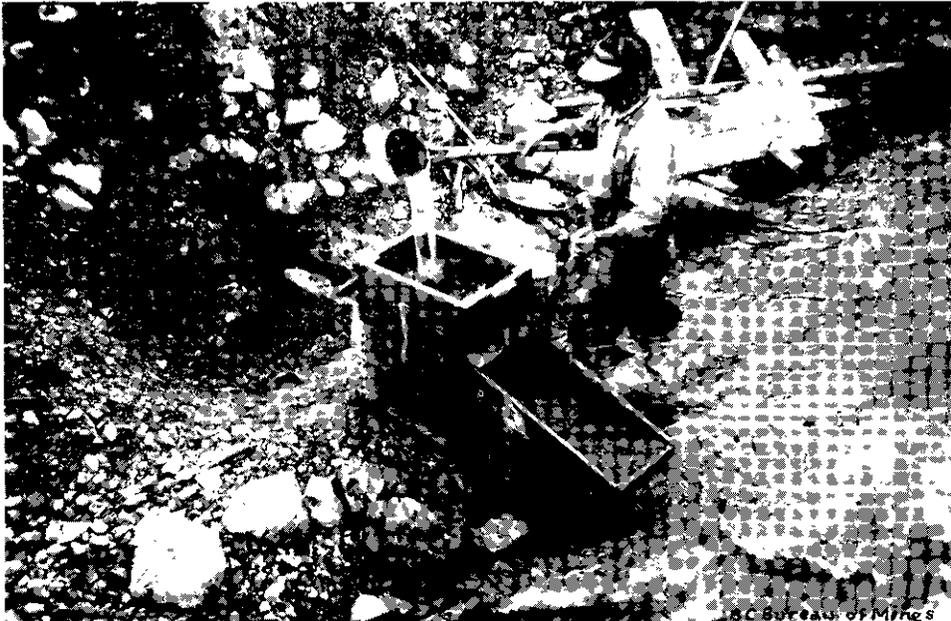
The year closed with a noteworthy event—namely, the bringing of the property of Cariboo Gold Quartz Mining Company, Limited, to the production point, which marks the commencement of a new chapter in Cariboo history. A full account of this property's expansion during the year will be found in Bulletin No. 3, 1932. The newly erected cyanide-mill was turned over during the closing days of the year, and the manager advises that actual milling operations commenced on January 2nd, 1933, and have subsequently progressed satisfactorily. As the result of the success achieved by the Cariboo Gold Quartz Mining Company, Limited, other activities in the vicinity developed, and a large number of claims were staked in the early fall. Very shortly thereafter there developed what can only be described as a "rush" and widespread staking followed.

Mining excitement is so frequently based upon hopes for which there is but little real justification that it is particularly gratifying to reflect that the present boom rests upon such a solid fact as a producing mine. It does, however, seem rather singular that no real live interest was evinced earlier.

A new lode-gold discovery, that of the *Polaris* group, situated near Aiken lake, at the head of the Mesilinka river, is reported by the Consolidated Mining and Smelting Company of Canada, Limited. This discovery was made by the staff of the company in the course of carrying out systematic prospecting.



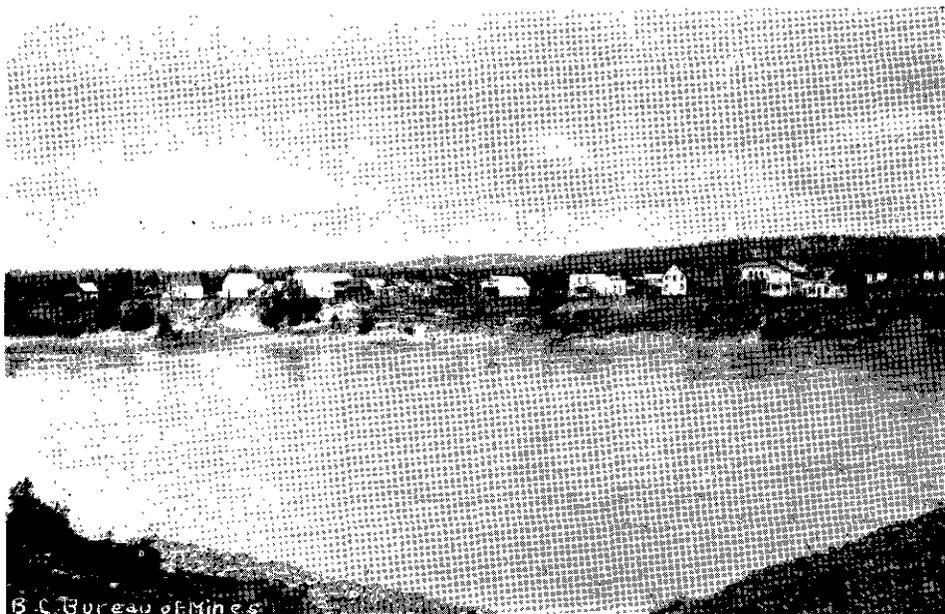
Spruce Creek, Atlin—Shovelling in to Sluice.



Spruce Creek, Atlin—Method of Washing Gravel with Rocker.



Diatomite Deposits on West Side of Fraser River North of Quesnel.



Quesnel, B.C.

PLACER-MINING.

Activities were general throughout the Cariboo and Quesnel Mining Divisions. Many new enterprises were inaugurated; several new discoveries of importance were made; and the number of prospectors, both experienced and inexperienced, in the field was without precedent in recent years.

Important developments took place in the Manson section, in which Germansen Placers, Limited, brought its property into production at the close of the season. The Consolidated Mining and Smelting Company of Canada, Limited, was busily engaged during the year in constructing, with aid from the Department of Mines, a road passable for motor-trucks, from the recently constructed bridge over the Nation river northwards to Slate creek, and in hauling over this road, as completed, the Sauerman slack-line plant, which this company is installing on its property on Slate creek.

An interesting discovery of placer was made on the McLeod river, particulars of which will be found in the body of this report, metals of the Platinum group being present in the gravels to a noteworthy extent, as well as gold.

McConnell creek, in the northern part of the Omineca Mining Division, attracted much attention during the year, and was the subject of special report—Bulletin No. 2, 1932, "McConnell Creek Placer Area, Omineca Mining Division."

It is desired to again express the view that the placer sections of this district offer a rich field for investigation, and much promise to capital in the hands of skilled operators.

Many possibilities of a major order offer in the Cariboo and Quesnel Mining Divisions, to which attention is more particularly drawn from time to time in these reports.

The Manson section has not as yet received as much attention as the older placer sections, probably largely because of its hitherto inaccessibility. The construction of the motor-road thereto, which has already reached a point considerably north of the Nation river, should be followed by much increased activity in this section.

COAL.

F. M. Dockrill continued the operation of his coal-mine near Telkwa, marketing a greater tonnage of coal than in previous year. A new enterprise was started in the fall at Lake Kathlyn coalfield, near Smithers, that of Lake Kathlyn Anthracite Coal Company, Limited.

OIL.

Drilling for oil on the Yorston ranch at Australian, in the Quesnel Mining Division, was resumed in May by F. A. Patrick and associates, but was discontinued after a few weeks. It is understood that the depth of the well is 1,600 feet.

NON-METALLICS.

A great improvement took place at the *Buccaneer of the North* claim, situated 1 mile west of Ritchie flag-station on the Canadian National Railway. This is a saline deposit in very finely divided form of calcium carbonate, in demand locally as a dressing for agricultural land.

G. H. Turner was engaged during the year in testing his deposit of diatomite at the Big Bend of the Fraser river, near Quesnel.

The writer desires to express his thanks to the prospectors, operators, and mining men of the district for many courtesies extended.

PROSPECTING.

Under "Prospecting" in the Annual Reports for the years 1931, 1930, and 1929 will be found much information on this subject of a general character, and in "Lode-gold Deposits of British Columbia," Bulletin No. 1, 1932, will be found specific information relating to prospecting for lode-gold properties. The detailed information given in these reports will not be repeated herein, but it is essential that the prospector, whether in search of lode-mineral or placer, should grasp the following broad facts:—

(1.) The geographic position of the three great batholiths which traverse the district should be recognized. While the Central and Cassiar-Omineca batholiths are not by any means unroofed, or exposed, at all points of their length, the systematic distribution of outcrops closely indicates their paths, which are given in "Lode-gold Deposits of British Columbia." It is the

contact-zones or aureoles of these batholiths, and that of outlying satellites, which are of such importance to the prospector, inasmuch as to the mineralizing influence of these batholiths is to be attributed, with one important exception, all lode-mineral occurrence of importance and all placer occurrence of local origin.

(2.) The important exception mentioned in (1) above is the system of gold-quartz veins exposed at certain points of the Cariboo and Quesnel Mining Divisions—namely, in the Barkerville, Stanley, and Yanks Peak areas—and the importance of which has been recently strikingly demonstrated by the successful operations of the Cariboo Gold Quartz Mining Company, Limited. These veins owe their origin to a deeply concealed batholith of pre-Mississippian and possibly pre-Cambrian age, and are therefore of very much greater age than the veins and other forms of mineral occurrence due to the three Jura-Cretaceous batholiths mentioned in (1) above. But it is to be particularly borne in mind that in the Cariboo and Quesnel Mining Divisions, besides the pre-Mississippian veins, there are many due to the Jura-Cretaceous Central batholith, and west of Stanley and Yanks peak veins of both ages occur comparatively close together. Further veins of both these ages have originated valuable placer deposits, but the richer placer deposits, with the single exception of Cedar creek, are due to the older vein system.

Lode-mineral.—Attention is directed to the importance of largely confining efforts to search for lode-gold properties at the present time. None of the following localities are really hard of access, all appear to merit close prospecting for lode gold, and their possible importance has been suggested largely as the result of recent developments. It should be understood that other localities of promise are mentioned in "Lode-gold Deposits of British Columbia" and previous Annual Reports:—

(1.) Nigger and Harvey creeks, Quesnel Mining Division.

(2.) Cedar Creek meadows—mountain-slopes on both sides. Promising, markedly auriferous, replacement mineralization in the rock has already been found in this region. Search should therefore be made for mineralization of this type as well as for gold-quartz veins.

(3.) The region between Babine lake and Takla, Trembleur, and Stuart lakes.

(4.) In the Manson section, the region more immediately south of the Omineca river between Germansen and Quartz creeks.

(5.) The region south-east of Hixon creek, across Terry and Canyon creeks towards Ahbau lake. Crossing Hixon creek is a highly altered belt of schistose rocks trending north-west and south-east through the property of Quesnel Quartz Mining Company. In prospecting it would seem that particular attention should be paid to the south-eastward continuation of this belt, as it may contain the richer veins, and for that reason may affect placer occurrence also.

(6.) On the north side of the Horsefly river, east of Black creek, occur frequent intrusions of pyroxenite, and well-mineralized quartz-feldspar dykes. Prospectors already engaged in this region should bear in mind the possibility of lode-gold deposits.

(7.) McLeod and Little McLeod rivers. While prospects here are more favourable for placer than lode gold, the possibility of the latter should be borne in mind. Further mention of this region will be found in the section next adjoining under "Placer."

Placer.—Each year there is afforded additional evidence of the fact that the placer sections still provide scope for the prospector, and that, moreover, without going far afield. It is, however, desired to emphasize the fact that there can be no kind of guarantee that even the experienced will make a grub-stake, while the chances of the inexperienced doing so are correspondingly less. At the same time, it is to be noted that the regions which offer most promise to those in search of a grub-stake are comparatively close to transportation routes, and it is most unlikely that any real hardship will be experienced therein.

Those prospecting for placer should note that the location of placer deposits is controlled by the batholiths previously referred to in the preceding paragraphs, and that therefore the localities in which lode-gold deposits are known to occur or are to be expected are the most favourable regions, in the absence of glaciation, in which to expect placer deposits of local origin. These are the most important placer deposits. Fine and flour gold may be, and is, transported by stream-action for great distances and may be reconcentrated on river bars and benches many miles from its point of origin.

The placer deposits of the Manson section are generally much more deeply buried than those of the Cariboo and Quesnel Divisions, and the inexperienced are therefore likely to do better in the last-mentioned areas.

The following regions appear to merit close prospecting:—

(1.) *McLeod and Little McLeod Rivers*.—An account of the recent discovery on these rivers will be found in the body of this report. Inasmuch as the causative influence of this placer is the Cassiar-Omineca batholith, which trends north-westerly in the direction of Mount Milligan, and outcrops on the McLeod river below the junction of the Little McLeod river and quite possibly south-east of this, streams which cut across the direction of the batholith, such as the McLeod river, should be more promising than those which flow parallel to it, such as the Little McLeod river. Any streams flowing in the direction indicated should be prospected first in this region.

(2.) In the 1928 Annual Report the region between the Willow and Fraser rivers, north of the Cottonwood river, was indicated as being of general promise. Since then several useful discoveries have been made in this region, which, in spite of a good deal of recent travel through it, probably still affords scope for close prospecting. The following localities seem likely to merit close attention:—

(a.) From the headwaters of Skaret creek southwards and south-eastwards.

(b.) At the head of the canyon on Terry creek there is evidence of an old valley or channel trending westwards. This should be prospected and followed towards Hixon creek.

(c.) From Hixon creek south-eastwards. A belt of highly oxidized schistose rocks trends north-west and south-east across Hixon creek in the vicinity of the property of Quesnel Quartz Mining Company, Limited. It would seem desirable to trace this belt south-eastwards, because it is possible that veins therein may be richer than those without it, and consequently it may have an important bearing on placer occurrence.

(3.) Dome mountain, near Telkwa. The occurrence of placer has never been reported in this region, but it is quite possible that there may be concentrations on some of the creeks. Those prospectors already engaged in this vicinity are advised to do some panning.

ROADS AND TRAILS.

An important piece of road-construction was carried out during the year—namely, the continuation of the road, started some years ago, northwards from Fort St. James, the object being to afford transportation to the Manson section. Assisted by the Government, the Consolidated Mining and Smelting Company of Canada, Limited, employed a large force of men on this road during the year, with the result that a road passable for motor-trucks is now available from Vanderhoof, on the Canadian National Railway, to a point about 20 miles north of the Nation river. The efforts of the Consolidated Mining and Smelting Company in the matter merit appreciative recognition, and the completion of this road will remove a disability from which this section has suffered.

OMINECA MINING DIVISION.

SKEENA SECTION.

Columario Gold Mines, Ltd.—No work beyond annual assessment was carried out by this company, but the management states that it is the intention to perform about 1,000 feet of development-work in advancing the *Tenderfoot* tunnel, with branch tunnels therefrom. An account of this property will be found in **Bulletin No. 1, 1932**.

Dardanelle.—It is reported that this group (*see* Bulletin No. 1, 1932) has been purchased by Mansell Clark. A small force was engaged at the close of the season in improvements to camp accommodation.

These claims are situated in the immediate vicinity of Usk, adjoining the railway-track on the west side, and are owned by A. Nyberg, of Usk. On the left bank of a small unnamed creek flowing into the Skeena river, close to an intrusion of aplite in the volcanic country-rock, an open-cut exposes a shear-zone about 5 feet in width mineralized with quartz and small amounts of pyrite, galena, and sphalerite. Assay of a sample of the best mineralized portions did not show gold or silver values, but it would seem advisable for the owner to endeavour to pick up the north-easterly continuation of the shear-zone on the higher valley-slope.

This group, owned by A. A. Macdonald, of Usk, is situated about 6 miles north of Usk, on the east side of the Skeena river, on a small creek flowing south-westerly into the latter. This creek has cut a rocky gorge in the mountain-slope through the volcanic country-rock, and at one point is exposed a quartz stringer from which

the owner obtained a piece showing free gold. Quite possibly further search in this region might disclose veins of greater width.

Big Boy. This group, owned by I. Loughheed, of Usk, is situated on Kleanza creek, about 4 miles up from the point of commencement of the trail. In this region the andesitic country-rock is intruded at numerous points by alaskite dykes, and on the left bank of the creek occurs an intrusion of aplite of considerable size. These intrusives are themselves pyritized, and in the vicinity of the aplite mentioned the pyritization in the intruded country-rock is quite heavy, and seams of solid pyrite several inches in thickness occur. Samples of the mineralized intrusives and country-rock, and of the seams of pyrite, did not show upon assay, however, gold or silver values. On the right bank of the creek, about 150 feet vertically above the latter, a shear-zone several feet in width in volcanic country-rock is mineralized with pyrite and a small amount of chalcopyrite. A sample of the seam of chalcopyrite assayed: Gold, trace; silver, 4 oz. per ton; copper, 7 per cent. Further prospecting is justified in view of the generally favourable surrounding geology, and gold-bearing quartz veins seem likely to occur in the vicinity.

Helen. This group was discovered in the fall of 1931 by the owners, G. Alger and associates, of Usk. It is situated on the North fork of Sand creek, which flows into the Skeena river from the west about 1 mile north of Pitman flag-station on the Canadian National Railway. A foot-trail about $3\frac{1}{2}$ miles in length leads from the railway-bridge across Sand creek to the showings.

The country-rock in the region of the showings consists of sedimentaries of the Hazelton series, mainly carbonaceous argillites and quartzites, intruded by granodiorite stocks. This belt of sedimentaries is quite possibly continuous with that which underlies the country for some miles north of Pacific, and extends eastwards across the Skeena river to Seven Sisters mountain.

The North fork of Sand creek cuts through these rocks in the near vicinity of an intrusion of granodiorite, and a mineralization of pyrite, chalcopyrite, and zinc-blende follows the bedding-planes of the sedimentaries. The greatest observed width of good mineralization at the chief point of exposure was 6 feet. It was noted that the mineralization appears to follow the carbonaceous argillites rather than the quartzites, and possibly the precipitation of sulphides may have been influenced by the carbon in the former; at any rate, this seems a point worth bearing in mind in development. The sedimentaries strike N. 80° W. (mag.) and dip at about 35° south-west. A sample across a width of 3 feet at one point assayed: Gold, trace; silver, 10.5 oz. per ton; copper, 3.5 per cent.; zinc, 4 per cent. The elevation of the exposures is about 2,470 feet. The mineralization on this property shows evidence of considerable strength.

Paine. This group is situated 2 miles from Dorreen Station on the Canadian National Railway, and consists of eight Crown-granted mineral claims owned by estate of Frederick Diver, administered by Toronto General Trusts Corporation, of 590 Pender Street West, Vancouver. The property has lain idle for some years, but in view of the fact that it has not been previously examined, and also because gold values seemed likely to be present, an inspection was made during the year. The Resident Engineer was shown over the ground by J. Carpenter, of Dorreen, who worked on the property many years ago. The showings and workings are obscured by the dense growth of vegetation which has sprung up in the eighteen years or so since the property was last worked.

The mode of mineral occurrence is that of two parallel quartz veins mineralized with pyrite, chalcopyrite, galena, and sphalerite, situated, as near as can be judged, 100 feet apart. These strike into the hill at about S. 15° W. (mag.), with steep south-easterly dip; the width of the smaller vein is about $2\frac{1}{2}$ feet, that of the larger about 6 feet. On the latter, at elevation 925 feet, an adit-drift has been run for a distance of about 100 feet. This is partly caved, and the heavy run of water from the back rendered inspection rather difficult. The face shows a vein 6 feet in width, with three seams of mineralized quartz separated by country-rock. A dump at the portal of the tunnel shows pieces of quartz well mineralized with minerals as above noted. A sample of selected portions of ore from this dump assayed: Gold, 0.04 oz. per ton; silver, 11 oz. per ton; lead, 11 per cent.; zinc, 8 per cent.; copper, 1 per cent. The other vein is exposed by numerous cuts along its strike, and appears to be fairly well mineralized, although step-faulted to some extent. Samples at two different points failed, however, to disclose more than a trace of gold.

It is disappointing that this property, which possesses many favourable surrounding features conducive to low operating cost, does not show better gold values. It seems to illustrate the fact previously pointed out in these reports concerning quartz veins in this region—namely, that the latter do not show promising gold values unless there is an intrusion of batholithic rock in the immediate vicinity. It might be noted that in 1925 a sample was taken from a vein on this property exposed by open-cut at a point a short distance below the wagon-road, which showed 0.3 oz. of gold per ton. It is therefore quite possible, even likely, that intrusions of batholithic rock occur on this property, and that, in the vicinity of such, better gold values will be found. The first step would seem to be in this case to search for outcrops of intrusive rock.

SMITHERS SECTION.

Activities of Jessie Gold Mines, Limited, at the *Jessie*; of W. R. Wilson & Sons at the *Silver Lake*; and of the owners of the *Snowshoe* on this property are recorded in Bulletin No. 3, 1932, and will not be further referred to herein.

Rainbow. This group, owned by Jas. Wright, of Smithers, and situated on Driftwood creek, is described in the 1930 Annual Report. The owner uncovered an encouraging mineralization during the year in the shear-zone discovered in 1930. An open-cut discloses a width of about 5 feet well mineralized with chalcopyrite, tetrahedrite, and pyrite. A sample of the best mineralized portion assayed: Gold, 0.6 oz. per ton; silver, 32 oz. per ton; copper, 9.4 per cent. It is advisable to do some further work in the open-cut to better expose the mineralization, and then to make another open-cut a short distance north-east in the shear-zone.

On the *Cimbria* (a description of which will be found in the 1927 Annual Report), in the Babine mountains, a considerable amount of work was done by the owners, B. Mueller and A. Elmsted.

TELKWA SECTION.

The operations carried on at the *Free Gold*, Dome mountain, by W. R. Wilson & Sons (Babine Gold Mines, Limited) are chronicled in Bulletin No. 3, 1932.

Hope. This group, owned by W. S. Duncan and associates, of Telkwa, is situated on the mountain-slopes on the right bank of the East fork of Goat creek at elevation 4,530 feet. It is reached by following an indifferent foot-trail from F. M. Dockrill's coal-mine, from which it is distant about 6 miles.

The mode of mineral occurrence is that of a small quartz vein in andesitic volcanics. The maximum width of the vein is 2½ feet, and it is well mineralized at one point with chalcopyrite, pyrite, and copper-stains. It is exposed on a steep mountain-side, and strikes N. 40° W. (mag.) and dips steeply north-east. A sample of the best mineralized portion of the vein assayed: Gold, 0.04 oz. per ton; silver, 5 oz. per ton; copper, 10 per cent. A sample of the oxidized portion of the vein assayed: Gold, 0.04 oz. per ton; silver, 5.4 oz. per ton; copper, 1 per cent. On the east side of this vein a small mineralized quartz stringer occurs in the country-rock.

HOUSTON SECTION.

Developments at the *Rex* (formerly *Horseshoe*) and adjoining claims owned by G. W. Smith and associates, of Houston, are recorded in Bulletin No. 3, 1932. A new discovery of copper is reported on the *Croesus* (see 1930 Annual Report) by the owner, R. J. Douglas, of Houston. Further work was carried out on the *Morrison* and *Quinn* groups (see 1930 Annual Report), Peacock creek, by the owners, N. Morrison and J. Quinn, of Houston.

TOPLEY SECTION.

An option was taken on the *Golden Eagle* (see 1930 and 1931 Annual Reports) by T. D. Packard early in the year, and it is understood that certain payments due under this option were made, although no actual mining operations were carried out.

L. Bartholomew has been prospecting for a number of years in the body of granite lying north-east of the property of the Topley Richfield Mining Company, Limited, although it is understood that he has not actually recorded any claims. This body of granite has been classified as pre-Jurassic by the Geological Survey, and consequently antedates the remaining country-rock in this area. In places this granite shows a slight mineralization of chalcopyrite and pyrite. At one point it was seen to be intruded by a small andesitic dyke about 2½ feet in width. Subsequent to injection, movement has evidently taken place on both walls, on which

occur a few inches of dyke breccia cemented with quartz mineralized with chalcopyrite. A sample of the more heavily mineralized portions of this assayed: Gold, 0.02 oz. per ton; silver, 0.8 oz. per ton.

MANSON SECTION.

A recent discovery is that of the *Purvis* group, situated on Slate creek, made and owned by T. Rush, of Prince George. This has not been inspected by the Resident Engineer, but it has been ascertained from a reliable source that it consists of a quartz vein upwards of 5 feet in width, mineralized with chalcopyrite, with promising values in gold, commercial possibilities being indicated.

NORTHERN PORTION OF OMINECA MINING DIVISION.

It has been ascertained from information kindly supplied by the staff of the Consolidated Mining and Smelting Company of Canada, Limited, that that company has, as the result of a systematic prospecting campaign carried on for some years past, discovered some lode-gold showings north-east of Aiken lake, at the head of the Mesilinka river, staked as the *Polaris* group. This is described as a number of quartz-filled fissures, some highly auriferous, in argillite. It is the intention of this company to develop this property in 1933.

This company also reports the discovery of an important copper-lead zinc mineralization, the *Cairn* group, situated about 1 mile east of the north end of Thutade lake. The mineralization is of the high-temperature class and occurs in hæmatite-zones in limestone, which is intruded by batholithic rocks. Every indication is afforded of ore-bodies of large size. Another property staked by this company, the *Calcine* group, is situated just north-west of the north end of Thutade lake. On this property superficial tuffaceous material contains a large amount of zinc sulphate, a very small amount of copper, and noticeable amounts of silver—an unusual form of mineralization. Investigation at this property has not extended below the tufa.

PLACER-MINING.

Kleanza Creek.

The deeply carved gorge-like valley of this creek offers many points of resemblance to that of Lorne creek, and, as in the case of the latter, at various points in its length there occur remnants of former channels, which have engaged the attention of placer-miners at different times. None of these, save one, are of noteworthy size. The exception mentioned is the outstanding feature of the creek from the placer standpoint. At about 1½ miles above its mouth this creek passes through a narrow canyon with vertical walls. This canyon possesses all the features of post-Glacial age, and this and other surrounding features very markedly indicate that a pre-Glacial channel-segment lies buried beneath the moraine on the north side of the canyon; that is, in the right bank of the present creek. This channel can be readily discerned on the surface, and at the down-stream end below the canyon what appear to be the rims of the ancient channel are exposed. A few shafts sunk in this region at the base of the moraine would seem well warranted to pick up the bed-rock of the ancient channel, which does not seem likely to be far below the surface at this point. The operations of the Cassiar Hydraulic Mining Company, described in the 1914 Annual Report, were directed to a false bed-rock concentration on glacial clay resulting from the post-Glacial waters of this creek cutting through the upper end of the ancient channel. True bed-rock slopes the wrong way for operation at this end with a view to recover values on true bed-rock.

Skecna River.

About 1½ miles south of Pacific, a short distance west of the railway-track, a high-lying bench flanks the river. A small creek cuts through this bench, which appears to consist of silt and fine sand, overlain by dense vegetation. The creek has effected a concentration of fine gold on false bed-rock. M. Orr, of Pacific, has staked a claim on this creek and has done a considerable amount of ground-sluicing. It seems likely that the river formerly occupied a channel in this region somewhat west of its present course, from the 1-Mile post south of Pacific for some considerable distance down-stream.

Lorne Creek.

Lease of M. Orr, J. Russell Smith, J. Matheson, and Associates.—A considerable amount of work was done on this property during the year. The surrounding features on this property strongly suggest that in post-Glacial times the original pre-Glacial channel of the creek was

blocked by the moraine of the glacier which occupied the gulch on the right bank of the creek at the lower end of the bench, on which encouraging placer values were found. This caused the creek to carve a post-Glacial channel in the rock north of its former position, forming the canyon which now exists. The pre-Glacial channel-segment is indicated as lying buried on the south side of the canyon.

Work done consists in running a tunnel closely adjoining the creek on the right bank of the latter, and about 30 feet vertically above the creek, the idea being to drive through the wall of the canyon, breaking through under the bench above the canyon, and then ground-sluicing the bench-gravels through a flume constructed in the tunnel. On the date of inspection in August the tunnel had been advanced a total distance of 62 feet. As determined by aneroid, the portal of the tunnel appears to be about 30 feet below the top of the bench, but an accurate survey should be made before work of this nature is attempted. The owners have also done work on the lower side of the canyon, uncovering on the right bank of the creek what appear to be ancient channel-gravels. Refer also to the 1931 Annual Report.

S. A. Corley's Lease ("Dry Hill").—This property is fully described in the 1930 Annual Report. Early in the year F. A. Neville obtained an option on this property, and in winter sunk a shaft in the "Dry Hill" hydraulic pit, close to the portal of the tunnel run some years ago by S. A. Corley. Operations were carried on for some months with a small crew, and then F. A. Neville suddenly left the country with wages on account of labour not fully discharged, and all work was suspended. Bed-rock is reported by F. A. Neville to have been struck in this shaft, which is now full of water. Inspection was not possible while work was in progress, and on subsequent inspection water in the shaft rendered it impossible to determine just what information had been gained by this work.

Among industrious workers on this creek may be mentioned A. McNaughton in the canyon below the upper end of "Dry Hill" channel; H. Olson and H. B. Lindstrum on a bench on the right bank of the creek on what appears to be the up-stream continuation of the "Dry Hill" channel; Norman Morrison on the segment of a high channel on the left bank of the creek, about three-quarters of a mile above the upper end of the canyon; W. F. Babcock at the junction of the South fork; and J. Jones on his lease, which is described in the 1931 Annual Report.

Northern Portion of Omineca Mining Division.

Activities on McConnell creek were the subject of special report, Bulletin No. 2, 1932, and are therefore not further mentioned herein. On Jimmay creek, tributary of the Osilinka river, Frank Martin, of Hazelton, and associates worked all the season and report hopeful results. This creek is named after Jim May, who discovered placer on it many years ago.

Manson Section.

Owing to pressure of work in other parts of the district it was not possible for the Resident Engineer to visit this section during the year. The following information is to hand concerning activities during the present year:—

Germansen Placers, Limited, under the management of R. C. McCorkell, completed the extensive programme of construction, and commenced piping at the close of the season, securing a clean-up, which is stated by the management to be decidedly satisfactory.

The Consolidated Mining and Smelting Company of Canada, Limited, had a large force of men engaged under W. M. Ogilvie throughout the season in constructing a road passable for motor-trucks northwards from the bridge across the Nation river, the ultimate destination being Slate creek, and in hauling over the road, as completed, the Sauerman slack-line plant, which this company is to set up at its property on Slate creek. Further reference to this road will be found in this report under "Roads and Trails."

It is understood that the Chinese operators on Vital creek had a successful season. New discoveries are reported on Steele's gulch, a tributary of Kenny creek, by natives; and on Manson creek by S. Rosetti. On Tom creek J. Warren carried out some further investigation of the buried portion of the ancient channel of this creek.

Dog Creek.

It was not possible for the Resident Engineer to visit this creek during the year, but it is known that quite a number were working on it. An account of it will be found in the 1931 Annual Report.

McLeod River Area.

This region may be reached either by trail from Fort St. James or by motor-boat from Summit lake. (This latter is distant 32 miles from Prince George by motor-road.) Activities focus on a region close to the Fort St. James-McLeod Lake Post trail and about 14 miles west of McLeod lake. The lake is 66 miles by the water route from Summit lake. Only skilled rivermen should attempt the water route.

It is not known by whom placer was first discovered in this region, but it was first brought to attention by H. Porter, of Prince George, who is a member of a private syndicate composed of Prince George citizens, and who discovered placer on the Little McLeod river last fall. In the spring of this year a party of students and graduates from the University of Alberta were induced to try their luck in this region, on the advice, apparently, of H. Porter. They did much painstaking prospecting in the region, finally settling on the McLeod river about 1 mile below the mouth of the Little McLeod river, where they struck profitable ground, and noteworthy amounts of metals of the Platinum group in addition to gold.

McLeod river flows north-easterly into McLeod lake by McLeod Lake Post (H.B.C.), and is joined by the Little McLeod river, flowing south-east, about 10 miles above its mouth. The area comprises a portion of the Nechako plateau, through which both rivers have cut to a depth of about 300 feet, both running on bed-rock in rocky gorge-like valleys, within the area examined (about 2¾ miles up the Little McLeod from its mouth and about 2½ miles from the latter point down the McLeod river). The gradient of the McLeod river is about 20 feet per mile and of the Little McLeod river about 40 feet per mile.

The area lies in the path of the Cassiar-Omineca batholith, and although the latter does not seem to have been extensively unroofed in this region, outcrops of ultrabasic and acid phases were discovered on the right bank of the McLeod river just below C. Nelson's claim. These intrude the older rocks of the region, which are exposed almost continuously in the portions of the river-valleys examined, and consist of interbedded andesitic volcanic flow-rocks and argillites. In the latter are numerous calcite veins, some a foot or so in width, but no quartz veins of appreciable size were seen, although such may of course occur. A few small mineralized quartz stringers occur on the property of the University students.

The placer which occupies attention occurs in shallow gravels overlying rock benches, which flank both banks of both rivers and are of frequent occurrence. These rock benches are situated only 2 or 3 feet or so above the rivers, but are not of any considerable size, with the noteworthy exception of one on the right bank of the McLeod river, on which C. Nelson's claim is situated. Higher-lying terraces of glacial gravels also occur on both banks of the rivers. Some of these may of course overlie rock benches. Gold and also metals of the Platinum group occur in the gravels on the rock benches mentioned and also in the cracks and crevices of the rock under the gravel. The placer gold observed is not of any great size, the coarsest piece being of about 15 cents in value, but it is obviously very easy to save, as also apparently are the metals of the Platinum group. Some of the placer is well worn, but the coarser pieces show very little wear, and in view of the fact that some placer occurs in bed-rock, and that in the latter also occur mineralized quartz stringers, and further because intrusions of pyroxenite suggest a near-by source of Platinum-group metals, it seems probable that some of the placer is of local origin, although some doubtless results from reconcentration of glacial debris effected by post-Glacial waters. It might be added that after return of the Resident Engineer to Prince George he was shown a sample of placer several ounces in weight, consisting of coarse nuggets up to \$1 in size. This was stated to have been recovered from a bench some distance below C. Nelson's claim. In one day, it was stated, a party of itinerant prospectors recovered 4 oz. of gold and ¼ oz. of platinum.

The total depth of material overlying these rock benches varies from about 3 to 6 feet, and the absence of boulders of large size renders it easy to recover placer by hand-mining methods, added to which is the fact that this placer is very easy to save in a sluice-flume. One difficult feature is the fact that river gradients are very low, and it is a somewhat laborious matter to get water on the benches by following a system of wing-damming and ditching. This difficulty could be readily overcome by a small mobile pumping plant, the use of which would be well warranted. C. Nelson, with considerable ingenuity, has erected on his claim a water-wheel

for elevating water to his sluice, but fluctuations in the level of the river are stated to have been rather a serious obstacle to steady operation.

While no great amount of work has as yet been done, the values of the ground, ranging from \$1 to \$2 per cubic yard or more, are decidedly promising. While doubtless the installation of a small mobile pumping plant would render operation of much of this ground profitable by hand-mining methods, large-scale possibilities are indicated on the bench on which C. Nelson's claim is situated, which cannot be more fully gauged in the absence of further testing.

The foregoing remarks apply primarily to the McLeod river, which offers more promise than the Little McLeod, quite possibly because the former cuts across the path of mineralization, due to the Cassiar-Omineca batholith, whereas the latter runs parallel to it. Close prospecting of the McLeod river, both down-stream from C. Nelson's ground and up-stream above the junction of the Little McLeod, is clearly justified. Ground in the region of the falls above the last-mentioned point on the McLeod river should be examined. Falls are frequently post-Glacial and indicate that an auriferous pre-Glacial channel-segment may lie buried on one side or other of the falls. Tributaries of the Little McLeod, especially those which flow either north-east or south-west, should also be prospected. It is likewise evident that close investigation should be made of the recovery of Platinum-group metals, and black sands recovered in washing gravels should be reserved for any treatment that may subsequently seem advisable.

Little McLeod River.—Leases on this river from a short distance above the mouth to points up-stream have been applied for by members of a private syndicate consisting of H. Porter, W. L. Armstrong, E. H. Burden, and associates, of Prince George. The mode of placer occurrence consists of shallow gravels on low-lying rock benches flanking the river, which are covered at high water, and owing to prevailing high water throughout the season considerable difficulty was experienced in prospecting these, which are stated to yield good values at various points. Country-rock consisting of interbedded andesitic volcanic flows and argillites is well exposed in the rocky valley through which the river runs in the vicinity of its mouth. At about 1½ miles above the mouth there appears to be a buried ancient channel-segment, both ends of which it would seem advisable to prospect closely. Tributaries of this river flowing north-east or south-west should merit prospecting.

This placer claim is owned by J. E. Hawkins, W. C. Tatham, R. C. Mair, **Cluckhoot.** H. S. McGowan, and W. W. Maybank, students and graduates of the University of Alberta. It is situated on the McLeod river about half a mile below the mouth of the Little McLeod. The mode of placer occurrence is that of shallow gravels on low lying rock benches. One such bench on the left bank of the river was being worked at the time of inspection; the method of mining being that of shovelling into a sluice-flume and cleaning bed-rock in the usual way, water being obtained by wing-damming the river. The total overlie on this bench is about 6 feet in depth, of which 3 feet is more or less barren sand, and the underlying 3 feet of gravels containing the "pay," which also exists in the cracks and crevices of bed-rock. The placer is very readily saved and only a very short sluice-flume was used. Pieces of gold vary in size up to about 15 cents. Some of the placer is comparatively unworn. At the time of inspection the total yardage mined was about 175 cubic yards, from which gold to the value of \$225 had been recovered, indicating a gold value of about \$1.25 per cubic yard.

One pan sample was taken, which the owners considered to be distinctly below the average. This, on the basis of 150 pans to the cubic yard, indicated a gold value of 91 cents per cubic yard, total gold being determined by fire assay. Another pan, deemed by the owners to be approximately representative of the value of the gravels, indicated a gold value of \$2.73 per cubic yard and a platinum value of \$0.97 per cubic yard, or a total value of \$3.70 per cubic yard. It should be understood that these pans were taken from pay-gravels only and do not include the more or less barren overlying sand.

A sample of black sand, from which gold had been removed by amalgamation, was assayed and yielded the following results: Gold, trace; platinum, \$4,500 per ton; iridium, \$780 per ton; or a total value of \$5,280 per ton. Values in this black sand call for special comment and plainly indicate that black sand should be kept, pending investigation as to the best method of recovery of the Platinum-group metals. The latter are comparatively coarse and to some extent evidently separable by panning; indeed, platinum in limited amount has been recovered by prospectors on this river.

C. Nelson's Claim.—This claim is situated on the McLeod river, about 1½ miles below the junction of the Little McLeod, at the lower end of a large bench about half a mile in length, which flanks the right bank of the river in this region. It is understood that the ground up- and down-stream from this point is covered by leases under application by members of the private syndicate of Prince George citizens, previously referred to in this report.

C. Nelson's claim is situated at the lower end of a low-lying rock bench. Just how far up-stream this bench extends remains to be determined, as a series of terraced benches at various levels extends up-stream from this point, obscuring bed-rock. Whether these benches are underlain by rock or not remains also to be determined. The uppermost bench extends a very considerable distance back from the river. The position of the right rim of the river-valley in this region and other topographic features indicate the possibility of a buried channel-segment of considerable length. The advisability of close prospecting to determine this, especially at the possible outlet end indicated by the topography, is markedly indicated. The outlet would be some considerable distance down-stream from C. Nelson's claim.

The depth of gravels overlying rock on C. Nelson's claim is only about 3 feet. Placer occurs in these gravels and in the underlying oxidized and decomposed bed-rock. Panning rendered evident that values are very promising. It is quite evident that large-scale possibilities may offer in this region, and investigation is fully warranted to determine such. The first requirement on this river seems to be a small mobile pumping plant to pump water for washing gravels.

COAL.

The output of coal was 2,782 long tons, as compared with 2,395 long tons in 1931.

Bulkley Valley Coal-mine.—A description of this property, operated by F. M. Dockrill on Goat creek, near Telkwa, will be found in the 1931 Annual Report. Mining operations were continued during the year with a small force of men sufficient to cope with market demands. The good qualities of this coal, which closely approximates to "high-carbon bituminous" in classification, are meeting with increasing recognition, and a gratifying increase in sales resulted during the year.

As viewed at the end of August, mining operations to date covered a distance of approximately 400 feet along the strike of the seam and extended to a depth of 220 feet measured along the dip. The width of the seam being mined is about 14 feet, of which between 9 and 10 feet is mined. The coal, save for a small seam of shale in the centre, is remarkably clean. Within the area mentioned above there is no evidence of any major disturbance, apart from the fact that the coal at one point was found to be somewhat sheared.

Lake Kathlyn Anthracite Coal Co., Ltd.—This is a private company which commenced operations in the fall in the Lake Kathlyn coalfield, a description of which will be found in the 1926 Annual Report and which will not be repeated herein.

Operations were commenced by construction of bunkers and of a wooden chute thereto 500 feet in length from the portal of the tunnel started on the Ballard seam. The bunkers are situated alongside the road to the property from the highway, and a branch road from the latter to Lake Kathlyn Station on the Canadian National Railway was also constructed. Operations in the fall were hampered by the bad state of the road, but improved in this respect with the advance of winter.

The age of this coal antedates that of the batholithic intrusion, which caused uptilting of the coal-measures, and the formation of Hudson Bay mountain and the lode-mineral deposits of that mountain. In consequence the coal-seams have been profoundly affected and metamorphosed by the close proximity of the hot intrusive, both physically and chemically. The effect has been that the coal in general has passed beyond the anthracite stage, but, nevertheless, it is found that some of the coal possesses good burning qualities, and a small tonnage has been marketed locally. This results from the advancement of the tunnel on the Ballard seam, which it is proposed to continue for some distance, and subsequently to crosscut from it to other seams.

NON-METALLICS.

Buccaneer of the North.

A description of this property will be found under "Bockner of the North" in the 1931 Annual Report. It was discovered during the year by the owners, August Johnson and A. J. Hillyard, of Ritchie, that the area underlain by this deposit of calcium carbonate on the south side of the small lake is very

considerable. A cut in this region, 100 feet long, 10 feet wide, and 5 feet deep, showed dense vegetation and heavy timber-growth immediately over this deposit, with little or no intervening soil beyond moss. The colour contrast between the vegetation and dead-white colour of the calcium-carbonate deposit is striking. The entire absence of any clay in the deposit renders it very easy to handle either by hand or any mechanical means. It is distant about 1 mile from Ritchie flag-station and can be mined and shipped at low cost. Whatever other use may be found for this material, it appears to be an excellent dressing for agricultural land, although no shipments have yet been made other than small quantities for testing purposes.

Diatomite.—G. H. Turner was engaged during the year in carrying out small testing operations on his diatomite property near Quesnel, at the Big Bend of the Fraser river.

PEACE RIVER MINING DIVISION.

It was not possible for the Resident Engineer to visit this Mining Division during the year. Accounts of it will be found in the Annual Reports for 1923, 1926, 1928, and 1930.

CARIBOO MINING DIVISION.

LODE-MINING.

An account of recent lode-gold developments will be found in "Lode-gold Developments in British Columbia during 1932," Bulletin No. 3, 1932, in which also will be found a report on the property of the Cariboo Gold Quartz Mining Company, Limited, by the Provincial Mineralogist. Much detailed information concerning lode-gold properties is also given in "Lode-gold Deposits of British Columbia," Bulletin No. 1, 1932. Reference to the foregoing bulletins is invited, as detailed information therein given will not be repeated herein.

Since publication of the first-mentioned bulletin the following supplemental information has been obtained concerning certain properties, which is appended below.

Cariboo Gold Quartz Mining Co., Ltd. The Department has been kept in close touch with recent developments by the management, appreciative recognition of which is expressed. The new mill was turned over on January 2nd, 1933, and continuous operation commenced on January 10th. It is also understood that another vein (No. 9) of gratifying commercial proportions has been struck in the long crosscut tunnel (No. 15 level) at 1,400 feet from the portal.

Reward Mining Co., Ltd. The management advises that all the holdings of this company as specified in Bulletin No. 3, 1932, have been bonded to Cariboo Consolidated Gold Mines, Limited (president, General J. Duff Stuart; vice-president, Dr. Victor Dolmage; managing director, R. H. Stewart; director, Elmore Meredith; secretary, A. C. Spiers), and that active work will be carried on during the winter, a compressor is to be installed, and an extensive development programme is proposed for next summer. The properties controlled by this company are undoubtedly of pronounced promise, all lying in the "No. 1" or "Barkerville" belt, in which is situated the property of Cariboo Gold Quartz Mining Company, Limited. Island Mountain holdings are described in Bulletin No. 3, 1932. As to holdings on Proserpine mountain, but little specific information can be given, save as to recent work on the *Pani* and *Pani South* claims, described in Bulletin No. 1, 1932, because many of the old workings have been inaccessible for many years. As to the *Hudson* group on Cunningham creek, this has for some considerable time past been recognized as a prospect of decided merit, to which attention has been frequently drawn in the reports of this Department.

Burns Mountain Gold Quartz Mines, Ltd. This company has recently been incorporated for the purpose of operating the *Perkins* group, situated on Burns mountain, near Stanley, and described in Bulletin No. 1, 1932. The president of this company is W. M. Halliday and the secretary is D. S. Tait, the registered office being 601-5 Bank of Toronto Building, Victoria. It is stated in the prospectus that a tunnel destined to cut the vein system at a depth of 250 feet, within an estimated distance of 300 feet, has been started.

Among other activities not mentioned in Bulletin No. 3, 1932, may be mentioned the following: Some prospecting activities developed in the region north-east of Prince George, east of Shelley, where work was done some years ago, and where batholithic rock-outcrops are in

evidence. In view of the fact that the placer occurrence on Skaret creek south-east of this is of local origin, keen scrutiny in the region mentioned for lode gold is justified. Among prospectors in this region may be mentioned T. Rush and associates, of Prince George, on the *Nani No. 1* and *Nani No. 2* claims; also J. and P. Lindsay, of Prince George, on the *Scotia* group (formerly *Snowshoe*; see 1918 Annual Report). This area is well served by the Willow River road from Prince George.

Scotia. This property consists of six Crown-granted claims and is situated on Pre-emption Lots 9240 and 4894. The country-rock consists of schisted argillites and grey quartzites intruded at one point by diorite, in which occurs a mineralization of pyrrhotite, pyrite, with some chalcopyrite, and in which a shaft now full of water is stated to have been sunk to a depth of 40 feet. From this point north-west for a very considerable distance, shafts, open-cuts, and other workings at intervals disclose a sparse mineralization. At the north end of the property occurs a quartz vein mineralized with chalcopyrite, tetrahedrite, and copper-stains. This has been opened up at intervals by shafts and open-cuts in an exposed length of some hundreds of feet. While the deeper workings are not now accessible, the vein is stated to be 5 feet in width at the point of lowest exposure. Samples of selected portions of mineral lying on a dump assayed: Gold, trace; silver, 0.8 oz. per ton; copper, 1.8 per cent. This vein shows considerable strength, and it is quite possible that samples at other points might disclose higher precious-metal values.

This claim is owned by Harry Crooks, of Quesnel, and is situated on the south side of Lightning Creek valley, about 1½ miles below Wingdam. There is here exposed by open-cut a quartz vein about 5 feet in width, which, although bleached white on the surface, at a depth of a few feet appears to be well oxidized. It is not as yet well exposed, but appears to strike parallel to the bedding-planes of the enclosing schisted argillite country-rock. While a sample taken across the most promising-looking portion of the vein disclosed traces only of gold and silver, some further prospecting in the vicinity seems merited.

PLACER-MINING.

The production of placer for the year was \$70,635, as compared with \$63,716 in 1931. A noteworthy expansion of activities was apparent, many new enterprises being inaugurated, and new discoveries were made, of which the most important seem to be that of G. S. Gagen on Gagen creek and that of A. Nani on a tributary of Hixon creek. In spite of the heavy fall of snow the previous winter, the amount of water available for hydraulicking was not as much as might have been expected. The number of prospectors in the field was very large.

Skaret Creek.

A discovery of fairly coarse gold on bed-rock was made on this creek in the fall of 1931 by P. Skaret, of Prince George, and was brought to attention this spring. A \$12 nugget was found by the discoverer on his claim.

Skaret creek, situated due east of Prince George, is a stream of fair size, which flows north-westerly into Tabor creek, a short distance below Tabor lake. The Willow River road from Prince George passes within about 3 miles of the scene of activities, and a trail about 3 miles in length leads from this road across Tabor creek and follows the right bank of Skaret creek up-stream. The total distance to the Discovery claim from Prince George is about 8 miles.

Up-stream from its mouth, Skaret creek occupies a wide valley for about 1½ miles, when a sudden bend occurs, and it is confined for a short distance within a short canyon-like gorge, from which point up-stream for 2½ miles (the farthest point examined) it is contained in a comparatively narrow V-shaped valley which again widens at up-stream points. It receives a tributary, Corless creek, on the north side a short distance above the canyon. Activity centres mainly on the portion of the creek above the canyon, the Discovery claim being situated just above the mouth of Corless creek.

Above the canyon and for some distance up-stream above the Discovery claim, the creek runs either on or close to bed-rock, which consists of volcanic flow-rocks of andesitic composition interbedded with argillite. In the country-rock occur small quartz veins. The placer gold, which is fairly coarse, occurs in the gravels immediately overlying bed-rock and in the cracks and crevices of the latter. The creek has not yet succeeded in entirely removing the glacial debris which occupied this portion of the valley at the closing stages of the Glacial period, and

much yet remains, including large boulders, immediately adjacent to the present course of the creek. The indications are that the placer gold is of local origin.

The grade of the bed-rock in this portion of the creek is about 6 per cent.; of ample grade for hydraulicking, but the best conditions for this are not present, although it is possible that the steepest portion of the creek from the canyon up-stream might be mined in this way. By taking accurate levels, and by detailed examination of the size of the gravels in the region mentioned, it would be possible to determine if installation of a small hydraulic plant is justified. The values in the gravel fully justify close investigation. Hand-mining methods are now being followed, gravels being shovelled into a sluice-flume and bed-rock cleaned in the usual way. At about 2 miles above the Discovery claim the valley widens again and bed-rock is not exposed, and at the time of inspection A. Anderson was here sinking a shaft in the left bank of the creek on a small flat, the depth reached being 25 feet.

Among the claims which seem to be of major importance are those of the discoverer, P. Skaret; of F. Peterson, next above the Discovery claim; that of Oscar Olson, the fourth claim below the Discovery claim, where there appears to be an older channel in the right bank of the creek; and below this is a group of seven claims owned by R. Corless and associates, which seems likely to contain the continuation of the old channel mentioned.

With reference to that portion of Skaret creek below the canyon, bed-rock is here not exposed, and the overlie of glacial debris is probably much heavier. In this region a short distance below the canyon on the right bank of the creek H. B. Bessac started a shaft, but discontinued sinking, owing to water encountered, it is understood.

In the vicinity of the canyon, just below the mouth of the latter, it would seem advisable to do some prospecting on and above the left bank of the creek, as there is some suggestion of a former channel in this region.

Although this ground has so far not proved very rich, nevertheless it is sufficiently so, at any rate, to afford a livelihood for quite a number, who are naturally spurred on by the coarseness of the gold. The discovery is a very useful one, and all concerned are putting much intelligent and painstaking effort into their search. The number of cabins which have been built to enable work to be carried on to the best advantage is a noteworthy feature. It is evident that further prospecting in this region is justified, especially in a southerly and south-easterly direction from the headwaters of the creek.

Tabor Creek.

This company has a Dominion charter; secretary, J. Mitchell, Dominion Hotel, **Prince George Gold Mines, Ltd.** Calgary; manager, Thos. Ramage, of Prince George. The property consists of two creek leases at the mouth of Tabor creek, over which lode-mineral rights have also been acquired. A car can be got on the ground in dry weather by following various side-roads from a point on the highway just south of the Tabor Creek bridge. No work was taking place at the time of inspection in May.

The mode of placer occurrence exhibited at this property is uncommon, but by no means unique; it is that of post-Glacial reconcentration of glacial debris consisting wholly of granitic material; and reconcentration has been effected on a false bed-rock afforded by a kaolinized layer of the same granitic material. It has points of resemblance to Terry creek and McConnell creek.

The moraine of the glacier which formerly occupied this creek-valley, and through which Tabor creek has cut to a maximum depth of about 150 feet at points near the Fraser river in a broad valley, consists wholly, in its upper portions at any rate, of granitic material, in which there is a considerable amount of free quartz. Some of the quartz particles are mineralized. In size the material varies from sand to medium-coarse boulders, without any material quantity of large boulders. Tabor creek now runs in the northern part of its valley over a false bed-rock of indurated kaolinized granitic material which lies a few feet below the valley-floor, and fairly coarse gold can be obtained at several points by panning false bed-rock gravels. Various shafts, in number five, and from 12 feet to 58 feet in depth, have been sunk in the deposit, and in some of these values are stated to have been obtained running up to \$1.40 per ton.

Such material probably originates from a source which is not far distant; a possible terrain might be afforded in the direction of the headwaters of this creek, which includes the Skaret Creek area. Apart from the question of such reconcentration of gold as has been effected by

the waters of Tabor creek, the average gold contents of glacial material of this character may be expected to be higher than that of ordinary glacial debris, although erratic distribution of values is to be expected.

The large yardage of material available and the absence of any material quantity of boulders of large size would render this deposit amenable to "high-line" operation if sufficient average values are proven. The possibilities in this direction certainly indicate that preliminary testing is justified. The latter might well consist of systematic pit-sinking and the washing of gravels resulting from pits, followed possibly by Keystone-drilling. Without such preliminary testing, commercial possibilities, although hopeful, cannot be accurately gauged.

Hixon Creek.

Operations of A. Nani and Edmonton and British Columbia Mining Syndicate.—A discovery of importance was made by A. Nani, a member of the syndicate mentioned, on an unnamed tributary of Hixon creek, flowing in from the north, at a point immediately east of the property of Quesnel Quartz Mining Company, Limited. This creek is locally known as the "North fork of Hixon creek" and also as "Little Hixon creek." The point of discovery is about 400 yards above the point of junction with Hixon creek, on lease No. 2514, standing in the name of Edith K. Nani.

The mode of placer occurrence exhibited is that of post-Glacial concentration on false bed-rock, and the character of the gold is coarse. It is stated that one nugget 4 oz. in weight was obtained, and the Resident Engineer was shown one nugget of about 1½ oz. weight stated to have been obtained from this ground. Coarse gold was disclosed by panning.

At the time of inspection in August a sluice had been constructed and a cut about 200 feet long opened up, disclosing a depth of about 15 feet of post-Glacial gravels and glacial material lying on clay false bed-rock, with many boulders of large size. Sluicing operations at this time had been suspended owing to shortage of water, and at that time construction of a dam to conserve a sluice-head of water was being considered. Subsequently, owing to litigation, no further operations took place during the season. It was stated by the discoverer that the total value of gold recovered from the cut amounted to \$460.

This discovery seems likely to prove important, and is situated in the region to which attention was drawn in the 1931 Annual Report as being likely to contain a buried ancient channel-segment of Hixon creek, a view which was formed by study of surrounding features of the glacial geology. It remains for further work to be accomplished before possibilities can be accurately gauged, but the region is of pronounced promise. Excellent camp buildings have been erected on a suitable site close to the scene of the discovery.

Operations of B. Briscoe.—B. Briscoe and associates hold a number of creek and bench leases on Hixon creek from the falls up-stream for some 3½ miles.

In May, B. Briscoe commenced mining bench-gravels on the right bank of the creek immediately behind the old stamp mill of the Quesnel Quartz Mining Company, Limited, and it is understood that it was as the result of these operations that rich quartz stringers were uncovered on the property, the lode-mineral rights in which are held by the company mentioned.

In this region the creek has cut down to a depth of about 200 feet in the plateau, and from the top of the latter down to the creek occur a series of gravel-covered benches. These have engaged the attention of "snipers" in the past, and good values exist at some points. At 75 feet above the creek, gravels rest upon a rock bench, which represents a former pre-Glacial bed of the creek, and it is upon this bench that the rich stringers mentioned were uncovered. The operations of B. Briscoe comprised mining gravels lying on this bench by hand, tramping them across the bench, and finally washing them in a sluice in the creek. Such was the only means of working available to the operator at the time, and was naturally expensive, and operations were not long continued. This rock bench affords excellent dump facilities, and were any large supply of water under pressure available so that a monitor could be set up on the bench, quite possibly operations would prove profitable. The upper-lying gravels on this bench are Glacial and post-Glacial, but it is quite possible, even likely, that gravels immediately overlying this rock bench are pre-Glacial, also that placer will be found in the bed-rock. It is understood that the operator had in mind pumping water for sluicing on to this bench, but was for various reasons unable at this time to carry out original plans. Attention has been drawn in the 1931 and previous Annual Reports to the potentialities of this creek.

Terry Creek.

A description of the modes of placer occurrence on this creek will be found in the 1930 Annual Report. This creek presents many unusual features, and the coarse placer found on it and on Hixon creek, coupled with promise from the lode-gold standpoint, indicates that the immediately surrounding area merits detailed field-study embracing both the features of bed-rock and glacial geology. Attention was again directed to this creek during the year following the discovery by G. Lahti of coarse gold up to $\frac{1}{2}$ oz. in size in gravels underlying the false bed-rock on which rested the superficial gravels which engaged the attention of the early operators.

Placer concentrations that have so far been worked on this creek all rest upon false bed-rocks of various kinds, of which the lowest appears to consist wholly of more or less kaolinized granitic and schistose detritus over which the creek runs. The occurrence of lignite in this material would indicate that its age is, at any rate, inter-Glacial. Below this false bed-rock no placer operations on this creek have so far extended, so that just what lies on true bed-rock is quite unknown. In view, however, of the general bed-rock geology, which indicates the likelihood of placer deposits of strictly local origin, the occurrence of placer on true bed-rock seems quite likely. A noteworthy feature of the creek is the large number of boulders, some of large size, of pegmatite and quartz which occur in the bed of the creek, and which appear to be indicative of those parts of the creek where the richest concentrations of false bed-rock placer may be expected. This is also the case on Hixon creek.

The country-rock, from Tom creek (about 4 to 5 miles above the mouth) up-stream, consists of interbedded schistose rocks, volcanics, and argillites, which have been profoundly altered and metamorphosed presumably by reason of the numerous intrusions of granitic rock which are evident in the vicinity. A belt of schists about half a mile in width has been extensively kaolinized, and argillites and phyllites occur.

Immediately above Tom creek, Terry creek is flanked for a distance up-stream of about $1\frac{1}{2}$ miles by low-lying bench deposits of gravel which engaged the attention of the earliest operators, and which occur on both banks of the creek. The width of the valley in this region is between 500 and 900 feet. It is on the right bank of the creek in this region that the recent discovery was made by G. Lahti. Above this the creek is contained in a rocky gorge for some distance, below and above which are intrusions of granodiorite and diorite. At about 3 miles above Tom creek there is a canyon about 300 yards in length, and above this the valley again widens. At the upper end of this canyon, the walls of which are about 90 feet in height, a clearly defined valley trends westerly in the direction of Hixon creek, and it is obvious that this may be an old channel and merits close prospecting. Also at the ends of both canyon and rocky gorge close examination should be made for the possible existence of buried channels.

Leases of F. German and G. Lahti.—These are situated a short distance above Tom creek. G. Lahti, as mentioned, discovered coarse gold underlying the false bed-rock above which were the concentrations of placer worked by the early operators. The valley is wide in this region, from 500 to 900 feet, and low-lying benches flank both banks of the creek. At the time of inspection, preparations had only just been commenced to work this ground by hand, and possibilities could not be fully appraised, although the extent of the ground indicated that prospects were decidedly encouraging.

Lease of T. H. Campbell.—This lease is situated in the immediate vicinity of Tom creek, a small creek flowing in from the south, between 4 and 5 miles above the mouth of Terry creek. T. H. Campbell has been working on this creek for some years and has accomplished much single-handed by painstaking effort. During the year he uncovered what appears to be either a former channel of Tom creek or of Terry creek in the left bank of the latter a short distance below the mouth of the former. This is overlain by glacial debris and rests on the false bed-rock of kaolinized granitic detritus over which Terry creek flows. This well merits further investigation.

Ahbau Lake.

Ahbau lake is the most southerly and the largest of a chain of three lakes—Lodi, Hay, and Ahbau—situated in an almost due north-and-south line in the order named at the headwaters of Ahbau creek, a large tributary of the Cottonwood river. The region has been recommended for prospecting for some considerable time past, and attracted attention during the year by reason of the discoveries of placer. It is reached by pack-trail leaving the Quesnel-Barkerville

road just east of the Cottonwood River bridge. The distance from the highway to the south end of Ahbau lake is between 16 and 17 miles. From this point the trail follows the west side of Ahbau lake to Ahbau House, situated just north of Ahbau lake. Ahbau House is the cabin built by Ah Bau, the Chinaman, who first discovered placer here many years ago, and is distant about 28 miles from the starting-point of the trail. It is in this vicinity that recent discoveries were made.

During the year Paul Jorgensen and associates installed a small hydraulic plant on Murray creek, which flows into Ahbau creek from the west about $1\frac{1}{2}$ miles south of Ahbau House, and G. F. Taylor and associates staked creek and bench leases on Ahbau creek south of Hay lake, working their ground by hand methods.

The country-rock in this region where exposed is seen to consist entirely of schist. A comparatively short distance south-east of this, north-east of the south end of Ahbau lake, and on Moosehorn creek, tributary of the Willow river, quartz veins are known to occur, and also intrusive rocks are in evidence at the latter point. The region lies in the path of the Central batholith, but whether the quartz veins are due to this source or to the ancient pre-Mississippian intrusion in evidence at Barkerville and Stanley can only be determined by detailed geologic field-work.

The placer occurs partly on bed-rock, but to a large extent on false bed-rock, and notwithstanding the last mode of occurrence it seems likely that it is of closely local origin. The south-easterly trend of placer towards Beaver pass seems fairly clearly defined, and close prospecting of the intervening region seems fully warranted, likewise that of prospecting north-westwards towards Terry and Hixon creeks.

On Murray creek, and on Ahbau creek south of Hay lake, bed-rock lies at shallow depth from 5 to 15 feet, but just west of this, on Alder gulch, flowing into Hay lake from the west, a shaft sunk some years ago is stated to have reached a depth of 80 feet, but just what the latter disclosed is not known, although the indications are that a deep and possibly auriferous channel exists in this region. On Murray creek the placer occurs on shallow gravels immediately overlying bed-rock, but on Ahbau creek the placer concentrations lie mainly on false bed-rocks of glacial material, and clearly result from post-Glacial waters cutting through the glacial debris which floors the valley, and this, even where not showing the effects of these waters, appears to carry fair values.

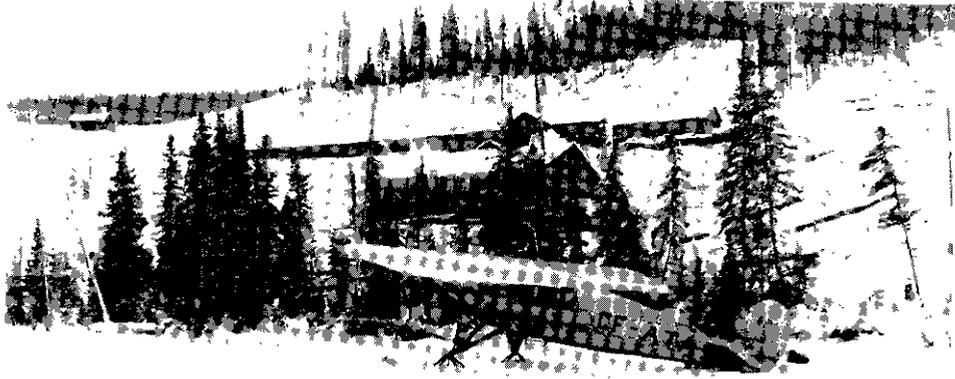
The possibilities for slack-line installation in the region of G. F. Taylor's ground seem distinctly favourable and could readily be determined by systematic testing, such as shafts systematically distributed, followed possibly by Keystone-drilling. The region, including the deep ground on the west, undoubtedly justifies close investigation. The nature of the gold is fairly coarse and well-worn. It is obviously easy to save.

Placer Leases of P. Jorgensen and Associates.—These leases are situated on Murray creek, which flows into Ahbau creek about $1\frac{1}{2}$ miles north of the north end of Ahbau lake. Murray creek is a fair-sized creek occupying a somewhat narrow valley and flows on a gradient of about 5 per cent. The country-rock is schist, exposures of which are frequent on the banks of the creek, which appears to flow on or close to bed-rock at most points. Low-lying benches, some of fair size, flank both banks of the creek in the wider portions of the valley, and the placer occurs in the gravels overlying these, and also on bed-rock. The gravels result from the reworking of the glacial debris which formerly occupied the valley, and a portion of which still remains.

The owners erected a small hydraulic plant in the spring, constructing a ditch-line 1,200 feet in length on the right bank of the creek, giving a head of about 80 feet at the monitor (maximum size of nozzle, 3 inches), which is set up about four-fifths of a mile from the mouth of the creek. The plant was put in after considerable testing of the ground by the owners, who report satisfactory results.

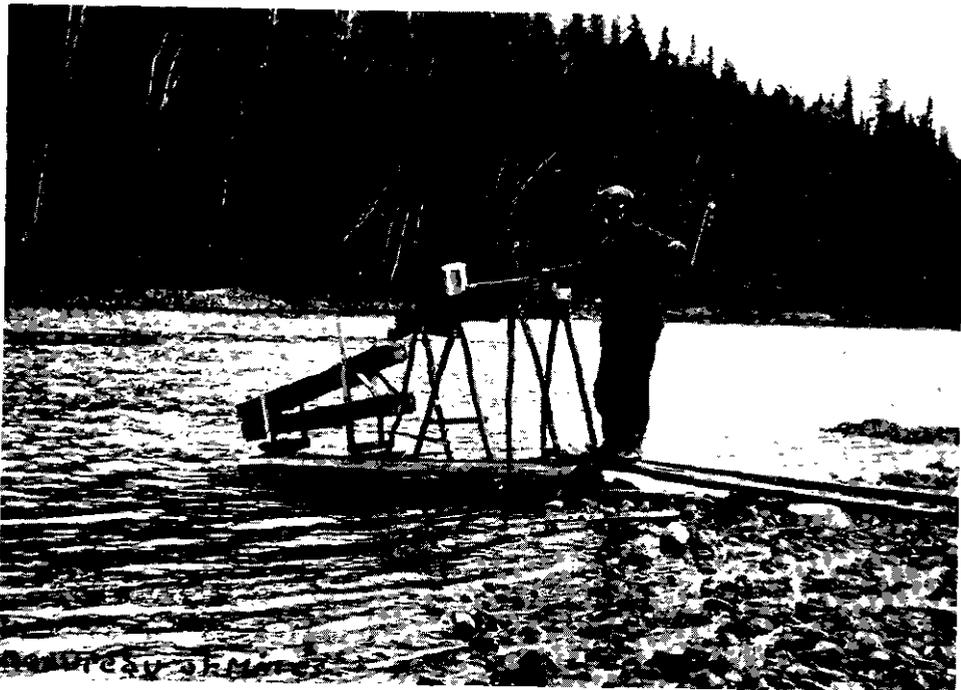
Leases of G. F. Taylor and Associates.—These leases are situated on Ahbau creek, extending from Hay lake down-stream, and comprise two creek and two bench leases, and cover the ground formerly worked by Ah Bau, the discoverer of placer in the region.

On this ground Ahbau creek runs close to bed-rock, which is exposed at several points. Placer occurs mainly on false bed-rocks of hard-pan and other glacial material, and to some extent on true bed-rock. It is well-worn and fairly coarse and easy to save. It results from the reconcentration of the glacial debris which flanks the banks of the creek. Pan-samples taken

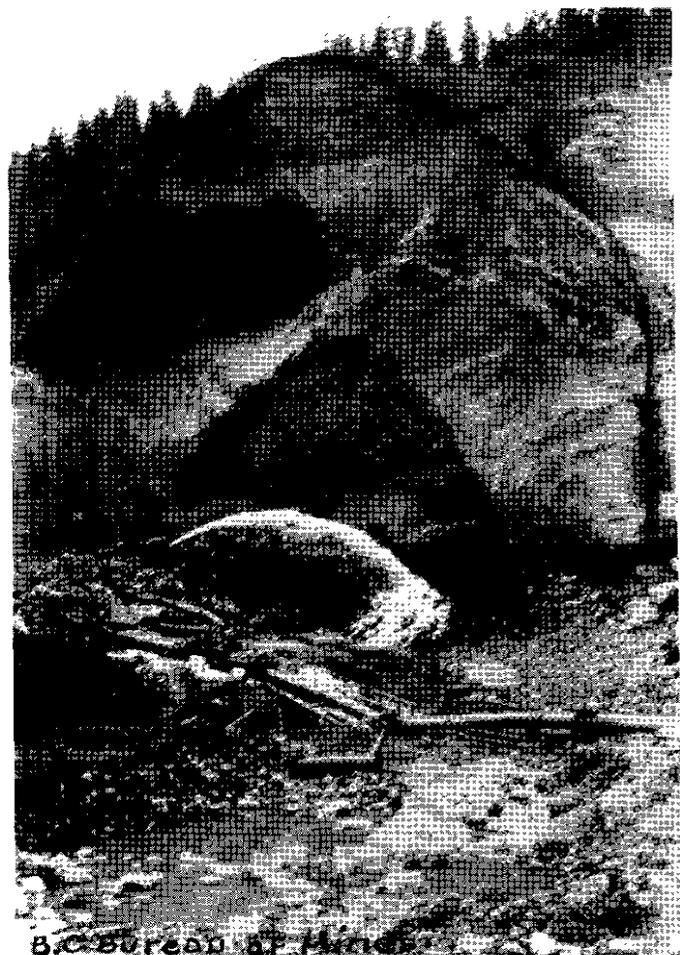


BC Bureau of Mines.

Caribou Gold Quartz Mining Co., Ltd., Jack of Clubs Lake.



Fraser River—A Long-tom in Use for Sluicing Gravel.



Moorehead Mines, Ltd., near Hydraulic.

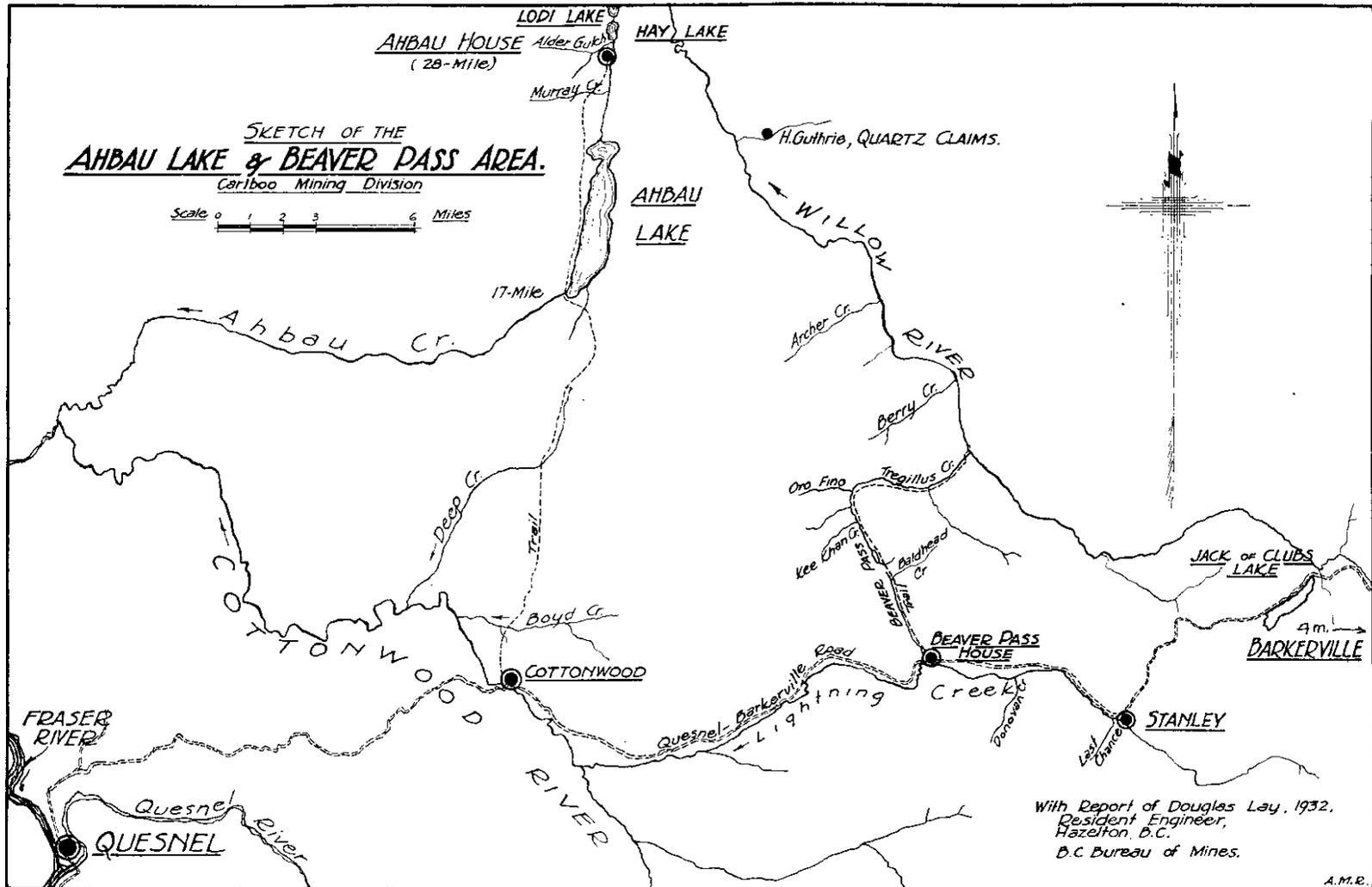


Hydraulic on Lowhee Gulch.

**SKETCH OF THE
AHBAU LAKE & BEAVER PASS AREA.**

Cariboo Mining Division

Scale 0 1 2 3 4 Miles



With Report of Douglas Lay, 1932,
Resident Engineer,
Hazelton, B.C.
B.C. Bureau of Mines.

A.M.P.

at various points indicate a region of distinct promise, and quite possibly a field for slack-line operation, and to this end systematic testing is undoubtedly justified. The unsorted glacial debris in this region also seems to contain more gold than is usually the case. It is known that deep ground lies west of this on Alder gulch, and just below Hay lake there is some evidence of a channel trending in the direction of the Willow river. G. F. Taylor and associates were working this ground by shovelling into sluice-flume.

H. Young, H. Bradley, and D. Parks during the year had a "lay" on a portion of G. F. Taylor's ground, and the form of dump-box at the head of the sluice, made by the first mentioned, merits a brief description. It consisted of a box of liberal dimensions, with gently sloping sides, and grizzly in the bottom, placed at the head of sluice-flume, the sluice-water discharging into the box. Desirable time-contact is afforded for thoroughly washing the coarse gravel, and the latter can be readily forked up the sloping sides of the box or hopper. This is a form of dump-box said to be in common use in Cumberland county, England, and might with advantage be adopted in hand-mining operations in connection with placer, especially in those cases where gravels are known to be rich.

Beaver Pass.

This wide valley, floored to an unknown depth with glacial debris, was possibly the Tertiary channel of the waters of Lightning creek. The existence of gold in the tributary streams flowing into this valley on both sides has long been known, and considerable activity developed here many years ago. A renewed interest was manifested in the tributary creeks during the year on account of the promising results secured by various prospectors, among whom might be mentioned H. S. Cameron and E. M. Falck, in consequence of which K. K. Langford and associates commenced operations by hand on Baldhead creek.

It is evident that much of the placer which attracted the attention of the earliest workers to this region was a reconcentration effected either on false bed-rocks of glacial clay or other impervious material, or on the bed-rock of the creeks, many of which occupy obviously post-Glacial channels, and in both these cases the reconcentration has been effected by the waters in the modern channels cutting into or across the buried pre-Glacial channels. These latter in several instances are plainly indicated as lying buried on one side or other of the modern channel; such is the case at Baldhead, Lake, and Khee Khan creeks. It seems quite likely that some of the ancient channels are normal to the Beaver Pass *bed-rock* valley, and therefore that their lower portions are below the level of the drift which, as mentioned, floors the main valley. It seems likely that the placer is of local origin. The advisability of close prospecting of individual creeks in this pass and the region north-westerly towards and beyond the north end of Ahbau lake is clearly indicated. The country-rock where exposed consists of micaceous schist and schisted quartzite.

Leases of K. K. Langford, H. S. Cameron, and Associates.—These leases are situated on Baldhead creek. This creek flows on bed-rock along the right rim of its pre-Glacial channel, which lies buried in the left bank of the creek. The ancient channel has been partly exposed by various operators, and the present operators are ground-sluicing the gravels on the right rim of the ancient channel at a point about 100 feet vertically above the floor of Beaver pass. The ancient channel-filling consists of glacial material and a large proportion of "flat-wash" gravels. The depth of the bed-rock of the ancient buried channel is quite unknown, and consequently also certain other factors affecting hydraulicking or sluicing. Encouraging values are being obtained in the gravels at the point indicated, which augur well for bed-rock concentration, and the property exhibits considerable promise. The character of the gold is fairly coarse and well-worn.

Lease of E. M. Falck on Lake Creek.—Lake creek flows into 4-Mile lake at the head of the latter. The owner of this lease is ground-sluicing post-Glacial gravels overlying glacial clay resting on bed-rock of the creek. Some coarse gold was obtained in these gravels. The ancient channel of this creek is indicated as lying buried in the left bank.

Lease of E. M. Falck on Khee Khan Creek.—This creek flows into Beaver pass from the west, just north of 4-Mile lake. The owner of this ground is ground-sluicing post-Glacial gravels lying on a false bed-rock of glacial clay just below the point at which the creek emerges from a rocky gorge, in the right bank of which an ancient channel-segment of this creek is plainly indicated as lying buried, and offers hydraulic possibilities. This creek is of considerable size and runs on steep grade, and a good head could be obtained for hydraulicking. Close examina-

tion of the higher portions of this creek is clearly warranted, likewise that of the general possibilities offering. Time did not permit of more than a brief inspection of the lower portion of the creek.

Another operator in this section is Nels Hanson on 4-Mile creek, who after doing a certain amount of prospecting was engaged in building a cabin.

Cottonwood River.

Lease of Jas. Johnston.—This lease is situated on the Cottonwood river, about 2 miles below the bridge over the river on the Quesnel-Barkerville road, at the outlet end of a depression very clearly defined, which trends in an easterly and westerly direction for some considerable distance on the right bank of the river some distance instream. On the right bank of the river, about 50 feet above the latter and 100 yards distance from it, pits have been opened up showing a foot or so of decomposed shattered rock overlying andesite. On this rest from 1 to 2½ feet of gravels which contain gold, and these are overlain by sand and chicken-feed gravels, the total depth to bed-rock being about 5 feet. Gold is medium-fine up to about 5 cents in size. The only source of water available for sluicing being that from the depression mentioned, which is small, the owner has been hampered by shortage of water. In the spring at high-water season it should be possible to open up a ground-sluice, when it may be possible to form a more definite opinion as to possibilities.

Swift River.

Operations of C. H. and J. A. McDonald.—At the end of the season the Sauerman slack-line plant previously in operation for a brief period at Kersley was erected upon the ground covered by leases 2061 and 2062. Arrangements for this plant involved a good deal of road-construction by way of preliminary, and it was not anticipated by the management in October that any lengthy run would be possible until the spring. This ground has already been Keystone-drilled, and an account of it appears in the Annual Report for 1924 under "Gold Dredging Syndicate, Ltd.," page 116.

Gagen Creek.

Leases of G. S. Gagen and Associates.—A discovery of importance was made by G. S. Gagen during the year on Gagen creek, a small creek named after the discoverer, flowing into Lightning creek from the south at a point about 5 miles above Cottonwood House. The property is reached by a trail leaving the Quesnel-Barkerville road 5½ miles from Cottonwood House, Lightning creek being crossed on a log, the total distance from the highway being between 1 and 1½ miles.

Gagen creek flows almost due north in its upper reaches, then turns sharply at right angles near the Lightning Creek valley just below a small lake, continuing south-westerly in the region of the discovery, and finally entering "Lost Valley" to flow north-westerly to its junction with Lightning creek.

The discovery was made on the right bank of the creek at a point at which rock seems to be everywhere very close to the surface and frequently outcrops. The rock is basalt mainly, but at one point occurs a highly oxidized and altered rock which could not be identified in the field, although it may possibly be an intrusive. The material overlying the rock consists of glacial gravels and shattered rock. Here placer, in character well-worn and fairly coarse up to a \$3 piece, occurs in the cracks and crevices of the rock and in the gravels. The ground is rich; \$2 pans were obtained from the discovery pit, which yielded 37 oz. of gold from a yardage of between 250 to 300 cubic yards. The bench on which the discovery was made is only a few feet above creek-level, but below this point the creek has deepened its bed, and bench-ground continues for about half a mile, and of width about 200 feet, offering considerable possibilities. The mode of occurrence in some respects resembles that of Cedar creek and is unusual. Two channels trend across the direction of Lightning creek in this region, about three-quarters of a mile apart, one being the valley in which the upper portion of Gagen creek is contained and the other "Lost Valley." The latter does not now contain any definite watercourse, but is very clearly defined and is upwards of 600 yards in width near Lightning creek. It seems likely that the gold on Gagen creek may have originated from reconcentration of the contents of the first-mentioned channel.

In the fall an option on this property was taken by C. W. Moore and associates, and it is understood that among the developments proposed is that of drilling "Lost Valley."

It is not altogether a digression to mention the fact that the discoverer, G. S. Gagen, has for several years past supported himself entirely by placer recovered in the course of prospecting, and has finally achieved signal success as the result of intelligent and painstaking effort.

Lightning Creek.

Lease of Swan Ackerblade.—In the near vicinity of "Lover's Leap," on the Quesnel-Barkerville road, there is evidence of a high channel trending across Lightning creek in a north-westerly and south-easterly direction, the continuation north-west of the road being very clearly marked by a valley occupied by a succession of meadows. In a gulch on the right bank of Lightning Creek valley, immediately adjacent to the road, and 150 feet vertically below the latter, Swan Ackerblade discovered fairly coarse gold in glacial gravels immediately overlying rock, and constructed a small "shooter" dam at the head of the gulch with a view to make use of seepage-water for ground-sluicing and valley-slope. While some useful work was accomplished, the supply of water was unfortunately poor, but in the spring it is quite possible that the excellent device adopted may expose the channel bed-rock, in which case the channel could readily be prospected by a drift.

Consolidated Gold Alluvials of B.C., Ltd.—This company employed a force of upwards of forty men on its property at Wingdam during the year, the work carried out being that incidental to the resumption of mining operations in No. 2 shaft. A No. 10 Layne and Bowler well-pump of capacity 1,800 gallons per minute was installed in No. 2 shaft, and a trial run made with satisfactory results. Much other constructional work, outlined in the 1931 Annual Report, has been completed. Completion of the necessary bunk-house accommodation for employees was in progress in October, and the manager, C. H. Unverzagt, stated that it was the intention to resume mining operation as soon as this was completed.

Mosquito Creek.

**Slade-Cariboo
Gold Placers,
Ltd.**

This company was organized and financed in Seattle for the purpose of operating the placer property of W. C. Slade and associates on Mosquito creek, a description of which will be found in the 1930 and 1931 Annual Reports. The general manager of this company is R. S. Eskridge, and the office is situated at 1410 Hoge Building, Seattle, Wash., U.S.A. Much useful and necessary preparatory work was carried out during the year with a view to enlarge the scale of operations. This comprised construction of a bridge across Lightning creek, and a surface tramway thereon, and much improvement in the water-supply for hydraulicking. This work was well advanced at the time of inspection in the fall and energetic development should be possible next spring.

Donovan Creek.

Property of C. M. Sundberg.—A description of this property will be found in the Annual Reports for 1927 and 1931. During the year the owner completed the construction of a storage-dam, the crest of which is 200 feet in length, on Donovan creek at a point a considerable distance above the pit, which will greatly improve the water-supply and lengthen the piping period possible each year. A short distance below the dam are situated old workings, which are stated to have indicated that while drifting of the channel was not profitable, nevertheless the ground would yield a considerable profit if hydraulicked. It seems, therefore, reasonable to anticipate a continuation of profitable ground between the present pit and these workings. Some considerable distance below the head of the pit, a gap in rock-outcrops on the left rim would seem to merit investigation to determine if there is the possibility of a tributary run on this side.

As has been previously pointed out, this property presents many features, such as steep bed-rock grade, good dump facilities, and comparatively shallow overlies of glacial debris, highly favourable from the point of view of economic hydraulic operation.

Last Chance Creek.

This property, situated on Last Chance creek, flowing north-easterly into Lightning creek just below Stanley, has been operated for many years past, but of late years somewhat spasmodically. Last year it was reopened by W. M. Hong, of Barkerville, the owner, and this year operations have been continued by the

owner, in conjunction with John Hind and associates. This creek was one of the richer tributary creeks of Lightning creek and in the sixties in one year yielded some \$250,000. Time only permitted of a brief inspection of this creek, and of the lower portion only, but that rendered evident that certain features of marked promise are present, and that a more thorough examination of the creek from mouth to source should be undertaken in order to more fully appraise the possibilities, and it is proposed to carry this out during 1933.

The outstanding feature of this creek from the placer standpoint is that the ancient pre-glacial channel lies buried in the right bank. The rich superficial diggings of the earliest days clearly owed their origin to the fact that the waters of the modern creek cut into their former channel at certain points and reconcentrated on the bed-rock of the modern creek the gold contents of the ancient channel. The fact that there was a buried ancient channel-segment downstream from the shallow diggings was clearly perceived by the earliest workers, who drifted this portion to an undetermined point from the vicinity of the mouth of the creek up stream, and hydraulic operations have been in the past and are at the present time carried on in ground that has been previously mined. A detailed examination of the entire length of this creek should enable an intelligent opinion to be formed as to the probable extent of the buried channel portions yet remaining that can be piped out. Such might of course disclose that prospects are such that an expansion of the present hydraulic system is justified. Water-supply is at present derived from Grub gulch and Van Winkle creek.

The fact that the placer on this creek originates from the pre-Mississippian veins (the ancient pre-Mississippian intrusives are exposed in the pit), and that the creek has a northerly flow, greatly strengthens the light in which its possibilities should be viewed, and likewise the reason for close scrutiny of the latter.

Houseman Creek.

An account of this hydraulic, owned by Mrs. Gertrude Murphy, will be found **Cariboo Eagle.** in the 1926, 1927, and 1931 Annual Reports. It is learned that no hydraulic operations were carried out during the year, but that a tunnel was run in the right bank of the pit to explore the ground beyond the older workings. During the winter it is proposed to drive another tunnel in the left bank of the creek.

Dry Gulch.

Property of J. F. Williams.—An option on this property has been acquired by R. S. Eskridge, who states that he proposes to develop it during 1933.

Devils Lake Creek.

This property is owned by W. J. Houser and associates, of Barkerville, and has been operated for a number of years. While originally at this property **Ketch.** there were two distinct runs of gold, one running up Devils Lake creek, now piped out, and one trending parallel to Slough creek, it is the latter alone which now engages attention. This consists of pay-gravels about 10 feet in thickness overlying a rock bench, and the placer therein is very coarse. Of the 10 feet of gravels mentioned, the upper half consists of dark-coloured gravels, and the lower half of red-coloured gravels containing much pyrite. Immediately overlying the pay-stratum is much tight glacial clay and debris. Inasmuch as these rock benches are an outstanding feature of Slough creek from Burns creek down-stream far below Devils Lake creek, the continuation of this feature between the *Ketch* mine and Burns creek seems a very reasonable anticipation. Unfortunately this property is hampered by an indifferent water-supply derived from Burns creek. Additional water could be secured by extending the ditch-line to Olally and Pinkerton creeks, and good natural storage facilities on the property can be rendered available, so as to give a piping-head of 135 feet, without any very heavy outlay. Of late an improvement has resulted in the "clean-ups" secured at this property.

Dragon Creek.

Leases of L. Ford and R. McDougall.—Accounts of this property will be found in the 1927, 1930, and 1931 Annual Reports. The owners report a satisfactory year and anticipate more productive ground in future, as the pit has now reached the region of the old workings.

Lowhee Creek.

Lowhee Mining Co., Ltd. The face of the pit is now within 1,200 feet of the Lowhee Creek-Stouts Gulch summit, somewhat beyond the mouth of Watson's gulch. The depth of the pit from surface to bed-rock is 145 feet. The face of the pit affords an interesting cross-section, and both rims of the V-shaped rock valley and the bed-rock of the latter are exposed. A thickness of 10 feet of post-Glacial gravels overlie the glacial gravel strata, in which latter is much boulder-clay, which rest on a few feet of pre-Glacial gravels lying on bed-rock. The latter shows a tendency to steepen, a feature greatly to be desired, as such might enable a portion of the long sluice-flume to be dispensed with. The new road from Barkerville to this property up Stouts gulch has now been completed and is open to motor traffic.

Williams Creek.

Hurdy. This real-estate claim, owned by E. W. Giddings, of Barkerville, was optioned by E. T. Fitzsimmons and R. L. Black during the year, and a small hydraulic plant has been installed at the upper end of the claim, water being obtained from Williams creek under a head of 200 feet. The property is situated on the right bank of Williams creek opposite Mink gulch, and represents a portion of Williams Creek valley that has never been worked. It may be described as very low-lying bench-ground heavily overlain by glacial debris. At the upper end of the claim the gravels immediately overlying the rock bench may be pre-Glacial. There appears to be no reason why this piece of ground should not contain sufficient gold to render hydraulicking profitable, and its exploitation seems warranted in view of the proverbial richness of the creek at other points. It is stated that encouraging amounts of gold have been recovered during the year.

Grouse Creek.

New Waverly Hydraulic Mining Co., Ltd.—A description of this property will be found in the 1931 Annual Report. Piping operations were continued during the year under the direction of C. W. Moore, but were hampered by encountering at one point cemented ground, a local feature only, and later in the season by shortage of water.

Antler Creek.

Guyet Placers, Ltd. This is a newly formed private company incorporated for the purpose of operating the *Guyet* mine (refer to Annual Reports for 1926, 1927, and 1928). This property contains an old channel crossing Antler creek diagonally, and the bed-rock of which is 260 feet vertically above the latter. The face of the pit shows well-stratified glacial gravels and slum strata overlying about 10 feet of gravels resting on bed-rock. The "pay" is contained in the last-mentioned stratum and in the bed-rock. The total depth from surface to bed-rock at the face of the pit is about 125 feet. By way of carrying out a preliminary test, hydraulic operations were carried on during the year under the direction of A. F. Curtis with a small force of men. It is stated by the management that, as a result of this, warrant is afforded for equipping the property with a larger hydraulic plant, and, further, that this will be proceeded with in the spring.

Two very favourable features of this property are the excellent water-supply which can be rendered available from Cariboo creek, and dump facilities, which are all that could be desired; therefore a low operating cost should be secured when the new plant has been installed.

French Creek.

French Creek Hydraulic Placers, Ltd. This, a private company, was incorporated during 1932 for the purpose of operating the leases on French creek owned by J. Wendle. The manager of this company is C. C. Ross, of Calgary. Apart from testing operations, no mining was carried out during the year, efforts focusing on the installation of hydraulic plant. It is understood that the matter of bringing in a supply of water from Williams creek is under consideration. Further accounts of operations on this creek will be found in the 1927 and 1928 Annual Reports.

Summit Creek.

Leases of A. G. Malcolm and Associates.—These are situated on the right bank of Summit creek, about 2 miles below 8-Mile creek, in which region an extensive bench (over which the

Barkerville-Bear Lake road runs) flanks the creek, 50 feet or so above the latter. The attention of early operators in this region was directed to superficial chocolate-coloured gravels of post-Glacial age, varying from a few inches to 2 feet in thickness overlying boulder-clay and glacial gravels resting on a rock bench. During the year A. G. Malcolm discovered that profitable values exist from the surface down to the rock bench, and accordingly installed a small monitor, and with such scanty water as was afforded by small creeks and seepage from the upper portions of the bench was enabled to make wages. Down-stream from this point, old workings suggest the possibility of a channel lying in-stream from the present creek, and possibly extending across the latter still farther down-stream. Further light will doubtless be thrown on this question by the continuance of the present piping operations. The owner of this property has made a commendable discovery which merits close investigation.

Cunningham Creek.

Trehouse. This hydraulic property is described in the 1931 Annual Report, and is owned by F. J. Tregillus, J. House, and F. de Witt Reed, of Barkerville. Further very encouraging results were secured during the present year confirming views previously expressed as to possibilities. As viewed in the spring, it then appeared likely that the width of the rock bench that now engages attention would prove to be about 130 feet.

Hixon Creek.

Quesnel Quartz Mining Co. On the property of the Quesnel Quartz Mining Company, Limited, on Hixon creek, now under option to J. H. Johnson and A. W. Alward, of Prince George, quartz stringers were recently discovered showing spectacular amounts of gold. The discovery is on Lot 52 and is said to have resulted from placer operations carried on by B. Briscoe, who in May last started to mine gravels overlying the solid formation in this region, he having a placer lease forming one of a number of creek leases extending from the falls for some $3\frac{1}{2}$ miles up-stream from the latter point.

The richness of the quartz naturally aroused intense local interest and the writer inspected the ground on August 23rd. At this time the high gold values had pinched out in the stringers and no actual mining operations, beyond prospecting, were going forward. Samples of very rich quartz were seen showing coarse gold stated to have been obtained from these stringers. A total of 9 tons of ore consisting of quartz stringers and adjoining decomposed schist country-rock was shipped to the Trail smelter by J. H. Johnson.

The working consists of a pit of irregular shape about 15 feet in depth sunk on a rock bench on the right bank of Hixon creek, about 80 feet or so above the creek, from which bench overlying gravels have been mined by B. Briscoe in the course of his placer operations, which latter have been discontinued, temporarily at any rate. The width of this pit is about 11 feet at the widest part, and three small quartz-seams about 3 inches in width occur in the highly oxidized schist country-rock. A few feet from the pit is exposed what may be a narrow highly acid sill of the quartz-feldspar type. This pit is situated at the top of the bench, at the base of which is the old tunnel described in the 1929 Annual Report on page 189. The south-western branch from this tunnel appears to be farther in the hill than the pit recently sunk and above described.

The dominating feature in connection with mineralization on this property and that of the adjoining *Cottonwood* group (two claims owned by C. H. Colgrove, of Hixon) and the adjoining *Cayenne* group (owned by E. Hann and J. Strbac, of Hixon) is a wide belt of intensely altered and oxidized schistose rocks. The width of this belt appears to be about half a mile, and it crosses Hixon creek through the properties mentioned in a north-west and south-east direction, and may extend as far south-east as Terry creek, a distance of upwards of 5 miles, as the same highly oxidized rocks occur in the right bank of that creek.

Within this highly oxidized belt occur the rich stringers recently discovered and numerous other larger quartz veins. While high values did not continue for any distance in the stringers recently discovered, a repetition of such within the zone of oxidation seems a reasonable anticipation. The schistose rocks on Hixon and Terry creeks are intruded at numerous points by batholithic rocks, to which latter mineralization is undoubtedly due. Save that it is much richer, the character of mineralization recently discovered on the property of Quesnel Quartz Mining Company is similar to that exposed by the tunnel on the *Cayenne* group. The question as to whether this wide and extensive oxidized schistose belt of rocks could be mined in whole

or in part, so as to form a very large mining proposition, has for some years past exercised the minds of various mining engineers.

It is evident that the tunnel started at creek-level affords a ready means of access to the ground immediately below the scene of the recent discovery. By continuing this tunnel, with branches therefrom, information of value would be obtained at relatively very small cost. The tunnel is 75 feet below J. H. Johnson's pit. There should first be a very careful field-study made of the geology of the immediately surrounding area. It is likely that the mineralization within this wide altered belt has quite a lot to do with placer occurrences within the surrounding area. This property requires highly skilled investigators at the outset and is undoubtedly of importance.

QUESNEL MINING DIVISION.

Reference to all important lode-gold properties in this Mining Division will be found in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia," which contains the latest information available to this Department from a first-hand source, as it was not possible for the Resident Engineer to visit the Yanks Peak region.

PLACER-MINING.

The production of placer gold for the year was \$56,746, as compared with \$45,866 in 1931. Much activity was also manifested in this Mining Division by operators and prospectors generally. While there was unfortunately a decided falling-off in the production from Cedar creek, it is quite possible that this deposit is not yet exhausted. Offsetting the decline in production from Cedar creek, several new enterprises were inaugurated during the year, the effect of which should be felt in 1933; gratifying developments took place at the property of R. N. Campbell and associates at Antoine creek, in the Horsefly section, and new discoveries were made as the result of activity by prospectors. Generally speaking, the prospects of further expansion in this Mining Division seem distinctly hopeful.

QUESNEL SECTION.

Bird. This group consists of twelve placer leases held by E. G. Hutton, A. C. Hutton, Chas. Hewitt, and associates, and covers extensive high-lying bench-ground situated on the left bank of the Fraser river near Kersley. This ground is situated at a height of from about 25 feet to about 75 feet above the river. A concentration of fine gold in the upper gravel strata has been found at a number of different points, and it is stated that in all fourteen shafts have been sunk to an average depth of about 13 feet, and also that metals of the Platinum group have been found in the gravels in addition to gold. There is a noticeable absence of boulders of any considerable size, and the total yardage of gravels is obviously very large. An option on this ground was taken early in the year by J. A. and C. M. McDonald, Limited, and this company erected a Sauerman slack-line plant, with bucket of $1\frac{3}{4}$ cubic yards capacity, during the early part of the season. The plant was in operation only for a period of about two weeks and was subsequently moved to leases 2061 and 2062 on the Swift river.

There are many examples on the Fraser river of bench deposits similar to this, and they are due to a slackening of the river-current at a turn or bend, resulting in superficial deposition of fine gold, and it is probable that wave-action also plays an important part in effecting concentration. Usually the concentration is purely superficial or is confined to upper gravel strata; more rarely auriferous strata may persist down to a false bed-rock of glacial clay. In this latter case concentration is due merely to cutting-down of post-Glacial waters through auriferous glacial debris, the clay in which forms an excellent medium on which concentration may take place quite irrespective of any change of direction of waters or slackening in the rate of flow. (The property of T. H. Oliver, described next below, exemplifies such a bench.) It is quite possible in the case of this property that there may be some concentration on some hidden false bed-rock of which there is no outward evidence. The question is frequently raised in connection with deposits of this kind as to a possible concentration of placer on true bed-rock. Such a possibility is, in its commercial aspects at any rate, apart from glaciation factors, dependent upon whether the stream erodes at the particular point under consideration a terrain of gold-bearing rocks such as might originate a placer deposit on true bed-rock. Such a terrain does not exist in the vicinity of this deposit, and therefore true bed-rock placer possibilities hardly merit serious consideration.

One thing is certain about deposits of this kind—good values may be found in the upper gravels at widely separated points, but values are likely to be irregularly distributed. That fact does not necessarily signify that a deposit of this class cannot be mined at a profit on a large scale, but it does signify that thorough and systematic testing is essential in order to form a correct estimate of average values. And it is quite evident that commercial success is dependent upon two factors—namely, thorough preliminary testing, and the recovery of the fine and flour gold characteristic of this mode of placer occurrence. In both these directions there is demanded a high degree of technical skill. The recovery of fine gold is not by any means a simple matter when large quantities of gravel are under treatment. While many different modes of recovery have been suggested, including flotation, the most hopeful seem to lie along the lines of stage-screening of all coarse material and passing finally only the finest material over blanket tables, the blanket concentrate being amalgamated. In this connection it might be stated that C. S. Parsons, of the Mines Branch, Department of Mines, Ottawa, devoted some time during the season to study of methods of saving fine gold in river bars and benches and his report is awaited with interest.

Property of T. H. Oliver.—This is situated on the right bank of the Fraser river, about 1 mile north of Mackin creek, and a car can be got within somewhat over a mile from the property by crossing from the highway on the Soda Creek ferry and following the road northwards on the west side of the river.

At this point a bench occurs on the right bank of the river about 10 feet vertically above the latter. The placer occurrence exhibited is not that of the ordinary river-bench deposit, and therefore largely superficial, but is that of post-Glacial reconcentration on a false bed-rock of boulder-clay. The top of the latter is about 55 feet above the river-level, and upon the boulder-clay overlies a thickness of about 40 feet of auriferous gravels.

To give sluice-flume grade to the river, the owner by much painstaking effort has made a cut in the boulder-clay from the edge of the pay-gravel strata, so that good dump facilities have been rendered available. Water for sluicing is obtained by collecting in ditches such small creeks and seepage-water as are available at the top of the bench. Overlying the pay-gravels is a small stratum about 3 to 4 feet in thickness of barren material. The owner states that encouraging values are obtained, but he is rather hampered by the water supplied by the present ditch system. This could be improved by extending the ditch system, and it is possible that investigation might disclose warrant for such. It was stated by the owner that on this side of the Fraser river above this point are some promising bars on the river, but available time did not permit of inspection of these.

Big Eddy, Fraser River.—Placer lease 2612, held by G. E. Barker, is situated on the west side of the Fraser river by Castle Rock, $1\frac{1}{2}$ miles north of the Alexandria ferry. (It might be noted that there are two *pairs* of places named Alexandria and Castle Rock, the former on the east side of the river and the latter on the west side, in close proximity to each other, which is apt to lead to confusion. The "Castle Rock" and "Alexandria" referred to in this report are the more northerly of the two pairs, and the "Castle Rock" referred to herein is situated almost opposite Windt creek.) The ground is known locally as the "Big Eddy."

Geologic evidence at this point indicates that the pre-Glacial channel of the Fraser river lies west of Castle Rock, and that its outlet end is to be found a considerable distance down-stream from this point, probably in the neighbourhood of 1 mile, and that its inlet end is immediately above Castle Rock. The ancient channel-segment is deeply buried beneath a mass of glacial debris, which blocked it, and in the course of post-Glacial rejuvenation the Fraser river carved a new channel through the Tertiary basalt of which Castle Rock is composed. As to the question of placer-gold values on bed-rock in this ancient channel, inasmuch as the ancient river did not in this region cut through a gold-bearing terrain, the prospect of commercial values on true bed-rock would not seem to be likely, and more especially having regard to the depth at which they lie. Glacial debris overlying the ancient channel has been terraced by post-Glacial waters, and terraces in this region occur at points 200 feet or more above the Fraser river. On the tops of such terraces on false bed-rocks there are likely to exist superficial concentrations of gold effected by post-Glacial waters, and old workings down-stream from Castle Rock indicate that some of these gravels were worked, although workings are not very extensive. Immediately above Castle Rock extensive bench-ground flanks the right bank of the river about 30 feet above the latter, which marks the up-stream end of the buried channel-segment.

The idea that such topography as is exemplified in the vicinity of Castle Rock indicates a "collecting-pool" for gold arises from a misconception as to the operation of those natural agencies which result in the formation of placer deposits. It has been pointed out that such topography is indicative of a buried channel, and any concentration of gold at the lower end of the "pool" would result from post-Glacial waters effecting reconcentration as they cut through the upper end of the buried channel. If there is no reason to suppose that the latter is pronouncedly auriferous, the effects of reconcentration would not be very great. In other respects gold found on benches above Castle Rock immediately adjacent to the river would result largely from reconcentration of glacial and other debris by the waters of the river, and its deposition would be of a superficial nature.

No samples were taken by the Resident Engineer, but four shafts have been sunk at the lower end of the large bench on the right bank of the river immediately above Castle Rock, where a good cabin has also been constructed. The deepest of these shafts is upwards of 30 feet and the depth of the others considerably less. It was stated by two men who were working in these shafts, and who accompanied the Resident Engineer, that no gold was found in the gravels resulting from these shafts.

Canyon. This property is situated in the Cottonwood canyon on the right bank of the Fraser river, and is the down-stream continuation of the buried segment of the Tertiary channel of the Fraser river, the up-stream continuation of which exists at the *Tertiary* mine, on the opposite bank of the river, at this point. A full description of the *Tertiary* mine will be found in the Annual Report for 1926.

The *Canyon* mine is distant 16 miles from Quesnel and a car can be taken to the ground in dry weather. During the early part of the season S. R. Craft and associates did a considerable amount of prospecting at this property, but after staking the ground and doing no small amount of work it is understood that they discontinued operations.

The property was visited by the Resident Engineer in May, at which time the lower workings were flooded, but at that time it was evident that the ancient gravel strata (these strata are cemented) at or immediately above the river-level contained coarse gold. Further, in view of the fact that the grade of this ancient channel is quite steep, averaging 3.5 per cent. or more, it seemed likely that the early investigations at this property might have been directed to a point too far above the Fraser river to pick up the gravels immediately overlying bed-rock, in which the "pay" exists. A close examination of this property seems justified.

Leases of H. W. Adcock and Associates.—These are situated on the left bank of the Quesnel river, below Beaver mouth, and are fully described in the Annual Report for 1931, page 91. It is understood that some small-scale operations were carried on during the year at this property, but available time did not permit of inspection.

LIKELY SECTION.

During the early part of the season, as the result of the bursting of one dam in Poquette pass, and the consequent rush of water carrying out another dam at the head of Poquette creek, much damage was done to the Likely-Keithley road, and the amount of material carried into the lake partially blocked the latter, causing swift water in the vicinity of the mouth of Poquette creek.

Operators who are considering the erection of dams, or alterations of existing dams, or other action connected with the use of water for mining purposes are strongly urged to note that the provisions of the "Water Act, 1914," must be strictly complied with. Copies of this Act, likewise information as to the obligations of licensees, may be obtained from the Comptroller of Water Rights, Parliament Buildings, Victoria, B.C. Apart altogether from the question of legal obligations, operators will find that the advice of the engineers of the Water Rights Branch of the Department of Lands, which must be obtained before construction, is of very real assistance.

Aneroid Levels.—The following elevations above sea-level will be found useful for approximate reference; they must not be used in any computations calling for any great accuracy: Quesnel lake, 2,250 feet; C. & S. flume at point of crossing Likely-Keithley road, 2,600 feet; C. & S. lower flume, 2,375 feet; C. & S. monitor, 2,200 feet; C. & S. ditch (*Victoria* ditch), 2,800 feet; Spanish Creek dam (just below mouth of Black Bear creek), 2,560 feet; S. S. Smith's tunnel, Spanish creek, 2,375 feet; Ruby Gold Mines tunnel, 2,250 feet; Spanish Creek bridge (highway), 2,275 feet.

Bullion. This property was operated during the year by Hircen Placers, Limited, a private company, under the management of W. T. Hircen. Operations were commenced somewhat late in the season, but progressed satisfactorily until the latter part of October, when an unfortunate cave of considerable proportions occurred in the pit, and it then seemed that it was unlikely that a fall clean-up would be secured. The manager stated that a clean-up secured during the earlier part of the season was distinctly in accord with expectations, and indicated that with the measures of economy now put into effect this enterprise was profitable.

Moorehead Mines, Ltd. This company, under the management of E. C. Annes, started operations early in the season, the water-supply being that derived from the company's low-level system, the installation of which was completed last year. Hydraulic mining was continued until slackening of water-supply towards the latter part of the season. The following particulars of the run are kindly supplied by the manager: Yardage piped, 200,000 cubic yards; one 8-inch and one 9-inch monitor in operation under a head of 100 feet; duty per miner's inch per 24 hours, 2.2 cubic yards; cost, 6.7 cents per cubic yard as against an estimated cost of 7 cents per cubic yard. It is further stated by the manager that the estimated average value of the channel-gravels—namely, 22 cents per cubic yard—will be exceeded by the actual yield as indicated by this year's operations. It is understood to be the intention of this company to construct its high-level water system in the near future. A full account of this property will be found in the 1927 Annual Report and particulars of the water-supply in the 1931 Annual Report.

North Fork of the Quesnel River.—Outstanding features of this river from the placer standpoint are the buried ancient channel-segments, which exist in both banks immediately adjacent to the river, and the false bed-rock concentrations of course gold that have been caused by the post-Glacial rejuvenation of this river as it cut down through one or other of its former channels. These false bed-rock concentrations engaged the attention of the earliest operators (whose extensive workings indicate that they were decidedly productive), and still engage the attention of present operators, although attention now mainly focuses on the buried channel-segments mentioned, and in connection with the latter on the south side of the river much activity developed during the year.

The buried ancient-channel system of this river merits detailed field-study, and in the absence of this many points must remain obscure, but in view of the fact that there is strong evidence of another buried channel, quite distinct from those mentioned above, which exists on the north side of the river, some 600 feet or so vertically above the latter and some considerable distance instream from it, trending south-west from the end of Cariboo lake through Wolverine lake, it seems likely that the early Tertiary drainage of Swamp River water system was by this channel. There was quite possibly in these times a contemporaneous and separate tributary drainage system, of which Sailor creek was the headwaters. However, the channel mentioned, which is the oldest, is not the object of present commercial enterprise, which concerns those channels immediately adjacent to the river.

The terrain eroded by this river and its former channels consists of rocks classified by Bowman as pre-Cambrian intruded by Jura-Cretaceous tongues (quartz feldspar) and containing numerous quartz veins. It is therefore evident that a concentration of placer on true bed-rock of the ancient channels is a justifiable anticipation, apart from the question of the effect thereon of glacial erosion.

The applicability of any particular method of mining the bed-rock gravels of these ancient channels must be very largely dependent upon certain critical factors; for example, (a) depth at which bed-rock lies in relation to the present river, (b) gradient of that bed-rock, and (c) values in the bed-rock gravels. It would therefore seem obvious that knowledge as to such criteria should be gained by operators before embarking upon the installation of any particular mining plant. It does not necessarily follow that, even should the ancient channel bed-rock fall below that of the present river, hydraulic methods will prove quite inapplicable; they might find limited application, for instance, even although it should prove necessary to elevate gravels by hydraulic elevator or by mechanical means. Still, a clear vision of the practical problems likely to be involved can only be obtained if the criteria mentioned are known beforehand. There are some points at which the ancient channels are obviously far less deeply buried than at others, and at such the wisdom of preliminary Keystone-drilling is clearly indicated.

At other points where there is a very heavy overlie of glacial debris the cost of Keystone-drilling would obviously be high, and, at such, some preliminary excavational prospecting by means of, for example, an incline shaft following the rim downwards is indicated as being preferable to drilling.

Buried Channels and Properties on the South Side of the River.—On the south side of the river there is an extensive buried channel-segment between an undetermined point above Sailor creek and a point $1\frac{1}{2}$ miles below the mouth of Spanish creek. How far this channel extends above Sailor creek it was not possible to determine in the time available, but the fact that there are falls on the river in this vicinity at once suggests that the latter may be post-Glacial, and that the channel in that case is continuous up to that point and possibly beyond it. Close examination of the falls and vicinity would readily elucidate this point. Down-stream the channel-segment clearly ends at the lower end of the property of Ruby Gold Mines, Limited. For a further distance of about half a mile down-stream its course either coincided with that of the modern river, or it entered the north bank of the latter (just which is uncertain and from the commercial standpoint unimportant) in this region to reappear on the south side of the river on the property of C. E. Salisbury, and to continue apparently on the south side of the river through the property of the C. & S. Mining Company and that of W. F. Bendtsen below Murderer's gulch. At the last-mentioned point it is again cut by the river, and below this its subsequent course has not been studied by the Resident Engineer.

Leases of Alex. Sutherland and Associates.—These comprise eight bench leases situated on the river down-stream from Sailor creek. On this ground the ancient channel is deeply buried and apparently continuous. Creeks that cut through it, such as Sailor creek and China creek, have originated false bed-rock concentrations, which have been extensively worked by earlier operators. The channel is well exposed immediately adjacent to the river at a point somewhat above China creek. Here glacial debris and glacial gravels 200 feet in height overlie the flat-dipping right rim of the channel. An option on this property was taken during the year by T. R. Nickson, but apparently no great amount of work was carried out.

Before an opinion can be formed as to specific commercial possibilities, and also as to the method of mining applicable, it seems obvious that a considerable amount of preliminary investigation and testing must be carried out. The fact that the channel is heavily overlain on this ground would indicate that some excavational development, such as a shaft following the rim downward at some favourable point, should precede any drilling. The method indicated will afford evidence of the depth of bed-rock in relation to the river, the gradient of the channel bed-rock, and the value of bed-rock gravels. Such factors are all-important, and until information concerning them is available proper appraisal of the commercial aspects and the means of mining cannot be made. It is evident that this property possesses many features of merit and should receive close investigation.

**Ruby Gold
Mines, Ltd.**

This is a private company, of which G. W. Branston is manager, and the property under option comprises three bench leases, Nos. 1860, 2589, and 2400 (also known as the "McAulay-Dwyer leases"), and is situated on the left bank of the river, about 1 mile down-stream from Spanish creek. On this property is contained the down-stream continuation of the buried ancient channel-segment above described.

A small force was employed during the year in preliminary investigation and in clearing out a former tunnel run by J. Palero in 1915 at about 30 feet above the river. It is stated that good "pay" was obtained in this tunnel. This tunnel is run for about 60 feet in rim-rock, at which point it breaks through into channel-gravels, in which are some branch tunnels. The workings indicate that the channel is not less than 110 feet in width, but no bed-rock is exposed, although large boulders at the face of the workings may indicate nearness to such. The gravels exposed are distinctly glacial, and it would seem advisable to follow the rim downwards to bed-rock. No new mining operations have been carried out, but it is understood to be the intention to continue in the manner indicated, and the washing plant has been laid out with that end in view.

An efficient and well-designed plant for washing gravels has been constructed at the portal of the tunnel on the bank of the river. Cars are hauled from the mine by a main-and-tail rope-haulage system and dumped on a grizzly with bars $1\frac{1}{2}$ inches apart, constructed in a small bin. After washing, effected by pump discharge, the oversize goes to dump and the undersize passes

to riffled sluice-flume. The idea of the bin is to give *time-contact* for thorough washing, an important point, but infrequently recognized. Tailings from the sluice-flume pass over a diagonal slotted screen ($\frac{3}{32}$ - by $\frac{1}{2}$ -inch slots); the oversize goes to dump and the undersize passes over a blanket table 12 feet long by 33 inches wide. Sluice-flume and blanket table are in duplicate, so that one set may be cleaned up without interrupting the washing process. Water for the sluice is supplied by a 4-inch Smart-Turner centrifugal pump delivering 475 gallons per minute, against a head of 35 feet, and set up at the river's edge. The pump is driven by a Novo gas-engine of 18 horse-power, which consumes from $3\frac{1}{2}$ to 4 gallons of gasoline per 8 hours. The main-and-tail rope-haulage system is driven by a Chevrolet car engine by sprocket-chain drive to a single-reduction sliding pinion, which actuates two independent rope-drums. The total cost of loading cars, tramming 200 feet, washing gravels, and pumping is stated to be 27 cents per cubic yard. Track-gauge is 2 feet. The plant shows much careful thought on the part of the manager of this company.

The operations which are proposed should throw much valuable light upon the possibilities of this ancient channel, which in this region is buried to the extent of at least 175 feet below the surface, and there appears to be warrant for continuation until conclusive results have been obtained.

Property of C. E. Salisbury.—C. E. Salisbury has an option on two leases adjoining down-stream the ground under operation by Ruby Gold Mines, Limited. These leases are held by the estate of the late P. Burns and by C. Burns respectively.

At the up-stream end of this ground there is exposed by a large cut what appears to be a channel that possibly originates from the vicinity of Black Bear creek, and represents a former tributary of the North fork, which it would seem to have joined at some point between the exposure mentioned and a point on the property under operation by the C. & S. Mining Company, Limited. There is some evidence pointing to the fact that Black Bear creek cuts through two buried ancient channels, one, the more northerly, being buried in the right bank of Black Bear creek and in the right bank of the lower portion of Spanish creek, and which constitutes the objective of the Spanish Creek hydraulic mine (not under operation at present); and the other, the more southerly, flowing south-westerly across Spanish creek just above the old dam at this point. The down-stream continuation of the latter may be the channel that is exposed on the property of C. E. Salisbury.

About 150 yards down-stream from the channel mentioned, a rock tunnel has been driven by earlier operators at a point a short distance above river-level, for a distance of about 190 feet, the intention being apparently to penetrate this channel. The tunnel is wholly in rock and possibly was not continued far enough to reach the objective, although a survey is indicated as being advisable. In any case, the depth at which the bed-rock of this buried channel lies being an unknown factor, the level at which a tunnel should be run to reach bed-rock gravels is also unknown.

Immediately above this tunnel is a cut-bank which extends down-stream for a considerable distance in the form of bench-ground at an elevation of 150 feet or so above the river. Directly opposite this tunnel there is exposed in the right bank of the river a channel which apparently continues down-stream on the south side of the river through the remainder of this property, that of C. & S. Mining Company, Limited, and that of W. F. Bendtsen below Murderer's gulch.

The top gravels of the high-lying bench mentioned on C. E. Salisbury's property exemplifies a post-Glacial run on false bed-rock, and the operator after a considerable amount of testing has formed the opinion that such might offer drag-line possibilities. Proof of such could, of course, only be afforded by detailed and systematic testing. This property appears to offer possibilities in more than one direction and merits thorough investigation.

This company, of which the manager is C. A. Johnson, and superintendent is **C. & S. Mining Co., Ltd.** R. M. Reid, has an option on the property of the Moose Syndicate, described in the 1931 Annual Report. A large force of men, upwards of seventy-five in number, was employed during the greater portion of the season in carrying out the heavy construction programme involved in bringing a supply of water on the ground from Spanish creek for major hydraulic operations. This comprised preliminary erection of a sawmill of 6,000 feet B.M. daily capacity to saw lumber for the large flume required; construction of about 1 mile of 5- by 4-foot flume, with necessary penstocks; installation of pipe-line varying in size from 36 inches at the penstock to 24 inches at the lower portions, and one

15-inch and one 16-inch branch line therefrom to monitors; and also reconditioning of the old *Victoria* ditch by which water is conveyed for some miles from Spanish creek. At the end of October this work was almost completed, one monitor was set up, and piping had been commenced. Both monitors are No. 6 in size and the maximum size of nozzle is 8 inches.

The water from Spanish creek is conveyed by the *Victoria* ditch (elevation 2,800 feet) for some miles and discharged into a meadow, from which it is conveyed by a flume crossing under the Likely-Kcithley road at elevation 2,600 feet for a distance of 1,500 feet and discharged into a penstock delivering to another flume at elevation 2,375 feet, also 1,500 feet in length, and discharging into penstock at the head of the pipe-line, giving a head at the monitor of 175 feet. All flumes are 5 by 4 feet in size.

The monitor is set up at a point about 35 feet above the river, and it is the intention to pipe off first the post-Glacial gravels in this region which overlie a false bed-rock of slum, and which, it is stated, carry good values, and which were in places extensively worked by early operators. Underlying these is the buried ancient channel of the river, the depth of the bed-rock of which is unknown, likewise its exact course. This channel in this region is not so deeply buried as at up-stream points. Piping operations will doubtless throw further light on the matter. It also seems possible that there may be found somewhere on this property the down-stream continuation of the channel exposed on the property of C. E. Salisbury, described above, in the report on that property, as possibly originating from the direction of Black Bear creek.

This property exhibits features of promise and a good water-supply has been rendered available. It is understood that a clean-up was secured before the close of the season.

Buried Channels and Properties on the North Side of the River.—In immediate proximity to the river, on the property of Quesnel Gold Mining Company, Limited, from a point somewhat above the old *Victoria* hydraulic pit for about half a mile down-stream, there is every indication of the existence of a buried channel, which, opposite the ground of C. E. Salisbury, is cut by the modern river, and is to be found on the south side of the latter at points farther down-stream. Above the *Victoria* pit this channel appears to have been largely eroded by the present river for some distance. In the vicinity of Spanish Creek bridge, however, and up-stream from this point, it is quite possibly less eroded, and false bed-rock concentrations and concentrations on rock benches in this region would seem to be due to waters of the present river cutting into gravels of the ancient channel.

This company holds a number of bench leases comprising a stretch of about 2 miles of the river opposite the property controlled by Ruby Gold Mines, Mining Co., Ltd. Limited, and by C. E. Salisbury. Some years ago an hydraulic plant was erected upon the upper end of the ground, and a considerable amount of hydraulicicking was carried out in this region, which was concerned with remnants of channel-gravels and a post-Glacial concentration on a high-lying rock bench. More recently operations have taken the form of investigating the buried channel by means of tunnels by the *Victoria* pit, and most recently near the indicated outlet of the buried channel opposite the ground held by C. E. Salisbury. This ground would obviously seem to offer better prospects and to be the logical point at which attention should focus. The indications are that the main outlet of the buried channel is to be found at a point about 300 yards up-stream from the western boundary of the property, and that a tributary outlet occurs somewhat up-stream from this point opposite the tunnel run on the P. Burns lease on the opposite side of the river. The left rim of the ancient channel is exposed in the *Victoria* pit, and it was originally necessary to cut through this to permit of hydraulic operations at this point, which were directed across the ancient channel. Just above the *Victoria* pit a tunnel was run by Quesnel Gold Mining Company, Limited, just above river-level, which apparently reached the right rim of the ancient channel, but how far above bed-rock this channel is was not determinable by inspection. The indicated width of the channel at the level of this tunnel is about 250 feet. Another tunnel is stated to have been run a distance of 165 feet at or just above water-level near the down-stream boundary of the property, but this was not accessible on the date of inspection. Somewhat down-stream from this tunnel in the vicinity of the old workings, at the point of the indicated main outlet of the channel, it would seem advisable to sink some pits, with a view to reaching the channel bed-rock, and obtain some idea of bed-rock values. In the absence of further information on these points it would seem inadvisable to embark on capital expenditure in connection with the water-supply.

Lease of F. Wissler and W. Westenheiser.—This covers a bench on the river immediately opposite the corresponding bench on the south side of the river, on which piping operations have been commenced by the C. & S. Mining Company, Limited. On both sides of the river in this region there is a concentration on a false bed-rock of slum, caused by the post-Glacial waters of the river cutting through its former ancient channel. On the lease of F. Wissler and W. Westenheiser quite coarse gold is obtained up to $6\frac{1}{2}$ dwt., and a considerable yardage of gravels, possibly of the order of 50,000 cubic yards, is available above the false bed-rock, although no idea can be given of the average values, but it merits detailed investigation. During the year the owners, utilizing water from Wolverine creek conveyed in a ditch running along the top of the rim of the river-valley, ground-slued a portion of the bench and obtained encouraging results.

Lease of T. Malone, H. Bradley, and G. S. Baker.—This is situated in the vicinity of Mitchell's gulch, about $1\frac{1}{2}$ miles above the mouth of Spanish creek on the north side of the river. The extensive benches on this ground merit investigation. The indications are that a buried channel exists in this region, and that in cutting through this the waters of the river have effected a concentration of the ancient channel-gravels on false bed-rocks of glacial material and also to some extent on rock benches.

Poquette Creek—Operations of B. Boe.—The leases on this creek formerly held by C. Lackie and associates were acquired by B. Boe during the year, who commenced preparations to continue hydraulic operations towards the end of the season. These operations will doubtless throw much light on the gold-runs of this creek and of Likely gulch, which are somewhat difficult to decipher, or to express an opinion upon, in the absence of detailed field-study.

Spanish Mountain.—The Spanish Mountain Mining Syndicate, with R. J. Balfour in charge of operations, obtained an option during the year on the property of J. Lyne (an account of which will be found in the 1928 Annual Report) and installed a pump-hydraulic plant. The property was visited by the Resident Engineer near the end of the season, when operations were on the point of being discontinued, but the manager stated that an unsuitable type of gravel-pump had been secured in connection with pump-hydraulic operations, a defect that it was hoped to remedy next year, and that in consequence no lengthy run of the pump-hydraulic system was possible. Such operations were therefore discontinued after trial and a considerable amount of testing carried out with rockers at various points. As a result of which an area has been delimited whereon the top gravels, about 9 feet in thickness, afford scope for the pump-hydraulic system next year. An examination of this area indicated that the gravels thereon exemplify very indifferent sorting by post-Glacial and glacial waters in operation for a short period only. The concentration is on false bed-rocks of glacial material. This occurrence exemplifies the fact that glacial debris may be *locally* quite rich, and may contain quite coarse gold, which shows but little signs of wear. This is an area of considerable interest, wherein the gold, although irregularly distributed, is coarse.

Spanish Creek.—S. S. Smith and associates obtained an option during the year on leases near the mouth of Black Bear creek, both on this creek and on Spanish creek. The original intention was to repair the old water-wheel at the Moore shaft-house and continue mining at this point after unwatering the shaft. After a certain amount of work had been done this idea was abandoned, and a tunnel was started close to the McGregor shaft on Spanish creek, on the right bank of the creek at elevation 2,375 feet (Likely, 2,250 feet), with the idea of reaching the deep channel from this point. At the end of October this tunnel had not been advanced more than a short distance.

Leases of A. Anderson.—These are described in the 1929 and 1930 Annual Reports. The owner is searching for the channel, which has been mentioned in this report under "North Fork of the Quesnel River" as possibly existing in this region. Single-handed, the owner carries out an immense amount of painstaking work.

Cedar Creek.—Operations during the year by B. Boe followed the gold-run south-eastwards on the *Sheridan* lease to the apparent limits of pay-ground, but it would seem unwise, in the absence of considerable investigation, to infer that possibilities in this direction have been completely exhausted. The richness of this remarkable deposit and the many indications of its local origin justify searching scrutiny of possibilities both in this direction and north-westwards. Considering its possible extension south-eastwards, there is the highly significant

fact of the occurrence on the western slopes of Cedar Creek valley above the meadows of a markedly auriferous replacement mineralization. Search in this direction should be guided by the fact that the upper end of this run is considerably *above* the meadows, and, moreover, that the bed-rock gradient is about 3 per cent. Therefore the continuation is to be sought on the *west* side of the meadows, and considerably above the latter. It also seems likely that search should be thorough if it is to be successful, in view of the fact that a shaft sunk from the surface within 5 feet of the "Second Nugget Patch" failed to disclose the latter. The possible continuation of this run north of Cedar creek is a very interesting and plausible possibility, which, stimulated by occurrences of placer on the east side of Quesnel Lake valley, has been the subject of much study. E. A. Bradley, after much preliminary field-study, has formed the opinion that the continuation of the run in this direction is the buried ancient channel of the South fork of the Quesnel river, which latter is to be found on the high-lying bench-ground on the south side of the river and lake directly opposite Likely, at which point he has commenced sinking in this channel. This view does not appear to be incompatible with any of the known facts, and may be correct, but the distance between the north-west end of the Cedar Creek run and the point mentioned is upwards of 4 miles, and it is not possible to express certainty on the matter.

Operations of B. Boe.—After pump-hydraulic operations had failed to disclose continuation of the run south-eastwards on the *Sheridan* lease, beyond a point about 500 feet south-east of the north-west corner post of this lease, profitable ground was again found immediately west of the Bagley tunnels, and operations were continued in this region until the end of the season and will be resumed here in the spring.

The question of the cost of operation of the pump-hydraulic system at this property is one of interest, as to which the following information is kindly supplied by the management: The plant installed by B. Boe in 1924 has been in operation since that date. In brief, it consists of a 10-inch Byron Jackson centrifugal pump (operated by a steam-engine, steam for which is supplied by two locomotive-type boilers of total rating 120 h.p.) delivering 1,800 gallons of water per minute, under a pressure of 45 lb. per square inch, to a monitor with a 3-inch nozzle. An 8-inch Byron Jackson centrifugal gravel-pump operated by a car-engine is set up at a convenient point over a sump in the pit, and elevates the previously mined and piped gravels to a sluice-flume so located that tailings are discharged to drain away from the pit, and water passes through various settling-reservoirs before reaching that over which the monitor pump is set up. The gravel-pump requires 25 horse-power for its operation and rarely gives any serious trouble through choking. A grizzly placed over the sump has 5- by 4-inch openings. The capacity of this plant is about 300 cubic yards per shift of ten hours. By trial it has been ascertained that about fourteen hours is required for water to drain back to the monitor-pump sump, so that ten hours in every twenty-four represents the longest time it is possible to operate to advantage daily. It should be understood that the only water available is seepage-water and surface run-off, which is impounded by the system of dams and settling-reservoirs and used over and over again. Further, the gravels which overlie bed-rock to a depth of between 15 or 20 feet contain much glacial clay, and are very tight and must be "coyote-holed" and blasted before being piped. Costs are given as follows:—*Per day*: Labour costs—1 engineer, \$5; 1 monitor-man, \$5; 2 men in pit, \$6; 1 gravel-pump attendant, \$4; giving a total labour cost of \$20. Costs of material—3 cords wood, \$15; 2 kegs black powder, \$6; 40 gallons gasoline at 37 cents, \$14.80; other expenses, including amortization and interest, \$27.90; giving a total cost for materials and other charges of \$63.70, and bringing the grand total to \$83.70, which is equivalent to a cost of 28 cents per cubic yard approximately.

Little Joe. After carrying out much preliminary field-work, accompanied by a considerable amount of testing, E. A. Bradley has acquired a group of bench leases, nine in number, extending from the *Bullion* mine up-stream on the south side of the South fork of the Quesnel river to Bilboa creek. This ground contains the buried ancient river-channel, the down-stream continuation of which has been worked at the *Bullion* mine.

Operations now focus on sinking a shaft to bed-rock, and mining the channel at a point on the high-lying bench-ground which occurs about 325 feet above the river immediately opposite Likely, close to the highway near the top of Likely hill. Suitable camp buildings have been erected in immediate proximity to the shaft, and but a short distance from the road. Some preliminary Keystone-drilling was first carried out at this point, in addition to some preliminary test-shafts, and the permanent working-shaft has already been commenced at a point estimated

to be directly over the centre of the channel, and the estimated depth to bed-rock is 165 feet. The right rim of the ancient channel is well preserved at this point and practically coincides with the left rim of the South Fork River valley. Old workings show that an attempt was made to ground-slauce the ancient channel-gravels—an attempt which evidently could not be persisted in owing to the preservation of the right rock-rim of the ancient channel.

It is E. A. Bradley's opinion that this ancient channel represents the down-stream continuation of the well-known Cedar Creek gold-run, now under operation by B. Boe. Inasmuch as the straight-line distance between the two properties is close to 4 miles, the matter is one as to which an opinion cannot be expressed with certainty, but E. A. Bradley's view is certainly rational, even plausible, and it has long been deemed by many, including the writer, that a down-stream continuation of the rich Cedar Creek deposit, north of Cedar creek, within the Quesnel Lake valley, was for many reasons a justifiable anticipation. It might be pointed out that the bed-rock gradient of the Cedar Creek deposit is approximately 3 per cent. This gradient, continued north-westwards, would approximately coincide with the level of the bed-rock of the buried ancient channel of the South fork. It is also to be noted that, even should E. A. Bradley's view prove to be correct, there would seem to be nothing incompatible with the suggestion that at some intermediate point the continuation of the Cedar Creek gold-run might be found on the east side of Quesnel lake.

Undoubtedly the investigation carried on by E. A. Bradley, supported as it is by some solid substratum of fact, is of a kind of which more is greatly to be desired, and calculated to avoid much fruitless waste of money and likely to result in some important discovery. It should be clearly understood that justification for E. A. Bradley's present operations is afforded by the possibilities of the buried ancient channel of the South fork *per se*, and not solely upon the identity of this channel with that of the Cedar Creek gold-run.

Leases of Colin Muir and John Thom.—These are situated on Beaver creek, flowing into Quesnel lake, and are described on page 199 of the 1928 Annual Report. As is therein pointed out, there is every indication that the buried pre-Glacial channel of this creek exists in the right bank. Its outlet is probably situated north of and close to the canyon, although the topography is not such as to indicate its exact position. During the year the owners carried out much open-cutting and prospecting on the north side of the creek above the dam, and it seems likely that both rims of the buried channel have been located, and in spots fairly coarse gold was discovered in the glacial overlying gravels. It seems quite possible that persistence of effort may result in important disclosures. The possibilities of the ground itself, apart from a hypothetical origin from a continuation of the Cedar Creek run, clearly indicate that further investigation is well justified.

A description of this property will be found in the 1931 Annual Report. An option was obtained on the property of this company during the early part of the season by United States Smelting, Refining, and Mining Company, Limited, and a certain amount of Keystone-drilling was carried out by that company, which subsequently relinquished its option.

KEITHLEY SECTION.

Descriptions of this property will be found in the 1930 and 1931 Annual Reports. The continuation of hydraulic operations during the early part of the season disclosed the fact that the bed-rock of the buried ancient channel was below the sluice-flume. Consequently it was decided to determine the level of the bed-rock, also the value of the bed-rock gravels by excavational development at the point of hydraulicking. The following particulars are kindly supplied by the management as to the work accomplished in the last-mentioned direction: An incline shaft was sunk to a depth of 65 feet, followed by 20 feet of tunnelling in rim-rock, when the working holed through into the channel, in which the tunnel was continued for a further distance of 70 feet. Particulars are not available as to values disclosed in the gravel.

Among other operators on tributaries of Keithley creek may be mentioned: F. L. Delong, who continued operations on Weaver creek; also J. M. Griffin and associates, who carried out some preliminary prospecting on the Haywood lease on Little Snowshoe creek, and reported that in view of encouraging results obtained further work was contemplated in 1933.

Nigger Creek.

This creek, known locally as Pine creek, for some distance flows south-easterly in a narrow V-shaped valley, and then turns abruptly north-easterly at a point about half a mile from Cariboo lake to enter a short canyon, from which it emerges to flow over bed-rock for some distance, and then again to turn south-easterly before flowing into the lake close to the north end of the latter. Immediately adjoining the canyon, on the south side of the latter, is a large glacial moraine several hundred feet in height. These features clearly indicate that a buried pre-Glacial segment of Nigger Creek channel lies buried under this moraine, and that its probable course is in a more or less straight line with that of the valley above the canyon. A slight depression in the moraine coincides with the direction mentioned. The indications are further that this channel is unglaciated, and the bed-rock geology lends support to the view that values in the bed-rock gravels are likely to be good. Old workings in this vicinity seem to have been directed to post-Glacial concentrations on the south side of the present creek and north of the indicated position of the pre-Glacial channel. A discovery of coarse gold was made at this point during the year by W. Hamilton and associates.

Leases of W. Hamilton, T. Bayley, and Associates.—These comprise five creek leases and two bench leases. The discovery was made in gravels overlying decomposed rock, which would seem to be some distance from the left rim of the ancient channel. The centre line of the latter, so far as it is possible to form an opinion, lies about 150 yards south-west of this point. A short tunnel was run at the point of discovery about 135 feet vertically above the lake in a north-westerly direction, "pay" apparently pinching in this direction. The outlet of the ancient channel would not seem to be very deeply buried, and it is possible that it could be discovered by sinking prospect-shafts at the point indicated, or by deflecting to the west the tunnel already started, which latter was understood to be the intention of the owners of the ground. This property shows considerable promise and well merits close investigation.

Leases of Placer Engineers, Ltd.—These cover the ground south and west of that above described, and at the time of inspection a ground-slucice had been opened up in an effort to locate the channel. This ground is also of potential promise and the continuation of the buried channel may be found on it.

Harvey Creek.

This creek occupies a very deep V-shaped valley, probably the most deeply incised placer creek in the Cariboo district, and in this respect bears some points of resemblance to Lorne creek, tributary of the Skeena valley. The direction of its flow, like that of Keithley and Nigger creeks, is south-easterly, and it joins Swamp river about 1½ miles above the head of Cariboo lake.

Although the creek-valley is at all points narrow and deep, its pre-Glacial channel was immediately north of the present channel and was buried under glacial debris to a depth of 75 feet or so. The old channel was very extensively drifted and largely mined out by early operators from a point somewhat below the post-Glacial falls, situated 2½ miles or so above the mouth of the creek, to and above the forks of the creek. High-lying terraces and extensive gravel benches exist on the higher points of the sides of the valley, and mark the effect of the post-Glacial waters as they cut down through glacial debris in the course of post-Glacial rejuvenation. In such there may be false bed-rock concentrations of gold, and some of such gravels may quite possibly overlie rock benches. Bed-rock gold is apparently of local origin. The narrow V-shaped valley indicates absence of glacial erosion. Interest in this creek was revived during the year by the discovery by H. Curtis, of Williams Lake, of gravels reported to be quite rich.

Leases of H. Curtis and Associates.—These comprise three creek leases and two bench leases extending from below the falls up-stream. The discovery was made on a rock bench about 25 feet above creek-level on the right bank of the creek a short distance above the falls. A tunnel was run at the level of the rock bench into the bank of the creek in glacial material containing many large boulders, and it is reported that high values were found in this glacial material. Such a bench represents a remnant of a former pre-Glacial channel left as a bench as this creek deepened its bed in pre-Glacial times. The extent of this rock bench and the value of this discovery can only be ascertained by further investigation, which is fully warranted. This ground has been purchased by B. Boe, who advises that he is making preparations to move an hydraulic plant to this ground and commence operations early in the spring of 1933.

Occurrence of Placer Gold near Williams Lake.—A concentration of fine placer gold in gravels overlying boulder-clay in a gulch on the valley-slopes immediately north of the town of Williams Lake was made by G. G. Groom, by whom the ground was staked. This occurs in a gulch, fed mainly by seepage-water, at a point about 550 feet vertically above the railway-track (elevation 1,925 feet). About 225 feet vertically above this point the gulch cuts a remnant of tight glacial gravels. More recent waters cutting down through such remnants would quite possibly originate a local concentration of placer gold should such waters in their course pass over any impervious layer such as boulder-clay, the latter forming a false bed-rock. Such is indicated as being the origin of this particular concentration.

HORSEFLY SECTION.

Noteworthy developments took place in this section during the year which give promise of assuming commercial importance, and which throw added light upon the placer occurrence, which differs in important respects from that exemplified at other points of the Cariboo district, and which was originally difficult to decipher. In the 1931 Annual Report will be found an exposition of views on this subject, necessarily in a measure hypothetical, although based upon a certain substratum of fact. While such are necessarily subject to modification in the light of further field-study or other evidence, they would, in view of the developments this year, seem to point in the right direction and reference to them is invited. In this section, to a much greater extent than in any other, commercial development rests upon a correct deciphering of the exact course of the Tertiary drainage system. As the result of developments of the year and a certain amount of additional field-study, it is possible to now supplement views on this subject expressed in the 1931 Annual Report.

An outstanding feature of this placer section is that, unlike those sections to the north of it, it was not subjected to any late Tertiary uplift. That this is the case is rendered evident by the entire absence of any deeply incised valleys and the prevalence of an immense amount of residual gravels in the buried Tertiary Horsefly river (by "residual" is meant gravels, the boulders of which consist wholly, or in very large part, of a resistant mineral such as quartz). The section has for a very long period been subject to uninterrupted erosion, during which it has been gradually reduced to a peneplain. There is one piece of very marked evidence of an interruption in the carving of the Horsefly River valley in early Tertiary times. This is exemplified in an extensive buried channel-segment lying in the north slope of the valley, about 600 feet vertically above the present river. This channel marks the first step in the carving of this river-valley. In its headwaters it apparently coincided with McKinley Creek valley; it is cut through by the waters of the present river immediately east of the falls on the river 4 miles above Black creek, and again cut in its down-stream course by the East fork of Black creek and by Black creek. Differential uplift in early Tertiary times caused rejuvenation of the waters of this river immediately south of the position they occupied in the above-mentioned channel, and still another buried pre-Glacial channel exists immediately north of the present river from the falls above mentioned for some miles down-stream. The bed-rock of this may be much below the present river. The falls are clearly post-Glacial, as also is the channel occupied by the present river for some considerable distance down-stream from this point, in which region it occupies a rocky channel, from which it emerges to continue in a broad valley immediately south of the position occupied by its former pre-Glacial waters. For a few miles south of Horsefly the exact courses of the Tertiary channels of the Horsefly river and Moffat creek cannot be exactly determined without further detailed field-study, but this region is at the moment of subordinate importance to other points at which development is taking place and at which commercial promise has been disclosed. The course of the Tertiary Horsefly river is indicated by the developments of the year as being by way of Antoine lake as depicted in the map published in the 1931 Annual Report. From developments at the property of R. N. Campbell on Antoine creek, it seems likely that there was inter-Glacial rejuvenation of the waters of the Horsefly river by this course, and preliminary investigation during the year has disclosed a gratifying concentration of comparatively coarse gold in, at any rate, the upper gravel strata (no testing in depth has yet been carried out). The presence in the gravels at this point of well-rounded boulders of the conglomerate, which occurs in place at "Hobson's Horsefly" mine, is an interesting and important feature, indicating heavy and prolonged flow of water and therefore good concentrating action. The path of these inter-Glacial waters seems to be marked by

a broad band of gravels on the right rim of the Tertiary channel. This band is of considerable width, and the gravels therein were again cut through by the waters of the present river in their course of post-Glacial rejuvenation by way of Quesnel lake. The result was to effect a reconcentration of gold on false bed-rock in the bed of the present river at points considerably down-stream from "Hobson's Horsefly" mine, as evidenced by the discovery of George Kuchan at his property on the Horsefly river. At the points mentioned ample justification has been afforded, by the promising results secured to date, for further development and investigation.

Antoine Creek.

Leases of R. N. Campbell and Associates.—An account of this property will be found in the 1931 Annual Report. Important results were secured by development at this property during the year, which seem to confirm the view previously expressed that the false bed-rock concentrations of placer, discovered a few years ago by the owners of this ground, result from Antoine creek cutting across a buried ancient channel of the Horsefly river.

An option on this property was secured during the year by G. F. Baird, of the North Western Dredging Company, and a small force of men under the direction of J. A. Mackenzie was employed in preliminary prospecting and testing operations. These comprised tunnelling from the right bank of Antoine creek into the channel disclosed by R. N. Campbell's shaft and sinking another prospect-shaft near the latter. A pump-hydraulic plant was installed and a certain amount of gravel washed by means of water pumped by a 4-inch centrifugal pump operated by a car-engine (a noteworthy feature of this engine is the installation of an additional carburettor enabling operation with fuel-oil, starting being effected with gasoline and the ordinary carburettor). Water is obtained from a dam on Antoine creek.

The tunnel portal is about 60 feet vertically below the collar of R. N. Campbell's shaft and about 200 feet distant from the latter. After continuing the tunnel for about 90 feet a raise was put through to the surface, a sluice-flume constructed in the tunnel, and piping of gravels commenced from the top of the raise. It is understood that the results gained were promising.

Further prospecting by means of shafts should readily at no great cost give further information on this old channel and afford valuable information as to the probable width of the channel and the values therein. To date, investigation indicates that the upper gravel strata contain gratifying amounts of quite coarse easily saved gold, and inclines the view that very possibly additional prospecting will indicate that there is warrant for the installation of a drag-line plant such as a Sauerman slack-line, which would be capable of digging to a maximum depth of 150 feet at a cost not exceeding 20 cents per cubic yard. It would seem that this preliminary prospecting should first be carried out, and the question of testing to depth, by Keystone-drilling, allowed to stand over for the present.

In view of the fact that the presence of quite coarse platinum was noted in the false bed-rock concentrations on this creek, operators would seem to be well advised to bear in mind the possibility of the existence of easily recoverable platinum in the gravels of the ancient river. This property shows decided promise, and it seems quite likely that it will shortly pass beyond the prospect stage.

It might be added that, as determined by aneroid barometer, the elevation of R. N. Campbell's shaft on this property is the same as that of the "Miocene" mine-shaft; that is, 2,535 feet. At the last-mentioned point the depth to true bed-rock is probably between 550 and 600 feet, as the "Miocene" shaft, which reached a depth of 550 feet, according to accounts, bottomed on rim-rock at this point. The depth to true bed-rock of the Tertiary channel in the vicinity of Antoine lake should be much as indicated by the "Miocene" shaft, but it should be understood that the gravels exposed at the property of R. N. Campbell and associates are those of a more recent channel than the "Miocene," although the two channels are probably close together, if not in immediate juxtaposition. At present no definite opinion can be expressed as to the probable depth to bed-rock in the vicinity of R. N. Campbell's shaft, but from the commercial standpoint the valuable information obtained by prospecting to date is that the upper gravel strata of the more recent channel seem likely to carry pay values practically from the surface downwards over a considerable area, the extent of which yet remains to be proved. A comparatively small amount of additional testing may demonstrate the existence of a commercial drag-line enterprise, apart from the question of deeper values and their recovery.

Horsefly River.

Leases of George Kuchan.—These cover "Hobson's Horsefly" mine, and extend down-stream from this point for some considerable distance. A promising discovery was made by the owner during the year, consisting of nice coarse gold on false bed-rock in the bed of the Horsefly river at a point about three-quarters of a mile down-stream from "Hobson's Horsefly" mine. This gold lies under a depth of 3 to 4 feet of swiftly running water, and it will be readily understood that in consequence prospecting is greatly impeded, although very fine pans can readily be obtained at the point of discovery.

The origin of this gold would seem to be due to the waters of the present river cutting down through inter-Glacial gravels which resulted from inter-Glacial damming causing inter-Glacial rejuvenation of the Tertiary Horsefly river on the right bank of the latter. This resulted in the deposition of a broad band of gravels more immediately adjacent to the right bank of the Tertiary Horsefly river. At various points such gravels are exposed on the banks of the present Horsefly river, and where they are cut by the latter a reconcentration of gold is to be expected. In view of the fact that distinctly post-Glacial rejuvenation was by way of Quesnel lake and the present Horsefly river, it seems likely that the broad band of gravels referred to is of inter-Glacial age.

It seems quite likely that the placer described above on this property can be recovered by wing-damming and drag-line operations. This property clearly merits close investigation. Refer also to the Annual Report for 1931.

Black Creek.

Rountree Mines, Ltd., and G. McKeracher.—Particulars of this property will be found in the 1930 Annual Report which it is unnecessary to repeat herein. During the year a reconnaissance trip was made by the Resident Engineer from this property over the course of the ancient buried channel of the Horsefly river, which is the main objective of operations, and which is indicated as lying buried parallel to the present Horsefly river at an elevation of 600 feet vertically above the latter. This ancient channel is cut by both Black creek and the East fork of the latter, and both of these creeks gave rise to a reconcentration of the ancient channel-gravels. The course of this channel is indicated by a depression which becomes very clearly defined eastwards, where the rims of the ancient valley are exposed, and can be traced from a point somewhat west of Black creek to the Horsefly river just above the first falls on this river, at which point it is cut through by the present river, and its up-stream course would seem to have coincided with that of McKinley Creek valley.

This channel affords the only positive evidence noted of differential uplift in Tertiary times in this section, and marks apparently the only interruption in the course of prolonged Tertiary erosion, which is a predominating characteristic of this section.

The only evidence obtainable at present of the bed-rock gradient of this channel-segment is afforded by superficial features. These indicate a gradient of about 5 per cent., which is possibly about the same as that of the bed-rock, inasmuch as the channel indicates a very early step in the carving of the Horsefly River valley, and it is quite likely that in that case bed-rock gradient had not been lost at the time differential uplift occurred.

An examination of the falls on the Horsefly river very clearly indicates that these are post-Glacial, likewise the rocky gorge below them, and that another pre-Glacial buried channel of the Horsefly river lies buried immediately north of the present river from the falls for some miles down-stream, and the bed-rock of which is probably much below the present river. The course of the channel above described, which is cut by Black creek, is approximately parallel to the present river, and after differential uplift in Tertiary times the river proceeded to deepen its bed immediately south of the position it formerly occupied.

Reconnaissance between Black creek and the Horsefly river disclosed that the bed-rock geology consists of volcanic flow-rocks of andesitic type and probable Jurassic age. These are intruded at numerous points by pyroxenite tongues between Black creek and its East fork. East of the East fork a large pyritized quartz-feldspar dyke outcrops prominently for a very considerable distance, trending N. 30° E. (mag.). In this a prospect-shaft is sunk to a depth of 20 feet at one point. An assay of a sample of the dyke disclosed traces only of gold and silver. At the falls a similar smaller dyke intrudes the prevailing andesite country-rock. No quartz veins were noted, but such may quite possibly be present, as much of the region is

overlain by drift. The bed-rock geology indicates that the terrain eroded is one such as might readily have originated concentrations of placer, both gold and platinum, on bed-rock, which is further confirmed by the reconcentrations effected by Black creek and its East fork.

It was the original intention of the operators of this property to continue hydraulic operations up Black creek across this channel. A highly critical factor, however, from the practical standpoint is the level of the bed-rock in relation to that of the present pit. Obviously, if the latter is above the channel bed-rock, the attempt mentioned must prove abortive. It would appear that the amount of Keystone-drilling carried out at this point some years ago is inadequate to form a sufficiently accurate opinion on three important points—namely, the depth at which the bed-rock lies, the values in the bed-rock gravels, and the bed-rock gradient. It is therefore desired to reiterate the previously expressed view that additional Keystone-drilling should be carried out before further operations are attempted.

East Fork of Black Creek.

E. von Liljestierna and Associates.—This property is situated on the East fork at a point considerably above that at which this creek crosses the buried ancient channel of the Horsefly river described in the report on the property of Rountree Mines, Limited. Placer was discovered by the owners of this property on this creek at elevation 4,430 feet, just above a point at which the creek runs over a rib of country-rock. A certain amount of gravels were washed, and it is stated that these contained encouraging amounts of gold. Insufficient work has as yet been carried out to form any very definite opinion as to whether a pre-Glacial channel of this creek exists buried at this point, or as to possibilities generally, but from accounts the discovery would seem to merit following up.

Claim of L. R. Kirby.—This is situated on the right bank of the Horsefly river at the head of the first falls on the river, where a pre-Glacial channel of the Horsefly river is indicated as lying buried, and the false bed-rock gravels, which are being investigated by the owner, originate from the post-Glacial waters of the river cutting across its former channel.

Operations of W. Sugarman.—Early in the season W. Sugarman obtained an option on creek leases on the Horsefly river held by C. R. Carfrae in the vicinity of Keystone drill-hole No. 4c, drilled by the Department of Mines in 1920 (refer to Annual Report for 1920 for full account). Under the direction of W. E. Loveridge, an attempt was made to sink a shaft close to the hole at a point 8 feet distant from the river, but the project was subsequently abandoned.

Big Lake Creek.

Property of O. W. Andriesen and Associates.—This creek flows out of Big lake into Beaver creek. About half a mile above the mouth of this creek high gravel banks occur on the right bank of the creek, and in this vicinity low-lying benches flank the banks of the creek. The gravels on these benches are intermingled with many large glacial boulders and rest on a false bed-rock of glacial clay. Workings of earlier operators render evident that, as might be anticipated, there is a concentration of placer on this false bed-rock, but the presence of the large boulders necessarily impedes work. During the year O. W. Andriesen and R. McConkey carried out a considerable amount of prospecting and recovered some gold, which was noteworthy by reason of its purity, the value being \$20.19 per ounce. It is quite possible that the high banks noted mark the course of the Tertiary Horsefly river at this point.

SOUTHERN AND CENTRAL MINERAL SURVEY DISTRICTS (Nos. 3 AND 4).

REPORT BY PHILIP B. FREELAND, RESIDENT MINING ENGINEER (HEADQUARTERS, PENTICTON).

INTRODUCTION.

About the end of April Districts Nos. 3 and 4, with the exception of the Lillooet Mining Division, were amalgamated and the headquarters moved to Penticton, which is the most central point for the larger number of operating properties and centrally located for convenient transportation to other points. The district now comprises ten Mining Divisions—i.e., Grand Forks, Greenwood, Osoyoos, Similkameen, Yale, Ashcroft, Nicola, Vernon, Kamloops, and Clinton—and is roughly outlined by the International boundary on the south; the waters flowing west from the Arrow lakes, the Columbia river, and the watershed of Canoe river to Tete Jaune Cache on the east; by the watershed of the North Thompson river and the height of land passing through 150-Mile House to the Itcha mountains on the north; and the watershed of the Chilcotin river and eastward-flowing waters of the Fraser river to Silver creek below Hope on the west.

PRODUCTION.

Due to the continued depression of the base metals, practically all development and exploration were confined to gold and platinum, either in place or in placer. The production of lode gold in Districts 3 and 4 for 1932 is 21,372 oz., as compared with a combined total of 45,627 oz. in 1931, but this latter figure included 28,153 oz. from the *Pioneer*, in Lillooet Division, and the 1932 production from this mine is now included in District No. 6 totals. The figure of 21,372 oz. therefore shows an increased production as compared with the preceding year. Production from the *Dawson* near Hope, the *Carmi* at Carmi, the *Gold Drop* and *North Star* at Jewel lake, the *Parvatu* near Penticton, and many smaller shipments of gold ore from other properties, as well as increased placer-gold recoveries, accounts for the larger production. In 1933 a larger gold production may be expected from lode deposits, and possibly from the property of Vidette Mines, Limited, in the Kamloops Mining Division, the *Planet* near Merritt, and other likely prospects in the Coquihalla, Fairview, Camp McKinney, Oro Fino mountain, Franklin Camp, and Paulson.

The following table shows the mineral production of Districts Nos. 3 and 4 for 1932:—

Division.	Ore.	Gold.	Silver.	Copper.	Lead.	Zinc.	Coal.
	Tons.	Oz.	Oz.	Lb.	Lb.	Lb.	Tons.
Clinton.....	25	28	.....	.....	.....	.....	.....
Grand Forks.....	26,456	19,218	131,713	13,402	198,955	402,479	.....
Greenwood.....	3,412	414	595,470	1,340	303,950	462,626	.....
Kamloops.....	.....	.....	.....	.....	.....	.....	512
Nicola.....	.....	.....	.....	.....	.....	.....	20,828
Osoyoos.....	386	1,367	203	.....	.....	.....	.....
Similkameen.....	529	1	14,461	.....	131,581	22,458	173,972
Yale.....	148	344	79	.....	.....	.....	.....
Totals.....	30,956	21,372	741,926	14,751	634,486	887,563	195,312

Division.	Bentonite.	Clay Products.	Gypsum and Gypsite.	Limestone (Flux).	Mica.	Platinum.	Soda.
				Tons.			
Ashcroft.....	.....	.....	\$400	.....	.....	.....	.....
Clinton.....	.....	.....	744	.....	.....	.....	\$7,452
Grand Forks.....	.....	.....	.....	16,043	.....	.....	.....
Kamloops.....	.....	.....	84,084	.....	.....	.....	1,061
Similkameen.....	\$176	.....	400	.....	.....	\$2,332	.....
Vernon.....	.....	\$5,441	.....	.....	\$1,080	.....	.....
Totals.....	\$176	\$5,441	\$85,628	16,043	\$1,080	\$2,332	\$8,513

Placer-gold production for all Mining Divisions in 1932 was valued at \$19,397, as compared with \$12,682 (not inclusive of Lillooet Mining Division) for 1931.

PROSPECTING.

The fact that the southern part of this district is exceedingly well provided with roads, trails, and electric power has been stressed in the Annual Reports from time to time. The phantom of enormous wealth to be located easily in distant fields away from transportation is an old one and should be treated as such, and some consideration given to the possibilities of finding ore in localities where mines, even though small, have existed. The trite saying that the place to find apples is in an orchard is a good one and may be successfully applied to prospecting for minerals. Until it is definitely assured that there are no more mines to be found or made in the older camps, they should receive the deserved attention. In most of these areas the surface gravels tend to make prospecting difficult for the individual, as the lack of new discoveries portrays, so that the problem appears to be in the hands of those financially able and willing to undertake it. The values per ton of ore found close to existing transportation and power may be mined more profitably than those at greater distances and a considerable outlay of capital eliminated. In respect to the above the country around Fairview and Camp McKinney may be especially mentioned. In both these localities small mines have operated in the past and the continuous outcrops of quartz veins offer a large field for intensive exploration.

In Bulletins Nos. 1 and 3, 1932, the Paulson, Lightning Peak, Jewel Lake, Hedley, Coquihalla, and Peers Creek areas were mentioned as likely prospecting areas for the individual. In most of these places the snowfall is heavy and the surface cannot be inspected until May or later.

PLACER-MINING.

Practically every stream in the district that had produced any gold in the past was again explored this year. Many green hands holding provisional free miners' certificates eeked out a livelihood by panning and rocking the bars, and much time was spent by the Resident Engineer in advising and explaining this type of mining. No spectacular discoveries were reported, but the find of coarse gold near the headwaters of Churn creek, and the exploration of the old channel possibilities on Rock creek which have in some cases uncovered good "pay" on bed-rock, may lead to profitable mining ventures.

The preliminary testing of the black sands from the Fraser and Thompson rivers by C. S. Parsons, of the Mines Branch, Ottawa, promises to be of great assistance to the operators, and his findings were such that it seems probable that over 90 per cent. of the would-be hidden values are in reality microscopic gold which can be satisfactorily saved after cleaning by barrel or plate amalgamation on the spot. Much of the Fraser River gold is very fine and often flaky, so that it floats easily. If immersed so that the flakes are entirely covered with water, they will sink and remain at the bottom providing they are not disturbed by coarse gravel in the sluice-boxes. For the purpose of saving these values in an ordinary operation an undercurrent is essential.

COAL.

Due to labour strikes the production from the Princeton coalfields was somewhat reduced. To offset this a new mine was brought in at Bromley creek by lessees from the Princeton Properties, Limited (Princeton Coal and Land Company), to whom much credit is due owing to the fact that there was practically no capital expenditure and all work was done without wages. This is only one of many other likely seams of coal near Princeton that could be mined profitably.

NON-METALLICS.

The Clinton and Kamloops Mining Divisions are particularly noted for deposits of non-metallics such as gypsum, sodium carbonate, and sodium sulphate, and reports of these occurrences have been made in former Annual Reports as well as in bulletins issued separately by the Department of Mines. Much valuable information can be obtained from this source by those interested in these types of minerals.

ACKNOWLEDGMENT.

The kindly assistance and hospitality shown by H. G. Nichols, former Resident Engineer, and the large operator and prospector are gratefully acknowledged.

PROVINCIAL GOVERNMENT GRANTS.

Many operators and prospectors were assisted financially in the building and reconditioning of roads and trails to mines and prospects by the Department of Mines, with the result that production was accelerated and material transported for development which otherwise could not have been accomplished due to lack of funds.

GRAND FORKS MINING DIVISION.

FRANKLIN CAMP.

Union. This group, consisting of the *Union, Idaho, Union Fraction, Paper Dollar*, and other claims, situated to the east and west, is registered under the name of J. F. McCarthy, of Wallace, Idaho, and financed by the Hecla Mining Company. Reference to the operations of the mine is to be found in the Annual Reports for the past few years and a map of the claims in the 1931 Report. The geology is described in C. W. Drysdale's Geological Survey Memoir No. 56, and a further reference may be found in Bulletin No. 1, 1932, British Columbia.

Practically all the ore mined and milled was taken from between No. 2 and No. 1 levels, where richer shoots containing higher gold values were found last year. The length on the rake of this shoot to the west was about 320 feet and stopes reached an elevation of 150 feet above No. 1 tunnel, or within 60 feet of surface, with high-grade ore-widths of 1.5 feet. The ore appears to have been formed against the minor horizontal faults, which have a maximum throw of 17 feet. Below the No. 1 level the higher-grade material continued for 20 feet, where it was cut off by a flat fault. There appear to be two main horizontal faults above and below No. 1 tunnel, between which there are many minor slips which dip to the south and west. The higher-grade ore disappears apparently on the main horizontal movements. In No. 3 tunnel a well-defined shear-zone filled with practically barren white quartz averaging 2.5 feet in width was drifted on for 200 feet without improvement. It seems probable that this level will be driven ahead to a point directly under where No. 1 level intersected the conglomerate contact to the west, in the hope that the ore-bearing formations continue under them. The extension of No. 1 level to the west intersected what is known as the *Maple Leaf* gulch fault and brought to light the fact that instead of a fault the depression was the contact of the conglomerates, which are a younger rock than the sedimentaries in which the ore occurs. It is probable that there has been a downward movement of the conglomerates which completely eliminates any chance of finding ore above No. 1 in the immediate area. The topography rises again to the west and possibly the conglomerates represent only a thin covering over the sedimentaries, under which the ore-bearing shear-zones may again occur. The same formations outcropping strongly to the west assist this theory. Some higher-grade gold ore has been discovered to the east and south of the new ore-zone above No. 1 tunnel. When this development-level was driven, only low values were found in the quartz vein. As long, apparently, as the quartz continues and physical conditions are favourable, equally good chances of finding ore remain.

The mill was closed down at the end of October until more ore can be found. In the meantime the company is continuing development in the mine with a diamond-drill and small crew of men in hopes of finding sufficient ore for further operations.

Maple Leaf. This group, owned by Bartell and associates, of Oroville, Wash., was bonded to the J. F. McCarthy interests owning the *Union*, and two crosscuts were driven, one from No. 1 level westerly and another from the intermediate level 100 feet below No. 1, to prospect copper-platinum outcrops found many years ago. According to reliable reports, a good deal of pyritic mineralization was found in the crosscuts, but no payable ore up to the end of November. In former years two car-loads of ore were shipped from an open-cut on the *Maple Leaf* near the contact of the sedimentaries and the pyroxenite intrusives, containing 0.42 oz. in platinum to the ton. In the lowest workings near the mouth of the tunnel a considerable amount of native copper was discovered in flakes in the highly altered greenstones. The genesis of this ore was never satisfactorily explained. This old work constituted a long crosscut tunnel with branches driven in a general westerly direction at an elevation of about 2,900 feet, whereas the copper-platinum outcrops occurred about 1,000 feet higher. The country-rocks found in this tunnel were chiefly altered greenstones and cherty quartzites impregnated with pyrite, and practically barren of values.

This group, consisting of the *Homestake*, *Deadwood*, and other claims lying to the west of the *Union*, is owned by Ab. Fee and associates, of Grand Forks.

Homestake. In 1932, after a spectacular pocket of gold ore was discovered in similar mineralization and formations as occur on the *Union*, the J. F. McCarthy interests bonded the claims. After diamond-drilling, a shaft was sunk for 100 feet and drifting commenced both ways from the bottom of the shaft. The drilling results showed a continuous mineralized body about 300 feet long, but this method of exploration was stopped, chiefly on account of the disintegrated condition of the drill-cores, which were difficult to save intact. The strike of the vein system varies from that found on the *Union* (east and west) and has a general bearing of north-west and south-east, which, if constant, will pass through the *Bullion* claim to the south and *Deadwood* to the north. On the latter claim a strong quartz shear-zone has been uncovered, and although no spectacular values were found there is at least a likelihood of ore in favourable structural zones. A general mineralization of pyrite (much oxidized) and occasional segregations of chalcopyrite was uncovered on the *Bullion*, and probably more work will be done during 1933. The above mineralization is found in the cherty quartzites and greenstones which strike in a north-westerly and south-easterly direction.

These adjoining claims, the former owned by Geo. Fee and associates and the latter by E. C. Henniger, of Grand Forks, lie to the south-east of the *Bullion*. **Athelstan and Nellie.** Several open-cuts put in on slightly mineralized outcrops in the general direction of the ore-strike from the *Homestake* failed to uncover any payable ore. On the *Athelstan* a considerable amount of oxidized pyrite in quartz was found extending downhill for 125 feet and striking easterly and westerly (mag.). On the *Nellie* an open-cut 16 by 21 feet exposed numerous mineralized fractures containing pyrite, chalcopyrite, and copper carbonates. The country-rocks are volcanic tuffs which have been highly altered by some igneous agency.

Buster. This claim, owned by Ab. Fee and K. Scheer, of Grand Forks, is situated on the south-east slope of McKinley mountain. Near the collar and on the dump of an old 20-foot shaft some high gold assays were obtained by the owners. After unwatering and sampling the quartz vein in place over an average width of 5 inches in several places down the shaft, values were found as follows:—No. 1: Gold, 0.02 oz. per ton; silver, 1 oz. per ton. No. 2: Gold, 0.44 oz. per ton; silver, 1.6 oz. per ton. No. 3: Gold, 0.20 oz. per ton; silver, 4.6 oz. per ton. No. 4: Gold, 0.30 oz. per ton; silver, 1.4 oz. per ton. A sample from the quartz-outcrop in the open-cut approaching the shaft assayed: Gold, *nil*; silver, 0.4 oz. per ton.

In and near the bottom of the shaft numerous stringers appear dipping from the vein on the hanging-wall towards the foot-wall. The vein occurs in a 4-foot shear-zone in the granodiorite and can be traced on the strike intermittently for 300 feet to the north-east. In places the quartz is 4 feet wide and is slightly mineralized with pyrite, galena, and sphalerite. In the bottom of the shaft the quartz widens to 2 feet, and, although the values are low, further work, on account of the high values found on the dump, appears to be justified.

Last Chance. This claim, owned by Chas. Hansen, of Grand Forks, is situated on the north-east slope of McKinley mountain and about 1 mile from the Franklin Camp road on the *McKinley* trail. A tunnel has been driven 21 feet long in the highly altered Franklin formation, mostly quartzite, in which there is a dense mineralization of pyrite and occasional specks of galena. Although samples contained only low values in gold and silver, due to the fact that the formations are attractive, more work is justified.

Some high-grade gold values were found in a tunnel driven on the *Copper No. 2*, mentioned in other reports and situated close to Franklin camp. The ore, consisting of pyrite in a quartz gangue, occurs in the Franklin formation close to its contact with the granodiorite.

PAULSON SECTION.

Molly Gibson (Burnt Basin).—This claim, which is one of a group situated about 4 miles from Paulson, on the Canadian Pacific Railway, has been reported upon in former Annual Reports. Although not examined this year, reports state that the lessee, O. Anderson, has discovered some new ore carrying values from 1.02 to 3.08 oz. per ton in gold.

This group, situated near Paulson and owned by the Contact Consolidated **Mother Lode** Gold Mines, Limited, with an agency office address of Hamilton, Wragge & **(Burnt Basin)**. Hamilton, of Nelson, was reported upon in the 1925 Annual Report, also in 1904 by R. W. Brock, of the Geological Survey of Canada, in pamphlet form, and again by W. F. Ferrier for the Munitions Resources Commission in 1918. As well as these, private examinations and reports were made by J. E. Snelus, of Cumberland, England, and B. Cochraue, of Republic, Wash., U.S.A., at about the time the mine was being developed. Extracts from these reports can be seen at the Resident Engineer's office in Penticton.

The geology of the area is described by R. W. Brock as follows: "The claims lie in a district of considerable geological complexity, which has been the scene of numerous igneous intrusions extending from probably Palaeozoic to Tertiary times, and during that period it has been subjected more than once to the throes of mountain-building. Consequently, the older rocks are much disturbed, sheared, fractured, and altered. The oldest rocks are limestones, argillites, and greenstones, the latter having the greatest areal distribution. A large part of the district is, however, composed of later igneous rocks.

"The limestones in places are sufficiently pure for use as smelter-flux, but are sometimes dolomitic. When comparatively unaltered they are dark and carbonaceous, but they are usually marmorized to a white marble. The argillites are often altered to schists and hornfels. These rocks have been invaded by the greenstone, probably an augite porphyrite, though now sheared and altered. The above rocks are cut by a coarse grey granodiorite, which sends dykes and apophyses into the older rocks. The greenstone of the *Mother Lode* is also cut by a basic gabbroidal rock, which bears some resemblance to the more basic monzonites. To the north of the property is a still more recent hornblende granite, with accompanying acidic and basic (vogesite) dykes. To the east is a large area of syenite, of pulaskite (alkali syenite) and monzonite habits. This rock is of Tertiary age. Some dykes of it carry free gold as a primary constituent plainly visible to the naked eye. Numerous dykes of syenite porphyry, some of them no doubt from this alkali syenite, cut all the older rocks.

"The veins lie in greenstone between two large porphyry dykes. The quartz, which is somewhat milky, has small amounts of metallic sulphides scattered through it. Pyrite, galena, and blende are the commonest, but chalcopyrite and some molybdenite also occur. On the surface the sulphides have been leached out, leaving free gold and some copper carbonates in the rusty and porous quartz. A little native copper is also reported to have been found at the surface. The principal value is in gold, but a little silver is also present. In one of the neighbouring porphyry dykes a little molybdenite was detected and the dykes are reported to assay about \$3 in gold. There appears to be a genetic relationship between these dykes and the ore-bodies in this part of British Columbia."

Four assays given in Brock's report show a platinum content varying from nothing to 0.1 oz. per ton. The claims of the original group now in good standing are the *Mother Lode*, *Daly*, *Mother Lode Fraction*, *Ajax*, and *Ajax Fraction*. Development consists of numerous open-cuts on various quartz-vein outcrops.

The following excerpt is from the report of E. Snelus: "A shaft (10 by 7 feet) has been put down on the dip of this ledge at an angle of 40° to the north for a distance of 65 feet. At 25 feet down the ledge is lost, shooting off into the hill towards the north-west. From the bottom of this shaft a crosscut tunnel has been driven N. 45° E. for a distance of 73 feet, cutting the upper ledge at 63 feet. This has been drifted on east and west for a total distance of 24 feet. The ledge where met by the crosscut is 6 feet wide, and the dip has increased to about 45°. In the east face of the drift the ledge is 2 feet wide and consists of white quartz carrying stringers of pyrites and copper-carbonate stains. In the west face it is not well defined, but the whole face is mineralized. An average sample taken over the entire length of the drift gave: Gold, 3 dwt. 22 gr. per ton; silver, 15 dwt. per ton.

"The upper ledge has been stripped along its strike for 30 feet, showing 4 feet wide of clean quartz, and on its dip for 40 feet, where it thins down to 2 feet in width. A tunnel was being driven N. 60° W. to crosscut the upper ledge at a vertical depth of 77½ feet, and upon my return to the mine on December 14th I found that it had just been cut at a distance of 232 feet, at a point immediately below the drift above, and opening up 140 feet of backs. The ledge at this point is 2½ feet wide and carries some iron pyrites and some galena. An average sample over 8 feet gave: Gold, 6 dwt. 13 gr. per ton; silver, 10 dwt. per ton."

Development since this report was made constitutes the extension of the lower tunnel for over 100 feet in a westerly direction as well as a crosscut to the south, the latter made in search of a possible parallel vein. To the east the vein was also followed for a considerable distance. The shaft was caved at a point about 35 feet below the collar, so that it was impossible to examine the work done beyond that point. It is quite evident from information obtained in the upper workings that there is only one vein, the lower one, on which the shaft was sunk, being the downward faulted section of the one above. Some enrichment has taken place against the fault in this area and much higher values, including free gold, discovered. It is possible that this faulted zone may extend into the hill to the west and that minable bodies of ore may be found in connection with it. Development only will prove or disprove this theory. The top or lower section of the vein measures about 6 feet in width, whilst the lower or top section measures about 8 feet.

Average samples across these widths assay about \$7 per ton in gold and silver. A picked sample assayed \$26.80 in gold and 81 cents in silver per ton. Samples taken from the face of the east drift below assayed: Gold, trace; silver, 9 cents per ton over a 20-inch width. A sample taken over 15 inches in the face of the west drift assayed: Gold, 80 cents; silver, 27 cents per ton. A picked sample taken across 20 inches of quartz 20 feet long, near the intersection of the crosscut and vein, assayed: Gold, 80 cents; silver, 21 cents per ton. A sample of heavy sulphides across 4 feet of quartz, 30 feet from the vein intersection, assayed: Gold, \$1.60; silver, 22 cents per ton. The vein narrows to a few inches, flattens and dips under the drift to the west, rising again about 20 feet from the face. Very little mineralization occurs in veins found on other parts of the property and no work has been done upon them since 1917, when an examination was made and only low values found. Most of the timber has been burnt by forest fires.

It is a peculiar coincidence that platinum was found in the early days (1902) in the ores both in the upper workings as well as in the lower tunnel, and that since then, in samples carefully selected from sections supposed to carry the metal, not even a trace was found either by the Department of Mines at Victoria or at Ottawa. Some of the most reliable firms in England, Germany, and the United States found not only platinum, but iridium, osmium, and ruthenium. From the foregoing it seems likely that the Platinum group of metals occur only in isolated segregations in certain sections of the mine, and that these were missed in the recent sampling or not exposed in the workings. The wide variance in platinum values found in samples in 1902 suggests this.

An interesting feature about the locality is stressed by R. W. Brock; that is, the finding of gold values up to \$3 per ton in one of the porphyry dykes and that free gold was also observed. The suggestion made by him that the porphyry may have been responsible for the ore is worth investigation. Large dykes of pulaskite invade the area.

Rock Rabbitt and Hurricane. These claims, owned by Murt. Carroll, Cascade, are situated 2 miles up Trout creek from Mile 8 on the Cascade-Rosslund road. Some interesting developments, by means of a 22-foot shaft as well as several open-cuts, have uncovered a sheared and highly altered contact-zone between the granite batholith and ferromagnesian rocks (probably dunite), the latter predominating to the south. Numerous apophyses of the granite intrude the dunite (?), and along its edges a heavy mineralization occurs containing varying quantities of pyrite, magnetite, and lesser amounts of niccolite. This is an intensely interesting area where a large variety of minerals are found, such as chromite, magnesite, and nickel, in the magnesian rocks and serpentines.

Pathfinder Consolidated Co. This company, formed thirty years ago to develop the *Pathfinder, Little Bertha*, and other claims on the Granby river about 12 miles north of Grand Forks, made an arrangement recently whereby G. Voshell developed the *Little Bertha*. The crosscut tunnel commenced several years ago has been extended and at the present time measures in the neighbourhood of 1,000 feet. The idea of driving this tunnel was to develop at depth the downward extension of the *Little Bertha* gold-bearing quartz vein which had been mined about 200 feet in elevation above, as well as to tap any hidden ore-bodies. In one section about 25 feet wide near the face of the tunnel fragmentary sections of quartz were found in a highly siliceous contact-zone near the granite intrusive. The remainder of the tunnel is reported to have been driven in country-rock, including porphyry dykes, etc. Of late Voshell has been working on what appears to be a narrow lead about 400 feet from the mouth of the crosscut. There are many mineralized contacts that up to the present carry only

low values in gold and silver. Other work was done to the south of the *Little Bertha* workings, the results of which are not to hand. The owners will be well advised before doing any further development to unwater the winze in the *Little Bertha* and ascertain definitely what has happened to the vein at the bottom.

LIGHTNING PEAK SECTION.

This camp, situated at the headwaters of the Granby and Rendell rivers, was not visited in 1932, but reports from prospectors, owners of claims, and operating companies were quite satisfactory and extensions of the gold-bearing quartz veins were found to the north and south.

In Bulletin No. 1, 1932, this section was dealt with in some detail, especially the findings on the *A.U.*, which is one of the Waterloo Gold Mines, Limited, claims. This company, with headquarters in Penticton, has made, it is understood, financial arrangements with the B.C. Investments, Limited, British Columbia House, Nos. 1 and 3 Regent Street, London, S.W. Very little was done upon the property during the year, except the cleaning-out of No. 4 tunnel on the *Waterloo* claim, which had caved in, and the reconstruction of several miles of road into the property. Most of the bad mud-holes were corduroyed and little trouble is anticipated in driving trucks over the 18 miles of side-road next year. A car-load of mixed ore was shipped to the Trail smelter that assayed \$30 in gold and \$13 in silver per ton. This ore was taken partly from the silver-bearing shear-zones on the *Waterloo* and partly from the gold-quartz veins on the *A.U.* claims. On the *Pay Day* group, which lies to the north of the *Waterloo*, another ledge, striking east and west, from which samples were taken that assayed 68 per cent. lead and 5 oz. in silver per ton, was discovered. On the *Killarney* work was confined to the No. 2 tunnel and tracing the faults on the surface, so that a better idea of the major movements has been obtained and development can be guided in the proper direction. Higher-grade gold-quartz ore has also been found in the vicinity of the *Dictator* claim, which lies to the north of the main camp.

This whole area has been reported upon from time to time and special notice may be brought to it at this time when the search for gold-mines is intense. Practically nothing is known about these gold-quartz veins, except in a few instances where values have increased in depth. The country for several miles square is rolling and generally covered with soil, so that prospecting is difficult. Nevertheless, at intervals either quartz in place or float can be observed striking generally north and south and traceable for several miles in length. Until two years ago most of the development was done on the silver-lead shear-zones on the *Lightning Peak*, *Killarney*, *Pay Day*, and *Waterloo* groups, and it was only when the price of base metals dropped that attention was paid to the fissure-veins, the persistency and frequency of which warrant exploration at depth.

PLACER.

Although no placer production has been reported from this Division, it is not without its possibilities. In former Annual Reports certain localities have been mentioned, such as the South fork of Pass creek, which flows into the Granby river about 12 miles north of Grand Forks. This creek at one time evidently flowed out of Jewel lake, in the neighbourhood of which there are many free-gold quartz veins. There are small creeks also flowing away from the Paulson area where free gold occurs in quartz. Fourth of July creek also produced some placer gold in the sixties. The placer gold, especially in such localities as Pass creek, may not be found in the present stream-bed, but on the benches adjoining, where it was left after the present waters cut the deeper channel.

GREENWOOD MINING DIVISION.

WALLACE MOUNTAIN SECTION.

The operations in this section, which have been reported upon in former Annual Reports, continued throughout the year despite the low price of silver, lead, and zinc. Considering the tremendously faulted and disturbed conditions of the shear-zones in which the silver ore occurs, great credit is due the operators.

The Bell Mines, Limited, which operates the *Bell* and *Highland Lass* claims, has produced throughout the year a rough combined total of 2,135 tons of ore which was shipped to the Trail smelter. About 1,600 tons of this shipment was mined in the *Bell*. Advice from the company

states that the *Highland Lass* ore-bearing shear-zones appear to become more uniform at depth, and recent developments have uncovered silver ore as high grade as any ever found in the camp. The *Bell* developments are well in hand and the future supply of ore indicated is as large as can be expected in such tremendously faulted shear-zones.

The *Sally Mines, Limited*, has been more fortunate of late in finding an ore-bearing shear-zone in the old *Sally* workings near the camp. A winze was unwatered and about 12 inches of high grade found in the bottom. An upraise was driven to develop this from an old working-level 125 feet below, and the ore discovered about 50 feet below the collar of the winze. One shipment has been made to the smelter and others are expected to follow.

The *Wellington* mine was operated steadily throughout the year with a small crew of men and between 600 and 700 tons of ore was shipped to Trail. Development consisted of sinking a shaft on an incline of 70° to a depth of 86 feet from the lowest level and driving crosscuts and drifts a distance of 530 feet. Ore was found above the level for 145 feet to the west of the bottom of the shaft. To the east at that elevation no ore has been discovered up to the present, but the possibilities are excellent, because there are high-grade ore-shoots at higher elevations in that direction. A 57-horse-power Ruston engine, with a 330-cubic-foot Holman compressor and starting unit, as well as two 4,000-gallon steel oil-tanks, have been added to the mine equipment.

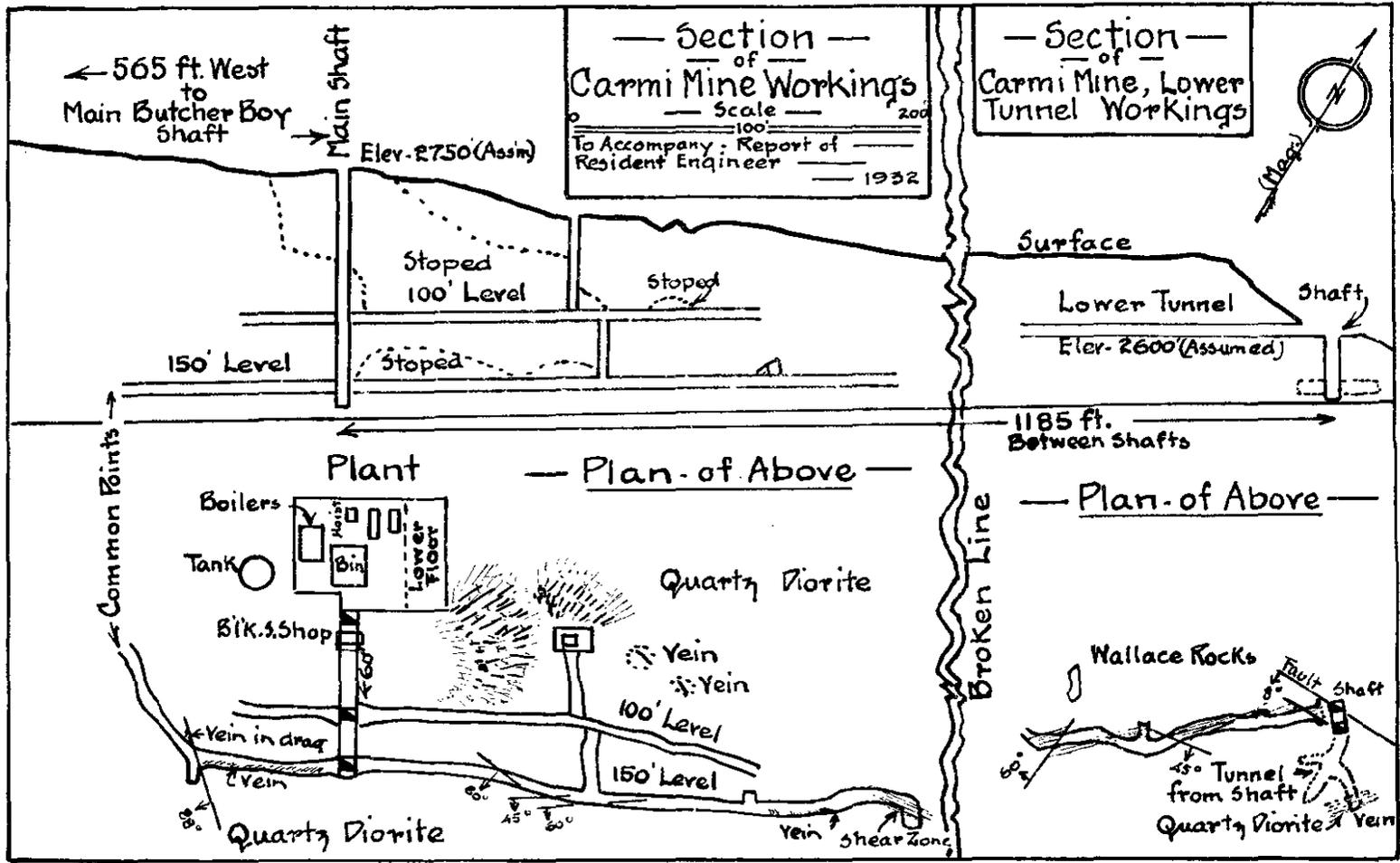
Work on the *Beaver* mine, which adjoins the *Bell*, was suspended in November. Major Angus Davis was in charge and, according to reports, developments are such that with an advance in the price of silver the mine stands an excellent opportunity of becoming a producer. An attempt was made to find the faulted section of the ore-body mined to the south-west of the shaft without success.

Canadian-American Mines, Ltd.

This syndicate has been operating under option the *Carmi-Butcher Boy* group, situated close to Carmi Station on the Kettle Valley Railway. J. E. Miller is trustee for the syndicate, with headquarters at Carmi or 40 Williams Building, Vancouver. An average of fourteen men was employed during the year working one day shift. Several shipments of partly sorted ore were made to Trail, the average analyses of which are about as follows: Gold, 0.50 oz.; silver, 3 oz. per ton; zinc, 3 per cent.; iron, 10 per cent.; sulphur, 9 per cent.; silica, 66 per cent. Treatment costs average slightly over \$2 a ton and railway freight approximately \$3 a ton. Fuel used consists of cordwood cut in the neighbourhood of the mine, and one boiler supplies steam-power to drive the engine and compressor, which operates a Waugh stoper, Ingersoll-Rand drifter, and Cameron pump, underground, as well as the hoist. A new blacksmith-shop was erected at the mine and wooden tanks for water-storage. The mine is not making much water and only occasional pumping is necessary.

Development consisted of extending the 100-foot level to the east; the face of this tunnel is now 238 feet from the shaft. On the same level to the west, or towards the *Butcher Boy* claim, a tunnel has been driven 69 feet. On the 150-foot level the east drift-face is now 319 feet from the shaft and the west drift 166 feet. The river-tunnel has also been extended a few feet. Stopping was carried on between the 100-foot level and the surface and above the 150-foot level. An upraise for air between the levels on the east side has been put through and another has been started farther east.

On the west side of the shaft in the 150-foot level the quartz, varying from a few inches to 3 feet in width, was followed for 80 feet, where a steeply dipping fault displaced the ore (*see map*) probably to the north. The drift beyond this point had not encountered a continuance of the quartz, although a sheared zone containing narrow quartz stringers was found. On the east side, about 49 feet from the drift-face, the quartz has again disappeared, and judging by the warping of the shear-zone this ore will continue its strike in a south-easterly direction. A crosscut put in south from the face uncovered several stringers of quartz in the shear-zone gangue. A particularly noticeable feature and one that may be a guide in searching for faulted or lost ore is the appearance of the shear-zone structure, which has a remarkable likeness to what is known as the Wallace formation, or a highly altered cherty and sometimes schistose sediment, with only occasional and slight resemblances to the quartz diorite to which, before shearing, it owed its origin. Since the ore in the shear is probably irregular and formed chiefly in structurally favourable locations, barren zones may be anticipated. Judging by the ore-body near the surface, which measures about 250 feet in length, and the same body on the 150-foot



level, with an indicated length of over 300 feet, the chances of finding prolonged lengths at depth appear to be good. There are also known shear-zones in the tunnel and shaft near the West-kettle river, a distance of over 1,000 feet to the east, and also in the *Butcher Boy* shaft, 600 feet to the west, in which pay-ore has been found and mined. There is no doubt about the continuity of the shear, because, though narrow in places, it has been definitely traced for 3,000 feet on the surface. Although it has been proved that there is not minable ore throughout this entire distance, it is more than likely that several enriched zones will occur. The gold content of the ore in the *Carmi* shaft, which varies, sorted, from 0.60 to 1 oz. per ton, will make excellent mill-feed, and it seems advisable to concentrate on development by shaft-sinking and blocking out tonnage rather than attempting to ship, except from development. The main mineral ore constituent is pyrite, with smaller amounts of sphalerite and galena, and should readily adapt itself to treatment by cyanide, which would eliminate costs of smelting and transportation. The mine is situated within a few hundred feet of the Westkettle river, in which there is plenty of water, and timber is available close at hand.

This claim, owned by J. Kelly *et al.*, of 2337 West Third Street, Spokane, **King Solomon.** Wash., is situated about 2 miles north of Beaverville, on the north side of the Beaver Creek road. In a narrow neck of the Wallace rocks two quartz veins about 200 feet apart and varying in width from a few inches to 4 feet have been traced over several hundred feet by open-cutting, tunnelling, stripping, and shallow shafts. The top vein-workings have been made on the vein where it step-faults down the hill, and in certain sections spotty gold values contained in pyrite and possibly arsenopyrite have been found. Two samples—one, picked and heavily mineralized from the second cut above the short tunnel, carried a trace in gold; the other, chipped across 3½ feet of quartz, also carried a trace in gold. A picked sample from the dump of the lower shaft carried a trace in gold. The owners have been able to obtain good gold values from time to time from some of these workings, and it appears possible that there is either free gold or arsenopyrite present in small widely distributed segregations. The veins are strong well-formed fissures, and as such are worth some surface prospecting in the hope that certain ore-shoots occur that have not up to the present been discovered.

This company, with headquarters at 1314 Dallas Road, Victoria, owns a group of claims on Horseshoe mountain, on the west side of the main Kettle river, about 24 miles by road north of Westbridge. The property was reported upon in 1929 and 1931, and, although not examined again this year, a reliable report states that under the supervision of W. W. Smitheringale, geologist, development was continued between October, 1931, and March, 1932, with interesting results. In the tunnel, described in the 1931 Annual Report, another crosscut was driven 76 feet in a southerly direction, 18 feet from the junction of the shaft intersection. This crosscut encountered ore at 6 feet and continued in it for about 26 feet. According to H. E. Hunnings, owner, samples taken diagonally along this zone assayed from \$5.20 to \$49 in gold per ton. The extension of this tunnel passed through the quartz diorite in which the ore occurs, and after turning again to the south more ore was discovered.

In former Annual Reports dealing with the mineralization in this area, certain possibilities regarding ore-deposition were stressed, and the fact that up to the present no continuous worthwhile bodies of ore had been found in the Wallace formation, but that in the quartz diorite, the underlying rock, the shear-zones were generally more persistent and often contained minable widths and values in gold. In the particular area covered by the *Mogul* group very little quartz diorite outcrops except at the old workings, and most of the exploration has been done in the Wallace group of rocks with unsatisfactory results. L. Reinecke, in Memoir 79, G.S.C., 1915, suggests that the Wallace group of overlying rocks seem to have stopped the ascending solutions on the contact of the quartz diorite, and only indefinite shear-zones occur in the Wallace, which has more than once been proved to be true. He also suggests that the ore found in the *Mogul* occurs in "stocks" in shear-zones and that the former are seldom well defined. The *Mogul* is the only known deposit in this area where such high-temperature minerals as pyrrhotite occur in the quartz-diorite shear-zones, and future development at depth appears to be warranted on account of the attractive assays in gold. The relation of the mineral-zones in the Wallace rocks to those in the quartz diorite has also interesting possibilities, and if the former are caused by the latter, as suggested in a few instances, then deeper exploration on the Wallace mineralized stocks where the diorite is in evidence appears to be justified.

GREENWOOD SECTION.

These claims, situated in the old Phoenix camp, were mined for copper thirty years ago. During the last few years R. Forshaw, Greenwood, acquired the **Stemwinder and Brooklyn** claims and has done some work in the "glory-hole" of the *Stemwinder*, and an 80-foot level in the *Brooklyn* mine that uncovered some attractive gold-bearing mineralization. The rocks in which the copper ores were mined in the past were limestone, whereas the recently found gold values are associated with pyrite and calcite in the brecciated volcanics lying on the hanging-wall side of the tilted sedimentary beds. A general sample of ore across a 6-foot section in the "glory-hole" assayed: Gold, 1.70 oz.; silver, 1.3 oz. per ton; and a 5-foot chip-sample taken across the face of the 80-foot level in the *Brooklyn* assayed: Gold, 0.80 oz.; silver, 0.2 oz. per ton; copper, *nil*. It has been a well-known fact for some years that a gold-pyrite zone existed between the *Stemwinder* and *Brooklyn* mines, and also that some high gold values were associated with the copper ores, but no work has been done as yet to prove the continuity or width of it. A shipment of 32.2 tons of ore was made to Trail from the *Stemwinder* claim, assaying: Gold, 0.426 oz.; silver, 1 oz. per ton.

D.A. This group, situated close to Greenwood and reported upon in the Annual Reports for 1925-26-27, which includes a map of the workings, was optioned by R. Crowe-Swords, of 1591 Twenty-ninth Avenue West, Vancouver, and a few men put to work on the old *D.A.* workings. The ore found contains galena, sphalerite, and pyrite containing values in gold and silver. Picked samples will assay as high as 1 oz. in gold per ton, but the average is much lower.

Winner. This claim, situated about 2 miles south-east of Phoenix, is under option by E. A. Wanke and associates, of Greenwood, from the Garland Estate owners. A considerable amount of work, old and new, has been done on a quartz fissure-vein in the granodiorite, consisting of stripping for several hundred feet, two vertical shafts, 35 feet and 32 feet deep (new), about 300 feet apart, as well as two intermediate pits about 6 feet deep. The strike of the vein is east and west (mag.) and the average dip 88° to the north. The lead in the shallow pits measures about 4 feet wide and quartz occurs on both foot and hanging wall, with chlorite-schistose gangue-matter in between. In the new shaft the quartz on the foot-wall varies in width from 6 to 32 inches, and on the hanging-wall from 2 inches to 2 feet. The ore-minerals are pyrite, chalcopyrite, with occasional specks of free gold. Two faults, one nearly vertical and another flat, have displaced the ore in the new shaft and probably thrown it to the west. At the east end of the claim near the *Ophir* claim-line the vein bends in a north-easterly direction. Samples of quartz from the dump of the old shaft assayed a trace in gold and silver. A 2-foot sample from one of the intervening pits carried a trace in gold and silver. Samples taken by the lessee from the new shaft assayed: (1.) Gold, 2 oz.; silver, 0.6 oz. per ton. (2.) Gold, 0.4 oz.; silver, 0.4 oz. per ton. It seems likely that either the new shaft has been sunk in the top of an ore-shoot or that there has been a certain amount of enrichment against the faults.

Some development is reported to have been done upon the *Dynamo* claim, close to the town of Greenwood. This claim has been reported upon in past years and some attractive values in gold found in some of the workings.

JEWEL LAKE CAMP.

C.O.D. This claim, owned by L. A. Altman, Travellers Hotel, Sacramento, Cal., was reported on in the 1931 Annual Report. In that report the results of samples taken many years ago from the shaft by a supposedly reputable engineer were quoted. These assays varied from \$8.70 to \$58.25 in gold per ton. This year the shaft was unwatered and some channel samples were taken across the vein near the bottom of the shaft, with the following results:—

No. 1, 20 inches quartz, 20 feet from bottom of shaft in north side: Gold, 0.50 oz.; silver, 5 oz. per ton.

No. 2, 12 inches quartz, bottom of shaft, north: Gold, 0.32 oz.; silver, 3 oz. per ton.

No. 3, 6 inches quartz, bottom of shaft, south: Gold, 0.16 oz.; silver, 1 oz. per ton.

No. 4, 4 inches quartz, 30 feet down from collar of shaft, south side: Gold, 0.06 oz.; silver, 1 oz. per ton.

No. 5, 2 feet quartz, 30 feet down, hanging-wall, south side: Gold, 0.80 oz.; silver, 7.4 oz. per ton.

This group, situated on the east side of Jewel lake and embracing the *Jewel Dentonia Mines* mine, has lain idle until recently, when Calgary capital interests who originally formed the company have, according to reliable reports, made arrangements to commence development. The possibilities of finding ore in this camp have been mentioned in former Annual Reports.

These claims, mentioned in the 1931 Annual Report, are situated on the east **North Star and Gold Drop.** vein system, which conforms and in places cuts the schistose rocks about parallel to the *Jewel* vein. During the early part of the year R. L. Clothier and associates, of Penticton, cleaned out the lower tunnel on the *North Star* and shipped three car-loads of ore to the smelter at Trail. The vein in the stopes, which measures about 40 feet in length, varies from a few inches to 4 feet in width and averages about 2½ feet. The gangue is quartz mineralized with pyrite, galena, and occasional specks of chalcopyrite, together with free gold.

On the *Gold Drop* the upper tunnel was extended in a northerly direction about 35 feet on the vein and the east drift was driven 215 feet ahead. A fault was encountered in the north drift-face and the vein was not looked for beyond. It seems likely that instead of two veins there is only one, and one or the other represents part of a "split," and that they will ultimately reunite somewhere to the north-east.

Except for spectacular pockets of telluride and free gold, this ore is generally too low grade to ship, and if, as appears possible, an average grade of \$15 per ton in gold can be obtained over minable widths, a small cyanide plant could be built that would pay dividends, providing there was no overhead. R. L. Clothier and associates are reported to have dropped their option on both these claims, so that they are open for investigation.

CAMP MCKINNEY.

Much has been written about this camp in the Annual Reports from 1897 to 1931, but very little has been done, by those financially able, to verify its future possibilities. The old *Cariboo-Amelia* mine was profitably worked about 1900, and, according to the reports of those interested at the time, the mine was not worked out, but the vein was lost on a fault, and also the type of mill then in use—that is, stamps, amalgamations, and tables—was not entirely adaptable to the ore found in the lower levels, which had become more base, and the gold, instead of being to some extent free as found nearer the surface, was intimately combined with the sulphides. The values found in the mill tailings concur with this contention, and money has been made by the lessees of the dump with such crude methods as an arrastra. Possibly fine grinding will solve the problem. According to reports and maps, ore has been mined in places to a depth of 540 feet over a length of 1,740 feet on an easterly and westerly strike and a dip of 80° to 95° to the south. The main shaft was sunk to a depth of 360 feet and levels below that to the east were attacked from a winze sunk about 250 feet distant in an easterly direction along this level. The rake of the ore-zone is apparently down to the east, which may account for the fact that only low-grade quartz has been found on the surface strike. There are apparently two major faults centring towards the west end which have thrown the vein to the south.

Practically all the deep development-work on other claims in this area was done to the west, where strong vein-outcrops occur such as on the *Eureka* and *Sailor*, etc., and where only small segregations of high-grade gold ore were found. It seems likely, if the ore occurrence found in the *Cariboo-Amelia* mine can be used as a criterion, that there is a distinct rake to the ore-shoots and only comparatively small outcrops, so that deep drilling to the east of these claims may bring satisfactory results.

On the *Waterloo* claim, about 2,000 feet to the east of the *Cariboo*, a similar type of ore was found, but owing to the fact that the adjoining claims into which the ore struck did not belong to the *Waterloo* Company, very little was done beyond sinking shafts, drifting, and building a small mill, which only operated for a short time. In addition to this main east-and-west vein system which apparently cuts at about right angles to the strike of the schists, there are other veins, striking in a north-easterly and south-westerly direction, which up to the present have not produced any minable ore-bodies.

On the *Gold Hill* group of eight claims, which lies a considerable distance to the north-west of the *Cariboo*, some interesting developments have been reported by John Carmichael, 703

Dominion Building, Vancouver, who did some work during 1932. A shaft was sunk between 50 and 60 feet on a quartz vein about 7 feet wide which improved in values at depth. A cross-cut driven to the south from the bottom of the shaft encountered three more quartz veins of a slightly different structure than the main vein, but all carrying gold values. A crosscut was also driven north from the shaft at a point 30 feet below the collar and another vein was struck. According to the owners, some of the quartz was a bluish colour and resembled the high-grade gangue found in the *Cariboo* mine. Five men were working until snowfall and work will probably continue in the spring of 1933. With a narrow but good motor-road traversing the camp, the railway within 8 miles, and the high-power electric line built from east to west through the area, facilities for mining appear to be ideal and warrant the attention of capital.

PLACER-MINING.

Boundary Creek.

A considerable amount of prospecting and preliminary development took place on Boundary creek, which flows into the Kettle river below Midway. The recoveries of gold were small, but they indicated that there are still virgin areas, both in the stream-bed and along the benches, that may be made to pay providing gold values are constant. A theory handed down from past years that there was no gold above the mouth of Norwegian creek has been exploded and some fairly coarse gold recovered along the edge of the flats north of that point.

At the mouth of Norwegian creek, which flows into Boundary creek about 2 miles up from Midway, W. G. Thwaites and associates, of Spokane, Wash., dug several test-pits and shafts along the creek and on the flat on the east side down-stream, and recovered sufficiently high values per yard on false bed-rock to warrant not only deeper exploration of the benches, but in the basin, about $1\frac{1}{2}$ miles long and $\frac{1}{4}$ mile wide, to the north. A narrow neck has been formed by the intrusion of a porphyry dyke, and Boundary creek passes through a short canyon at the lower end of the basin, where at low water the lip of bed-rock can be seen dipping up-stream and possibly forming a catch-basin. Before attempting to drain the basin-gravels the owners will be well advised to drill so that bed-rock depths and values may be ascertained and a rock drain commenced at the proper elevation.

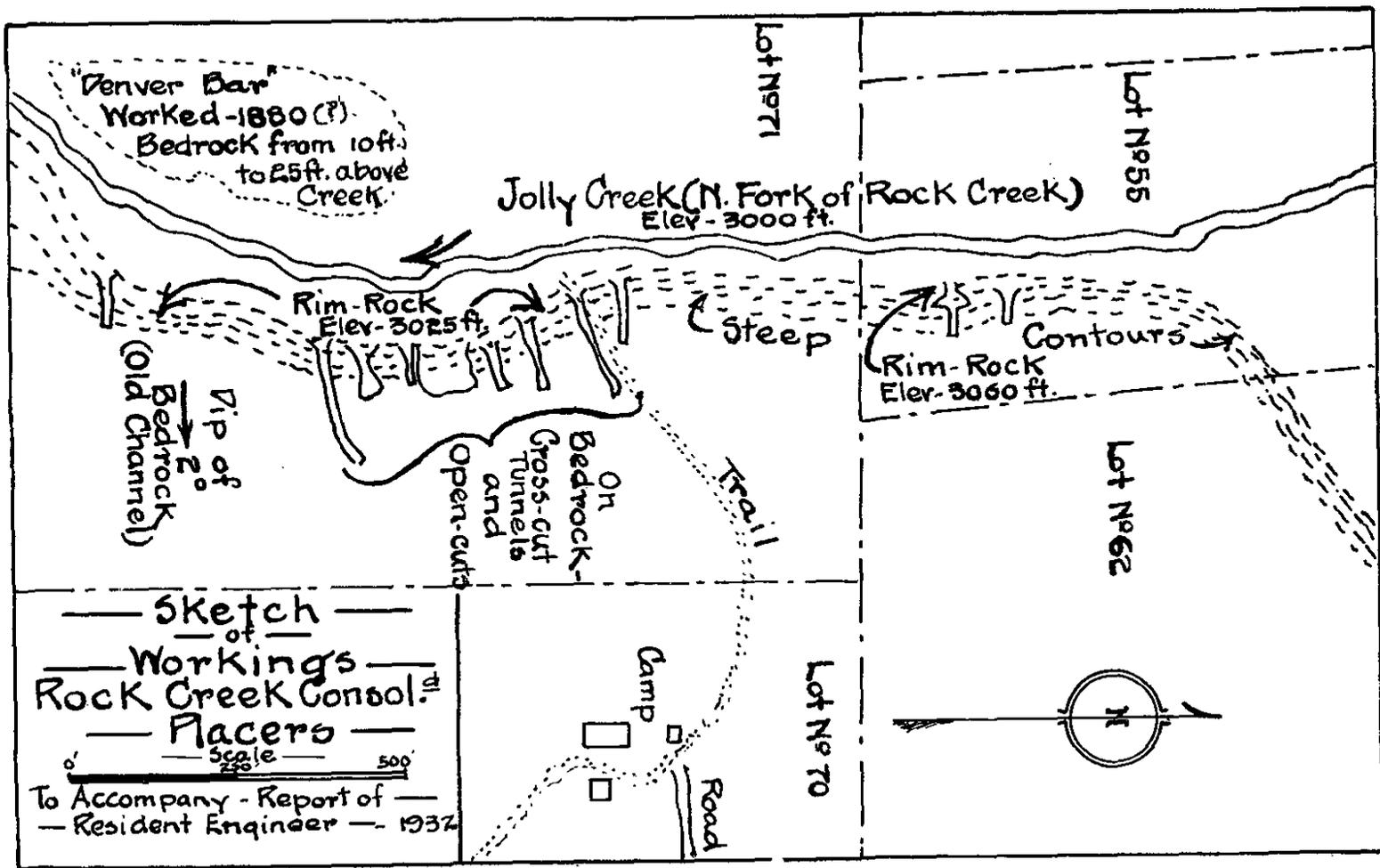
On the adjoining leases down-stream B. E. Lang and associates, of Vancouver, sunk two shafts on a bench about 10 feet above the creek on the west side. The lower shaft reached bed-rock at about 22.5 feet and the upper one, 208 feet north, at 25 feet, and, as nearly as the operators could estimate, the values in gold averaged \$1 per yard. On the east side farther north another shaft was sunk 10 feet deep, but bed-rock was not reached before winter set in. Immediately east of this, a drift was driven 15 feet into the bank and the ground panned gold all the way.

Due to heavy morainal material along the creek, it is difficult to theorize at present as to the possible direction of an old channel, but there is sufficient evidence to warrant the assumption, and old rim-rock can be located at several points above the present creek. The lower reaches of Boundary creek are skirted by Tertiary lava-flows, and it is not beyond the realm of possibility that under the edge of the lavas the old stream-gravels may be found. The recovery of gold on bed-rock in narrow channels under water-soaked gravels presents considerable difficulties, unless the water can be withdrawn by driving a bed-rock drain and the surface waters dammed and flumed off.

Rock Creek.

On the new maps the names of the tributaries of Rock creek have been changed, and instead of the North and South forks they are called Jolly and McKinney creeks respectively, and the subsidiary Baker creek is now part of the main Rock creek. A good deal of confusion has already arisen, due to the fact that the new topographical maps do not print both names, and in former reports the older names were referred to.

The development of the old channel possibilities on Jolly creek has not made the progress hoped for on account of the difficulty of obtaining money. The map incorporated in this report portrays the extent of work done, and all that can be said at present is that remarkably attractive values have been found on an apparently wide and almost flat floor of an old channel about 25 feet above the present creek. No direction is indicated, although the "Denver bar" has about the same elevation and was possibly at one time part of the same winding watercourse.



The almost complete absence of interlayering of the gravels and heavy glacial overburden completes the puzzle, and until more work is done any theory may be correct. If, as is suggested, the old channel wound its way backwards and forwards and, later, Jolly creek cut across, then good pay-gravel may be looked for in the present creek just below the intersections.

During the winter months the work done by lessees of the Rock Creek Consolidated Placers, Limited, consisted of driving drifts at different points into the old channel. No indication of rising ground or the eastern limit of the channel was found. A 2-oz. gold nugget was recovered amongst many others of lower weight, but large enough to rattle in a pan. In the Annual Report for 1931 Rock Creek placer-mining possibilities have been reviewed in detail.

Five leases staked near the headwaters of Jolly creek and embracing both the creek-bottom and adjoining benches are owned by the following: Frank Wilson (lease No. 51), G. A. Williams (lease No. 81), H. Claves (lease No. 82), R. Kerr and Bartton (lease No. 87), W. W. Wills (lease No. 89), and, according to the owners, have had two years' assessment-work done upon them.

Part of the present creek-gravels have been worked in former years and, according to history, good values per cubic yard recovered. Judging by the work done and the discovery of rim and bed-rock, there appears to be an old or diverted channel of the creek that has been filled with glacial debris and the watercourse changed to that of the present creek.

Development done consists of an attempt to ground-sluice the debris out of the old channel, which failed on account of the depth of gravel and silt; numerous cuts and short drifts which have proved the existence of bed-rock at the mouth of the old channel, and two crosscut tunnels, one through the rim-rock, which, according to reports, struck pay-gravel and quicksand, the latter filling the workings and driving the miners out; and work done this year consisting of an open drain and tunnel driven 60 feet westerly from the present creek, and an incline winze 20 feet from the face of the drift, all on bed-rock. In these workings the owners claim to have found gravel which sluiced about \$1.25 per cubic yard, the largest nugget being valued at 90 cents. Most of the gold found is comparatively coarse and is similar to that mined in other parts of the creek lower down.

Whether or not there is sufficient "pay" gravel in this old channel to warrant the working of it can only be proved by exploration. The rim and bed-rock at the lower end offers an excellent opportunity at a comparatively low cost to drive a bed-rock tunnel up-grade under this heavily covered area. The finding of gold, both along the rim and also on the lower lip of bed-rock, appears to make this endeavour worth while.

The equipment on the property consists of a car, truck, picks, shovels, and sluice-boxes. Water rights are held by the lessees and storage can be obtained in a beaver-pond about 300 feet higher in elevation and about 1,000 feet distant from the workings. This elevation and distance have not been checked. The property was reported upon in the Annual Report for 1930.

On lease No. 58 (*see* map, 1931 Annual Report), now owned by Ed. Meldrud, Greenwood, an attempt was made to drive a tunnel at a point about half a mile down-stream from the old road crossing on the north side of the creek on what appears to be the outlet of an old channel. The topography on the north bank of the stream portrays a decided depression about a quarter of a mile in length with a high rim-rock exposure between it and the present creek. The old-time miners tried to explore this channel, and after building a wooden water-wheel and pump were driven out of the workings by quicksand, in which some of the tunnel timber sets completely disappeared. The new work done by Meldrud, consisting of a tunnel 69 feet long, in which he struck one of the rims of the old channel, was started at a higher elevation than formerly, and he may possibly be able to drain the quicksand under which the values are reported to exist. This lease appears to have some of the most attractive possibilities on the creek, and before continuing the tunnel bed-rock depths should be ascertained either by shaft-sinking or drilling.

On McKinney creek, on lease No. 73, owned by Joe Pringle, Bridesville, and on lease No. 55, owned by Rehder, Rock Creek, some interesting finds were made.

KETTLE RIVER SECTION.

In the vicinity of the Vernon-Edgewood road crossing of the main Kettle river a good deal of placer-prospecting was done without tangible results. In regard to this locality, prospectors are reminded that the creeks flowing into the Kettle river from Monashee mountain warrant prospecting on account of the numerous veins and stringers, some of which carry free gold,

cutting the argillites and schistose rocks, and which may have been responsible for placer deposits.

OSOYOOS MINING DIVISION.

Dividend and Lakeview. These claims, situated near the International boundary-line at Osoyoos, were reported upon in the 1927, 1930, and 1931 Annual Reports. In this issue a compass map of the underground workings is attached, showing location of samples and assays. In the east No. 2 drift it will be noticed that better values and ore-widths than those found in No. 3 were obtained, and in the bottom of the No. 2 face the ore appeared to be widening, so that development in this direction should be favourable. With so much development-work done in No. 1 tunnel, comparatively short drifts will explore the possible downward extension of the ore-bodies both to the south and east. Ten stamps and two Wilfley tables are installed, but not housed, below No. 1 tunnel, and compressor, engine, and all necessary equipment for mining are reported to be on the property. Water for milling was procured from the irrigation-ditch. The mine closed down in the autumn after an attempt by the M. F. Watt interests to mine, mill, and ship concentrates to the Tacoma smelter by truck. Fifteen tons of ore and concentrates were shipped to Tacoma, averaging about 2½ oz. in gold per ton. Treatment costs amounted to \$7.66 and freight by truck \$7.50 a ton.

FAIRVIEW CAMP.

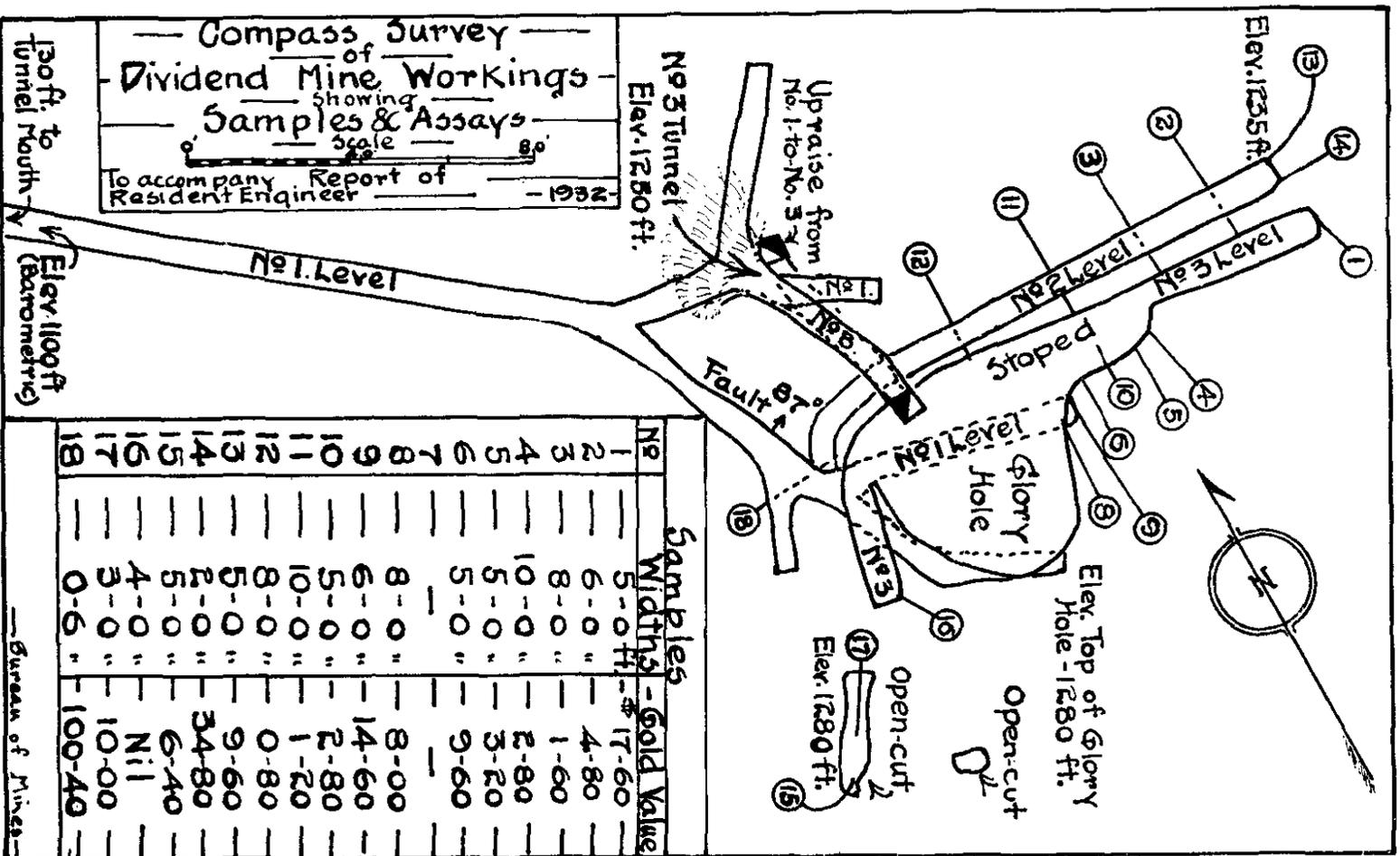
A good deal of attention has been attracted to the gold-quartz veins in this old camp on account of the demand for gold properties. In Bulletin No. 1, 1932, a general statement of the possibilities of finding gold in this area was made under the heading of "Osoyoos Lake." It is not necessary to repeat what was said, but those searching for likely prospecting areas may be interested in the stretch of country lying between the Similkameen and Okanagan rivers and Osoyoos lake and Twin lakes. The veins, varying from a few inches to 20 feet, are in evidence along the Similkameen River slope, also close to the Keremeos-Fairview road, and, except in certain buried areas, practically the whole way from a few miles south of Twin lakes to Fairview.

Morning Star-Black Diamond. This group is situated about 2 miles from Oliver on the Fairview road and mentioned in recent Annual Reports as well as those about thirty years ago. This year R. L. Clothier, Penticton, acquired by arrangement a three-quarter interest in this group from D. McEachern and the Shatford Estate, leaving the other interest belonging to Steve Mangott, Oliver, to be settled later. In addition to these claims, a large adjoining group of claims to the south has been acquired, making a considerable block of likely prospecting-ground.

The shaft on the *Morning Star* is being unwatered, and directly this is accomplished the vein on the 80-foot level, which according to reports contains minable gold values over 6- and 10-foot widths, will be sampled.

In the neighbourhood of the *Morning Star* shaft there are two nearly parallel veins varying from 2 to 20 feet in width and traceable for several thousand feet. Surface work done indicates that these veins at a point a few hundred feet to the south of the *Morning Star* workings diverge and swing to the east and west on each side of the old Fairview townsite. Underground work has not proved whether these veins join at depth. The east vein near the surface dips away from the main *Morning Star* ledge. In Bulletin No. 1, 1932, part of H. S. Bostock's geology is mentioned, and in it the veins are described as conforming to the bedding and occurring in the schistose rocks, which are thought to be Permo-Carboniferous in age or older. A report on these claims can be found in the Annual Report for 1923.

Oliver (Victoria). This claim, owned by A. Carmichael, Oliver, and adjoining the *Susie* group to the north, was worked under option by P. E. Petersen, Vancouver. Development prior to this option consisted of numerous open-cuts, a tunnel 15 feet long with a winze sunk 14 feet deep at the face, and an open-cut 20 by 15 feet at the mouth. In the neighbourhood of this tunnel a well-mineralized 6-inch quartz vein striking N. 32° E. (mag.) cuts the main fissure-vein, which measures 5½ feet wide in the tunnel, dips nearly perpendicular, and strikes N. 10° E. (mag.). A strong fault striking N. 20° W. (mag.) displaced both veins to the east and has evidently caused some enrichment at the point of intersection. The lessee mined and sorted 18 tons which was shipped to Trail. The ore-minerals



are pyrite, with lesser amounts of galena and occasional specks and films of free gold. The country-rock is granite.

Susie.

This group, situated about 3 miles north of the Fairview camp and owned by the Federal Mining Company, was reported upon in the 1922 and 1923 Annual Reports, and since then very little work has been done. It is understood on good authority that the quartz vein in the 200-foot shaft assayed sufficiently well in gold and silver to warrant further development, but that in the drifts the ore was spotty, with nearly barren zones in between. The outcrop of the vein on the *Federal* claim lies nearly 1,000 feet to the south-west of the *Susie* outcrop, and it is difficult to believe that the vein has been faulted for this distance. The results of the last work done by the company are not to hand, and possibly some definite information regarding these veins and their relation, if any, was obtained before the mine was closed down.

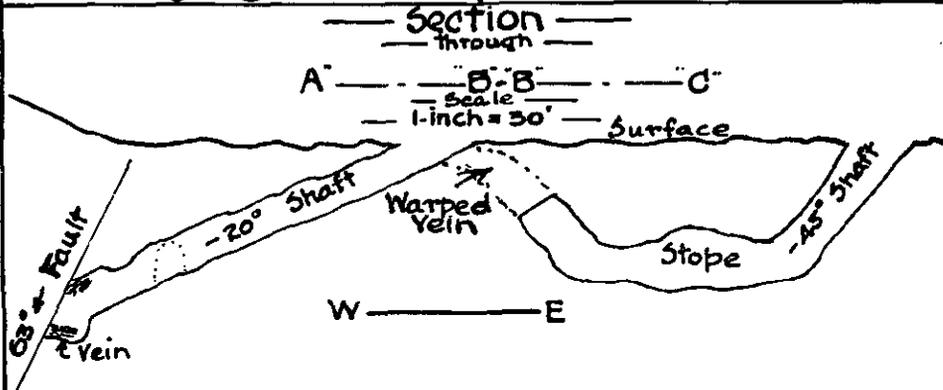
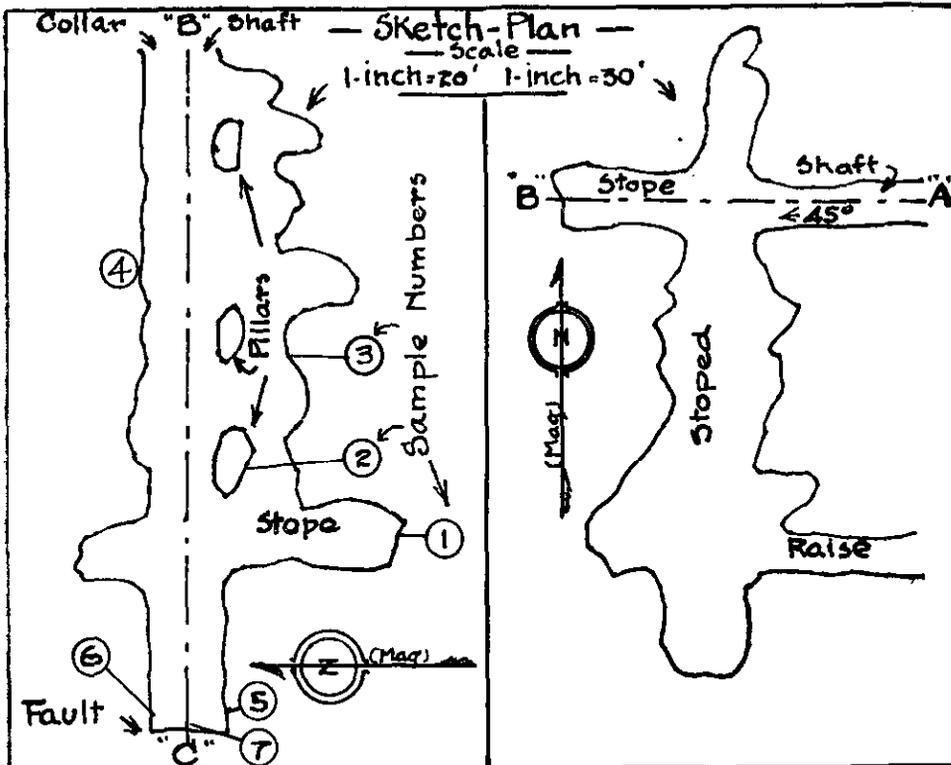
Parvenu Mines, Ltd.

This company, which is a private syndicate with head offices in the Rogers Building, Vancouver, bonded the *Summit*, *Bluebird*, *Eureka*, and other claims, situated on Oro Pino mountain, about 26 miles south-west of Penticton by motor-road, from the B.E. Mining Company, of Leavenworth, Wash., and some of the original owners, among whom are Al. Piper *et al.*, of Oliver. Since the Parvenu Company took over these holdings practically all the work has been done on the *Summit* claim, including two shafts; a sketch of which is attached to this report. The total net returns from ore shipped and gold bullion recovered from the mill, which was taken from these two comparatively small workings, amounted to about \$23,000. The shipping-ore averaged about \$70 per ton and the mill-heads \$27, according to M. J. St. Clair, the manager. The continuation of the shaft on the dip of the fault is reported to be still in quartz, which points to the possibility of a downward throw of the hanging-wall, but until more work is done the fault-movements cannot satisfactorily be worked out, because the whole section, about 250 feet wide and 600 feet long, lying to the east of the workings, has been subjected to severe stress, and there appears to be a likelihood of several separate and distinct periods of upheaval. The vein to the east of the shafts is broken and distorted and probably will be found in saw-tooth sections or waves, in which a certain amount of enrichment has taken place. Where the vein is exposed in an oxidized condition free gold can generally be panned. Insufficient work has been done to determine the north and south extent or value, but in the old workings the vein tapers in both directions. The ground drops steeply to the north, with a gradual slope to the south towards the camp, where two or three vein-outcrops have been excavated and values in gold up to 0.70 oz. per ton have been found, excluding some spectacular pockets of free gold and galena. The relation of these vein-outcrops to those found in the workings, and also to the west, is in doubt, and there may be a series of veins conforming to the strike of the schistose rocks, or one, which has been badly faulted.

The plant at the mine consists of a 15-horse-power Fairbanks-Morse semi-Diesel engine and a 6 by 8 Ingersoll-Rand compressor, both housed; a 12- by 12-foot blacksmith's shop fully equipped, as well as a Tugger hoist, skip, and wooden ore-bins of 80 tons capacity. The bins and track-dump are said to contain mill-feed of 200 tons or more, but due to snow this could not be properly checked.

The mill consists of a small jaw-crusher, 20-horse-power Fairbanks-Morse semi-Diesel engine, a 3 by 3 ball-mill, amalgamation-plates, and a Wilfley table. For water-supply, which is obtained from springs in wells in a small creek at the camp, a square concrete tank 12 by 12 by 4 feet has been built, with 1½-inch pipe-lines to the mill. A larger supply of water could be accumulated by building a dam in the creek as well as larger tanks. There is 6 feet of swamp loam on hard-pan in the creek-bed which offers excellent facilities for a light dam foundation. It seems likely that the ore found on the *Summit* claim could be suitably treated by cyanidation. This process, if adaptable, will save transportation and smelter costs. The full mill capacity has not been tested, but a rough estimate sets the figure at 10 tons per 24 hours. The ore-minerals are pyrite, with lesser amounts of galena and free gold.

The mine barometric elevation is 4,700 feet and the camp, about 1,500 feet distant, 4,300 feet. Two log cabins, one to accommodate eight men and the other a combined cook-house and dining-room, have been built, as well as a 16- by 18-foot frame office building. A narrow road leads to the property from the White Lake-Keremeos road.



Samples			
No	Widths	O ₇₅ Gold	O ₇₅ Silver
1	3-0'	0-16	0-04
2	5-0'	3-70	0-30
3	3-0'	0-08	0-02
4	5-0'	3-00	0-60
5	3-0'	0-90	0-10
6	2-6"	4-20	0-80
7	1-2"	0-22	0-10

— Plan and Section —
 of —
 Underground Workings
 on —
 Summit Claim —
 Parvenue Mines —
 Scales —
 1-inch = 20ft. & 1-inch = 30ft. —
 To accompany Report of —
 P.B. Freeland —
 Resident Engineer —

Grandoro Mining and Milling Co. (Oro Fino and Independence). This private company was formed in December, 1931, with offices at 17 Williams Building, 413 Granville Street, Vancouver, and is almost entirely owned by W. V. Somerville and Emily A. Somerville, 1406 Barclay Street, Vancouver. Two of the claims owned by the company are the *Oro Fino* and *Independence*, and in former Annual Reports will be found under this heading. These properties are old Crown-granted claims, situated close to the *Parvenu* mines on the south-east, and developed about the same time as the Fairview camp thirty-two years ago. Development consists of numerous open-cuts, tunnels, shafts, and winzes on a strong quartz vein varying from 2 to 5 feet in width in the schistose rocks, and probably the same system as that found on the *Parvenu*, although not definitely traced. This year the tunnel on the *Independence* was lengthened and a winze sunk, in which the owner claims to have found good values. Near the mouth of this tunnel a streak of oxidized quartz contained much free gold, and it appears that in favourable structural zones formed either by faulting or warping of the vein a considerable amount of enrichment has taken place. The ore-minerals are similar to those found in the *Parvenu*. About 76 tons of ore averaging \$20 to the ton are reported to have been treated in the *Parvenu* mill and the concentrates shipped to the Trail smelter. A camp has been built on the east slope of Oro Fino mountain close to a spring.

Something Good. This claim, situated in the Olalla camp, has been developed by W. C. McDougall, the owner. A sample across 20 inches of quartz 10 feet above the tunnel assayed: Gold, 6.48 oz. per ton; silver, 1.2 oz. per ton. The quartz vein from which this sample was taken occurs in a brecciated volcanic which has been considerably sheared and faulted. On the strength of this assay further work is justified.

Cracker Jack (Lot 3278) and Whirlwind-Peggy Group. These claims, situated to the west of Hedley, have been optioned by J. S. Graham, of Bellingham, Wash. Development-work consisted of an open-cut and, according to the owners, a short tunnel driven on the *Cracker Jack*. The surface cut exposed a segregation of pyrite and arsenopyrite in a lime-silicate gangue. A sample of the sorted ore from the dump of this cut assayed: Gold, 0.60 oz. per ton; silver, 0.04 oz. per ton. A sample across the face of the cut 3½ feet carried no gold or silver. The ore occurred against a block-fault close to the diorite-contact, and tongues of this igneous rock have intruded the limestone in the vicinity of the ore-zone. A further search for mineralization up the hill appears to be justified. Other work was done on the *Whirlwind-Peggy* group, lying to the west of the *Cracker Jack*, on which high-grade arsenical-iron ore carrying good values in gold has been found in the past. All this ore occurs in the altered limestone-beds adjacent to the diorite intrusive. The close proximity of these claims to railway, transportation, and electric power is an added attraction.

Pollock. This group, consisting of six claims, situated on Henry creek across the Similkameen river west of Hedley, is owned by H. Guernsey and Victor Locke, of Penticton. A great deal of exploratory work was done throughout the season, and several veins striking in a northerly and southerly direction, and apparently converging to the south, were uncovered by open-cuts and trenching. On the *Maple Leaf* claim a sample across 20 feet in an open-cut assayed: Gold, 0.77 oz. per ton; silver, 0.43 oz. per ton. A shovel sample from the dump of the old lower tunnel assayed: Gold, 0.54 oz. per ton. A grab sample from a 2.5-foot vein above this tunnel assayed: Gold, 0.40 oz. per ton. The gold occurs generally in the arsenical iron. The country-rocks are argillites, brecciated volcanics, and greenstones in contact with the diorite batholith.

Patsy. This group, situated on Sterling creek, was worked by two men and a considerable amount of development done on quartz veins containing gold-bearing arsenopyrite. It is understood that the group is still controlled by the Sterling Gold Mines Company, of Vancouver. The owners of the *Patsy* and other claims are Dan McKinnon and associates, of Hedley. The group has been reported upon in former Annual Reports.

Hedley Gold Mining Co. This company's property, which was closed down last year, has been bonded by J. W. Mercer, of the Mercer Exploration Company. Development consisted of driving a crosscut about 240 feet from the upper levels under the *Sunnyside* ground. During the earlier operations of the Hedley Gold Mining Company a considerable amount of ore was mined from this property, and it is the opinion of the

consulting engineer, Paul Billingsley, that more ore may be found there. The tunnel has been driven in the lime silicate, which is recognized as the ore gangue. Work was stopped temporarily by sudden zero weather which blocked the flume at the power plant with crushed ice. The shaft on the *Sunnyside*, which is 750 feet deep on an incline of 15° at the top and flattening to 10° near the bottom, is being unwatered for inspection. About twenty-one men are employed at the mine and at the Hedley plant under the management of Wallace Knowles, of Penticton, former mine superintendent.

This group, situated a few miles north of the *Nickel Plate* mine, is owned by **Clift.** R. McDonald, of Hedley, who has prospected the area by means of open-cuts, tunnels, and shafts over a period of many years. The geology of the group was described by C. Camsell in 1910. In the metamorphosed limestone-beds, containing much garnetite and epidote developed in the upper tunnel, the presence of radioactive elements as well as metals of the Platinum group were reported as found. Samples of this rock were sent to the Ore Dressing and Metallurgical Department, Mineragraphic Laboratory, at Ottawa, with the following results:—

“A determination for radioactivity carried out by W. R. McClelland, of the Hydrometallurgical Laboratory, Mines Branch, Ottawa (Report A-10, September 7th, 1932), proved the absence of any radioactive elements. A spectrographic analysis was carried out on the powdered sample. This showed a very faint trace of silver, no gold, and no Platinum-group metals. A trace of copper was detected, along with minor amounts of manganese. The latter is probably present in the garnet, which forms an essential constituent of the rock.”

More development was done in the early part of the year on the *Golden Zone* **Golden Zone.** group mentioned in the 1930 Annual Report, with the result that the extension of the ore was found below the old mill. This group has interesting possibilities, and if the volcanic and sedimentary rocks, in which the ore occurs, continue under the heavy surface covering, a larger tonnage of gold ore may be developed.

PLACER-MINING.

There are no records of placer-mining production in this Division during the year. Those interested in this type of mining are directed to the possibilities of the country lying between the Okanagan and Similkameen rivers, where free gold in quartz veins has been found. Any creeks, dry or still running, are likely places to search.

SIMILKAMEEN MINING DIVISION.

SUMMIT CAMP.

This company's claims on Treasure mountain, reported upon in the 1930 and **Silver King** 1931 Annual Reports as well as formerly, were operated during most of the **Mining Co.** year by W. B. Dornberg until his death in August, and afterwards by McKoy and Oisen. The Pulmac grinding-machine purchased last year was not adaptable to the type of ore and the plates soon wore out, with the result that coarse material found its way into the flotation-cells, where it could not be handled. In place of the Pulmac a small ball-mill was installed which gave very satisfactory results, and it seems likely that when the price of base metals recovers an operation of this kind may be made to pay. Practically all the ore milled was mined above No. 2 level. About 130 tons of lead concentrates was shipped to the Trail smelter.

Similar types of ore occur in other parts of this camp, and the adjoining claims, the *Eureka* group, owned by A. Jensen and associates, of Tulameen, contain the continuation of the vein system.

This claim, owned by T. Rabbit, of Tulameen, and situated about 6 miles **Liquidator.** up the Tulameen river from Tulameen, has been developed by a tunnel 63 feet long and numerous open-cuts on a quartz vein varying from 1 to 3½ feet in width, and traceable for about 1,000 feet up and down the hill from the workings. The ore-minerals, pyrite and chalcopyrite, occur in stringers and segregations in the quartz. A sample across 2½ feet of quartz in the face of the lower tunnel assayed: Gold, *nil*; silver, *nil*. A sample of sacked ore assayed: Gold, 0.30 oz. per ton; silver, 1 oz. per ton; copper,

0.6 per cent. The vein strikes N. 19° W. and dips nearly vertical in a highly altered schistose rock.

GENERAL.

Development-work on the following copper claims was continued: The *Crown* group, owned by Dan Vuich, Tulameen; the *Spokane-Motherlode* group, owned by J. Osborne and associates, Tulameen. When the price of metals increases these claims will be worthy of attention. They were reported upon in the 1928, 1929, and 1930 Annual Reports. The *Copper Mountain* mine, owned by the Granby Consolidated Mining and Smelting Company, remained closed during the year. About 35 miles south of Princeton and half a mile across the Similkameen river from the Trans-Provincial road, the *Indian Maid* group has been prospected by M. J. Meeker, of Princeton. A strong quartz vein associated with a syenite-porphry dyke invades the schistose rocks in the neighbourhood of Yorkie creek and along this contact work has been done. At present only low values in gold and silver have been found, but further development appears to be warranted.

PLACER-MINING.

Continued interest was shown in the search for gold and platinum on the Tulameen and Similkameen rivers, as well as on Granite creek and adjacent streams, and many small lots of these metals were recovered from different locations. In former Annual Reports the point has been stressed that the possibilities for finding placer gold and platinum, seeing that the old-time miners worked most of the shallow ground, lie in the old high channels and water-soaked benches adjacent to the rivers, and that testing bed-rock depths and values can only be done by those with sufficient financial backing to purchase equipment for pumping, etc.

On the Champion Creek Placers, Limited, ground, situated near the mouth of Champion creek on the Tulameen river, a small hydraulic plant was installed which removed about 5,000 cubic yards of gravel. A certain amount of "pay" was found, but the company considered it insufficient to warrant continued operations of this kind. Several open-cuts and shallow shafts were dug with negative results, and most of the equipment was stored during the winter in Tulameen. Work was in charge of C. S. W. Barwell.

There is a theory that the old channel of Champion creek cut across the present promontory dividing the creek from the Tulameen river, and although the surface indications show only a slight depression, such a channel might exist and be filled with detritus. Rather than continue blind operations, it seems advisable to definitely locate its course, if there, by drilling.

On the Sootheran leases, located a short distance below Eagle creek, some work was done by twelve men, and about 50 oz. of platinum and a few ounces of gold was recovered, amongst which was a ½-oz. nugget of platinum. Spectacular pockets of gold and platinum have been discovered on these leases from time to time, but due to insufficient capital to flume water from Eagle creek to work the ground, only a comparatively small recovery has been made. An 8-oz. nugget of gold is reported as found near the mouth of Lawless creek.

The operations of the Slate Creek Consolidated Placers continued under the management of Norman McCormick, of Tulameen, and according to reports the tunnel was continued in the "bluff," and when the rock in place was encountered an upraise was excavated and the tunnel continued from the next bed-rock shelf, and so on until the gravel excavated had to be handled three times before reaching the dump. A shaft was then sunk in a small gulch about 50 feet below the crest of the hill, and at a depth of 20 feet what is considered the east channel rim was struck. The management considers that at no great distance from the shaft the old channel will be found.

About 4 miles down-stream from Coalmont, on the Tulameen river, the Eldow Placers, lease No. 520, was operated under the management of E. C. Brooke, Coalmont. The lease is located on a bench on the north side of the river and extends east to a point of high ground around which the present river runs. The possibilities of an old channel across this point, now filled with glacial debris, has often been suggested, and gold and platinum values found in stratified gravels in the vicinity uphold this theory to some extent. Development-work until this year was done on comparatively small old-channel remnants from 10 to 50 feet above the present river, as well as prospect pits and trenches at higher elevations. In all these workings segregations of both gold and platinum were found in favourable locations, but the general run of gravel did not pay. A small gasoline engine and pump were used for hydraulicking.

This year new equipment was installed consisting of a full Deisel engine and 4- by 5-inch centrifugal pump, and from 80 to 125 cubic yards of gravel were sluiced per day from a pit opened up across higher ground. Ribs of rock forming the rim of rock shelves had to be blasted away for drainage purposes and the gravel removed by hydraulicking. Conditions were found to be similar and values occurred in favourable spots only. Later in the year work was confined to prospecting by means of shafts, and the theory evolved by the management is that the old channel, if any, lies at least 350 feet away from the Tulameen river and is partly buried by glacial moraines and slide-rock. It seems evident that the series of rock steps uncovered between the river and the last workings are remnants of the old bed-rock, most of which have been eroded away by stream-action, and that in this particular bay very little workable ground remains. Future exploration should be confined to the ground to the east, where an old channel could be protected by the high rim of bed-rock outcropping along the north side of the present river. Accommodation for seven men has been provided.

About 3 miles above Princeton, on the Tulameen river, the Bed Rock Gold Mining Company installed a suction-pump outfit, removed from the mouth of Granite creek, where it operated last year, and worked the shallow bed-rock on which numerous large boulders had acted as a riffle. The outfit consisted of an engine, pump, suction-hose, the end of which was guided by a diver, and sluice-boxes, carried on a small scow. Some coarse gold was recovered beneath the boulders on the north side and better recoveries were expected on the south side of the river.

On Petersen flats, about 1 mile below the above operation, numerous shafts were sunk by C. Snowden and associates, of Princeton. According to reports, bed-rock was encountered about 6 feet below the surface and some values in gold were found. Other work consisted of sinking a shaft across the river close to the Tulameen river and putting the excavated gravel through sluice-boxes. The results of this work were entirely satisfactory to the owners and good values in gold and platinum were reported.

On the Lambert lease, mentioned in former Annual Reports and situated on the South fork of Granite creek, a considerable amount of work was done by J. Hartman, A. Broomfield, and associates, of Princeton. The creek was dammed and flumed off and a siphon used to drain the residual water from the workings. A ground-sluice was used and the gravel shovelled into the boxes. The stream-bed measures about 40 feet wide and the depth of gravel 6 feet; about 3 feet of which was very old virgin ground containing heavy gold where the bed-rock was rough. On each side of the creek the banks rise precipitously, forming a canyon through which the water rushes in the spring and during seasonal freshets, so that at times the workings are entirely filled with gravel. This is evidently the reason why this virgin ground was not worked in the old days. Along the south-west bank the outcrop of rim-rock about 6 feet above the creek-bed suggests the presence of a higher buried channel. Preliminary exploration uncovered gold values along this rim amounting to \$4 per cubic yard. The deep covering of gravel over this may create a hindrance to such an extent that profitable mining will be impossible, but the values are sufficiently attractive to warrant exploration. Due to freshets after rain the present creek-gravel could be more profitably worked in the dry season by widening the working-face, doubling the sluice-box capacity, and putting more men to work, so that the ground can be quickly removed and the expense of cleaning out the workings from time to time eliminated.

In January, 1911, some churn-drilling was done by F. Satchell Clarke, superintendent of the British Columbia Drilling and Dredging Company, Vancouver, on ground held under a dredging lease extending from the junction of the Tulameen and Similkameen rivers downstream for 5 miles. From a report made at that time by Mr. Clarke the following information has been abstracted: The ground has an average width of 600 feet and average depth to bed-rock of 12 feet. Some heavy boulders occur on the surface, but it is stated that the gravels generally could be handled by a modern dredge. Bed-rock is said to vary from clay to a fine silty sandstone. Values shown by the drilling were said to vary from 11 cents to \$3.19 per cubic yard, with an average of \$1.05. This includes a little platinum, besides which values are said to occur in the black-sand concentrates from panning. The area prospected was 60 acres and an estimate shows a value in this ground of \$1,167,720. Transportation, fuel, and other conditions are such that low-cost operation of a dredge would be possible. The report is interesting, but some checking of the stated values would be advisable before assuming they are proven.

There are extensive areas down the Similkameen river beyond where this drilling was done that, in the face of the values found, appear to warrant prospecting by those financially able

to undertake it, and where a small dredge might operate profitably providing pay-gravel exists. The iridium contents associated with platinum should be taken into consideration.

COAL.

A new coal-mine was brought into production this year by the lessees of Lots 970 and 385 near Bromley creek, which is situated about 5 miles south-west of Princeton. The owners of this land are the Princeton Properties, Limited, with P. W. Gregory, of Princeton, as agent, which is a company formed to take over the assets of the old Princeton Coal and Land Company, the former operators. Development-work blocked out a 4-foot seam of commercial coal which analysed as follows: Moisture, 12.8 per cent.; volatile matter, 31.68 per cent.; fixed carbon, 47.44 per cent.; ash, 8.08 per cent.; and a ready market was found locally and in the Okanagan valley. Much credit is due to the lessees, who are local men, for the good work done in developing this property without any material capital assistance from outside, and this is only one of many other prospects in the Princeton area that could become producers in the hands of the right men.

The Princeton Properties, Limited, owns extensive coal-measures and is willing at all times to consider leasing its holdings on a royalty basis. In 1906 a hole was drilled near Bromley creek by Alex. Sharp, the results of which are appended (First Thought mine):—

Description.	Depth.	Width of Seam.	Serial No. of Seams.	Description.	Depth.	Width of Seam.	Serial No. of Seams.
	Ft. In.	Ft. In.			Ft. In.	Ft. In.	
Gravel.....			---	Coal.....		1 0	9
Sandstone.....	7 6		---	Shale.....			---
Coal.....		9 0	1	Coal.....		3 0	10
Shale.....			---	Shale.....			---
Coal.....		1 6	2	Coal.....		3 0	11
Shale.....			---	Shale.....			---
Coal.....		1 0	3	Coal.....		3 10	12
Shale.....	36 0		---	Clay.....			---
Coal.....		2 8	4	Coal.....		3 0	13
Shale and sandstone.....	460 0		---	Shale.....			---
White clay with dark spots.....	536 0		---	Coal.....	603 0	3 6	14
Coal.....		7 6	5	Shale.....			---
Clay or shale.....			---	Coal.....		1 0	15
Coal.....		2 0	6	Shale and sandstone.....	712 0		---
Clay or shale.....			---	Coal.....		3 0	16
Coal.....		2 0	7	Shale and sandstone.....			---
Shale.....			---	Coal.....		3 0	17
Coal.....		1 6	8	Shale and sandstone.....	863 0		---
Shale.....			---			51 6	

Due to labour strikes, the Tulameen and Pleasant Valley coal-mines were closed for a short period during the winter, and the market for their product considerably injured due to competition from Alberta.

GENERAL.

The trunk trail from Copper mountain to the mouth of the Pasayton river and from thence to the Ashnola river was finished this year by the Provincial Government, and its completion fills a much-needed want, because it opens an attractive prospecting area and gives access to a country about which very little is known. On the north similar geological conditions are found to those existing in the neighbourhood of Hedley, and in the south the contact of the sedimentary and igneous rocks offers opportunities for finding mineral-deposits. The geology of the southern belt can be found in R. Daly's report on the "Forty-ninth Parallel," Memoir 38, G.S.C., 1912, and although he does not mention any particular minerals, since the report deals only with rock-types, nevertheless a study of his findings will probably be valuable, especially in the neighbourhood of the gabbros and porphyry-dyke contacts. In the much-metamorphosed schists lying near the headwaters of the South fork of the Ashnola river, deposits of tungsten and native arsenic have been found.

VERNON MINING DIVISION.

Pre-Cambrian Gold Mines. This company, with headquarters in Smith Tower, Seattle, under the direction of P. H. Holdsworth, owns a group consisting of the *White Elephant, Summit, Pre-Cambrian No. 1, No. 2, and No. 3*, situated about 4 miles by road from Ewings Landing on the west side of Okanagan lake, which has been reported upon in several former Annual Reports, as well as by C. E. Cairnes in the Summary Report, 1931, Part A.

The main outcrop of quartz on the *White Elephant* measures about 40 feet on the surface and widens to 70 feet at the bottom of the 185-foot inclined shaft, and is enclosed on the east, south, and west by granite. The latter was not observed close to the workings on the north, and until more work is done it is difficult to theorize as to whether the vein is a fissure that has been displaced by faulting or warping and does not outcrop on the dip and strike where anticipated, or whether it is just a "plug" or segregation of quartz completely surrounded by granite. Four narrow flat-lying dykes varying from a few inches to 4 feet and cutting both the granite and quartz were crossed whilst sinking the inclined shaft at distances of 40 feet, 85 feet, 90 feet, and 110 feet respectively from the collar. The complete fracturing of the quartz-body suggests some other agency than that of the dykes, and it would not be surprising to find that one of the so-called walls was in reality a fault or slip and the entire quartz-mass had been removed from its original setting. An isolated plug of quartz having the characteristics of a fissure-vein such as this is rare, so that lateral exploration may have interesting possibilities. No mineralization was noticed along the contact of the quartz and the dykes. Drifts have been run at intervals to the east and west walls, and in certain parts of the workings segregations and stringers of telluride (bismuth) and free gold accompanied by scheelite were observed. The main mass of quartz in the shaft appeared to be free from mineralization, except in the fractures, where iron oxide, probably due to leaching from above, was in evidence. In conjunction with the pyrrhotite away from the wall the high-grade ore occurs in lenses and stringers, and, according to the management, which had followed development closely and sampled carefully, there appears to be a minable width of ore containing this high grade, following a certain elliptical zone between the east and west walls.

The shaft follows the south end of the ore-body, the lower side being in granite and the remainder in quartz. The values rake at a flatter angle and if constant will be found near the apparent hanging-wall. Development was carried on only for a short period during the year in the shaft, due to lack of money. Water for mining and domestic purposes is brought in buried 6-inch pipes, reduced to 2 inches and 1½ inches at camp, from a dammed slough about 700 feet higher and 4,200 feet distant.

Falcon. This claim, situated about 2 miles north-west of Vernon and owned by Frank Mitchell, 2064 Penzance Road, Victoria, has been reported upon formerly.

This year, at the request of the owner, another examination was made with the following results: The shaft, supposed to be about 50 feet deep and examined several years ago, was filled with water. The vein at the shaft-collar varies from 14 inches to 2 feet in width, strikes north and south (mag.), and dips about 43° to the west. The extension of the vein can be traced for about 300 feet to the north, where it splits and disappears in the tuffaceous rocks. To the south no indications of the vein appear on the surface or in an extensive open-cut, about 100 feet distant from the shaft. About 200 feet farther north-west another quartz vein, 1 foot wide, containing oxidized pyrite, has been uncovered in a 4-foot shaft. Although no work has been done beyond this point, a certain amount of float indicates that the strike of the vein is to the south-east, and if it continues in this direction will intersect the shaft-vein. The ore-minerals are pyrite and arsenopyrite, with lesser amounts of galena and free gold. The quartz gangue in the shaft assayed 0.24 oz. in gold per ton. A picked sample of pyrite assayed 1 oz. per ton in gold. The segregations of pyrite which contain the better values are widely separated. A wagon-road leads from the Vernon-Kamloops highway to the property.

Skookum. Some work was done on this group, situated on Newport creek, near the north-west end of Okanagan lake, by V. Locke, of Penticton, who took an option from H. J. Blurton, the owner. Development consisted of stripping and open-cuts along the creek on quartz veins that varied in size from stringers to 14 feet in width. A picked sample of galena, which occurs in isolated segregations, assayed up to 2 and 3 oz. per ton in gold.

St. Paul. This group, situated near Monashee and owned by Dr. Van Etter and associates, of New Westminster, has been reported upon in the Annual Reports as well as by C. E. Cairnes, G.S.C. This year a winze was sunk about 40 feet deep, 45 feet from the face of the west drift (now 90 feet from crosscut). Some high-grade ore, containing pyrite, arsenopyrite, and stibnite in a gangue of quartz and calcite, was found in the drift at this point and the management decided to determine its source. About 10 feet down the winze the high values petered out and only pyritic mineralization remained, containing low values in gold and silver. The vein occurs in the argillites close to the granite-contact and varies from 2 to 5 feet in width. As a rule, the better-grade ore is associated with the stibnite.

COAL.

Shorts Creek.—About 6½ miles up Shorts creek, on the north side of the valley, several coal leases have been staked by James and William Forester and associates, of Vernon. The development of these measures covers a comparatively long term of years, and numerous open-cuts, trenches, one shaft stated to be about 80 feet deep, and a tunnel about 40 feet long.

Briefly, the coal-measures occur in an elevated Tertiary basin resting upon pre-Tertiary formations. The coal-outcrops, varying from 4 to 10 feet in width, interbedded near the surface with a considerable amount of shale, etc., can be traced for several thousand feet. About 40 feet down the 80-foot shaft, which was half-full of water at the time of examination, the size and appearance of the coal-seams had improved, although there were no minable widths uncovered. No samples were taken on this account. At the present time a tunnel is being driven to intersect the seam at its lowest exposure. This development is to be recommended; also, when the seam is struck, drifting along under the surface exposures to the east, where a greater depth on the dip may be attained. It is possible, of course, that, due to the closeness of the granite and intrusive basaltic dykes, no clean commercial seams may be found, but the width of the surface exposures warrant some prospecting at depth.

In developing this coal area the owners have in mind the proximity of the Okanagan market, which imports a large quantity of coal from outside points, chiefly Alberta. Should clean coal be found, the 7-mile road haul to Okanagan lake, where it can be loaded on scows and transported by water at a cheap rate, would provide reasonable transportation. The coal is of bituminous quality.

GENERAL.

Drilling for oil about 6 miles from Kelowna, near Mission creek, continued spasmodically during the year and a total depth of 2,560 feet was reached late in the summer. An analysis of the drill-sludge taken between 2,530 and 2,538 feet is as follows: SiO_2 , 66.88 per cent.; Al_2O_3 , 16.42 per cent.; FeO_3 , 5.22 per cent.; CaO , 4.24 per cent.; MgO , 1.33 per cent.; ignition loss, 2.34 per cent.; alkalis, 3.57 per cent. The Okanagan Oil and Gas Company, of Kelowna, which is doing the work, is optimistic regarding the chances of finding oil in spite of the extremely adverse report by C. E. Cairnes, in the Summary Report, 1931, Part A, G.S.C.

Some interesting occurrences of mica have been discovered lately in the neighbourhood of Okanagan lake, and similar deposits have been known for several years near Armstrong (*see* Annual Report 1927) and also near Cherryville. The gneissic rocks in this area are favourable for this mineral, and if unfractured plates from 2 by 2 inches and up can be found in quantity, there will probably be a market for the product providing it is close to transportation. The deposit near Armstrong is quite extensive and warrants exploration to prove its worth both in quantity and quality.

PLACER-MINING.

Several placer-miners were working along Monashee creek, about 45 miles east of Vernon, and some small recoveries were reported. The hydraulic possibilities along the old creek-channels are being tested by O. L. Willoughby and Dr. Fales. About \$20,000 in gold has been taken out of this area by hydraulic mining in the past, and, judging by the appearance of the alluvial gravels uncovered by testing-pits, other parts of the old channel have flowed under the high benches. It remains to be proved whether or not pay-gravel will be found that can be attacked by this method of mining.

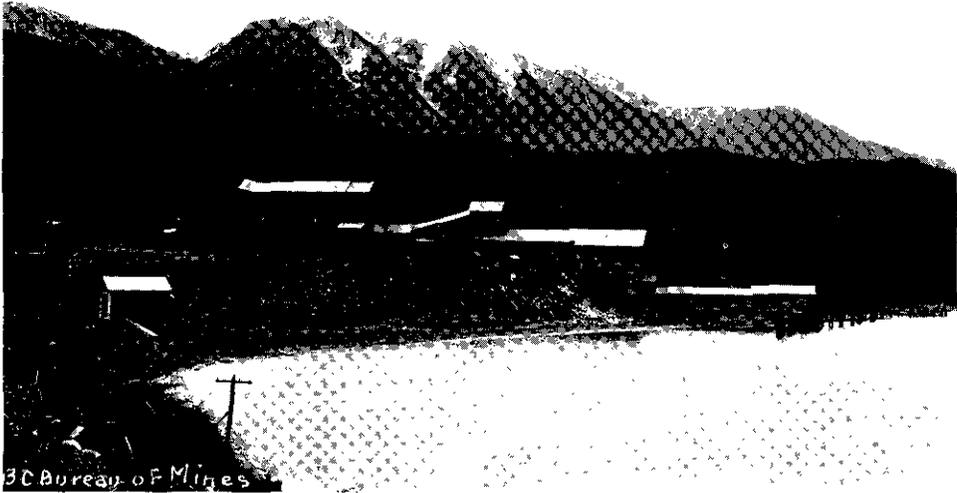
On Moffat creek, which flows into Hart lake a few miles north of Vernon, near the Vernon-Kamloops road, a considerable amount of placer-prospecting has been done by J. O'Neill and associates. The creek cuts a deep ravine through the metamorphosed slates, wherein several



Vidette Gold Mines, Ltd., Deadman River, Kamloops M.D.



Guest Placers, Tulameen River.



Mammoth Mine—Mill on Siocan Lake.



Weaver Creek—A Boomer Gate for Placer-mining.

quartz veins are known to occur which contain widely distributed segregations of free gold associated with iron sulphides. Open-cutting along the creek-banks in partly assorted glacial material produced some attractive small nuggets and fine well-worn gold. A small dam was built higher up the creek and the water flumed for a small hydraulic operation. The results so far have not been satisfactory, but better values are anticipated along the rim of what appears to be a buried high channel now filled with glacial debris.

KAMLOOPS MINING DIVISION.

Evelyn-Venus. This group, owned by C. Johnson and associates, of Magna Bay, and situated on Crowfoot mountain, about 10 miles north of Shuswap lake, was reported upon in the 1930 and 1931 Annual Reports. The fact was mentioned that a sketchy programme of electrical prospecting had been carried out over an area 200 by 1,000 feet, followed by a rough chart showing the equipotential curves. Within the area of these curves, this year a shaft was sunk 29 feet deep and several open-cuts excavated. Unfortunately the shaft was full of water and could not be examined, but the dump contained highly metamorphosed, silicified limestone, with a considerable quantity of quartz, carbonaceous matter, and fine-grained pyrite along the fracture-planes. The ground is saturated with water from the spring until the winter, and consequently shaft-sinking without proper equipment is costly. A tunnel can be driven to explore this section from the east, where the mountain slopes steeply.

The equipotential curves pegged out may have several different meanings, and the proper person to determine these indications is the original operator. It appears to be quite easy to obtain reactions with different electrical devices, but the right interpretations can be reached only by those especially qualified to do so.

One of the owners wanted to diamond-drill the section within the curves to find out exactly what was indicated. The suggestion is a good one providing sufficient money can be obtained for the purpose. The mineralization occurs in fractures and narrow elongated lenticular bodies both in the limestone-beds and argillaceous remnants. It is possible that at depth more permanent structures and larger ore-deposits may be found, but at present the surface displays no indication of them, and instead of a general mineralization throughout the limestone the ore is confined either to quartz-fissures striking across the bedding-planes or conforming to them. Lying to the north-east, outcrops of diorite were observed.

Allies. This group, owned by O. Batchelor & Sons, of Kamloops, and situated on the Middle fork of Tranquille creek, was reported on by H. G. Nichols in Bulletin No. 1, 1932. Since this report was made a considerable amount of open-cut work has been done close to the creek, but no definite strike or dip found to the quartz vein mentioned. Very high-grade samples of decomposed oxidized quartz have been taken and free gold panned. Up to the present none of the high-grade ore has been found below the blue clay strata. It appears likely that the whole area in which the flat-lying veins and boulders occur is the result of displacement by glacial action from some point higher in elevation. Remnants of nearly barren quartz are found in the displaced porphyry, but the matrix of these appears to have a different composition from the high-grade quartz lying above, so that there is probably no genetic connection between the two veins.

Goldfield. This group of claims, situated in the Harpur camp, about 12 miles north-east of Kamloops, on the north side of the South Thompson river, is owned by O. Batchelor & Sons, Kamloops. A strong quartz vein from 2 to 4 feet wide, traceable for several hundred feet, occurs in a much disturbed brecciated volcanic. Development consists of a 50-foot incline shaft sunk on top of the hill, as well as numerous open-cuts and short tunnels on the vein. A few tons of ore, containing oxidized pyrite—assaying: Gold, 0.84 oz.; silver, 4.60 oz. per ton—was mined in an open-cut driven between two faults at a point about 125 feet south-west of the shaft. A short tunnel driven ahead from the cut did not encounter any ore. On top of this tunnel there is a 6-inch streak of the same class of ore that was mined in the cut. It is apparent that the vein has again been faulted to a higher elevation and that the tunnel was driven too low. The ore found in the shaft consists of pyrite associated with fragmentary quartz and stringers of calcite, and is low grade. At the bottom of the hill a well-defined low-grade quartz vein outcrops. Due to the fact that the quartz vein where found in place is practically barren of values, it appears likely that minable ore will only be found where structural conditions are favourable, such as in the open-cut mentioned above. Picked ore from

this cut is said to assay \$25 per ton in gold. A narrow road runs within three-quarters of a mile of the claims and, with a small amount of grading, cars can be driven up to the workings.

GENERAL.

A considerable amount of prospecting by means of shafts, open-cuts, and stripping was done on the following claims: On the *Pilot* group, owned by T. E. Ogilvie and associates, of Armstrong, and situated near the headwaters of Boulder creek, which flows into the Salmon river, a shaft sunk 18 feet on a mineralized zone in the volcanic tuffs beside the creek uncovered segregations of pyrite, pyrrhotite, and chalcopyrite in a quartz gangue, containing low values in gold and silver. A sample in an open-cut close to the shaft assayed 0.40 oz. in gold per ton, and the shaft was sunk with the idea of exploring the possibilities at depth. The locality is heavily covered with soil and gravel and prospecting is difficult. The granite batholith is exposed about 1 mile to the north.

About 15 miles from the headwaters of the Salmon river and 6 miles north-east of Fish lake, the *Sunnyside* group of six claims was staked and developed by L. Empey, T. J. Lancaster, *et al.*, of Armstrong. Numerous inclined shafts and open-cuts were driven in the Tertiary lavas over distances of about 2 miles in length. According to the owners, some mercury was found in these formations and the work was done on the strength of this discovery. Later, it came to light that the samples had been salted. The vesicles of the lava contained small amounts of apatite, but the potash contents were too low for economical extraction.

On the *Annex* group, owned by James Linton, of Sicamous, and situated about 8 miles up Shuswap lake on the east side, development-work has been carried on for many years on a quartzite-band varying from 3 to 20 feet wide and traceable for 3 miles. A tunnel has been driven and several shafts sunk on other narrow quartz veins containing pyrite in the chlorite and mica schists without finding any tonnage of commercial value. In one vertical shaft about 75 feet deep the owner was driven out by gas, and in another open-cut close to the lake-shore an explosion supposed to be gas was reported. The reason for this is difficult to explain, but possibly in such old metamorphosed sedimentary rocks pockets containing some form of gas may have been formed.

On the *King Tut* group, mentioned in former Annual Reports and situated on the Adams plateau and not examined this year, according to the owners, F. A. McLeod and associates, of Salmon Arm, exploration uncovered the vein for 1,000 feet on the surface and approximately 2,000 feet lower in elevation. This discovery will permit deep development by tunnelling. The ore contains silver, lead, and zinc.

On the *Speedwell* group, owned by John R. Thornton and associates, of Salmon Arm, and also situated in the same locality as the *King Tut* claims, exploration has indicated a mineral-zone about 50 feet wide containing bands of silver-bearing galena and sphalerite in the sediments. An average of samples taken by the owner assays about 16 oz. in silver per ton; lead, 17 per cent.; and zinc, 10 per cent. Occasionally the galena carries as high as 40 oz. in silver per ton.

COAL.

A small syndicate of men, including J. MacQuarrie, has been mining a 30-inch seam of coal at Chu Chua, on the North Thompson river, and shipping the product to Kamloops, where it found favour for domestic purposes. The coal is described as semi-bituminous and from several analyses the average B.T.U. content is 12,642. Only the main level in the mine is being worked on a modified long-wall system at a distance of about 500 feet from the surface.

PLACER-MINING.

In the neighbourhood of Hefley lake, which lies about 20 miles in a north-easterly direction from Kamloops and can be reached by the North Thompson River road, a considerable amount of work was done on streams flowing into the lake from the south, and also on Dow creek, which flows in a westerly direction a short distance to the south. Practically all the creeks cut through large moraines of glacial gravel and the present bed consists of impervious blue clay. Wherever the miners have broken through the clay stratum, which is about 12 feet thick, some fairly coarse gold, both lemon and rusty in appearance, was found in another stratum of gravel. It is possible that the glacial material has covered an old channel, but until bed-rock has been found and values determined it is uncertain whether the gold is a partial concentration from the glaciers or a regular stream deposit. No uniformity of gravel was seen in the upper workings.

Prospecting on the branches of Tranquille creek, which drain a large area to the north-west of Kamloops and where free gold is found in quartz, should be attractive. In this section glaciation played an important part in the removal and breaking-up of rocks containing gold where it can be concentrated by swiftly flowing waters. In some localities this action has been detrimental and in others, where a reconcentration is possible, they are attractive.

NON-METALLICS.

About 2½ miles west of Cherry Creek, two 8-acre lakes, one containing sodium sulphate and the other sodium carbonate crystals, are owned by C. W. Austin and A. C. Knowles, of Cherry Creek. The sodium carbonate only was worked by means of injecting steam into the deposit and liquefying the crystals, which were pumped into a settling-tank and recrystallized, ready for shipment to the Royal Crown Soap factory in Vancouver. The depth of the crystal-bed varies in thickness from 8 feet on the outer edges of the lake to about 36 feet in the centre.

ASHCROFT MINING DIVISION.

PLACER-MINING.

Many "snipers" with provisional free miners' certificates worked the edges and bars along the Thompson and Fraser rivers and adjacent creeks, with the result that many of them were able to make a living. Small nuggets of gold up to \$2 in value were found, generally under the larger boulders on the bars.

Hollywood Placers Syndicate.

This syndicate controls three leases, Nos. 309, 310, and 311, in the names of Geo. G. Fleming and Edgar A. Jamieson, of Vancouver, and Fred C. Elliott, of Victoria. The property is situated about 62 miles west of Kamloops, on the north-west side of the Thompson river, about 1 mile from the motor-highway, to which it has access by means of a narrow by-road. The Canadian National Railway passes through the leases. Test-pits have been dug by hand and also trenches by a gasoline-shovel, 300 feet long and 18 feet deep, across the old river-channel, which now forms a high bar about 800 feet wide and 1 mile long adjoining the north-west bank on the inside of a long bend of the river. No large boulders were observed and, according to the owners, values of \$10 per cubic yard in gold and platinum were recovered. Consistent values were also reported as found from the surface down to a blue clay, false bed-rock varying from 35 cents to \$2.70 per cubic yard; the platinum value representing 25 per cent. of that of the gold.

A 10-horse-power Diesel engine, belt-connected to a 500-gallon-per-minute centrifugal pump, supplies water for sluicing. A 40-horse-power semi-Diesel engine, connected to a 3,000-gallon-per-minute centrifugal pump, is also on the ground pending larger operations. The syndicate contemplates installing a complete gold-saving unit capable of handling at least 500 cubic yards in eight hours. The property was examined but not sampled owing to the fact that the owners were absent. If the values found in the testing operations persist in length and depth, the property is an attractive one from an operating standpoint, and the gravels can be removed and sluiced economically by ordinary drag-line scraper and the finer gold saved by undercurrent sluices, followed by amalgam-barrels or mercury plates.

A few miles below Lytton a small dredge owned by Mrs. E. King and W. F. Austin, of Lytton, worked for a short time in a bend on the east side of the Fraser river. The dredge was built on pontoons having a deck-space of approximately 50 by 18 feet, upon which was constructed a head-frame, grizzly, and sluice-boxes, with a hoist and gasoline-engine attached to a separate cable for raising the drag-line bucket. On the shore a donkey-engine and boiler controlled the dredge by means of a cable passing through a swivel-block anchored to a rock point up-stream. The operation consisted of lowering the dredge down-stream, dropping the drag-line bucket, and then pulling the dredge up-stream. When the bucket was filled it was hoisted and dumped on to the grizzly and the contents sluiced. Due to a sudden rising of the river the dredge was wrecked. According to the owners, 45 oz. in gold was recovered by this means from a two-day run over ground that had already been worked.

Kanaka Leases.—Kanaka bar lies about 7½ miles south of Lytton, on the east side of the Fraser river. In the early days of mining this bar produced a considerable quantity of placer gold, and since then smaller amounts have been recovered from time to time by Indians. The pay-streak was found on a false bed-rock, according to reports, about 18 feet below the surface and could be worked only in low water. There still remains some virgin ground on the bar,

but the difficulty in locating it is extreme, since no survey was made of the numerous shafts sunk or the under-gravel work done.

On the opposite bank of the river a considerable amount of exploration has been carried on over a period of years, both along the river's edge and on the low benches, without very much success. History relates that rich ground was found on the Indian reserve on the west bank close to Kanaka Station on the Canadian Pacific Railway, and that the prospector who found it was driven away by hostile Indians. The find, according to the story, was quartz in place about 18 inches wide and extremely rich in gold. Since that time the Canadian Pacific Railway excavated the gravel banks and all signs of former work have been obliterated.

In connection with Kanaka bar the possibility of an old channel cutting across behind a rock promontory has been suggested, and numerous shafts not deeper than 50 feet have been sunk near the summit of the low divide in an endeavour to locate bed-rock or river-gravel. So far these attempts have been unsuccessful. The surface of this low-lying ground near the summit is filled in part by huge boulders, probably glacial, and granite slide-rocks from the precipice which skirts the western edge. To the north the ground flattens gradually and is covered with light gravels and loam, and the drainage-waters flow north into the Fraser river. On the south the bank is steeper and rises abruptly to a summit elevation (barometric) of about 300 feet above the railway, and the ground-water flows south. The stratified gravels, dipping west, exposed in the railway-cuts suggest glacial action, and there is no sign of alluvial wash. It seems likely that if there is an old river-channel it has been completely filled, and perhaps scoured on the south end by glacial material and slide-rock, and the proof of this can be ascertained only by sinking a shaft and drifting east and west on the summit or churn-drilling the area. On the north end the topography suggests more attractive possibilities, and under the flat-lying ground concentrations of gold may have occurred. Practically no exploration-work has been done at this end. The rocks outcropping on the east are igneous and the bed-rock along the west bank of the Fraser river consists of highly altered volcanics and schist.

This private company was formed by Vancouver investors in October and now has a controlling interest in a group of claims formerly owned by D. B. Sterrett and associates, of Kamloops, and situated about 43 miles north of Savona, at the head of Deadman creek. H. G. Nichols, former Resident Engineer, reported upon the property in Bulletin No. 1, 1932, and since then a copy of some information from Gordon F. Dickson, consulting engineer for the company, has come to hand, as follows: "At the Vidette Mines an active development programme has been carried out since October 1st last, when a controlling interest in the property was acquired on option by a small group of Vancouver investors.

"From a short crosscut tunnel at a depth of 60 feet below the surface a continuous length of vein had been proved, averaging 10 inches in width, with an average value for the full length of \$17 per ton. A winze sunk from the tunnel to a depth of 45 feet showed ore of equal width and value to that proved in the tunnel-drifts.

"Under present management the winze has been continued on the vein to a depth of 120 feet. Drifts have been extended from the winze at a depth of 115 feet for a distance of 60 feet north and 90 feet south. At a depth of 75 feet below the tunnel-level in the winze there was a marked improvement in the width of the vein, which continued to the present level and for the respective distances, north and south, so far driven. The actual average width of the vein proved in this later work is 15 inches, with full maintenance of the value proved in the upper level. On the surface, 250 feet farther north than the face of the tunnel in that direction, continuity of the vein has been proved with values. At a distance of 400 feet south of the tunnel-face surface-trenching has proved, for a length of 100 feet, a vein averaging 16 inches in width, assaying an average from all samples of \$25 per ton. Although this occurrence is not directly on the strike of the tunnel-workings, indications of faulting in the south end of the tunnel-drift and on the surface point to the probability of this being continuation of the same vein. A vertical shaft sunk to a depth of 86 feet passed through the vein between 50 and 60 feet. The width was 16 inches and the average value \$33 per ton. A crosscut at 82 feet is now being driven from the shaft to intersect the vein.

"The strike of the vein is N. 49° W. and the dip 45° to the north-east. The ore consists of quartz, with iron sulphide and chalcopyrite as the chief accompanying minerals. Argentite and some telluride are also present, the former being generally indicative of high gold value.

"Tests made on the ore by amalgamation, followed by flotation, showed that 87 per cent. of the gold content was recoverable by these methods from a product ground to 76 per cent. through 100-mesh. The additions and alterations to the mill will be completed by the end of April. There has been added a 4- by 4-foot ball-mill and two additional flotation-cells. The method of treatment will be crushing and classification, recovery of free gold and concentrates from hydraulic separator and blankets by amalgamation-barrel. The flow from blanket tables is to flotation-cells, thence over concentrating-table to tailings. The mill will have a capacity of 20 to 25 tons per day."

This group was developed this year by Alberta capital under the direction of L. Davis. Development consisted of numerous open-cut trenches, a tunnel 75 feet long, from which a winze was sunk 25 feet deep on a shear-zone in the granitic rocks containing chalcopyrite and pyrite. Due to the present low price of copper, work was suspended early in the year.

CLINTON MINING DIVISION.

NOTE BY PROVINCIAL MINERALOGIST.—Owing to public interest in the *Big Slide* property, caused to some extent by extensive advertising regarding the showings, in connection with a stock-selling campaign, A. M. Richmond, Assistant Resident Engineer, was instructed by the Honourable the Minister of Mines to make a special examination of the property. The report, based on this thorough examination, shows clearly the real conditions and indicates what future possibilities may be. It is printed in full for the information of all those interested.

BIG SLIDE MINING AND DEVELOPMENT Co., LTD. (N.P.L.)*

The property of the Big Slide Mining and Development Company, Limited (N.P.L.), more familiarly known as the *Big Slide* mine, and situated in the Clinton Mining Division of British Columbia, was discovered about 1872 by an Indian.

Subsequently the Foster Gold Milling and Mining Company was formed; the present No. 1 and No. 3 adit crosscut tunnels were driven to intersect the vein; an unsuccessful attempt was made to recover the gold values in the ore by means of a crude arrastra about 1881; and finally in 1886, after the ores from the mine had been tested in San Francisco, a 10-stamp mill with desulphurizing furnaces and chlorinating plant were constructed at the mine-site.

Active mining and milling operations with a crew of about fifty were discontinued after a period of three to four months' operation. It was stated shortly after the closing of the plant that difficulties in the method of gold-recovery were largely responsible, but from information presented later in this report it would appear that possibly the low-grade tenor of the ore mined in 1887 had something to do with the shut-down.

At any rate, the property remained idle until 1928, when the present company was formed to take over the ground and develop the quartz veins to the point where a small milling plant might be justified. The old mill erected in 1886 was destroyed by fire many years ago.

Company Structure.—The Big Slide Mining and Development Company, Limited (N.P.L.), is capitalized for \$2,000,000, which is divided into 8,000,000 shares of 25 cents par value. Some 3,212,827 shares of this capitalization had been issued as at March 15th, 1933, approximately 671,000 shares of the total issue having been subscribed for and fully paid up, the remainder of the issued shares having been given for considerations other than cash. The head office of the company is 342 Pender Street West, Vancouver, while the following are officers: President, L. A. Lewis, of New Westminster; vice-president, A. Clarke, of Vancouver; secretary-treasurer, R. M. Abernethy, of Vancouver; directors, W. J. Whiteside, of New Westminster, and D. D. Murdock, of Vancouver.

Property and Title.—According to records on file in the Mining Recorder's office at Clinton, fourteen claims were recorded in the name of the company as at April 11th, 1933. They were *Plant No. 1, Plant No. 2, Mandy No. 4, Mandy No. 5, Mandy No. 6, Mandy No. 7, Mandy No. 8, Mandy No. 9, Mandy No. 10, Mandy No. 11, Mandy No. 12, Mandy No. 13, and Ophir No. 12*. Additional to the above fourteen claims, it is recorded that sixteen claims are held in the names of parties connected with the company, and as I am informed by the secretary-treasurer that the company owns twenty-two claims in all in the vicinity of Kelly creek, it is presumed that eight of these sixteen claims have been transferred to the company. The claims are all held on

* Report by A. M. Richmond, Assistant Resident Engineer (Headquarters, Victoria).

location. With two exceptions they are full claims, so that an area approximating 1,100 acres is held.

Location.—The *Big Slide* property may be reached via Kelly Lake either by all-road transportation from Vancouver, or by water and rail transportation via the Pacific Great Eastern Railway. The railway passes through claims held by the company, but the nearest station is at Kelly Lake, which is near Mile 153 (north of Squamish) and 10 miles west of Clinton. Kelly Lake via the Fraser River highway, Ashcroft and Clinton, is 277 miles by road from Vancouver.

From the station a fairly good road 5 miles long leads down Kelly creek to the head of the mine-trail at 3,150 feet elevation above sea-level. This trail, which is 2½ miles long, drops in the last half-mile from an elevation of 1,550 feet to the mine camp at 800 feet elevation, some 60 feet above the level of the Fraser river at this point. The upper 2 miles of the present trail at one time was a wagon-road leading down to the mine and it could, if required, be reconstructed at a nominal cost. It would be difficult to make a wagon-road down the last portion of the trail, due to the precipitous nature of the gorge down through which Kelly creek tumbles to the Fraser, but the very steep go-devil trail now built can be kept open quite readily.

The mine camp, with accommodation for a crew of twenty men, is situated just at the mouth of Kelly creek near the former mill ruins. The mine-workings are about 300 yards to the south across the slide from which the mine takes its name. This slide of fine rock is a conspicuous feature of the topography of the Fraser river in this area, and while it is spectacular in its grandeur, it is not dangerous except in wet and windy weather, when precautions must be taken to guard against rolling stones.

Topography, Timber, Power, etc.—The Fraser river in this area flows in a southerly direction through a rugged terraced canyon-like valley, with precipitous sides up to the level of the first terrace at about 500 to 800 feet above the river-level. South of the mine camp and to the east of the river Pavilion mountain rises in a series of rugged, steep bluffs and lightly timbered mountain-slopes to an altitude of about 5,000 feet. Erosion of the mountain-side gives an excellent exposure of the *Big Slide* vein system for a length of about 1,000 feet south of the mine tunnel portals.

The climate is moderately severe in the winter-time, with a light snowfall at the camp and with heavier snows and lower temperatures prevailing at the higher elevations. The mine climate is similar to almost all parts of the Interior Dry Belt of the Province and during the summer months hot, dusty days are common. Mountain-fir suitable for mine-timbers and fuel is plentiful on the higher levels of the company's property. Water rights covering a flow of 28 c.f.s. from Kelly creek are held by the company, and if required an economical high-pressure-head water-power installation could be easily developed. Kelly creek drains both Pear lake and Kelly lake with their tributary streams.

Geology.—The quartz-filled series of fissure-veins which strike S. 30° E. from the camp, dip into the mountain in a north-east direction at 70°, and outcrop just to the south of the big slide, occur in an altered and metamorphosed phase of a small granitoid (diorite) stock that outcrops in the vicinity of the mouth of Kelly creek and for 4 or 5 miles north of the mine-workings. Surrounding this stock of igneous rock on the east and south are greenstones and cherty quartzitic rocks, with which are occasionally found interbedded bands of limestone.

In the area of the mine-workings the rocks are badly fractured and sheared. Underground evidences of fracturing, shearing, and minor reverse-faulting are to be seen at several points, and it is probable that the two vein sections encountered in the three levels of the mine, and which are approaching one another with depth-development, may be the same original vein which at one time was faulted by a flat reverse fault. Evidence to this end can be seen quite distinctly in the upper two levels of the mine-workings and in the surface outcrops. Looking at the vein-outcrop from across the Fraser river with a high-power binocular fails to show more than one distinct vein after the immediate vicinity of the mine tunnel portals is left, while close to the tunnels the vein is quite distinct in its double relationship. Several small flat-dipping stringers or offshoots from the main vein are discernible along the outcrop which can be traced for about 1,000 feet along the bluffs. The vein pinches and swells along the outcrop, and while individual lenses of approximately 3 to 4 feet can be seen, it is considered that the average width of the vein would possibly be 8 to 12 inches.

Two thousand feet south-east of the main workings small outcrops of quartz-filled fissures have been prospected, and 1 mile south of the mine another series of fissures have been filled

with quartz, pyrite, and chalcopyrite mineralization. This last vein system is on the property of the Pavilion Gold Mines, Limited.

The wall-rocks surrounding the vein in the mine are for the most part a basic phase of the granite, classified as a hornblende diorite. A later and more basic intrusive is in evidence in the winze recently sunk below the No. 3 level.

Underground the vein, which is mineralized with quartz, pyrite, some chalcopyrite, arsenopyrite, and minor amounts of gold and silver, varies in width from less than 1 inch to as much as 4 feet. The average width as determined by 110 measurements in the three upper levels, the new winze, and No. 5 level gives an average of just under 8 inches for the vein-width.

The mineralization in general occurs as a banded structure of the sulphides with the vein-quartz, though it was occasionally noticed that isolated masses of sulphides occurred in the wider sections of the vein. The gold occurs as a constituent of the sulphides, and while one sample of free gold has been reported, no samples or specimens containing free gold were seen by the writer. Silver in the ratio of about 2 oz. silver to 1 oz. of gold occur as a subsidiary value in the ore.

The vein-walls are free from the quartz-filling and in most parts of the underground workings a thin parting of gouge occurs on both the hanging- and foot-wall sides of the mineralization. Oxidation of the pyrite has extended down in the vein in the northerly or shallow end of the mine-workings on all three levels, but unaltered sulphides are found in the recent work in the No. 2 winze and the No. 5 level.

Mine Development.—The accompanying map shows in plan and section that the mine has been developed on five levels, three of which are adit-levels. The top level (No. 1), comprising 385 feet of drifting and crosscutting, develops what are called the Front and Main veins for a length of 80 and 215 feet respectively. The two sections of the vein on this level are 60 feet apart. A raise up 50 feet on the stope in the Main vein is still about 170 feet below the outcrop exposure of the vein.

The No. 2 adit-level, 35 feet below No. 1 level, consists of a 65-foot crosscut to the Front vein and a drift for 55 feet along this vein to where a fault was encountered. The drift was turned in an easterly direction, and after crosscutting for 35 feet from the Front vein strike the Main vein was encountered and drifted on in a north-westerly direction for 28 feet, from which point a raise was put up to connect with the No. 1 level. The levels are also connected with a raise on the Front vein.

The No. 3 level, at 843 feet elevation above sea-level and 65 feet below No. 2 level, is the main working entrance to the mine at the present time. It is connected to the level above by an ore-pass raise on the Main vein. After crosscutting 240 feet to strike the Front vein over 500 feet of drifting and crosscutting has been done to develop a length of 70 feet on the Front vein and 350 feet on the Main vein. Two sub-levels have been developed by the present company through winzes put down from this level. The No. 4 level, 35 feet below the junction of the main crosscut with the vein system, is now flooded and is stated to consist of 100 feet of drifting and crosscutting on the Main vein. The No. 5 level is reached through a winze put down on the Main vein at a point about 118 feet south-east of the main crosscut.

No. 5 level is 103 feet lower than No. 3 level, and on April 11th it consisted of a drift 137 feet long, 66 feet of the drift being to the north-west of the winze. The two faces of this level are the only points in the mine at which underground development-work was in progress during the time of the examination. The faces were each being advanced 2 feet per double shift by hand-mining methods.

The shaded sections on the map indicate, as near as it was possible to measure, the stoping done during the time the mine was operated in 1886 and 1887.

Sampling and Assay Details of the Veins.—With the exception of one grab-sample of ore taken from the 60- to 70-ton dump of sorted ore (mostly from No. 2 winze and No. 5 level) at the portal of the No. 3 level, all sampling was done with a single jack and moils. Care was taken to take a uniform cut from the several sections of the vein, when they were combined to make a composite sample of individual mineralized shoots along the vein. In the upper levels several cuts from sections of the vein were combined to give a composite sample and on the map these separate sample widths have been indicated. In the No. 2 winze individual samples were cut across seven places in the vein, while on No. 5 level, where the vein is narrow and confined to the north-westerly end of the drift, three composite samples representing six

channels across the vein and one single channel sample were taken. The locations of all samples taken are shown on the drawing accompanying this report.

The assay results are tabulated in the following table and for clearness the results are reviewed briefly:—

Assay Results, Big Slide Samples.

Sample No.	Level.	Widths in Inches.	Gold.	Silver.	Remarks.
			Oz. per Ton.	Oz. per Ton.	
18553A	Surface	14" in upper surface tunnel.	Trace	Trace	At point 2,000 feet south from main workings.
18554A	1	4, 5, 7½, 11, 13.....	0.20	0.60	Along 60-foot section of vein.
18555A	1	10, 2, 6.....	0.20	0.20	Along Main vein.
18556A	1	6, 8, 14.....	0.10	0.60	Front vein.
18557A	2	9, 6.....	0.08	0.20	Main vein.
18558A	2	16, 14, 16, 8.....	Trace	Trace	Front vein.
18559A	3	24.....	0.34	1.60	Main vein.
18560A	3	27, 9.....	0.04	0.20	Front vein.
18561A	3	20, 6.....	Trace	Trace	Front vein.
18562A	3	36, 34.....	Nil	Nil	Main vein.
18563A	3	14, 27, 15.....	0.06	0.20	Main vein.
18564A	3	14, 11, 17.....	0.06	0.40	Main vein.
18565A	Winze	18" of 48" vein.....	0.50	0.50	Main vein.
18566A	Winze	39.....	0.40	0.40	Main vein.
18567A	Winze	5.....	0.55	0.90	Main vein.
18568A	Winze	8.....	Nil	Nil	Main vein.
18569A	Winze	16 (9+7).....	0.28	0.90	Main vein.
18570A	Winze	20.....	0.16	0.60	Main vein.
18571A	Winze	6.....	1.64	1.50	Main vein.
18572A	5	7, 5.....	1.30	2.00	Main vein.
18573A	5	5, 6.....	0.56	1.20	Main vein.
18574A	5	4, 4.....	0.84	0.80	Main vein.
18575A	5	8.....	0.88	2.60	Main vein.
18576A	Dump	Grab-sample.....	1.80	1.80	60 to 70 tons sorted.

NOTE.—Samples Nos. 18553A to 18575A cut with hammer and mells, and the widths given show the widths of vein sampled as illustrated on the accompanying map.

No. 1 Level Sampling Results.—Two samples were taken on the Main vein on this topmost level in the mine. The first sample, No. 18554, was a composite of five channels cut across a section of the vein 68 feet long and averaging 8 inches wide. The assay return was: Gold, 0.20 oz. per ton; silver, 0.6 oz. per ton; which with gold valued at \$20 per ounce and silver valued at 30 cents per ounce is equivalent to a gross valuation of \$4.18 per ton.

Sample No. 18555 was a composite of three samples taken from the widest sections of a length of the vein which averages 5½ inches wide and is 113 feet long. The assay return was: Au, 0.20 oz. per ton; Ag, 0.20 oz. per ton (\$4.06). Parts of this section of the vein could not be sampled as the timbering in the stoped section was not strong enough for safety. In one 40-foot section included in the 113-foot length the vein pinched down to 1 to 4 inches of gouge.

One sample, No. 18556, was taken from the Front vein on this level. It was a composite of three channels and represents a section of the vein 45 feet long and 9½ inches wide. The assay return was: Au, 0.10 oz. per ton; Ag, 0.60 oz. per ton (\$2.18).

No. 2 Level Sampling Results.—Sample No. 18557, taken as two channel cuts to represent the 10-foot section of the Main vein exposed in this level, with an average width of 7½ inches, assayed: Au, 0.08 oz. per ton; Ag, 0.2 oz. per ton (\$1.72). Sample No. 18558, taken across four cuts in a 58-foot section of the Front vein lying to the north-west of the fault across an average width of 13½ inches, assayed: Au and Ag, trace.

No. 3 Level Sampling Results.—The 70-foot section of the Front vein exposed in the Front drift on this level averages 16 inches in width, with a maximum width of 27 inches at the main crosscut. Four channel cuts across the vein were taken and combined into two samples, No. 18560 and No. 18561 respectively. The assay average for these two samples was: Au, 0.03 oz. per ton; Ag, 0.1 oz. per ton (\$0.63).

At the Main vein at its intersection with the main adit-crosscut a sample taken across 24 inches assayed: Au, 0.34 oz. per ton; Ag, 1.6 oz. per ton (\$7.28).

South-east of this point for 170 feet the vein is persistent and averages about 10 to 12 inches in width, with occasional places where the vein pinches to 2 or 3 inches, or alternately widens to as much as 24 inches. Due to the age of the timbering in this stoped section of the Main vein, it was not possible to take any representative samples of the ore, but a careful inspection of the vein-filling, with the aid of a beam light, left the impression with the writer that it carries approximately the same percentage of sulphide mineralization as the sample last mentioned (\$7.28 per ton), and certainly not as heavy sulphide mineralization as occurs in the mineralized section of No. 2 winze.

Three other short sections of the vein were sampled along the old stope and drift back south of the collar of the No. 2 winze. The first section sampled, 30 feet by 14 inches, and from 55 to 85 feet from the winze, was a composite of three channel samples. The assay was: Au, 0.06 oz. per ton; Ag, 0.4 oz. per ton (\$1.32). The second section from 105 to 135 feet south from the winze averaged 19 inches wide and a three-cut composite channel sample assayed: Au, 0.06 oz. per ton; Ag, 0.02 oz. per ton (\$1.26). The third section, 25 feet long by 35 inches wide, the widest section except one that was sampled, cut by two channels and combined, assayed: Au and Ag, *nil*. In between these three sections of the vein which were sampled the fissure containing the vein-filling is from 1 to 3 inches in thickness and for the most part carries no visible sulphide mineralization.

The vein pinches out about 25 feet from the face of the drift, and a short crosscut to the east from near the end of the drift has discovered a 6-inch stringer of white quartz sparsely mineralized with iron pyrite.

No. 2 Winze.—This working, put down from the No. 3 level to the level of the new No. 5 level, uncovers the best mineralized section of the vein exposed in the underground workings of the property. Parts of the winze were tightly lagged and as a consequence could not be sampled nor carefully examined in detail, but the section drawing accompanying this report gives the detail at present accessible and indicates by means of dotted sections the parts of the winze which could not be carefully inspected and sampled. The average width of the vein as exposed in the winze is just over 20 inches (this takes the width at sample No. 18565 as 48 inches) and the weighted assay value as determined by the seven samples, No. 18565 to No. 18571, inclusive, was: Au, 0.422 oz. per ton; Ag, 0.84 oz. per ton; equivalent to \$8.69 per ton. The highest assay return was from sample No. 18571, across a width of 6 inches at the bottom of the winze, with an assay of: Au, 1.64 oz. per ton; Ag, 1.5 oz. per ton (\$33.25). An inspection of the drawing of the winze shows that the vein pinches out to a stringer at a depth of 53 feet below the collar and widens again at 65 feet depth.

No. 5 Level Sampling and Assays.—On this the lowest level in the mine, 220 feet below the No. 1 level and approximately 450 feet below the outcrop exposure of the vein, the mineralization is confined to a narrow fissure-vein heavily impregnated with pyrite, some quartz and chalcopyrite. South-easterly 38 feet from the winze the vein is cut off by a flat-dipping fault, and while one or two small patches of mineralization are said to have been encountered south of this fault, the face of the drift was barren the day it was examined.

North-westerly from the fault the vein averages 5.6 inches in width for a length of 104 feet (the present north face), with a short barren section just to the north of the fault-plane. One small patch of mineralization was found in the bottom of the drift 15 feet south of the winze, where the vein had swelled to a width of 16 inches. In the north face of this level two stringers, 2 inches and 4 inches wide respectively, were seen when the drift was examined on April 11th.

The average assay value of the vein over a length of 90 feet and an average width of 5.6 inches, as determined by eight samples (including No. 18571 from the bottom of the winze), was: Au, 1.055 oz. per ton; Ag, 1.75 oz. per ton (\$21.62).

At no place on this level is there any evidence that there has ever been a 4-foot face of ore as reported in the press.

Surface Sampling.—A grab-sample was taken from the 60- to 70-ton dump of sorted ore at the portal of No. 3 level. The assay returned: Au, 1.80 oz. per ton; Ag, 1.8 oz. per ton (\$36.54). This ore was apparently sorted from material coming from the No. 2 winze and No. 5 level and consisted principally of heavy sulphides in fairly coarse pieces. There was a minimum quantity

of fines mixed in the lower portion of the dump. A sample across 14 inches in the face of the upper tunnel at the camp 2,000 feet south of the main workings assayed a trace in gold and silver.

Summary of Sampling Results.—An inspection of the above assay results and the assay-map gives a very disappointing picture, for, with the exception of a portion of the Main vein as exposed in the No. 5 level, the No. 2 winze, and possibly along the back of the stoped area on No. 3 level in the vicinity of the winze and main crosscut, the values are very poor when the narrow width of mineralization is taken into consideration.

It must be remembered that the minimum width it is practical to mine by machine-stopping is about 3 feet, and with hand-mining methods about $2\frac{1}{2}$ feet. With the narrow widths as exposed on No. 5 level, it would mean that at least five to six times as much waste as ore would have to be mined, with a consequent corresponding dilution of the values, or, alternately, considerably increased mining costs.

Similarly, in the No. 2 winze, where the average width is just over 20 inches, approximately 45 per cent. waste, with a decreased valuation of the ore to correspond, would have to be broken down in any machine-mining operation. This gives a value of: Au, 0.234 oz. per ton; Ag, 0.467 oz. per ton; or \$4.82 per ton over the 36-inch stoping-width.

Plant and Equipment.—The property is equipped with a bunk-house and boarding-house to accommodate twenty men; a small office residence for the superintendent; a small blacksmith-shop at the portal of No. 3 level; two or three $\frac{1}{2}$ -ton dump-cars; hand-mining tools; strap-iron rails throughout the working portions of No. 3 and No. 5 levels; and a small hand-winch and buckets for use in the No. 2 winze.

Ore Reserves.—It is not possible to designate any of the ore exposed in the mine-workings as assured ore. From a study of the assay-maps it can be calculated that there is a block of ground 120 feet long on No. 3 level, 90 feet long on No. 5 level, with an average thickness of 12.5 inches and a depth of 105 feet in the winze that contains about 950 tons of probable ore which may average \$9.85 in gold and silver content. This would be reduced by dilution in mining to about one-third of this value, or to \$3.28 per ton over a width of 3 feet. The rest of the sampling in the mine, particularly in the upper two levels and on the Front vein on all three levels, eliminates any tonnage calculations being presented.

Conclusions.—Summarizing briefly, the vein is persistent in its length along the outcrop for a length of about 1,000 feet as exposed, and possibly longer; it is narrow for the most part and averages by measurement about 8 inches in width underground, but occasionally swells to as much as 3 and 4 feet in width, and alternately pinches to a seam less than an inch in width.

The values are low, except in portions of the vein heavily impregnated with sulphide mineralization, and the only tonnage calculation possible is for about 950 tons of probable ore between the No. 3 and No. 5 levels in the vicinity of the No. 2 winze. This block of ground has a possible average value of \$9.85 over a width of 12.5 inches and would, with a 3-foot stoping-width, be diluted to about 3,000 tons of \$3.30 rock. The values are mainly in gold, with silver occurring in the ratio of 2 oz. silver to 1 oz. gold content.

The possibilities of the property are decidedly limited, and unless materially wider widths of heavy sulphide mineralization are discovered in the future prospecting and development-work in the lower levels of the mine, the property as a commercial enterprise is unattractive.

The writer wishes to acknowledge the courtesies extended to him by the superintendent of the company, Wm. Tompkins, during the period of examination, from April 9th to 12th, 1933.

This group, owned by W. N. D. McKay and associates, of Clinton, is situated **Winnifred.** about 7 miles north of Clinton, on the west side of the Bonaparte river and within $1\frac{1}{2}$ miles of the Pacific Great Eastern Railway. In a highly serpentinized belt of dunite rock skirting the river-banks numerous nodules of high-grade float as well as narrow segregations of speckled chromite in place have been found. Further prospecting for the high-grade ore in place is proceeding.

PLACER-MINING.

The early summer placer-mining operations in this Division were reported on by A. M. Richmond, Assistant Resident Engineer, of Victoria, and appeared in the "Six Months' Summary and Review of the Mineral Industry of British Columbia," issued in July, 1932. A few notes from this report have been briefed for convenient reference.

Practically all the ground available between High bar and French bar, which points are approximately 12 miles west of Jesmond and 30 miles north-west of Clinton, has been acquired by Vancouver men, and a limited amount of prospecting and testing was done during the summer months.

On the North fork of Watson Bar creek, the Watson Bar Syndicate, under the direction of W. E. Johnstone and with a crew of eleven men, installed a small hydraulic plant to wash remnants of an old channel recently discovered a short distance above the creek-bottom. The syndicate holds four placer leases and one placer claim on the upper end of the creek.

Below this operation on the same creek are several parties making very good "pay" by sluicing, including the operation of M. Daly, who annually recovers sufficient coarse, rough gold to provide comfortably for himself. The gold occurs in the top 18 inches of a badly fractured diorite bed-rock channel which averages 18 feet in width. There is from 12 to 20 feet of low-grade overburden on the pay-channel and about 100 lineal feet of this overburden is removed each spring during high water by ground-sluicing methods. The bed-rock, thus exposed, is then taken up with pick and shovel and washed on pole riffles in a small box sluice. The channel in the past has yielded about 2 oz. of gold per lineal foot of its length.

Messrs. Webber, Harris, and Adams hold three placer leases below M. Daly's property, and during the summer were drifting to reach the pay-channel. When the area was visited in June they had about 40 feet of drifting to complete before striking their objective.

A complete description of the property of the Crow's Bar Placers, Limited, situated 57 miles by road north-west of Clinton, is contained in the aforementioned report. Considerable time was spent in checking up on the values of gravel at this property and the results were very disappointing. The working of the ground on the benches, except for possibly small areas of 25-cent ground located close to the river, cannot be considered as a profitable venture. After the examination of the ground the company abandoned the pump-hydraulic operations and spent considerable time in testing the Fraser River bottom, a possibility which could not be checked at the time of examination, due to the extreme high water of the Fraser river.

Since the above examination was made, exploration-work was continued in the gravels at the bottom of the Fraser river. A scow 30 feet long and 18 feet wide was built, and a 115-horse-power steam-boiler, derrick, pump, and sluice-boxes erected upon it. Tests were being made in the gravel by immersing a 4-inch pipe, attached by a rubber hose to the suction unit, in the centre of the river, and at the time of examination (September 20th) only light colours of gold were recovered, due possibly to the difficulty of making the pipe penetrate deeply enough to reach a heavier gold concentration, if any, below. The theory of the suction-pump for recovering gravels in swiftly flowing rivers such as the Fraser sounds reasonable, but until some means can be found to divert the ever-moving barren top gravels from the suction-hole very little benefit can accrue, because every time the pipe is withdrawn the hole refills and has to be cleared again.

On the benches mentioned by Richmond the possibilities of an old channel-run are apparent, and since values found in the cut along the present river-bank, where very little protection was afforded, were attractive, though too low grade for hydraulicking, it seems advisable, since a full equipment is already on the spot, to test the ground farther north and more under the protection of the high banks. As the run of gold is generally sinuous, more favourable conditions may be found. Also, the dip of the gravel strata into the bank suggests lower elevations to the east and possibly a heavier gold concentration.

Churn Creek.—A new find was reported from Fenton creek, a tributary of Churn creek near the headwaters. The latter creek, according to those who know the country, is not properly located on the maps. The headwaters apparently derive their source from Poison mountain, which lies at an elevation of 7,000 feet about 56 miles due west of Clinton. Comparatively coarse rough-edged gold was found in the creek-gravels, which vary in depth from 5 to 30 feet. Large glacial boulders are found in the creek-bed. Due to the short season work ceased in September. At the present time a rough trail climbs steeply up the west bank of the Fraser river from near the mouth of Watson creek, and thence in a westerly direction to Churn creek.

This company, with headquarters at Williams Lake and under the direction of Hooper, Smedley, and Mackenzie, was operating spasmodically on a series of leases situated on the east side of the Fraser river, 1½ miles below the Chilcotin suspension bridge. The bench upon which the work has been concentrated is about three-quarters of a mile long, with outcrops of rim and bed-rock every few hundred feet. In between the rock projections certain elliptical bays have been formed, containing variable depths of alluvial gravel and glacial boulders. The benches, which average 300 feet in width, slope up and reach a maximum height of about 75 feet above the river. The gravel found in the bays has evidently been deposited at different periods during the cutting-down process of the present channel, so that a great deal of the detritus has been deposited in comparatively calm water. The depth of gravel where developed varies from about 6 feet higher

**Silver Tip
Mining Co.**

up the bench to 15 feet closer to the river. Lower down the bench the workings were filled, so that bed-rock depths could not be ascertained. Some fairly coarse gold has been recovered by hydraulicking with a small gasoline outfit, but the capacity of the pump prohibited washing the gravels higher up. The yardage of gravel in this particular bench does not appear to be large enough to warrant the installation of more powerful machinery for hydraulicking, but with further testing of the bench-gravels, values per cubic yard may be found to be high enough to warrant the expense of installing a drag-line, so that the material can be taken to the river and sluiced. A series of flat benches skirt the river above this lease, and if pay-gravel occurs in them the whole mass may be treated in the same way. Care should be taken that a pay-streak is not covered by a heavy overburden of barren gravel which will have to be removed.

Some fine gold was discovered by E. L. Greenlee, of Canim Lake, on the upper reaches of Boss creek, which flows into the lake about 22 miles north. Very little work has been done in this area to prove the extent of the find, but the gold, which varies from a lemon to a rusty colour, is well rounded and is found chiefly behind the protection of the boulders.

NICOLA MINING DIVISION.

PLACER-MINING.

A certain amount of placer-mining was carried on near the mouth of Spius creek, near Canford. At the time of examination (late in the season) no one was working, but, according to the owners, values in gold and platinum had been recovered. The valley measures nearly 1 mile wide near the junction of Spius creek and Nicola river, and it is probable that there is a large area of workable gravel, providing the values are present. Test-pits will have to be sunk to prove this. A good many small operations were carried on in this section by groups and individuals and small recoveries made.

YALE MINING DIVISION.

COQUIHALLA SECTION.

These groups, mentioned in the 1932 bulletin, have been optioned by the **Dawson and Aurum** Consolidated Underwriters, Limited, 714 Exchange Building, Vancouver. The winze sunk on the "hanging-wall" vein in the *Dawson* mine has reached a depth of 137 feet on the rake of the ore. The average width of mineralized quartz in the winze measures 2 feet. At the bottom of the winze the ore-rake flattens considerably and a sub-level is being driven in a south-easterly direction. A sample across a 5-foot face in this drift taken by the superintendent assayed \$293 per ton. No. 4 tunnel, commenced from outside many years ago and 165 feet below No. 2, is being driven ahead, with the idea of tapping the ore-shoot found in the winze. About 115 tons of roughly sorted ore was shipped to the smelter, carrying values chiefly in gold. Another shipment is in transit. The old mill was reconditioned early in the season, but only used for a short period. A new flow-sheet has been worked out and probably within the next few weeks milling operations will commence. A larger compressor plant is being installed and ten men are working on the property.

A few men have been developing the *Aurum*, but no important ore-strikes have been made. Reports on this area and individual mines have been written by C. E. Cairnes, of the Geological Survey of Canada, in 1924 and 1929, also by H. G. Nichols in the British Columbia Annual Reports. The area as a whole is an intensely interesting one, and many series and networks of quartz veins have been found; some containing gold values and some almost entirely barren were developed. The future possibilities of these claims appear to lie, not in the hope of finding high-grade pockets, but in the development of the veins at depth, where, according to dips and strikes, they may have converged and permitted the concentration of values over minable widths.

This group, situated on the Middle fork of Ladner creek in the Coquihalla, **Home Gold Mining Co., Ltd.** and also reported upon by C. E. Cairnes, has been further developed by a new crosscut tunnel 280 feet south-east and 160 feet lower in elevation than the lower tunnel mentioned by Cairnes. This crosscut has been driven 350 feet, with an offset tunnel about 40 feet long at a point 294 feet from the mouth. **(Pipestem Group).**

In the crosscut numerous stringers and lenses of quartz intersect the country-rock. In the offset tunnel these stringers become more massive and form a web-like structure about 10 feet wide, including dense pyritic mineralization and enclosed fragments of country-

rock (slates). According to the management, samples of this ore assay as high as \$25 per ton in gold.

The vein-structure appears to be have improved both in size and mineralization at depth. If values of about \$15 per ton in gold can be obtained over minable widths the property deserves further development. In any case, it seems advisable to drift-sink and upraise on the vein system in the lower tunnel, followed by careful sampling, to ascertain definitely whether or not the ore found on the surface rakes at a different angle either above or below the present workings. The property is equipped with a small Pelton water-wheel and compressor which provides power for development.

This property adjoins the *Aurum* and has been reported on many times in the British Columbia Annual Reports, as well as by C. E. Cairnes in 1924. It was reported upon in the Summary Review for 1932 and Bulletin No. 3, 1932. Since then, according to the management, a new crosscut has been driven 182 feet at an elevation of approximately 175 feet lower than the one mentioned above. It is estimated that the vein system should be intersected at a point 430 feet from the mouth of the new tunnel. Ore is being sorted and sacked from the upper tunnel at the rate of about 1 ton a day. This ore is expected to average \$45 per ton. A new camp has been built on the same level as the new crosscut, and a building that will accommodate a small mill, should one be required. The water-line was extended 130 feet to the new camp. Shipments of ore are expected in 1933.

PEERS CREEK SECTION.

This group, consisting of eleven full claims and owned by E. Rice and associates, of Coalmont, and L. Fripp, of Tulameen, is situated between one of the South forks of Peers creek and the headwaters of 18-Mile creek, at varying elevations between 4,775 and 6,175 feet (barometric).

A light-grey, fine-grained, granite batholith outcrops on the south and west of the area and is overlain by argillites to the east. A peridotite intrusion traceable for several miles and varying from 25 to 40 feet wide cuts the argillites in a south-easterly and north-westerly direction. The rocks lying to the north-east of the peridotite are somewhat complex and appear to be a mosaic of quartzite, tuffs, and porphyrites. Numerous granite-porphyry dykes cut the argillites and quartzites in different localities, and one more recent dark micaceous dyke 6 feet wide cuts through all formations, including the peridotite and porphyry.

At the lower elevations in the granite numerous parallel quartz-fissures from a few inches to 4 feet in width, and striking about north and south (mag.), have been uncovered in open-cuts and short tunnels. The mineralization in these veins varies; some containing pyrite, chalcopyrite, arsenopyrite, and molybdenite, and others pyrite alone. Along the south-west contact of the peridotite, striking diagonally across the granite veins, another quartz vein, varying from 2 to 6 feet in width and containing pyrite, arsenopyrite, and chalcopyrite, is traceable for several miles. The actual contact of this quartz vein and those occurring in the granite is obscured by talus-slopes, so that the relation between the two could not be ascertained. Several other strong quartz veins outcrop close to the camp and appear to strike in a north-easterly and south-westerly direction. At the time of examination the different veins had only been prospected on the surface, where the veins outcropped and were sparingly mineralized. Possibly in the ravines, under cover, better ore will be found. The precipitous nature of the country permits easy development by tunnelling on the vein-strike.

Many samples were taken from the outcrop of these veins over 4-foot widths and the results varied from a trace in gold and silver to: Gold, 0.26 oz. per ton; silver, 5.52 oz. per ton. Picked samples assayed as high as \$14 in gold per ton. At present no high-grade ore-shoots have been found to outcrop, but the general mineralization, continuity of the veins, and contact between the fissures in the granite and those associated with the peridotite warrant exploration.

The claims can be reached by trail which branches from the Tulameen Summit Camp road (elevation 4,200 feet, barom.), about 1 mile from Dornberg's camp, and follows the Tulameen river to its source, and from thence across the headwaters of the South fork of the Tulameen (elevation 4,900 feet) and down one of the north branches of Peers creek. From the junction of this fork (elevation 2,900 feet) and the main creek the trail climbs over a high ridge (elevation 5,500 feet) and then down to a 10- by 12-foot log-cabin camp (elevation 5,275 feet), or a total distance of about 20 miles. The claims lie approximately 8 miles in a direct line

from Jessica Station on the Kettle Valley Railway. There is plenty of timber and water for mining purposes in the valleys and a waterfall of sufficient height to generate power in season.

PLACER-MINING.

Just north of the International boundary-line on the Skagit river, several leases have been staked by the Consolidated Mining and Smelting Company, of Trail, and a churn-drill has been testing the ground. The results of this work have not been reported.

On the Coquihalla river and Ladner creek, which flows into it from the north-west, a great many small operations took place and some coarse gold was recovered.

Coquihalla Mines, Ltd.—F. H. S. Wolverton, president of this company, secured creek, bench, and dredging leases for 11 miles on the Coquihalla river. Preliminary testing was made but nothing further done according to reports.

Fullbrook Lease.—Captain Fullbrook and associates placer-mined on a lease situated half a mile north of Jessica Station on 15-Mile creek. Altogether about 51 cubic yards of gravel was washed over a 12-inch ground-slucice and \$48 in very coarse gold recovered, some of the nuggets weighing as high as 112 grains. The operators thought that about 40 per cent. of the values were lost owing to the crude methods used. Numerous other tests portrayed the possibility of fairly good ground, and it is the opinion of those interested that hydraulicking certain sections may be made to pay. Unfortunately time did not permit an examination of the area.

Several dredging leases were staked by A. Nesbit and associates on the Fraser river at Hope and some churn-drilling done. It is unofficially understood that results were unattractive and no further work was done.

In the vicinity of Yale the North Western Dredging Company, Limited, 626 Standard Building, Vancouver, commenced drilling the Fraser River gravels late in August and covered the area in front of Yale and 1 mile below by October 12th, when operations ceased on account of high water. More work was anticipated during the low-water season.

Some prospectors brought in some very coarse gold from Log creek, which flows from the north into Nahatlach (Salmon), a tributary of the Fraser, between North Bend and Keefers.

At the junction of Stoyoma creek and the Fraser river J. W. James and associates worked the gravel-bars at low water with a suction-pump, sluice-boxes, and undercurrent, and recovered a considerable quantity of gold. There are two pay-streaks, one 3 feet from the surface, followed by about 3 feet of barren gravel and then 3 feet more of "pay" on a clay false bed-rock. Most of the fine gold was caught on a 4- by 6-foot blanket riffle in the undercurrent sluice.

On the *Wonder Claim* lease at the mouth of Johnston creek, half a mile north of Hope, on the west side of the Fraser river, Geo. Jefferson recovered a considerable quantity of very fine gold by sluicing the top gravels. About 100 feet of sluice-boxes were used and the first 88 feet given a gradient of 3 inches in 12 feet, with only one 2- by 4-inch block riffle. The last 12-foot box was given a gradient of 14 inches in 12 feet, with pole riffles on sacking. At the head and foot of this box two 2- by 4-inch blocks were laid under the sacking. All coarse rocks over 2 inches in diameter were washed and kept out of the sluices by means of a fine grizzly. The recovery of fine gold by this simple means was remarkable.

About a quarter of a mile north of Choate Station, on the south side of Texas creek, what is called the "Musicians" shaft was sunk for about 35 feet in what appeared to be well-washed alluvial gravel. A small quantity of gold was recovered, but bed-rock was not reached. The flats on the west side of the Fraser river, in which the above shaft was sunk, are extensive, and there seems a possibility of finding the old river-gravel under this area, which is now in part covered by more recent concentrations from Texas creek.

During low water in October many snipers, both men and women, made a living by rocking the gravels chiefly around the large boulders. Most of this gold is a new run concentrated from the glacial moraines along the Fraser river and each year small quantities are deposited.

EASTERN MINERAL SURVEY DISTRICT (No. 5).

REPORT BY B. T. O'GRADY, RESIDENT MINING ENGINEER (HEADQUARTERS, NELSON).

INTRODUCTION.

Briefly summarizing the year's activities, there has been no appreciable improvement in regard to silver-lead-zinc operations and, with the exception of small shipments by lessees, production has been confined to that made by the *Sullivan* mine of the Consolidated Mining and Smelting Company at Kimberley. This great mine held its own exceptionally well in the face of continued abnormally low metal prices which have caused cessation of production in so many other cases.

Pronounced interest in gold-mining, both lode and placer, has been sustained throughout District No. 5. Lode-gold mining activities are chiefly concentrated in West Kootenay, where placer-mining has also been active in certain areas. In East Kootenay no lode-gold mining, other than the investigation of prospects, has been undertaken, but the widespread placer-mining activities promise in the aggregate to make an appreciable contribution to the gold-output of No. 5 District. While the present combined production of placer and lode gold cannot be considered very important, the testing which has been carried out and plans for the future in the case of placer gold, with construction, development, and preliminary exploration in the case of lode gold, indicate that a considerable increase in gold production should be made in 1933. The various activities are specified under their respective Mining Divisions in the East and West Kootenay.

GEOLOGICAL SURVEY WORK.

It is understood at the time of writing that the Salmo 1-inch-to-1-mile topographic map, with geology by J. F. Walker, is being engraved and will be produced toward the end of 1933. Meanwhile useful photo-prints at \$1 can be procured from Ottawa.

The forthcoming Summary Report of the Geological Survey of Canada, which is expected to be printed in June, will contain the following items of great interest to District No. 5: "Waterton Lakes, Flathead Valley Area, Alberta and British Columbia," by G. S. Hume (dealing with oil possibilities); "Mineral Possibilities in the Vicinity of Cranbrook," by C. E. Cairnes (including the geology of placer, lode, and certain non-metallic deposits). Of importance to the Slocan, Slocan City, and Ainsworth Mining Divisions are the Slocan and Sandon topographical sheets, Maps 272A and 273A respectively, with geology by C. E. Cairnes, recently made available.

PRODUCTION.

Mine or Group.	Tonnage.	Character of Ore.
Fort Steele Mining Division—		
Sullivan.....	1,440,520	Silver, lead, zinc.
Lardeau Mining Division—		
Ophir Lode.....	13	Gold.
Nelson Mining Division—		
Arlington.....	3	Gold, silver.
Blackcock.....	55	Gold, silver, lead, zinc.
Boulder City Group.....	174	Gold, silver.
Columbia.....	19	Gold, silver.
Enterprise.....	84	Silver, gold, lead, zinc.
Golden Eagle.....	3	Silver, gold.
Gold Hill.....	2	Gold, silver.
Goodenough.....	408	Silver, gold, lead, zinc.
Granite-Poorman.....	137	Gold, silver.
Keystone.....	27	Silver, gold.
Kootenay Belle.....	242	Silver, gold.
Nevada.....	28	Gold, silver.
Perrier.....	858	Gold, silver.

PRODUCTION—Continued.

Mine or Group.	Tonnage.	Character of Ore.
Nelson Mining Division—Continued.		
Queen.....	600	Gold, silver.
Reno.....	2,088	Gold, silver, lead, zinc.
Royal Canadian.....	3	Silver, gold.
Second Chance.....	4	Gold, silver.
Vancouver.....	113	Gold, silver.
Venus-Juno.....	123	Gold, silver.
Yankee Girl.....	8,162	Silver, gold, lead, zinc.
Ymir-Wilcox.....	607	Gold, silver, lead, zinc.
Slocan Mining Division—		
Bosun.....	22	Silver, lead, zinc.
Cliff.....	2	Silver, lead, zinc.
Rio.....	43	Silver, gold, lead, zinc.
Silversmith.....	150	Silver, lead, zinc.
Standard.....	10	Silver, lead, zinc.
Victor.....	64	Silver, gold, lead, zinc.
Slocan City Mining Division—		
Chapleau.....	5	Silver, gold.
Gold Viking.....	1	Silver, gold.
Kilo.....	5	Gold, silver.
Little Daisy.....	2	Silver, gold.
Meteor.....	17	Silver, gold.
Trail Creek Mining Division—		
Evening Star.....	79	Gold, silver.
Gold Drip.....	2	Silver, gold.
I.X.L.....	82	Gold, silver.
Midnight.....	341	Gold, silver.
Snowdrop.....	1	Gold, silver.

GOLDEN MINING DIVISION.

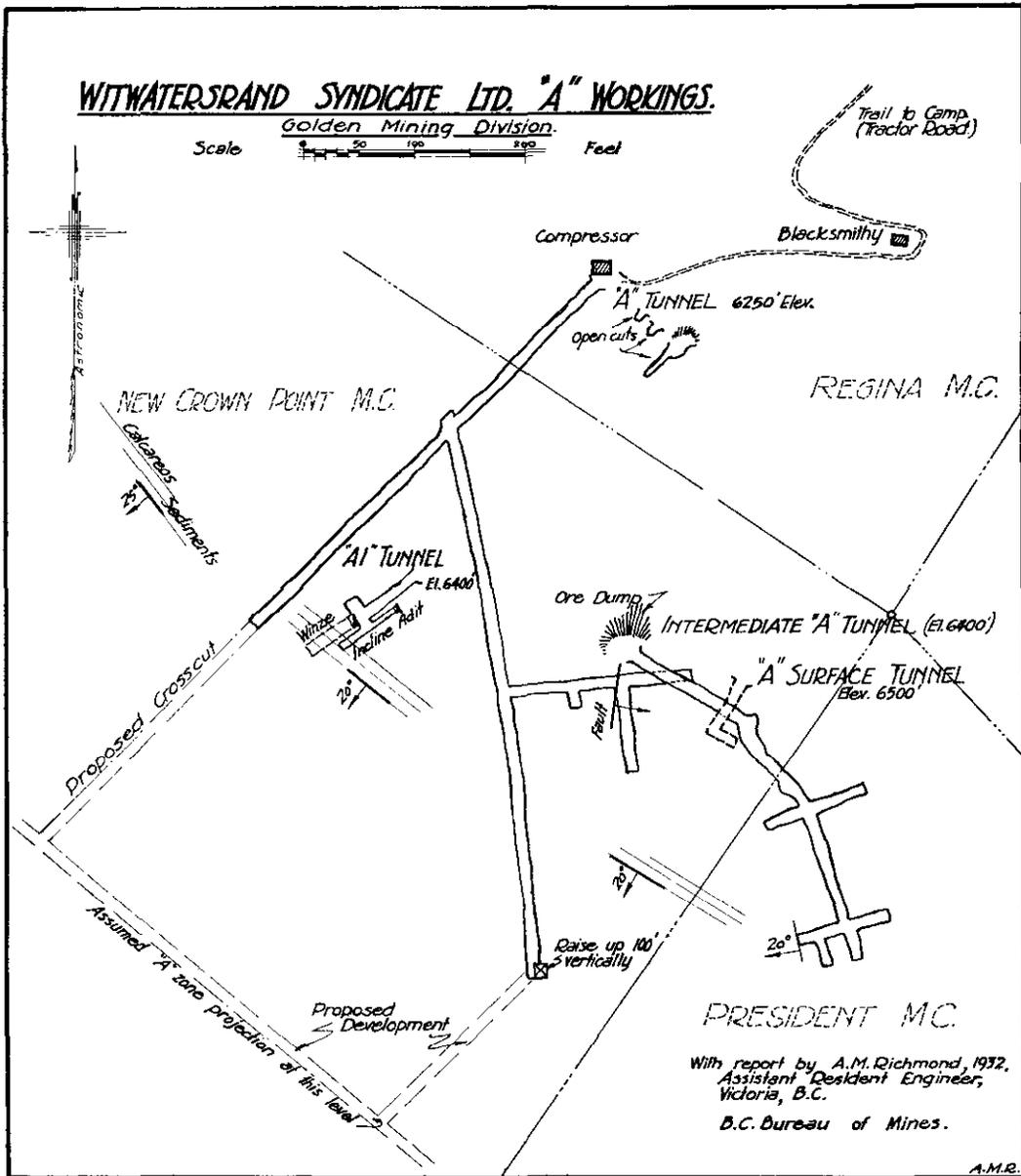
Work at this company's property on the North fork of McMurdo creek, a tributary of the Spillimacheen river, was continued throughout 1932 with **Witwatersrand Syndicate, Ltd.*** a small crew under the technical direction of G. W. Edwards. The property has been described in considerable detail in the 1929 and 1930 Annual Reports and only a few notes are presented here as a summary of the more recent activity. The map of the "A" workings accompanying these notes illustrates the data given in the 1930 Report and shows the advances which have been made underground in the "A" and Intermediate "A" tunnels. Just to the south-east of the "A" tunnel, at 6,250 feet elevation, three open-cuts were made on exposures of white quartz veins which traverse the chlorite-schist country-rock. A grab-sample from a 13-ton pile of sorted ore at the most southerly cut assayed: Gold, 0.48 oz. per ton; silver, 0.1 oz. per ton; lead and zinc, *nil*.

Prospecting was continued during the summer months on exposures of mineralized quartz at what is called the Rialto tunnel, situated about 1,000 feet north-westerly from the "A" tunnel. Here there is an outcrop of numerous narrow quartz stringers aggregating 25 feet in width which cut across the schistosity of the enclosing chlorite. The quartz is mineralized with pyrite which carries a small gold content. A grab-sample of a 5-ton dump of sorted pyrite-bearing quartz at the mouth of the Rialto tunnel assayed: Gold, 0.16 oz. per ton; silver, 0.4 oz. per ton.

Approximately 500 feet south-westerly from the "A" tunnel, and off the limits of the map, a new discovery of galena-zinc-bearing quartz was prospected during the summer of 1932. The quartz vein, in places heavily mineralized with sulphides, has been exposed for a length of 300 feet in widths varying from a few inches to as much as 4 to 5 feet. It cuts across the chlorite-schist, and where it enters the overlying bedded limestone the mineralization has a tendency to be wider and better defined than it is in the schists.

Great difficulty is experienced each year in getting supplies in to the property, and this winter use was made of aeroplane transportation from Golden to the mine, an air distance of 21 miles.

* Report by A. M. Richmond, Assistant Resident Mining Engineer, Victoria, B.C.



WINDERMERE MINING DIVISION.

No lode-mining activity was recorded in this Division during 1932 other than prospecting and assessment work.

FORT STEELE MINING DIVISION.

A valuable contribution to the economic geology of this important Division is the preliminary report by C. E. Cairnes, entitled "Some Mineral Occurrences and Possibilities in the Vicinity of Cranbrook." This report will be published in the Summary Report of the Geological Survey of Canada during the coming summer.

Another contribution to the economic possibilities of the Fort Steele Division is the preliminary report on the oil possibilities of the Flathead River district by G. S. Hume, of the Geological Survey of Canada. Through the courtesy of W. H. Collins, Director of the Geological Survey,

this report is printed in this Annual Report at the end of Fort Steele Division. Owing to the large number of road and trail applications and other miscellaneous duties, chiefly in the West Kootenay, the writer has not had the opportunity to engage in a detail study of mineral possibilities in specific areas, and the following report is restricted to a brief recital of the salient features of the 1932 activities.

Sullivan. This outstanding operation of the Consolidated Mining and Smelting Company at Kimberley was maintained on a very satisfactory basis, demonstrating the ability of this highly efficient organization to survive in the battle for existence among producers of lead and zinc. There was very little change in the operations at the mine and concentrator during the year under review. A total of 1,440,520 tons of ore was milled and 6,403 tons of crude lead ore was shipped to the Trail smelter; 165,994 tons of lead concentrates and 200,156 tons of zinc concentrates were produced. Total shipments of ore of all classes to the end of 1932 is roughly estimated at 15,155,013 tons. All drill-steel is now sharpened and tempered underground, for which two electric furnaces are in use. One-inch, hollow-round vanadium steel is being used in the stopes in place of the 1¼-inch hollow round. Another 10-ton Granby-type mine-car, capacity 156 cubic feet, was built and put in commission, with satisfactory results.

At the surface plant the ore-sorting extension in the rock-house was completed, which enables twelve more ore-sorters to be placed on the picking-belts when necessary. In the concentrator the only construction-work of importance was the erection of a 20-cell flotation-machine, taken from the Moyie mill, on the table floor. Progress of mining conditions and methods is very adequately described by H. E. Miard, Inspector, in the section of this Annual Report under "Inspection of Mines." At the end of the year work was resumed in the 3,901 winze driven to open up the ore-body below the 3,900-foot level. This important development feature, initiated in 1931, is described in the Annual Report for that year.

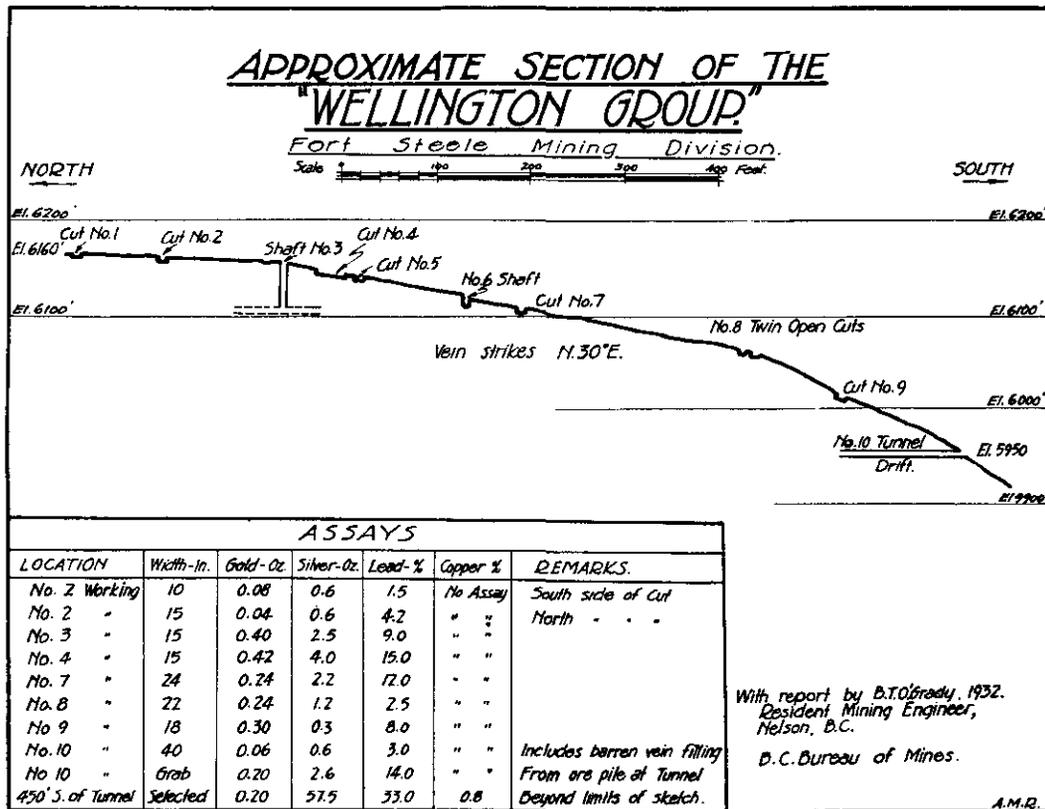
B. and V. At this prospect small-scale activities have been carried on intermittently since it was last referred to in the Annual Report for 1930. At the lowest workings the tunnel has been advanced 15 feet beyond the point where it connects with the bottom of the shaft. The No. 2 shaft, at about 4,500 feet elevation, has been started and was down 10 feet when last visited.

Belleville. This group of four claims, owned by J. Hamilton, of Cranbrook, is situated on Fish Lake creek, now accessible by road from Smith lake. No activity has occurred here recently, and the property, described by A. G. Langley in the Annual Report for 1926, was visited to bring information up to date. The lower tunnel-workings now aggregate about 700 feet of work. They develop scattered silver-lead-zinc mineralization in quartzite along the contact with a diorite sill (Aldridge formation). Pyrite, galena, sphalerite, and occasional chalcopyrite occur in spots chiefly associated with quartz stringers and crushed zones of decomposed material. A branch drift to the north-west, in quartzite, has just penetrated into quartz containing streaks of "carbonates." A sample across 30 inches of this partially exposed showing assayed: Gold, 0.44 oz. per ton; silver, 2.2 oz. per ton; no lead or zinc. Selected samples from other points assayed: Gold, trace; silver, 3 oz. per ton; lead, 11.5 per cent.; zinc, trace; and gold, trace; silver, 1.4 oz. per ton; lead, 3 per cent.; zinc, 2 per cent.; copper, 1.4 per cent. Further work might be done to advantage to prove the character and continuity of the first-mentioned sample giving the interesting gold assay.

Wellington. Owned by J. Angus, of Marysville, and situated on the East branch of Hell-roaring creek, about 7 miles by trail from the road near St. Mary lake, this property was formerly known as the *Mascot* group, being described under that name in the Annual Report for 1915. The area in which the claims are located is underlain by argillaceous quartzites of the Creston formation as shown on Map 147A accompanying Memoir 76, "Geology of Cranbrook Map-area," by S. J. Schofield, which contains a reference to the group under *Mascot* and *Eclipse*. The vein, very sharply defined, apparently follows a strong fault fissure-zone conforming more or less closely with the schistosity of the enclosing quartzites rather than with their stratification, the strike of which approximates N. 30° E., with the dip varying from 65° to 80° to the east. On the hillside about 200 feet below the vein-outcroppings the sediments are intruded by a stock of porphyritic granite as shown on the above-mentioned geological map. The gangue is quartz and the associated minerals noted include galena, pyrite, and occasional chalcopyrite. In places the vein is decomposed and stained from decomposition

of the sulphides, but in general the deposits are not affected to any appreciable extent by oxidation.

Values are apparently entirely confined to the quartz pay-streak which favours the hanging-wall side of the vein. On the foot-wall side of this pay-streak there is usually present a width of several feet of rusty, schisted, and crushed material. This was sampled at several points with negative results. The superficial workings shown on the accompanying illustration cover a length of about 1,000 feet of outcrop ranging from 5,950 to 6,160 feet in elevation (aneroid readings). Southerly from the tunnel, and beyond the section reproduced, three open-cuts and a large surface excavation trace the continuity of the vein for an additional length of about 500 feet over a vertical range approximating 200 feet.



Work done by the owner since the 1915 Annual Report by J. D. Galloway includes the drift-tunnel, 127 feet long, and additional surface excavations. The samples taken by the writer and those quoted in the 1915 Annual Report make it evident that the vein is well mineralized in the 700-foot stretch between the shaft and the drift. The sample taken by the writer in the face of the last-mentioned working included some waste which reduced the assay, but the 22-inch pay-streak at this point looks much the same as at other points to the north, where samples show fair values. The shaft-workings were not accessible at the time of the writer's visit. Other concentrations of mineralization no doubt occur on the claims.

Summarizing conditions, the vein is very persistent in lateral extent and general conditions are favourable for mining. Systematic prospecting of the deposits, laterally and in depth, might well disclose larger widths of similar mineralization on the property. The ore-minerals could apparently be easily concentrated.

At this group of six claims, 4 miles by trail from the end of the Findlay Creek road at Jeffrey's ranch, prospecting-work was continued by the Blake Bros., of Fort Steele. Since the reference to this property by A. G. Langley in the Annual Report for 1928, the winze in the upper tunnel (elevation 6,250 feet) has been advanced

Lead.

a short distance and another crosscut tunnel, 85 feet long, driven below it at 6,430 feet elevation. These workings develop a series of widely separated seams and stringers, containing iron, lead, and zinc sulphides, in a granite sill intercalated between metamorphosed sediments. The mineralized fractures strike north and dip from 10° to 12° to the west, apparently coinciding with the attitude of the sill. Similar veinlets, up to 12 inches wide, are exposed in the adjacent precipitous bluffs. Typical selected material assayed: Gold, 0.04 oz. per ton; silver, 7 oz. per ton; lead, 10 per cent.; zinc, 4 per cent. About 150 feet north-easterly from the portal of the lower tunnel a shallow excavation along the foot-wall contact of the sill partially exposes some mineralization, apparently associated with argillaceous quartzite, consisting of quartz with galena and oxidized crushed material. The accessible portion of this material, 10 inches wide, assayed: Gold, 0.06 oz. per ton; silver, 8 oz. per ton; lead, 11 per cent.; zinc, 2 per cent. The showings in the granitic rock are not of much interest in themselves, but their presence suggests the existence of mineralization in the underlying sediments worthy of investigation. In this connection the showing at the base of the sill, possibly part of a larger width of mineralization, warrants further work to prove its character and continuity.

WATERTON LAKES-FLATHEAD VALLEY AREA, ALBERTA AND BRITISH COLUMBIA.*

By G. S. HUME, GEOLOGICAL SURVEY OF CANADA.

INTRODUCTION.

In south-western Alberta and south-eastern British Columbia is an area mainly of pre-Cambrian strata (Fig. 1) extending from east of Waterton lake to the Flathead valley and from the International boundary northward for 25 miles to North Kootenay pass, 13 miles south of Corbin. The south-east part of this area, extending west to the Interprovincial boundary along the Rocky Mountain summit and for 12 miles north of the International boundary, lies within Waterton Lakes Park. This area is noted for its scenic beauty and has long been of interest to the geologist because of the structure of the mountain-front and the unusual association of oil-seepages with rocks of pre-Cambrian age. Seepages of oil and gas are known from several localities and were visited and described by Selwyn† in 1891, following some prospecting activity that resulted from their discovery. At that time Selwyn, following Dawson's‡ reports of 1875 and 1885, regarded the oil-seepages as occurring in Cambrian rocks. In 1902 Willis.§ studying Lewis and Livingstone ranges in Montana, discovered the great Lewis overthrust-fault where strata of late pre-Cambrian age are overthrust into Cretaceous rocks. The late pre-Cambrian of the Lewis and Livingstone ranges was correlated by Willis with Dawson's section, and this correlation was definitely established by Daly|| in 1912, who ascribed all the pre-Cambrian rocks to the Lewis series.

Scope of Work and Acknowledgments.—For some years intermittent drilling has been done in Sage Creek area on the east side of Flathead River valley. In one well, in which drilling was being continued in 1932, a depth of 3,260 feet had been reached and shows of oil and gas had been reported from what were believed to be pre-Cambrian strata. These interesting results had given rise to repeated requests to the Geological Survey for information on this area, and accordingly the writer was instructed to devote part of the field season of 1932 to an examination of the stratigraphy and structure with a view to determining the prospects for oil and gas, if any. A reconnaissance study of six weeks spent in the area between Waterton lakes and Flathead valley, with detailed work in the Sage Creek area, proved inadequate for the solution of all the geological problems encountered, but considerable data were collected which it is hoped may prove advantageous in further exploration.

The writer wishes to acknowledge his appreciation of the kindness and help given him by Mr. Herbert Knight, superintendent, and the various officials of Waterton Lakes Park. Thanks are also due Mr. John Gloyn, of Pincher Creek, who put at the writer's disposal his extensive knowledge of the area and pointed out to him the various seepages on Cameron and Lineham brooks. In Flathead valley Mr. James Fisher gave much valuable assistance and the various

* Published by permission of the Director of the Geological Survey of Canada.

† Selwyn, A. R. C.: Geol. Surv., Canada, Ann. Rept., Vol. V., Pt. 1, p. 9A (1890-91).

‡ Dawson, G. M.: British Boundary Comm. Rept., pp. 67, 68 (1875). Geol. Surv., Canada, Ann. Rept., Vol. 1, p. 39B (1885).

§ Willis, Bailey: Geol. Soc. Amer. Bull., Vol. 13, pp. 305-352 (1902).

|| Daly, R. A.: Geol. Surv., Canada, Mem. 38 (1912).

officials of the Crownsnest-Glacier Oil Company put all information regarding drilling at the writer's disposal and, as well, provided every possible means for the prosecution of the work in hand.

The writer also wishes to acknowledge his indebtedness to his assistants, C. O. Hage, C. E. Michener, and S. Tabacchi, whose co-operation at all times was much appreciated and whose industry added greatly to the knowledge acquired.

ACCESSIBILITY OF AREA.

Waterton lakes may be reached by good gravel roads from McLeod, Cardston, or Pincher Creek. Within the park, the Parks Branch has constructed good roads up Blakiston (Pass) creek and up Cameron brook to Cameron (Summit) lake on the International boundary, 9 miles south and west of the town of Waterton. A narrow but fair road leaves the Cameron Brook road about half a mile north of Cameron lake and crosses the Rocky Mountain divide through Akamina pass. It can be followed to the Akamina Valley Oil Company's property 6½ miles

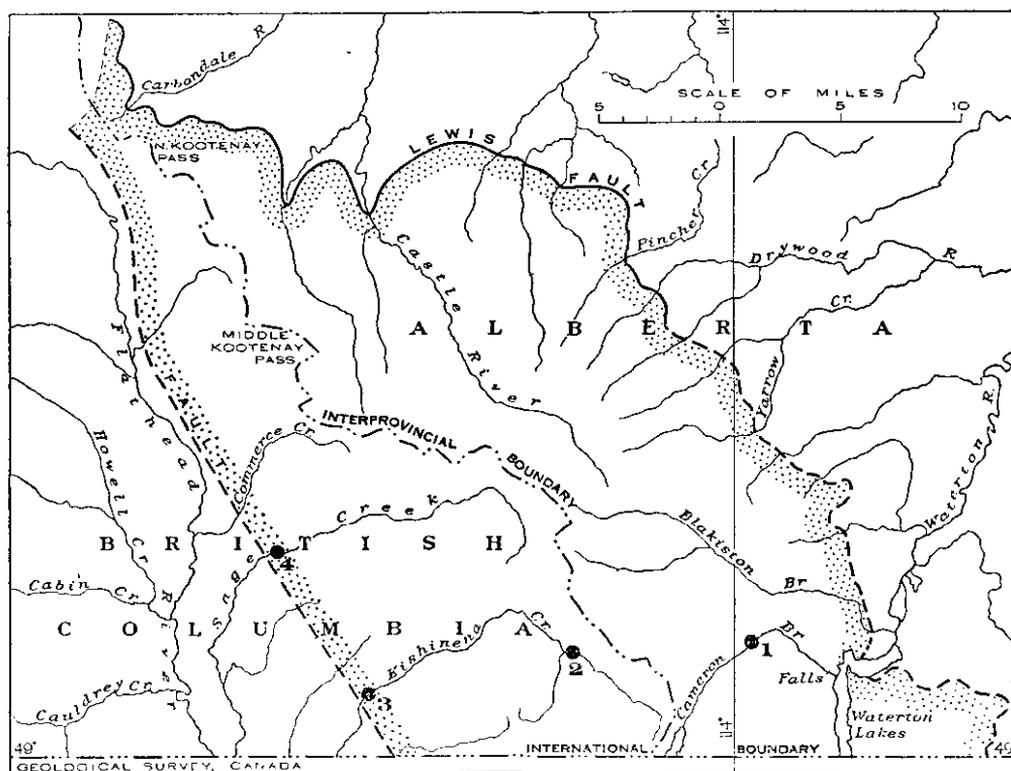


Fig. 1. Waterton Lakes-Flathead Valley area, showing outline of area of Pre-Cambrian strata. 1, Cameron Brook petroleum seepages at "Oil City"; 2, Akamina Valley Oil Company; 3, Kishinena dome; and 4, Sage Creek dome.

north-west of the Interprovincial boundary. From the Akamina Valley Oil Company's property a pack-trail can be followed westward along Kishinena creek to the Flathead river in Montana. About a mile north-east of the point where this trail crosses the International boundary another trail leads north-westward out of Kishinena valley and across Elder and Fisher creeks to Sage creek. Originally a trail led up Sage creek and across the divide to the headwaters of Blakiston (Pass) creek. This trail is now only passable for a pack-train for 4 miles above the well-sites on Sage creek. There is a good automobile-road from Montana up Flathead valley to the Sage Creek well locations, but this area is inaccessible from any point in Canada except by pack-train. From Sage creek a pack-trail leads across the Flathead valley to the old Corbin wagon-road. This road is now only passable by pack-train as far as a ford on Flathead river south of the

Flathead townsite, or about 14 miles south of Corbin. A poor automobile-road leads southward from Corbin to the Flathead townsite.

From Flathead townsite a good trail goes east over North Kootenay pass to the headwaters of Carbondale creek and down this stream 11 miles to the forest ranger's station, where it joins a fair automobile-road that leads out to the main highways. The trail on the west side of North Kootenay pass is fairly steep and the pass has an elevation of 6,774 feet. The middle Kootenay pass is said to be impassable, due to fallen timber. It can be approached fairly closely, however, from the east side up the West fork of Castle river. The trail from Beaver Mines up the main branch of Castle river and down Blakiston (Pass) creek is in good condition and was the trail followed in taking the party's pack-train to Waterton.

PHYSICAL FEATURES.

The mountains in southern Alberta that comprise the Clarke range are sharply separated from the eastward-flanking plains, above which they rise abruptly several thousand feet. The town of Waterton on upper Waterton lake is in a sharp angle of the mountain-front, where the trend of the mountains changes from westerly to northerly and the lake southward from the narrows at the town lies in a deeply incised trench within the mountains. North of the narrows, however, the lake turns easterly and lies on the plains in front of the east-west-trending mountains. From Waterton lakes northward many eastward-flowing streams have cut deep valleys through the mountains and divide them into massive, steep-sided peaks and ridges. Within the mountains are many picturesque cirque lakes and the topography is rugged, with the mountains rising 2,000 to more than 3,000 feet above the valley-bottoms. The tops of the mountains are as a rule above timber-line, although the flanks are well timbered with fir, spruce, larch, etc.

The western edge of the Clarke range at Flathead valley is almost as abrupt as the eastern edge at the plains, the mountain-slopes descending sharply to a broad flat, through which runs the North fork of Flathead river. Much of the flat is covered by boulder, gravel, and sand deposits, underlying which are gently tilted Tertiary deposits that were laid down in a lake in the valley, and hence are much younger than the structural features to which the valley owes its origin.

STRATIGRAPHY.

The following succession of formations occurs within the Waterton Lakes-Flathead area:--

Recent.		
Tertiary.	Eocene (?).	Kishinena formation.
Mesozoic.	Cretaceous.	
	Jurassic.	
Palæozoic.	Pennsylvanian.	
	Mississippian.	
	Devonian.	
	Ordovician (?).	
	Cambrian.	
Pre-Cambrian.	Lewis series.	Kintla formation.
		Sheppard formation.
		Purcell lava.
		Siyeh formation.
		Grinnell formation.
		Appokunny formation.
		Altyn formation.
		Waterton formation.

The Clarke range is composed mostly of pre-Cambrian rocks warped into a broad synclinal basin, in the central part of which are Cambrian and younger Palæozoic rocks. Palæozoic, Mesozoic, and Tertiary strata occur in the Flathead valley west of the Clarke range, and Mesozoic and possibly Palæozoic strata underlie the pre-Cambrian rocks of the Clarke range as a result of thrust-faulting on a tremendous scale. The pre-Cambrian area has a maximum width of 24 miles along the International boundary. Its eastern and northern limit is the outcrop of the plane of the great Lewis fault, but 25 miles north of the boundary, just beyond

North Kootenay pass, the area narrows to a point and the pre-Cambrian beds disappear under younger rocks.

The stratigraphy along the International boundary has been described in detail by Daly* and will be only briefly outlined here.

Waterton Formation.—This formation, exposed, according to Daly, at Cameron falls, on Cameron brook near its mouth, consists of thin-bedded dolomite and argillite of grey-brown and purple colour. Its total thickness is unknown. A well drilled near Cameron falls penetrated the Lewis thrust underlying the Waterton at 1,233 feet.† The dip of the beds near the well is about 55°, but the general dip in this area is only 15° to 30°. It is probable, therefore, that the total stratigraphic thickness drilled was not more than 1,000 feet. Daly reports 200 feet of Waterton dolomite exposed at Cameron falls and vicinity. It is probable, therefore, that at Cameron falls the greatest thickness of the formation to the Lewis thrust is about 1,200 feet.

Altyn Formation.—This formation consists of white or light-grey magnesium limestone, quartzite, and argillite. Daly gives the thickness as 3,500 feet. This is approximately the thickness of the exposed beds, but it is believed these are repeated somewhat by faulting. The thickness, however, is very great.

Appekunny Formation.—The contact between the Altyn and Appekunny formations is well defined, the top bed of the Altyn containing cryptozoans in some abundance. The base of the Appekunny consists of yellow-weathering argillaceous sandstones and limestones passing upward into a very hard and thick gritty limestone, the quartz grains on the weathered surface giving the rock almost the appearance of a fine conglomerate. Above the limestone are white quartzite-bands as much as 30 feet thick alternating with argillite and limestones. Above these beds there are about 1,100 feet of grey argillites with one prominent zone of red argillites. The total thickness as measured on Ruby ridge is 2,020 feet. In the Sage Creek area the thickness is more than 3,000 feet. In this area the white quartzite-beds are particularly prominent, but no prominent series of red argillite-beds were observed below the Grinnell formation.

Grinnell Formation.—The Grinnell formation consists of red argillites with white and red quartzite-bands near the top and bottom of the formation. The thickness as measured on Ruby ridge is 1,025 feet.

Siyeh Formation.—The Siyeh formation consists mainly of yellowish-weathering, somewhat argillaceous limestones with some quartzites and argillites. In the Waterton Lakes area the thickness is estimated to be about 3,200 feet, although Daly gives a thickness of 4,000 feet along the International boundary. This thinning was also noticed in other formations and seems to become much more pronounced northward, the total observed thickness in the North Kootenay Pass area being much less than farther south. The Siyeh formation contains a prominent diorite sill about 25 feet thick on the face of Mount Lineham, but only 9 feet thick in the North Kootenay Pass area. Towards the base the formation carries a limestone member, 40 to 50 feet thick, composed wholly of cryptozoans. The Siyeh is a very prominent cliff-forming member and its yellowish colour on weathering is in striking contrast to the red of the underlying Grinnell and the black of the overlying Purcell lava.

Purcell Lava.—Overlying the Siyeh is the Purcell lava, a dark-greenish or purplish amygdaloidal basalt with an estimated thickness of 200 to 300 feet. The lava appears to be conformable on the Siyeh formation and seems to thicken to the northward rather than thin like the sediments.

Sheppard Formation.—The Sheppard formation is composed of yellowish-weathering siliceous limestone, quartzites, and argillites. In certain areas it contains a relatively thin lava-flow, below which are thin-bedded red argillites and sandstones. In other areas both the red sediments and the lava-flow are absent. The total thickness is 400 to 600 feet, thinning to less than 100 feet in the North Kootenay Pass area, where heavy reddish quartzites occur near the base of the formation.

Kintla Formation.—The Kintla formation can readily be divided into four divisions, which in order of age, from youngest to oldest, are as follows: (4.) Grey argillites with small amounts of red argillites and containing at least three porphyrite sills. The thickness is not less than 2,000 feet and may be as much as 2,500 feet in some areas. The thickness is dependent on the

* Daly, R. A.: Geol. Surv., Canada, Mem. 38, Pt. 1 (1912).

† Johnston, W. A.: Geol. Surv., Canada, Sum. Rept., 1931, Pt. B, p. 75.

amount of erosion, as the top of this formation is everywhere an erosional unconformity. In the North Kootenay Pass area this member is lacking. (3.) Red quartzites breaking into very massive blocks. The thickness is about 400 feet. (2.) Grey and greenish argillites, 150 feet thick. (1.) Red argillites and quartzites 1,200 feet thick. Evidently this lower member was the only one observed by Daly along the International boundary, where it forms the tops of many of the ridges and hills and is very conspicuous on account of its deep-red colour.

Cambrian.—Above the Kintla formation and in erosional unconformity with it are thin, coarse-grained quartz sandstones or quartzites of white or pink colour and probably Cambrian in age, although no fossils were found in them. In the area north of the Akamina Valley Oil Company's property on Akamina brook, 17 miles west of Waterton lake, these sandstones rest on the upper member of the Kintla formation, but elsewhere they rest on the next lower member, the Kintla red quartzites. The thickness of the sandstone is not definitely known, but is thought to be between 50 and 100 feet. Above the sandstone are shales of red, green, and grey colours and these contain abundant trilobite remains at certain horizons. The thickness of these beds is not known, as the upper contact with overlying limestones was not seen. In one area only a few hundred feet were present, but in another area a much greater thickness was suspected. It is possible that there is another erosional unconformity above these beds, although this has not been definitely demonstrated.

Silurian.—Above the Cambrian shales in the area north of the Akamina Valley Oil Company's property is a series of hard and gritty, massive limestones. In this area about 600 feet of these beds form a massive mountain in the centre of the Waterton Lakes-Flathead Basin structure and farther north it seemed as if a much greater thickness occurred. The limestones contain many poor corals, and although these are difficult of definite determination they indicate a Silurian age. None of these beds was proven to be present in the vicinity of North Kootenay pass, as the lowest beds of the limestone-shale series above the Cambrian yielded Devonian fossils. No Ordovician fossils were seen and it is possible that there is a large erosional break at the top of the Cambrian, as these beds seemed much thicker in some areas than in others. Such an erosional interval would account for the complete absence of the Ordovician with Silurian limestones overlying the Cambrian shales in the Waterton Lakes-Flathead synclinal basin.

STRUCTURE.

The rocks exposed in Clarke range between Waterton lakes and Flathead valley are mostly pre-Cambrian, but have been thrust over much younger strata of Mesozoic and Palaeozoic ages. The fault, known as the Lewis thrust, was described by Willis* from Montana, where it has a north-west trend and a south-west dip of 3° to $7\frac{1}{4}^{\circ}$. On Chief mountain in Montana, near the International boundary, according to Willis the fault has an elevation of between 7,000 and 8,000 feet. In the vicinity of Waterton lakes (elevation 4,202 feet) the fault-plane is completely concealed under outwash and drift material in front of the mountains. A well drilled several years ago near Cameron falls in what is now the town of Waterton penetrated the fault at an elevation of slightly more than 3,000 feet, or 1,233 feet below the surface (elevation of well 4,239 feet). In the vicinity of Waterton lakes the elevation of the fault-plane where it comes to the bed-rock surface beneath the drift cannot exceed the level of the lakes; i.e., 4,200 feet. As the fault-plane apparently dips west, the difference in elevation of 2,800 to 3,800 feet of the fault-plane at Chief mountain and at Waterton lakes may be due to the fact that there is a deep re-entrant of the mountain-front at Waterton, but there is also a possibility that the fault-plane is warped, as has been stated by Willis,† who pointed out that the change in strike and dip of the Lewis thrust in Montana indicated a warped surface for the fault-plane. No study was made by the writer of the Lewis thrust along the mountain-front in Canada, except in the vicinity of North Kootenay pass, 40 miles north-west of Waterton. Here another sharp local change in the trend of the mountain-front occurs. North of the pass, on North Kootenay mountain, the Lewis fault-plane has a maximum elevation of more than 6,900 feet, a westerly dip of 21° , and a strike of N. 20° W. in conformity with the trend of the mountains. Three miles to the south-east on Mount McCarty the trend of the mountain-front is east and west and the Lewis fault-plane, with a maximum elevation of 6,480 feet, shows a strike of S. 80° W.

* Willis, Bailey: Geol. Soc. Amer., Bull. 13, p. 330 (1902).

† Willis, Bailey: Geol. Soc. Amer., Vol. 13, p. 332 (1902).

and a southerly dip of 13° to 14° . This change in strike of 80° , with accompanying changes in direction of dip, suggests, as in Montana, warping of the fault-plane subsequent to faulting.

Direct evidence of folding subsequent to faulting can be seen on Mount Crandell at Waterton (see Fig. 2). Here the top of the upper part of the mountain is cut by a thrust-fault whose outcrop trace encircles the mountain and can be seen to be folded with the strata. The fault is most easily traced from the north-east face of the mountain to the west face above Crandell lake. In part of this distance Appekunny grey argillites are overthrust on to a relatively thin slice of red argillites and quartzites of the Grinnell formation, and in many places the fault-plane can be observed and its strike and dip measured. On the west face of the mountain the outcrop of the fault is well above the level of Crandell lake (Fig. 2), and the fault can be seen again on the east face of Ruby mountain to the west of Mount Crandell, the intervening area showing Altyn limestones below the plane of the fault. Similarly, the fault on the south-west and south side of Mount Crandell can be again observed on Cameron mountain across the valley of Cameron brook and south-east of the narrows at the south end of upper Waterton lake on Sheep mountain,

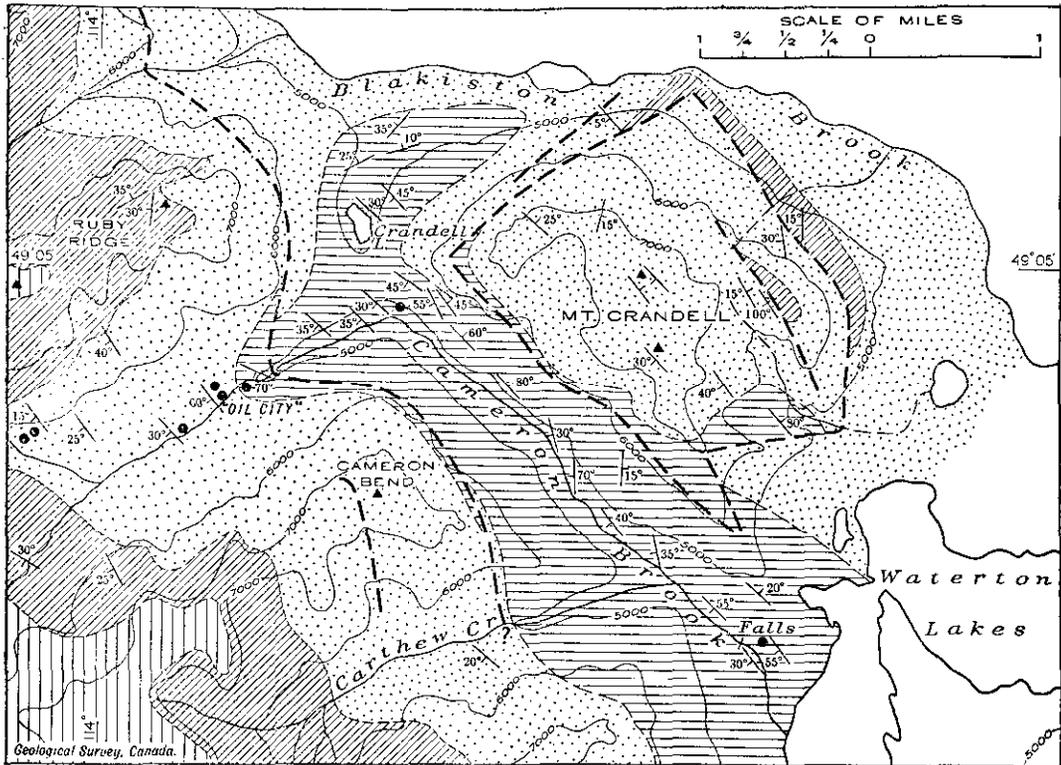


Fig. 2. Sketch map of Mount Crandell and vicinity. Siyeh formation shown by vertical ruling; Grinnell formation by diagonal ruling; Appekunny formation by stipple pattern; and Altyn and Waterton formations by horizontal ruling. Bore-holes shown by solid circle, and faults by heavy pecked line.

where Appekunny strata are overthrust on to a relatively thin band of red Grinnell sediments that wedge out westward. This wedge is quite obviously the same as that which occurs on the north-east and north faces of Mount Crandell and which shows a wedging-out on the east face of this mountain. The structure on the east face of Mount Crandell appears at first sight to be highly complicated. This is due to the fact that the fault itself is folded, but when the fault is traced the major structure can be seen to be relatively simple.

This evidence of folding subsequent to faulting presented by the fault just described and the evidence given by the Lewis thrust itself is highly suggestive of folding of this major fault, which, if true, is of great importance in regard to the prospects for oil and gas in the area under consideration.

West of the mountain-front, where the faults above described occur, there is very little faulting in the Lewis series, which forms most of the Clarke range. The regional structure between Waterton lakes and Flathead valley is a broad syncline the axis of which in British Columbia is nearly parallel to Akamina brook, a tributary of Kishinena creek from the south-east. This syncline crosses Cameron brook at the north-east end of Cameron lake on the International boundary 6 miles west of Waterton, trends north-westerly for several miles, beyond which it appears to turn more northerly. It plunges to the north and west and north-west of the Akamina Valley Oil Company's wells, 17 miles from Waterton, is occupied by Cambrian and later Palaeozoic limestones that rest on an eroded surface of the upper beds of the Lewis series. The west limb of the syncline is occupied by beds dipping 25° to 30° north-east, and the whole sequence from the top of the Kintla to the lower part of the Appekunny is exposed between the syncline and Flathead valley. Along the east side of Flathead valley the Lewis series is faulted against younger strata, but the nature of this fault has not been absolutely determined. Daly* and Mackenzie† both thought it was a normal fault with downthrow to the west. Link‡ in a more recent paper pointed out the possibility of underthrusting, and from regional information this explanation seems to the present writer to be much more logical. Such an explanation, however, does not fit all the facts observed by the writer during the reconnaissance trip of 1932. For the most part the fault is obscured by outwash or glacial materials and by Tertiary beds deposited subsequent to faulting. This is particularly the case from Sage creek south to the International boundary. A short distance north of Sage creek, on Commerce creek, Devonian§ limestones dipping easterly at 45° were observed in a long narrow ridge only a short distance west of the outcrops of the Lewis series. Nowhere, however, was the position at the fault closely located except directly south of North Kootenay pass, but owing to difficulty of travel the whole of the intervening area was not traversed. South of the North Kootenay pass, on a north-east-facing mountain, Siyeh beds dipping 25° north-westerly occur. About 50 feet in elevation above the highest outcrop of these beds Palaeozoic limestone thought to be of Mississippian age occur, also dipping 25° in the same direction. Within a short distance southwards the Palaeozoic limestones display the same relation to the Grinnell and possibly the Appekunny formations. This contact of the Palaeozoic limestones with the apparently underlying pre-Cambrian cannot mark an erosional unconformity and overlap of the Palaeozoic, because only 2 miles north the complete succession of the pre-Cambrian, Cambrian, and younger Palaeozoic formations is exposed. The only possible explanation seems to be that the Palaeozoic strata have been thrust from the west over the beds of the Lewis series. The writer could arrive at no satisfactory explanation of this peculiar anomaly of younger beds thrust over older, and consequently, instead of solving the problem of faulting, has only found facts that make it more confusing. It has always seemed remarkable that normal faulting which results from tension should occur in an area where thrust-faulting is predominant, and it does not seem logical, therefore, to expect normal faulting on any large scale in the Flathead valley. Mackenzie, however, believed the evidence on the west side of the Flathead valley indicated normal faulting, and this problem was investigated by the writer on Caudrey creek (*see map, Geol. Surv., Canada, No. 182A, accompanying Memoir 87*). West of the outcrops of Tertiary on Caudrey creek occur a series of brown sandstones and limestones underlying undoubted Mississippian rocks. Mackenzie, therefore, mapped these beds as Devono-Carboniferous and drew a normal fault between them and a large area of Mesozoic rocks occurring to the north of them. A careful search for fossils, however, revealed the fact that these so-called Devono-Carboniferous beds in reality are Jurassic and the sediments are strikingly similar to the Fernie as exposed elsewhere. It is therefore quite apparent that the Mississippian beds on Caudrey brook are overthrust on to the Fernie, and such preliminary investigations as were made by the writer lead to the deduction that the Mesozoic strata occur in an embayment of the fault-front from which the overthrust Palaeozoic rocks have been removed by erosion. This, then, eliminates the possibility of normal faulting on the west side of the Flathead valley and no evidence was found to support the contention that normal faulting is present on the east side.

* Daly, R. A.: Geol. Surv., Canada, Mem. 38, p. 90 (1912).

† Mackenzie, J. D.: Geol. Surv., Canada, Mem. 87, p. 1 (1916).

See also Royal Soc. Canada, Vol. 16, Pt. IV., p. 108 (1922).

‡ Link, T. A.: Amer. Assoc. Pet. Geol., Vol. 16, No. 8, p. 786 (1932).

§ The age is based on fossil determination by E. M. Kindle.

As already pointed out, there is a sharp descent from the mountains of the Clarke range to the Flathead valley. This abrupt change is accompanied by a reversal of the direction of dip of the strata from east to west, giving anticlinal forms within the Lewis series along the mountain-front. This anticlinal arrangement is, however, quite strongly modified by east-west cross-folds which throw the strata into a series of domes. Three of these domes were observed—namely, on Kishinena creek, on the headwaters of Fisher and Elder creeks, and on Sage creek, where drilling is being done. Others are reported to be present, as on Starvation creek* south of Kishinena creek, and no doubt a thorough examination would reveal several more along the mountain-front. In each of the three observed domes the Appekunny formation forms the lowest beds exposed, but the Kishinena and Sage Creek domes are eroded about 2,000 feet deeper than the Fisher-Elder Creek dome. The Fisher-Elder Creek dome lies midway between the Kishinena and Sage Creek domes and is slightly east of a line joining the other two. It is thus higher up the flank of the mountain range, thereby accounting for the fact that the strata exposed in it are not so low stratigraphically as in parts of the others where valleys in each case have been eroded through the domes.

It has already been stated that the character of the fault along the east side of Flathead valley is unknown. Since oil-seepages escape through the pre-Cambrian, in which it is highly improbable that oil could originate, it seems necessary to postulate an origin in younger rocks underlying the pre-Cambrian strata and in faulted contact with them. It is unknown whether this fault is the westward extension of the Lewis thrust or an east-dipping fault along the east side of Flathead valley as suggested by Link. If it is the Lewis thrust, then the Flathead valley would be a window through the fault, as has been suggested.† The known facts, however, do not seem to fit such a theory, nor, on the other hand, are they altogether in harmony with the east-dipping or underthrust fault as suggested by Link. In the present state of our knowledge, therefore, it seems impossible to go further than to state that a fault probably underlies the pre-Cambrian in Sage and Kishinena Creek areas and that the oil as found in the seepages comes from below this fault.

In the vicinity of North Kootenay pass the Lewis thrust was observed in several places and in each it was associated with the coal series of the Kootenay formation. This is similar to the conditions found in the foot-hills north of Highwood river, where all known low-angle faults of large displacement are associated with coal-beds. Not only are these coal-beds less competent than the enclosing sediments, and hence readily broken by faulting, but the coal seems to act as a lubricant in large displacements of this character. The reasons for this are perhaps obvious when it is remembered that coal and graphite are essentially similar in composition and that graphite is a splendid lubricant for certain types of mechanical uses. Where the Lewis thrust-plane was observed the coal had been ground into a gouge a foot or more thick lying directly under the hard beds of the Lewis series and in contact with them. In a few places the Kootenay beds were lying above the basal Blairmore conglomerate, over which they may have been thrust. The conglomerate in turn was overlying other Blairmore beds, and it is considered that in certain places the relationships were due to slicing, whereas in others the beds were overturned. In other places huge masses of Palæozoic limestone occurred surrounded by Kootenay coal-bearing beds and directly below the strata of the Lewis series. An individual mass of Palæozoic limestone of this kind seen on Mount McCarty was at least 100 feet long and 50 feet thick, and it was suspected that much larger masses occurred, but it could not be proved that they belonged to one block because exposures were not continuous. These masses of Palæozoic rocks undoubtedly have been dragged along the fault, and hence presumably there are areas where the fault-plane must cut the Palæozoic limestones from which these masses have been torn. The assumption is, therefore, that both Mesozoic and Palæozoic rocks occur in contact with the Lewis series in various places under the Lewis thrust. Since similar Mesozoic and Palæozoic rocks are believed to be capable of generating oil, and oil and gas have been produced from them in various places in Alberta, it seems probable that rocks of the same type underlie the Sage Creek and Kishinena Creek areas, and that the oil has been generated and accumulated in them and is escaping from the reservoir rocks in them through fracture-zones in the overlying pre-Cambrian strata.

* Daly, R. A.: Geol. Surv., Canada, Mem. 38, p. 90 (1912).

† Kirkham, V.: Private report for an oil company.

OIL-SEEPAGES AND OIL AND GAS PROSPECTS.

Cameron Brook Area.—Seepages of oil on Cameron brook, 5 miles west of Waterton lake, were visited by Selwyn in 1891. These seepages are still to be seen, although since Selwyn's visit they have been somewhat changed by pits dug to collect the oil. The seepages seen by the writer are at "Oil City," east of the location of the present Oil City Royalties No. 1 (Patrick Oils, Limited) well and the small derrick said to be the site of the Original Discovery oil-well. By digging in the gravel at several places along the edge of Cameron brook and throwing the gravel into the water, an iridescent film of oil can be seen and a strong odour of oil can be detected. Also small pits will collect a thin scum of oil in a short time, and a large pit several feet deep dug on the south side of the brook and some distance from it contained at the time of the writer's visit a few gallons of water with a considerable amount of heavy black viscous oil. This pit is said to represent a genuine seepage, although its character might lead a sceptical observer to have some misgivings. There is no doubt, however, that genuine oil-seepages occur at this place, and in the early days considerable quantities of oil are said to have been collected by a man named Aldridge by digging trenches and skimming the oil off the water at the level of the brook. The so-called Original Discovery well drilled in 1902, and claimed to be the first well drilled for oil in Alberta, still has a small derrick over it. This well is reported to contain considerable quantities of drilling and fishing equipment and has defied all efforts to clean it out. Government records contain an affidavit by John Lineham, at that time president of the Rocky Mountain Development Company, the company that drilled the well, to the effect that the well produced 8,000 gallons (about 230 barrels) of crude oil, of which 700 gallons were sold. At the time of the writer's visit only a very thin film of oil was present on the water filling the casing to within a few feet of the surface. Another well between one-fourth and one-half mile west, however, shows quite a thick scum of oil on the surface of the water filling the casing.

Other seepages were seen on Lineham brook a short distance north-west of the Cameron Lake road. Here in a canyon in hard, dense Appekunny argillites a small amount of oil with water is seeping from the rocks along bedding-planes and cracks, and is dripping slowly into the water of the creek, where the oil quickly forms an iridescent film. The odour of petrolcum is quite evident even before the seepages are seen.

The seepages near "Oil City" on Cameron brook (*see* Fig. 2) can be quite definitely related to structure. East of the Original Discovery well location is a fault, the plane of which is almost parallel to the bedding-plane of the strata. Nearer the well the strata are quite highly tilted, suggesting minor faulting, and it is believed the oil which forms the seepages at this place is migrating along the fracture-zones of these faults and so escaping to the surface. The angle of dip of the fault-plane is not absolutely known, but it is thought the Original Discovery well penetrated the fault-zone at about the horizon where oil was encountered—namely, at 1,020 feet. The chances of obtaining any steady or commercial flow from such a fracture-zone do not seem very good, although, no doubt, a few barrels of oil might be obtained as happened in the case of the Original Discovery well. At a considerable distance north and east of this location is the Cameron Brook anticline, but as far as could be learned no seepages occur near the crest of the anticline, which roughly parallels Cameron brook for about 4 miles from the falls at Waterton lake north-east to the bend in the brook a short distance east of "Oil City." The seepages are, as stated above, a considerable distance down the south-west flank of this anticline, but the migration of the oil up the fracture-zones of the faults towards the anticlinal axis is quite in harmony with the anticlinal theory of oil-concentration. A number of shallow wells have been drilled in the Waterton-Cameron Brook area, but only one near Cameron falls made a test of the oil prospects. This well, at a depth of 1,233 feet, penetrated the Lewis thrust and below it passed into Mesozoic strata. There are conflicting reports as to whether this well contained any oil, but if oil was present it was in very small quantities. The site of the well is now covered by a house, but the stand-pipe of an old water-well adjoining the oil-well is still to be seen.

The prospects of obtaining oil in any quantity either on the Cameron Brook anticline or on its western flank at "Oil City" are dependent on two factors—namely, (1) the presence of suitable porous horizons to act as reservoir rocks and (2) favourable structure to cause a concentration of any oil present. It is inconceivable that the Lewis series could have acted as source rocks for oil and gas since these rocks are too highly metamorphosed. Hence it is believed the origin of the oil is in the Mesozoic strata underlying the Lewis thrust, and any

concentration of this oil in these Mesozoic strata is dependent on the Cameron Brook anticline extending downward across the fault into them, since the pre-Cambrian strata are too dense and hard to act as reservoir rocks except where they are excessively shattered by faulting. Any oil in the shattered pre-Cambrian rocks, however, would seem to have been derived from a concentration below the fault-plane or in a favourable anticlinal structure in the Mesozoic rocks under the Cameron Brook anticline. Such a condition assumes that the Lewis thrust has been folded subsequent to faulting, and, as has already been pointed out, there is evidence to support such an hypothesis. Prospects of obtaining oil in commercial quantities, therefore, are dependent either on finding highly shattered zones in the pre-Cambrian where a sufficient porosity has been developed by fracturing, or by drilling through the pre-Cambrian into the anticlinal structure of the Mesozoic rocks where there is a possibility of the presence of porous reservoir rocks. No predictions can be made as to the exact age of the strata likely to be encountered under the Lewis thrust at this place other than the probability that they will be Mesozoic. In a well at Cameron falls where the Lewis thrust was penetrated the strata are thought to belong to the Crowsnest volcanics, and these beds in themselves would not be expected to be very porous except in so far as they contain fracture-zones. Thus, though there appears to be a possibility that below the Lewis thrust where it passes beneath the Cameron Brook anticline the strata may also lie in an anticline and in the vicinity of the thrust be so broken as to be a potential reservoir for oil, no direct evidence that this is so exists, and although the seepages of oil at "Oil City" indicate that a certain amount of oil is present, there is no proof that commercial quantities are present.

At "Oil City," where drilling is proposed by Oil City Royalties (Patrick Oils, Limited), the elevation is approximately 1,000 feet above the well at Cameron falls, where the fault-plane was penetrated at 1,233 feet. The fault is known to have a general westerly dip, but the amount is unknown. The minimum observed dip on the Lewis thrust is 3°, and if this amount be postulated between the well at Cameron falls and "Oil City," Oil City Royalties well could hardly be expected to penetrate the Lewis thrust at less than 4,000 feet. If the dip of the fault-plane is somewhat steeper the depth will be still greater. If, as is probable, the Lewis thrust approaches a bedding-plane fault, then it may be assumed that about the same horizon of the pre-Cambrian will occur at "Oil City" immediately above the fault as at Waterton, where the depth to the fault-plane and the approximate thickness of the strata above it are known. The Oil City Royalties well location is on Appekunny strata close to the Altyn-Apppekunny contact. In this area Daly believed the Altyn formation to be 3,500 feet thick, although the writer would consider the thickness to be slightly less owing to repetition by faulting. Below the Altyn is the Waterton dolomite, not less than 1,200 feet thick. The stratigraphic thickness of beds above the Lewis thrust at "Oil City" is, therefore, not less than 4,500 feet, and the best that could be hoped would be a degree of dip of these strata of not less than 30°. Thus the drilling-depth to the Lewis thrust would be expected on this basis to be in excess of 5,000 feet. It is believed by the writer that a fair test of the prospects for oil should include a well drilled through the Lewis thrust, as dependence on fracture-zones within the pre-Cambrian is likely to lead to disappointing results, although it must be admitted a lucky site might yield some results from fracture-zones above the fault.

The seepages on Lineham creek north-west of "Oil City" are further removed from the Cameron Brook anticline than are those at "Oil City," and any well drilled in this locality would commence in strata near the top of the Appekunny formation, with the prospect of having to drill at least 2,000 feet more of pre-Cambrian beds than at Oil City.

Akamina Valley Oil Company's Property.—Several shallow wells have been drilled on Akamina brook in British Columbia, 17 miles west of Waterton lake. In some of these oil shows occurred and at certain times of the year one seepage is reported* to yield oil. As has been already stated, the valley of Akamina brook is in a broad syncline and at the Akamina Valley Oil Company's wells Kintla strata outcrop. It is therefore obvious in this area, if the same horizons in the pre-Cambrian occur above the Lewis thrust as at Waterton, then the thickness of pre-Cambrian above the Lewis thrust is not less than 10,000 feet. This is considered a minimum rather than a maximum, because it is thought the Lewis thrust, like many thrust-faults in the foot-hills, is likely to cut deeper stratigraphically in the direction from which the

* Personal communication from Mr. John Gloyd.

thrust originated. At the North Kootenay pass the strata immediately above the Lewis thrust belong to the Siyeh formation, whereas at Waterton the beds immediately above the same fault are nearly 8,000 feet lower stratigraphically in the pre-Cambrian. This, then, is evidence that lower stratigraphic beds are cut by the Lewis thrust from north to south in Canada, and since there was apparently an eastward as well as a northward movement to the overriding mass of pre-Cambrian strata above the Lewis thrust, it is probable the beds above the Lewis thrust in the area of the Akamina Valley Oil Company's wells are as low if not lower stratigraphically than at Waterton. The thickness of the pre-Cambrian is thus too great in this area to warrant drilling through them, and although the synclinal surface structure may not be indicative of the structure in the beds below the fault, from which any oil must be derived, yet there is no evidence to show favourable structure for oil accumulation is present in the lower beds even though they were within reach of the drill. It is thus inferred that the prospects for oil in this area are negative, and if any oil-seepages do occur they could readily be explained as a concentration of a small amount of oil by waters following bedding-planes and fractures toward the central part of the basin-structure, and hence have no significance as indicating probable commercial quantities of oil at depth in this locality.

SAGE CREEK, FISHER-ELDER CREEKS, AND KISHINENA CREEK DOMES.

Sage Creek, Fisher-Elder Creeks, and Kishinena Creek domes lie within the pre-Cambrian on the east side of Flathead valley. All these domes appear to be of the same general character, although only the Sage Creek dome has been studied in any detail. (See Fig. 3.)

The Sage Creek dome lies within the valley of Sage creek between high precipitous walls which rise nearly 3,000 feet above the valley-floor, here about 1 mile wide. The structure is essentially a dome with some minor wrinkles or folds. On the north side, high up on the mountain-slope, are evidences of a fracture-zone in a narrow area less than 100 feet across, in which the strata are highly tilted or even slightly overturned, and yet outside this zone on both sides of it the beds dip at angles of only a few degrees. Other fracture-zones were also seen and there seems little doubt but that the seepages are connected with one or more of these.

The seepages are very remarkable and consist of both oil and gas. In order to arrive at some definite conclusion in regard to the amount of flow, one seepage was bailed morning and night for a period of six days. This seepage occurs in gravel into which a steel barrel with the bottom removed has been sunk. Water comes with the oil and gas, but the oil is so light that it can be readily separated from the water by allowing the latter to flow out through a small aperture in the bottom of the container. The record of this seepage was as follows:—

Date.	Amount of Oil recovered per Day.
August 12, 1932	8.00 gallons (approximate).
August 13, 1932	3.00 gallons (approximate).
August 14, 1932	1.25 gallons (approximate).
August 15, 1932	1.50 gallons (approximate).
August 16, 1932	1.50 gallons (approximate).
August 17, 1932	1.25 gallons (approximate).

It is thus considered that the settled flow of the seepage amounts to $1\frac{1}{4}$ to $1\frac{1}{2}$ gallons per day. The amount of oil obtained was somewhat dependent on the time taken to remove the last small quantity of oil and water from the hole, because when the head of water, amounting to several gallons, had been removed there was always a strong ebullition of gas with oil and a minimum amount of water flowing into the hole. The larger amounts recovered on the first and second days, however, were the accumulated supply over a period of several days prior to bailing, the oil previous to our visit having been periodically taken from this hole for general purposes of camp use at the drilling-site of the Crownsnest-Glacier Oil Company. It is said that in wet weather or in the spring the amount of oil that occurs in this seepage is much larger. This is undoubtedly true, as other seepages in the immediate vicinity also contained oil, and oil occurred on the water of a small stream near by. The movement of the water through the gravel would no doubt carry the oil and gas with it and more oil would find its way to the seepage in time of high water-flow. The position of the seepages can be seen on Fig. 3. The seepage that was bailed was close to the road, but north of it and east of the small stream shown. It can be seen that the amount of oil escaping from the several seepages is considerable, but

perhaps even more impressive than the oil-seepages are the strong gas-flows evident in several places, indicating a reserve volume under pressure.

As already explained in the case of the "Oil City" seepages on Cameron brook, it seems inconceivable that this oil could have originated in the Lewis series, which here forms the surface outcrops. The observed fracture-zones offer a logical means of escape from depth, presumably from Mesozoic or Palaeozoic rocks underlying the overthrust pre-Cambrian Lewis series. It has been suggested by Mackenzie,* although considered highly improbable, that the oil in the Sage Creek area may have been derived from the Kishinena formation of Tertiary age. A detailed

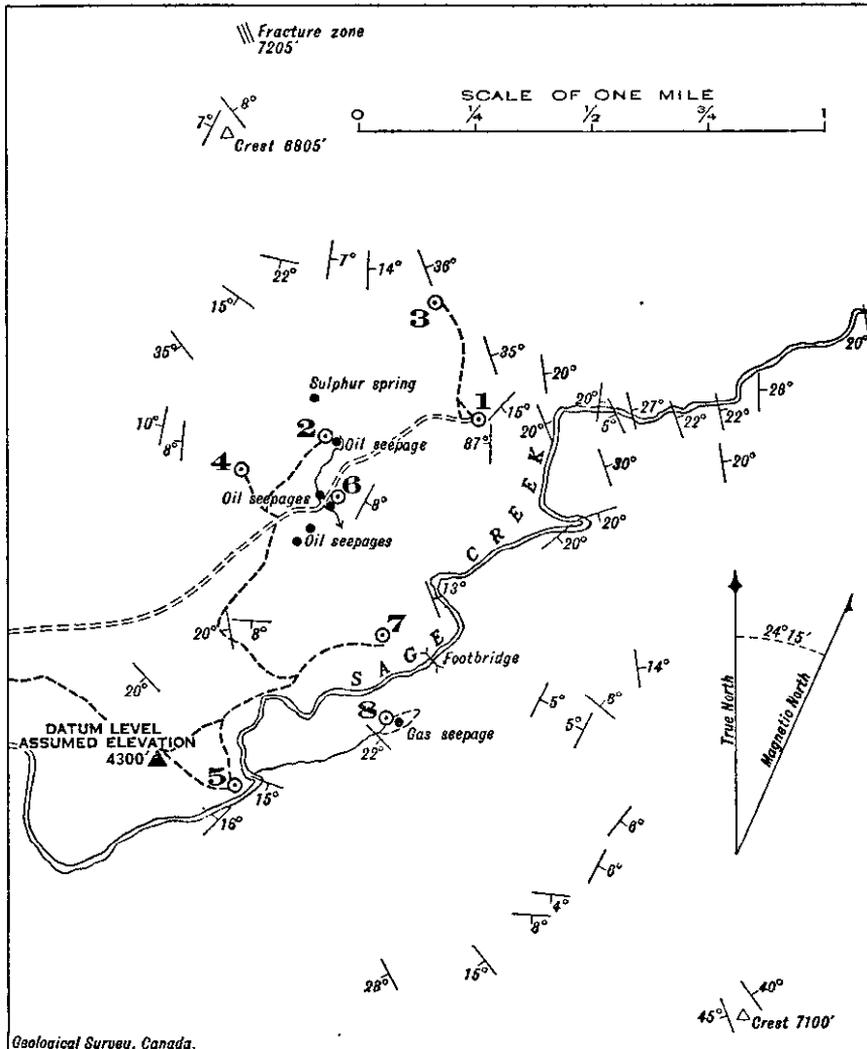


Fig. 3. Sage Creek dome. 1, Crowsnest Glacier No. 1; 2, Crowsnest Glacier No. 2; 3, Crowsnest Glacier No. 3; 4, Crowsnest Glacier No. 4; 5, Flathead No. 1; 6, Flathead No. 2; 7 and 8, British Columbia Oil and Coal Development Company.

study of conditions shows that this cannot be so unless the Kishinena formation occurred under the pre-Cambrian. Mackenzie, however, recognized that the Tertiary beds were deposited subsequent to the faulting that formed Flathead valley and that the Kishinena strata overlapped on to the pre-Cambrian. At the present time no Tertiary strata occur in the immediate vicinity

* Mackenzie, J. D.: Geol. Surv., Canada, Mem. 87, p. 48 (1916).

of the oil-seepages, and yet fairly strong gas-flows are found with the oil-seepages, and gas sufficient to blow the mud fluid from the hole was encountered in the Crowsnest Glacier well. There is no obvious way in which this gas with the accompanying oil could have migrated from the Tertiary strata into the pre-Cambrian. The Tertiary beds, moreover, were deposited under fresh-water conditions as is evident from the abundant fossil remains found in them, and it is highly improbable that they are capable of producing more than small quantities of oil or gas, if any. On the other hand, there seems no reason to doubt that the seepages on Cameron brook and at Sage and Kishinena creeks are of the same type, and the only possible source seems to be from beds that, although younger, yet due to faulting underlie the pre-Cambrian rocks.

It is unfortunate that the direction and dip of the fault-plane on the east side of Flathead valley are unknown, because, lacking this knowledge, no accurate prediction of the thickness of the overlying pre-Cambrian can be made. The reversal of dip along the west side of the pre-Cambrian mass is in harmony with underthrusting as suggested by Link, but, as already pointed out, the only evidence observed—namely, that in the area south of North Kootenay pass—is not in accord with this hypothesis. The beds exposed in the valley of Sage creek on the Sage Creek dome belong to the base of the Appekunny formation, and the formations that underlie strata of the same age in the Waterton Lakes area are the Altyn and Waterton formations, the thickness of which is considered to be about 4,500 feet. If the fault under the Sage Creek dome is an underthrust—that is, an eastward-dipping fault as suggested by Link—it may cut off the Lewis series at a higher horizon than the Lewis thrust does at Waterton. If the fault is the Lewis thrust, and if, as is believed, it cuts strata at progressively lower horizons in the direction from which the thrust originated, then lower pre-Cambrian horizons are probably present in the Sage Creek area than at Waterton, in which case the depth to the fault will exceed 4,500 feet by an unknown amount.

Lacking the seepages in the pre-Cambrian rocks east of the Flathead valley, this area would never have been considered as an oil or gas prospect on account of the character of the rocks through which the seepages must come. The seepages and the associated domed structure, however, suggest accumulations of oil and gas at depth, and it is impossible to understand how this oil could have got into the pre-Cambrian rocks unless the younger rocks under the fault lie in a structure such as would favour concentration of oil. East and west folds were found to be present in the Sage Creek area, and this suggests that the domed structure of the pre-Cambrian may be later than the faulting, since, as already shown, folding subsequent to faulting took place in Waterton Lakes area. If this is so, then the folding also extends down into the younger rocks underlying the fault, and hence the conditions in these beds would favour a concentration of any oil there present. The escape of small amounts of this oil through fractured zones such as are known to be present in the pre-Cambrian rocks would be an expected result of the action of gas-pressure in the oil-reservoir rocks.

Only one other factor has a bearing on possible oil production, provided the structure is favourable at depth and the fault is within drilling-depth. This is the amount of porosity likely to be encountered in the productive horizon. Beds of Jurassic or Palaeozoic age might have sufficient porosity to act as oil and gas reservoirs, or, if not, the very great fracturing of the strata below the fault-plane is a favourable factor.

Several shallow wells have been drilled in the Sage Creek area. The only well being operated at present is that of the Crowsnest-Glacier Oil Company, which at the time of the writer's visit was being drilled with a diamond-drill at a depth of 3,259 feet. In some of the old abandoned wells a considerable amount of gas occurs, and in one well east of Sage creek and on the north-west edge of a beaver-dam lake a small quantity of water-white oil occurs. This oil is regularly collected and is used in kerosene-lamps. It burns without giving off any smell or soot. The well of the Crowsnest-Glacier Oil Company (No. 1) periodically yields sufficient volumes of gas to clean the hole of water, with which some oil is ejected. A small quantity of non-inflammable sulphur-gas is escaping from a well drilled by the British Columbia Oil and Coal Development Company. At present all leases on the Sage Creek dome are said to belong to the Amalgamated Oil Company.

Summing up the prospects of the Sage Creek dome, it may be said that it is quite apparent that oil and gas are undoubtedly present in this area, as is shown by the seepages and to a less extent by drilling. The surface structure is a dome in pre-Cambrian strata, and if this dome persists to depth into younger rocks below the pre-Cambrian the prospects for production would

appear to be favourable. The oil doubtless originated in these younger rocks and is now escaping through fracture-zones in the pre-Cambrian. The depth to the younger rocks under the pre-Cambrian is not known. It does not seem probable that it can be much less than 4,500 feet and may be somewhat more.

A preliminary examination of the Kishinena dome on Kishinena creek seems to show that this structure is essentially like the Sage Creek dome. Only one seepage was observed and this is issuing from gently inclined Appekunny strata. The oil is slightly more bluish than the oil from the Sage Creek seepages and is thought to be of slightly heavier gravity, although sufficient was not collected to make a test. The drilling-depth in the Kishinena dome would, presumably, be approximately the same as at the Sage Creek dome, and if the latter is found to be productive the former would warrant a test by drilling. Up to the present no wells have been drilled on it.

The dome at the headwaters of Fisher and Elder creeks is intermediate in position between the Sage Creek and Kishinena domes. On account of the higher elevation, however, it would require approximately 2,000 feet deeper drilling. It is much more difficult of access than the others and as far as known yields no seepages. Tests are not warranted on this structure until the merits of either the Sage Creek or Kishinena domes have been proven.

A great part of the southern end of Flathead valley in Canada has been leased for oil and gas. The area is to a considerable extent covered by Tertiary fresh-water deposits, but on the west side of the valley, in the vicinity of Howell, Cabin, and Cauldrey creeks, is an area of Mesozoic rocks bounded on the north-west and south by Palæozoic rocks and on the east by the Tertiary of Flathead valley. The Palæozoic rocks are overthrust on to the Mesozoic, and such Mesozoic strata as now outcrop owe their exposure to erosion of the Palæozoic rocks that formerly covered them. The Mesozoic rocks thus appear as an embayment through the fault-plane and are thus bounded by the overthrust Palæozoic rocks on three sides. As has been shown by Mackenzie,* these Mesozoic beds appear to dip in one direction only and hence provide no closure for oil or gas fields. The structure of the whole Flathead valley, excluding the Tertiary beds which are an overlap, is not as simple as the structure of the exposed Mesozoic beds might lead one to suppose, because on the east side of the valley on Commerce creek, a short distance north of Sage creek, is a long ridge exposing Devonian limestones. No structures in the Mesozoic or Palæozoic rocks favourable for oil and gas accumulations have so far been demonstrated in the Flathead valley proper, and the outcrop of these beds would provide a ready means of escape for any oil or gas they may have originally contained.

The Tertiary beds belonging to the Kishinena formation, as already stated, are an overlap on to all older beds. For the most part these Tertiary beds have an easterly dip and as far as known no folds suitable for oil accumulation have been found, although a certain amount of folding is present, and it cannot be said favourable structures are not present since outcrops are few and very scattered. The Tertiary sediments, however, are of fresh-water origin, and although they might yield small shows of oil or gas, it seems highly improbable they could give rise to commercial quantities of these materials. Only one well is at present drilling in the Flathead valley proper—namely, the Canadian Kootenay well at the bridge over Flathead river, about 4 miles north of the International boundary. This well is drilling in Tertiary beds which, as far as known, dip only in one direction—namely, easterly. As the Tertiary beds overlap on to the Mesozoic on Cauldrey creek west of the well location, the base of the Tertiary must come to the surface, although it is concealed by gravel and drift. It is impossible to see, therefore, how this well has any merit as an oil or gas prospect, unless it should penetrate favourable structure in the Mesozoic strata under the Tertiary overlap, a condition concerning which no data are available.

Drilling Equipment.—The pre-Cambrian rocks are very dense and hard and much difficulty has been experienced in drilling them with standard cable tools, due to the shearing of pins on the bits and other mechanical breakages. Several wells have been lost in the Sage Creek area, due to tools lost in the hole, and excessive drilling costs have resulted for small amounts of footage drilled. The writer had the opportunity of seeing a diamond-drill at work on the property of the Crowsnest-Glacier Oil Company, and although the equipment was not in good condition its effectiveness for drilling the highly metamorphosed rocks was amply demonstrated. It is recommended, therefore, that operators should at least consider this type of drilling equipment before launching on any extensive drilling programme in these pre-Cambrian strata.

* Mackenzie, J. D.: Geol. Surv., Canada, Mem. 87, Map 182A.

SLOCAN MINING DIVISION.

In this Division, normally responsible for a large aggregate production of silver-lead-zinc ore and concentrates, all company operations, including production and development, continue in abeyance pending improvement in metal prices. Lessees shipped ore in car-load lots from the *Bosun* and *Standard* at Silverton; the *Rio*, Rambler Siding; *Silversmith* and *Victor*, Sandon. An important contribution to geological information has been made available through publication by the Geological Survey of Canada of the Slocan and Sandon topographical sheets, Maps 272A and 273A respectively, with geology by C. E. Cairnes. Location of mining properties and mineral claims is facilitated thereon by grid letters and figures shown in red along the borders of the maps.

Lessees who shipped ore were: G. D. Serra and J. Moro, of Sandon, from the *Rio* in Jackson basin; E. Doney, of Sandon, from the *Victor*; J. M. Pendry and M. C. Vandergrift, of Silverton, from the *Bosun*; J. H. Dalzell and associates, of Silverton, from the *Standard*; A. Olsen, of Sandon, from the *Silversmith*. At the time of writing lessees at the *Standard* include C. Towgood and J. Donohue, who have opened up a good showing on the No. 4 level, including a pay-streak of clean galena and grey copper, from 12 to 24 inches wide and 20 feet long; and A. McDaniel and associates, who are driving a tunnel to get under a surface showing of clean galena on the *Alpha* claim. At the *Mammoth* property of the Western Exploration Company, near Silverton, J. Rowlands is leasing on No. 1 level. Two car-loads of oxidized ore containing high silver values have been extracted for shipment when metal prices improve.

SLOCAN CITY MINING DIVISION.

During 1932 activities in this Division, which contains numerous silver and silver-gold prospects in an area of porphyritic granite, were limited in scope. A number of these "dry-ore" prospects are shown on the recently issued Slocan sheet, Map 272A, published by the Geological Survey of Canada.

Meteor.*

This silver-gold property on the divide between Chapleau and Springer creeks was worked under lease and bond by C. Lundstom and associates, of Slocan.

A description of the property is contained in the Annual Report for 1919, since which time the No. 6 level, 160 feet on the dip of the vein below No. 5 level, has been extended to intersect the main fault. This fault on the No. 5 level separates the two mineralized sections of the *Meteor* vein by a horizontal distance of 160 feet, and it is estimated that approximately 220 feet of drifting in a N. 35° E. direction along the main fault-plane will have to be accomplished before the downward extension of the ore-shoot near the end of the No. 5 level will be picked up.

When the property was examined in July, 1932, ore was being mined from unstopped sections of the vein above the No. 6 level. A grab-sample taken from a pile of sorted ore at the portal of this level assayed: Gold, 1.11 oz. per ton; silver, 347 oz. per ton; lead, 1.5 per cent.; zinc, 3 per cent. A sample taken across a 12-inch section of the vein near the end of the No. 6 level drift assayed: Gold, 0.6 oz. per ton; silver, 18.2 oz. per ton.

An appreciable tonnage of high-grade sorted ore has been shipped in the past from the *Meteor* vein, and further work is recommended from the end of the present No. 6 level with a view to picking up the downward extension of the narrow but high-grade ore-shoot exposed in the north-easterly end of No. 5 level. The results of this work, if favourable, would ensure a steady but small production from the property.

Elk.*

The *Elk* property, owned by P. Bruin & Son, of Slocan, is situated about half a mile north-west of the *Meteor* on the ridge to the south of Springer creek. Several open-cuts along the ridge and a short adit-tunnel at 7,200 feet

elevation have been made on a narrow oxidized quartz vein enclosed in the feldspar-porphry-granite country-rock of the area. The vein strikes N. 65° W., dipping to the south-west at 30°, and varies from 8 to 12 inches in width. The tunnel at 30 feet from the portal encountered a fault, and a 20-foot crosscut to the south-west picked up the continuation of the vein. The owners were engaged in mining and sorting a small shipment of oxidized quartz, sparsely mineralized with pyrite, from their vein, and a composite sample taken from the thirty sacks of ore lying at the portal of the tunnel was assayed and found to contain: Gold, 0.20 oz. per ton; silver, 10 oz. per ton.

Royal.*

This property, owned by R. F. Ainslie, of Slocan, is situated just to the north-west and downhill from the *Ncepawa* (or *Peg Leg*) group on Enterprise creek. The workings consist of an open-cut across a large, well-mineralized quartz vein, which is quite possibly the south-west extension of the *Westmont* vein, and a 50-foot well-timbered crosscut tunnel. A chip-sample across the full width of the vein, as exposed over a width of 7 feet 6 inches in the open-cut, was taken and assayed as follows: Gold, trace; silver, 11.2 oz. per ton; lead, 2.8 per cent.; zinc, 4 per cent. The outcrop of the vein, striking south-west with a steep dip to the south-east, has been traced up the slope of the mountain for some distance, and the present tunnel-working has been driven in 50 feet with a view to intersecting the vein some 250 feet below the open-cut just mentioned. This tunnel is still in overburden and slide-rock and requires a considerable extension before the vein is encountered. The showing is worthy of more intensive prospecting and development.

Gold-Galena.*

This property, situated at the head of Enterprise creek in what is known as Boomerang basin, is owned by R. F. Ainslie and J. Ballairigion, both of Slocan. The workings are about 8 miles by trail from the end of the Enterprise (10-Mile) Creek road. The country-rock in the vicinity of the property is a coarse feldspar granite and in a sheared zone which strikes north across the granite several persistent exposures of quartz vein-filling have been uncovered.

The mineralization, consisting of pyrite, galena, sphalerite, and associated silver and gold values, occurs across comparatively narrow widths, but the exposures are sufficiently attractive to warrant intensive prospecting with the hope of finding wider and profitable ore-shoots along the quartz-filled veins.

Two adit-tunnels at 6,847 and 6,780 feet elevation have been driven north along the vein for about 100 feet. In the uppermost tunnel the vein at the face is 18 inches wide and other exposures in the tunnel show the vein (here on the foot-wall side of the shear-zone) to be from 12 to 16 inches in width, with one 60-inch width at the point where a cross-vein joins the hanging- and foot-wall veins. In the lower tunnel the vein (here on the hanging-wall side of the shear-zone) should be picked up with a short crosscut to the east from a point 100 feet north of the tunnel portal. With gold values up to 3.8 oz. per ton, with an average of about 1 oz. per ton, stated to have been obtained from ore exposed in the foot-wall ore-shoot, the persistence of the vein-exposures over a length of 1,400 feet and a vertical range of 600 feet make the area worthy of intensive prospecting.

Eagle Bank.*

This property, owned by R. F. Ainslie and situated just south across Boomerang basin from the *Gold-Galena* group, a very persistent fissure-vein striking N. 45° E. and dipping 28° to the south-east appears along the sides and base of a precipitous bluff of coarse porphyry granite. The outcrop of the vein can be traced for several hundred feet. It has an average width of from 8 to 10 inches, and a sample taken across five places in the vein assayed: Gold, 0.4 oz. per ton; silver, 12.6 oz. per ton; lead, 12.4 per cent.; zinc, 4.5 per cent.

The vein is well mineralized throughout the exposed length, and while the intersection of this vein with the *Gold-Galena* vein could not be located on account of slide-rock and snow, the possibilities of increased mineralization over minable widths at this intersection are worth investigating.

Little Daisy.

At this prospect, tributary to Enterprise creek, T. S. Cleary, of Trail, and associates, started work in November. A portable 2-drill compressor was installed and a contract was given to W. Tattrie to drive a tunnel. This is a gold prospect described in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia."

Kilo.

At this gold property, on Chapleau creek, Ted Anderson, of Silverton, had a crew of men engaged on development-work, retimbering and reconditioning the old workings. Conditions are not materially changed since the property was described by the late W. Fleet Robertson in the Annual Report for 1904.

From the neighbouring *Chapleau* a trial shipment of gold quartz was made by lessees, including W. Greenwood, of Slocan.

At the *Goldstream* gold prospect, 1¼ miles by trail beyond the *Kilo*, stripping of the quartz vein was continued by G. Soucie and associates. This is described in Bulletin No. 1, 1932, above mentioned.

* Report by A. M. Richmond, Assistant Resident Mining Engineer, Victoria, B.C.

AINSWORTH MINING DIVISION.

In this Division silver-lead-zinc development and production operations continue to mark time and activities have been restricted to those by leasers and prospector-owners. A summary of publications by the Geological Survey of Canada covering portions of this Division is contained in the Annual Report for 1931. Since then additional information has been made available by distribution of the Slocan and Sandon sheets, by C. E. Cairnes, Maps 272A and 273A respectively, the eastern portions of which show the geology of the area lying between Kokanee Glacier Park and Kaslo, including Keen creek.

At the *Whitewater* leasing operations conducted for several years by Sid Ross were continued and a substantial tonnage of high-grade silver-lead ore has been accumulated for shipment when metal prices improve. Under the same management representing a Nelson syndicate, work commenced in August in the upper workings of the *Wellington* mine. At the *Contact* group, described in the Annual Report for 1931, A. J. Curle reports making trails to connect the easterly and westerly workings, and while so doing finding float and "gossan" at numerous points in the intervening area, indicating continuity of the mineralization. On Keen creek F. Helme continued work at his *Silver Bear* property.

In the upper Duncan River area, on Hall creek, R. F. Rotter, of Nelson, had a few men working during the summer at the *Elizabeth* and *Galena Prince*. The vein-continuity was tested by trenching and open-cuts.

On Woodbury creek, north of Ainsworth, seasonal activity occurred in connection with the property of the Scranton Consolidated Mining Company, where F. Olson, of Portland, Oregon, had a crew driving a crosscut tunnel and getting the camp in good shape.

ARROW LAKE MINING DIVISION.

No mining activity of appreciable importance occurred in this Division during the period under review. Since the close of 1932 it has been announced that development-work is to be done during the coming season at the *Chieftain*, on Caribou creek, near Burton, by A. W. Davis, of Vancouver, on behalf of the Beaver Silver Mines, Limited. The ore consists of auriferous and argentiferous pyrite, chalcopyrite, galena, and zinc-blende in a quartz gangue. The deposits occur in rocks of the Slocan series. A report on the *Chieftain* is contained in the Annual Report for 1920. In Geological Survey of Canada Summary Report, 1928, Part A, C. E. Cairnes states, on page 107A, under "Economic Geology" (Geological Reconnaissance in Slocan and Upper Arrow Lakes Area, Kootenay District, B.C.): "Unfortunately time did not permit of examination of properties in the vicinity of Mineral City, where geological conditions seemed on the whole best suited for mineralization and where work in the past has opened up significant discoveries." In the same vicinity the *Millic Mac*, described by A. G. Langley in the Annual Report for 1923, is an exceptionally interesting prospect, now dormant, with similar deposits from which shipments containing substantial values in gold and silver have been made in past years.

REVELSTOKE MINING DIVISION.

LODE-MINING.

During the period under review no lode-mining of importance has occurred, activities having been confined to those by prospector-owners, chiefly on the streams tributary to the Columbia river north of Revelstoke, including a small development operation on the *Sterling* silver-lead-zinc-molybdenite prospect mentioned in the Annual Report for 1931. Lode-gold mining has not yet been developed to any appreciable extent in this Division, past efforts having chiefly been directed to exploration of silver-lead-zinc occurrences. Information concerning auriferous deposits is contained in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia." Publications of the Geological Survey of Canada covering portions of the Revelstoke 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."

Sterling. At this prospect, adjoining the highway 35 miles north of Revelstoke, development has been continued by A. Smith and associates. New workings included two short drift-tunnels and a 95-foot crosscut tunnel when the property was visited in August. The mineralization originally exposed (*see* Annual Report for 1931) was

in the form of low-grade molybdenite disseminations accompanied by pyrite, but new showings include, in addition to those minerals, appreciable amounts of galena and sphalerite. The following samples were taken:—

Description.	Gold.	Silver.	Lead.	Zinc.	Molybde- nite.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Grab-sample.....	Trace	6.6	1.0	2.0	*
Selected (containing MoS ₂).....	Nil	Nil	*	*	1.3
5-inch quartz-vein.....	Trace	5.0	0.6	3.5	*

* Not assayed.

The original upper tunnel has been continued and included an 80-foot crosscut leading to a 20-foot drift. Summarizing conditions, the workings jointly develop two parallel flat-lying zones of mineralization in silicified phases of the enclosing metamorphosed schistose sediments. The upper one, approximating 20 feet in width, contains much pyrrhotite in places, with occasional streaks of molybdenite. The lower vein, about 6 feet wide, also contains low-grade disseminations of MoS₂, with included quartz stringers mineralized with galena and sphalerite.

On Galena creek, a short distance northerly along the highway from the **Hard Pan.** *Sterling*, this prospect consists of four claims owned by A. MacIntosh and F. B. Wells, of Revelstoke. Mineralization, including molybdenite, similar to that at the *Sterling*, is exposed in shallow excavations on the edge of the creek at two points about 50 yards apart. Insufficient work has been done to accurately determine the width or character of the deposits, but they appear to conform in strike and dip with the enclosing schistose rocks. At the lower showing, partially exposed, a width of 18 inches of quartz contains disseminated pyrite, pyrrhotite, and molybdenite. At the upper showing similar mineralization is visible over a width up to 2 feet. The country-rocks strike N. 40° W. and dip from flat to 25° to the south-west. The following samples give an idea of the values:—

Description.	Gold.	Silver.	Lead.	Zinc.	MoS ₂ .
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Selected from lower showing.....	Nil	Nil	*	*	2.69
Selected from upper showing.....	Trace	7.0	*	*	0.05
Selected, containing galena, sphalerite, and MoS ₂	Trace	10.0	0.3	2.3	*

* Not assayed.

Placer-mining activity in this Mining Division is described in Bulletin No. 1, 1933, "Placer-mining in British Columbia."

LARDEAU MINING DIVISION.

New life was put into the old Camborne camp by the undertaking initiated late in 1932 by the Meridian Mining Company, Limited, of Vancouver, in connection with the consolidation of the *Eva* and *Cholla* groups of the Imperial Development Syndicate of Nelson, the *Oyster-Criterion*, and *Lucky Jack* properties. Under the direction of W. R. Bonnycastle, hydro-electrical engineer, and A. G. Langley, consulting engineer for the company, work was started on the power-installation on October 26th, and water was turned into the pipes on January 12th, 1933. Water is delivered to the nozzle of the Pelton wheel under a static head of 485 feet and the plant is capable of delivering sufficient water to generate 1,000 horse-power. The big wheel was put in motion under a gauge-pressure of 210 lb. per square inch, which was subsequently boosted to 275 lb. The high-pressure half of the compressor, which is capable of delivering about 800 cubic feet of air per minute under a pressure of 80 to 90 lb., has operated very smoothly. The low-pressure side of the compressor will be installed when warranted by expansion of the scope of operations. At the time of writing, development is proceeding on two levels of the *Oyster-Criterion* property. A summary of information concerning past operations is contained in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia."

Ophir-Lade. On this property, situated on Gainer creek, near Ferguson, development-work was carried on during the open season by J. Flagel, of Ymir, and associates. Information concerning this gold prospect is contained in the Annual Reports for 1922 and 1925 and in Geological Survey Memoir 161, "Lardeau Map-area."

Seasonal prospecting was continued by Mrs. Jowett, of Trout Lake, at her *Foggy Day, U and I, Hercules*, and other claims on Silver Cup mountain. New showings have been opened up in which the ore contains substantial gold values associated with sulphides of iron, lead, and zinc.

Spyglass. At this silver-gold property, near the head of Poplar creek, interesting developments are reported by E. Foley-Bennett, of Penticton, as a result of exploratory work carried on with a small crew during the summer season. Seven additional claims were staked along the strike of the vein, and in connection with these very large widths of mineralization have been encountered. The new showings will be inspected during the coming season.

NELSON MINING DIVISION.

In the following report the activities specified under various camps are all in connection with gold ores, and the limited amount of silver-lead-zinc exploration is subsequently mentioned under "Miscellaneous." Considerable information concerning gold occurrences in this Division is contained in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia," and Bulletin No. 3, 1932, "Lode-gold Developments in British Columbia." The following publications of the Geological Survey of Canada also contain information regarding gold areas in the Nelson Division: Summary Report, 1911, "Geology of Nelson Map-area" (O. E. LeRoy); Memoir 94, "Ymir Mining Camp" (C. W. Drysdale); Summary Report, 1929, Part A (J. F. Walker). The last mentioned is shortly to be supplemented by publication of the author's full report on the Salmo Map-area.

NEAR NELSON.

On and around Toad mountain, south of Nelson, a large number of claims were staked on discoveries made in the old days. The majority of these claims were Crown-granted, as shown on Mineral Reference Map 1T300, and quite a few have reverted to the Crown for taxes, being available for acquisition by lease and purchase. A class of gold lead in this section includes lodes or mineralized zones in the schists of the Rossland volcanic formation consisting of parallel lenses and stringers of quartz alternating with bands of schist, both of which are mineralized. Possibilities for large tonnage of very low-grade ore in the *Starlight* belt (extension of *Victoria* and *Jessie*, alluded to below) was mentioned by R. G. McConnell in the Summary Report of the Geological Survey of Canada for 1896, and at the *Cottonwood* property (*Golden Wreath* and *Golden King*) by G. M. Dawson in the Summary Reports on the Operations of the Geological Survey of Canada for the years 1888 and 1889. Similar deposits in this area are on the *Deadwood* claim, part of the *California* group, and the *Birdseye* property. While desultory efforts have been made to test such deposits in some cases, no comprehensive investigation of these belts has ever been carried out. Commercial concentrations of values may be found along the trend of the mineralized zones, where special geological conditions exist, but not necessarily on the claims specified. The following brief notes on the *Victoria*, *Jessie*, *Starlight*, and *North Star* are submitted in the absence of more complete information on such occurrences, for the proper appreciation of which it has not yet been possible to allocate sufficient time. The general geology of the area is shown on Geological Survey Map 62A, which is in the nature of reconnaissance-work.

Victoria. This and the adjoining *Jessie* claim, both Crown-granted, have been acquired by Al. Holmquist, of Nelson, and associates, who spent part of the summer season in establishing a camp, reconditioning the old drift-cut, and in making trenches across the strike of the mineralized zone. These and other claims staked by the same interests adjoin the *Silver King* mine road on Toad mountain south of Nelson. The elevation of the main working by the roadside is about 5,400 feet, or about 3,400 feet higher than the town. At this point a long drift-cut and trenching just south-east of it partially expose a wide zone of alternating schist with quartz stringers and lenses. The quartz is well mineralized with iron sulphides, which also impregnate the intervening schists to some extent. The deposits apparently follow a zone of shearing conforming with the strike and dip of the country-rock, which

is an altered eruptive member of the Rossland volcanic formation. An area of granite is exposed to the north. The schists strike up the hill S. 65° E., with a dip of about 50° to the south-west. The following sample results give an idea of the values in the adjoining workings:—

Width.	Gold.	Silver.	Description.
	Oz. per Ton.	Oz. per Ton.	
14-inch pay-streak.....	0.90	0.1	Quartz-streak in centre of trench above drift-cut.
Rusty schist.....	0.21	.....	Adjoining quartz-lens in face of drift-cut.
Selected.....	0.54	.....	From quartz-lens containing sulphides in face of drift-cut.
Selected quartz lacking sulphides.....	0.10	.....	Ditto.
30 inches.....	0.53	.....	Lower part of face in drift-cut.
25 inches.....	0.33	.....	Upper part of face in drift-cut.
Selected heavy sulphides.....	0.485	.....	From face in drift-cut.

Along the strike some 1,500 feet away to the south-east a new trench, not yet seen by the writer, is said to expose similar showings. The results of the very limited amount of shallow exploration accomplished warrant systematic trenching along the trend of the mineralized zone, which, at a lower elevation and in echelon, parallels the ore-bodies of the well-known *Silver King* silver-copper mine. Here the ore-bodies coincided in attitude with the enclosing schists where they were cut by a system of cross-fissures at short intervals. The experience gained regarding the importance of the cross-fissures in this case might be applied in future exploration of mineralized schists such as occur on the *Victoria*, *Jessie*, and other claims on Toad mountain.

Starlight. On this claim, adjoining the *Victoria* to the north-west, the extension of the same band of mineralized schist has been explored by old workings. These consist in part of two shallow shafts (full of water) and some open-cuts which are distributed along a few hundred feet of outcrop. All show a good width of quartz more or less mineralized with pyrite. A sample of selected ore, well mineralized with pyrite, from the collar of the 35-foot flooded shaft at 5,450 feet elevation assayed: Gold, 1.4 oz. per ton; silver, 4.6 oz. per ton. Directly below this working a tunnel crosscuts the formation, which here contains frequent quartz stringers and lenses, some of which contain pyrite, as at one point where short drifts extend to the north-west and south-east along narrow quartz veins. Values on this level were probably too low or confined to very narrow widths, judging from the discontinuation of exploration. However, the work done definitely establishes that mineralization to some extent persists along the strike, and suggests that at some point along the trend of the schistose eruptive rock where favourable conditions, such as cross-fissuring, occur, the auriferous sulphides may be sufficiently concentrated to form workable ore-bodies.

North Star. This Crown-granted claim, under lease to the late C. W. Riley, adjoins the *Starlight* to the north. Old superficial workings explore a pyritized and silicified zone of shearing over 40 feet wide, coinciding with the strike and dip of the enclosing schistose rock, which, towards the foot-wall side, is much weathered and iron-stained. At 5,150 feet elevation a long trench cuts deeply into the side-hill, exposing a section 30 feet wide. Of this the most highly mineralized portion is the 8-foot width between the hanging-wall and a 24-inch lamprophyre dyke striking with the formation. According to C. W. Riley, the average of five samples across this 8-foot section assayed: Gold, 0.27 oz. per ton. Beyond the dyke towards the foot-wall side assays approximating 0.1 oz. per ton were obtained over a width of 20 feet of rusty, weathered rock. Beyond these limits the soil is red from oxidation of sulphides in the underlying rock. Down the hill from the surface cuts an old crosscut tunnel, now caved at the portal, was driven a short distance, but discontinued apparently before proving the ground below the hanging-wall showing. Granite is exposed on the *Great Western* claim, owned by C. V. Riley, adjoining the *North Star* to the north. The old superficial workings are mostly caved and inaccessible. At about 5,200 feet elevation a drift-cut exposes a vein, 4½ feet wide, striking N. 50° E. at right angles to the strike of the formation, and dipping 55° to 60° to the north-west. The hanging-wall rock is granite and the foot-wall is schist. Of the vein, 12 inches on the hanging-wall side is honeycombed quartz containing iron oxides and the rest is composed of silicified country-rock.

Athabasca, Venus, Juno. It has just been announced in the press by P. Lincoln, president and general manager of the Noble Five Mines, Limited, that this company has acquired the above contiguous gold properties under lease and bond. Situated on the east slope of Morning mountain, south of Nelson, the *Athabasca*, *Venus*, and *Juno* groups are reached by road 7 miles long and connecting trails. References to the geology and general conditions are contained in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia." The *Venus* and *Juno* workings, which are connected underground, were worked continuously throughout the year by J. C. Allison, G. Allen, and associates, of Nelson, as described in Bulletin No. 3, 1932, "Lode-gold Developments in British Columbia during 1932." No comprehensive report of all three properties is available, but considerable information concerning the *Athabasca* is contained in the Annual Report for 1900 (W. Fleet Robertson); in the Summary Report of the Geological Survey for 1911; and in the Journal of the Canadian Mining Institute, Vol. V., 1902. The consolidation in one operation of these three groups of claims offers the best solution for profitable production from numerous small veins, all naturally tributary to the *Athabasca* mill. This plant, situated on Giveout creek close to the power-line leading to the *Silver King* mine, was equipped with ten stamps, amalgam-plates, Frue vanners, and cyanide-tanks, and formerly connected by aerial trams with the *Athabasca* and the *Venus*, these two mines having been jointly worked for short periods. There are definite objectives for developing ore at depth and laterally in veins from which the past production was made, and in unexplored veins, warranting systematic development to assure reserves for a milling operation.

Granite-Poorman. At this property, west of Nelson, new activity was initiated in the spring by H. R. Smith, representing the Livingstone Mining Company, an extra-provincial company with head office at Seattle. About 120 tons of sorted ore was shipped, chiefly derived from the *Hardscrabble* vein above the main working-level. Towards the end of the year several groups of lessees went to work in various parts of the property, including: G. Gormley and four sons, in the *Red Rock* tunnel on the *Granite* vein; A. E. Jerome and partner, in the upper *White* tunnel; B. A. Pickering and four partners, in the upper *Poorman* tunnel; D. J. MacDonald and associates, in the central *Poorman* workings; W. Lucke and partners, in the northern upper extremity of the *Hardscrabble* workings. At the time of writing the total number of lessees is twenty-one and two men are working on company account. According to the management, the mill was operated for a short period in December and some bullion derived. Car-load shipments of sorted ore are being maintained at intervals.

West of the *Granite-Poorman* minor activities include small shipments made by E. Bergstrom, of Nelson, from the *Royal Canadian* and by D. Norcross from the *Nevada*.

225th. On this claim, adjoining the *Granite-Poorman* holdings to the north-east, prospecting was continued by J. Roche and associates close to the contact of the granite and schistose eruptive rocks of the Rossland volcanic formation. Along this north-westerly-trending zone, which crosses the Kootenay river at Beasley, contact-metamorphic mineralization, chiefly with copper and iron sulphides, is in evidence at numerous points, low gold values being associated with the copper in places.

Stillwater. On this and adjoining claims, on Whitewater creek south-west of Nelson, prospecting was continued by ground-sluicing and tunnelling by T. P. Moran, of Nelson, and associates. Additional discoveries of high-grade float-ore are reported such as are described in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia."

Rover. This group of claims, on Anderson creek just east of Nelson, and owned by W. J. Richards and associates, has been taken over under a lease and bond by A. D. Westby, of Spokane, the agreement calling for development to start as soon as snow conditions permit convenient access. The claims were formerly acquired by the Silver Leaf Mines, Limited, which failed to complete payments. This prospect, described in former Annual Reports of this Department, was considered to be a silver-lead-zinc proposition. Recent investigation has shown appreciable gold values, associated with lead and zinc sulphides, in an 8-inch pay-streak following the foot-wall side of the 6-foot vein in the south-western drift from the lower tunnel. Selected ore assayed for the owners gave good gold assays, but systematic sampling of the vein remains to be done.

SOUTH OF NELSON.

Perrier. At this property, adjoining the road and railway 4 miles south of Nelson, 858 tons of crude ore was shipped early in 1932 to the Trail smelter by F. J. Sur and associates on a siliceous smelting rate. This operation was subsequently discontinued, and towards the end of the year J. Fligel, of Ymir, and associates started work on a leasing basis. A new showing, from which ore is to be shipped, was recently opened up in drifting to the south from the shaft.

In the same vicinity W. Jarvis, of Nelson, and associates worked the *St. Anthony* and *Catherine* gold prospects for a short period. At the *Mystery* group north-east of Apex Siding, G. Blaney, of Nelson, and associates have made surface cuts on a new discovery not yet inspected. Ore assayed for the owners gave: Gold, 0.67 oz. per ton; zinc, 27.1 per cent. In this locality granitic rocks of the Nelson batholith contact with the Rossland volcanics and rocks of the Pend d'Oreille group.

Humming Bird. At this prospect, situated at the head of Roaring creek, F. T. Harbour and associates, of the Nelson Gold Mining Syndicate, have a crew of men engaged on development-work with the expectation of shipping ore. New camp buildings include bunk and cook houses; the trail has been widened for a length of $4\frac{1}{2}$ miles to where it connects with the road leading to Apex Siding; and underground work done consists of a 75-foot crosscut tunnel, with a drift northerly along the vein towards an ore-shoot exposed in old workings, including a 10-foot shaft and trenches made by ground-slucing. These superficial workings exposed high-grade pay-streaks in the quartz vein at three points, separated by areas 100 and 200 feet wide respectively, in which the outcrop is covered with deep overburden. The vein strikes northerly, coinciding with the trend of the metamorphosed sedimentaries, probably corresponding to the northerly extension of the Pend d'Oreille schists of the Ymir camp. In the vicinity of the workings these rocks are intruded by granitic tongues from the neighbouring extensive exposures of the Nelson batholith. In the pay-streaks the ore contains gold associated with iron sulphides, galena, and sphalerite. Several veins are indicated in the immediate proximity, widths varying from 1 to 5 feet. A 2-drill portable compressor has been installed. According to latest advices, a pay-streak of high-grade ore, 4 to 24 inches wide, has been continuous for a length of 70 feet in the drift.

Gold King Fraction. Some preparatory activity occurred at this prospect, situated on Hall creek, $3\frac{1}{2}$ miles by road from the highway south of Nelson, where J. Fisher, of Hall Siding, built a cabin and had a survey made for a Crown grant. Former references to the property are contained in Geological Survey Memoir 94, "Ymir Mining Camp," and in the Annual Report for 1915. Since these reports, by C. W. Drysdale and J. D. Galloway respectively, the prospect-shaft has been sunk to about 60 feet, where a drift extends south-westerly along the vein for a length of 50 feet.

Summarizing conditions briefly, the quartz vein, from 4 to 45 inches wide in the shaft-workings, cuts basic eruptive rocks of the Rossland volcanic formation and is similar in trend and character to the veins of the well-known *Fern* property, situated half a mile to the south-east. Mineralization consists of free gold, pyrite, and occasional chalcopyrite. Small amounts of galena have also been reported. The shaft-workings were sampled as follows:—

Description.	Width.	Gold.	Silver.
	Inches.	Oz. per Ton.	Oz. per Ton.
In shaft 10 feet down from collar.....	11	0.10	0.4
In shaft 20 feet down.....	36	0.25	1.0
In shaft 25 feet down.....	45	1.21	1.2
In shaft 50 feet down.....	36	0.04	1.3
In drift 5 feet from shaft.....	6	0.15	0.4
In drift 15 feet from shaft.....	9	2.06	3.5
In drift 20 feet from shaft.....	7	0.26	1.3
In drift 25 feet from shaft.....	4	0.17	0.7
In drift 30 feet from shaft.....	7	0.09	0.3
In drift 35 feet from shaft.....	6	0.17	1.1
In drift 40 feet from shaft.....	14	0.29	0.9
In drift 45 feet from shaft.....	12	0.08	1.0
In drift 50 feet from shaft.....	18	0.04	0.7
Grab from sacked ore (oxidized).....	---	4.34	3.2

Reports state the vein has been traced along the surface for over 1,000 feet, but the very limited amount of underground work done is localized near the creek-bed. The tunnel on the northern side of the creek was not accessible for caving at the portal at the time of the writer's inspection, but this working is not known to have been advanced since it was mentioned in the Annual Report for 1915.

About half a mile up the creek from the *Gold King Fraction*, C. Peterson, of Hall, continued development on a quartz vein in the same general formation on his *H.B.* and *Rainbow* property.

Ohio.

This group of claims is a relocation of the *Gold Cup*, situated on the western slope of Elise mountain north of Ymir, and reached by trail 3 miles long from Porto Rico Siding. The old workings, which were reconditioned by J. Gallo and W. Applegate, of Calgary, consist principally of an adit-tunnel connecting with the bottom of an 85-foot shaft. The elevation of the tunnel is 5,200 feet, or about 2,600 feet higher than the Great Northern Railway tracks in the valley below. The total footage of underground work amounts to 643 feet, of which 388 feet was done on the vein. This is a very clean-cut, quartz-filled fissure striking easterly through altered schistose eruptive rocks of the Rossland volcanic formation, which strike about north with vertical dip. The vein, up to 5 feet wide, dips at from 68° to 75° to the south. Mineralization, which is bunchy, includes chalcopyrite and pyrite, with copper carbonates and iron oxides in the quartz gangue.

The shaft, sunk on the vein-dip, contains short drifts at the 40- and 60-foot levels, and at the bottom, or 85-foot level, 198 feet of drifting has been done mostly to the west of the shaft. In this main tunnel-drift, 42 feet westerly from the shaft, a winze (half-full of water) has been sunk 65 feet on the vein. The country-rocks are greenstone-schist and granite-porphry schist contacting close to the shaft. Above the workings massive augite porphyrite is exposed in rock bluffs. At the collar of the shaft there are two quartz-bands, 8 and 18 inches wide respectively, separated by from 30 to 36 inches of waste. In the shaft the vein widens to a maximum of 5 feet at the bottom, this width being maintained as far as can be seen down the winze below this level. From the bottom of the main shaft, 32 feet to the face of the east drift, the vein gradually narrows down to 5 inches. For 42 feet westerly from the shaft the vein is from 4½ to 5 feet wide, but in the next 22 feet, continuing westerly, it narrows down to 30 inches, where a fault has caused minor displacement. In the next 48 feet it is down to 10 inches, which width is maintained to the western extremity of the drift. A crosscut connects this drift with the surface. The following samples give an idea of the values at points where some concentrations of the mineralization occurred:—

Location.	Width.	Gold.	Silver.	Remarks.
	Inches.	Oz. per Ton.	Oz. per Ton.	
At collar of shaft.....	18	0.20	0.2	} Quartz-bands separated by 30 inches of country-rock.
At collar of shaft.....	8	0.20	1.5	
In face of west drift, 40-ft. level in shaft.....	22	0.60	1.0	
In shaft at 60-ft. level.....	50	0.92	5.1	
In main drift at bottom of shaft..	54	<i>Nil</i>	<i>Nil</i>	

Scattered sulphide mineralization is in evidence in the adit-tunnel drift at the bottom of the shaft, values apparently being spotty. While no ore-shoot of definite dimensions is exposed in these old workings, the strength and persistence of the quartz vein is impressive. No attempt to trace the vein on the surface was noted, and further efforts might well be directed to testing the outcrop farther along the strike in both directions. In addition to the workings described, a tunnel, 95 feet long, has been driven easterly from the adit-crosscut along some quartz stringers, well mineralized in places, which parallel the main vein 30 feet to the south.

YMIR DISTRICT.

This well-known property, connected with Ymir by aerial tram, contributed **Yankee Girl.** 8,150 tons since March, 1932, when shipping started under the management of E. P. Crawford, who, with F. R. Weeks, of Vancouver, took over the property under agreement with the owners, Texas Yankee Girl, Limited. Principal values are

in gold, with minor amounts of silver, lead, and zinc, the ore being shipped to the Trail smelter on a siliceous smelting rate. Most of the mine-work has been on the 800-foot level and production has come from both the *Spur* and *Yankee Girl* veins in approximately equal amounts. A considerable portion of the ore produced has come from development-work above the 800-foot level and 935-foot level, with some from development above the 1,035-foot level. The grade has maintained a steady and satisfactory average, although all metals except gold, under prevailing conditions, have very little realizable value. The management considers that the mine has never been in better shape from the standpoint of ore-exposures. In addition to underground work, certain improvements have been made on the surface, chiefly the laying of about half a mile of low-pressure pipe of 14 inches diameter to replace the old flume that supplies water for the power plant. An additional head of 100 feet was obtained in relocating the water-conduits. A sorting plant with conveyor sorting-belts was installed at the mine portal to enable better sorting of the ore. The crew averaged about twenty men in the latter months of the year.

Goodenough. This property, on Wild Horse creek, was worked for a short period during the summer by the owners, H. Jackson, A. McDonald, of Ymir, and associates, who shipped about 407 tons of ore. Towards the end of the year a start was made under a deal with J. F. Coats, of Vancouver, and associates, but this work was suspended for the winter months, and at the time of writing plans call for resumption of development when the property is more easily accessible after the spring thaw. Vancouver Island capital is said to be interested in the undertaking. Information concerning the *Goodenough* is contained in the Annual Reports for 1927 to 1931, inclusive, also in Bulletins Nos. 1 and 3, 1932.

Ymir-Wilcox. At this property, on Wild Horse creek beyond its North fork, D. Norcross, of Nelson, J. Cullinane, and associates, have suspended work. The 10-stamp mill was operated for a few months, some bullion being recovered and concentrates shipped. Small intermittent production has been made during recent years and conditions are not substantially changed since the mine was described in Geological Survey Memoir 94, "Ymir Mining Camp."

Blackcock. This property, located westerly from the *Ymir-Wilcox*, was worked under lease and bond between June and August by R. B. Stetler, of Texas, and associates, who shipped 55 tons of ore. As in similar ores of this area, gold values are associated with iron, lead, and zinc sulphides. The property is mentioned in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia."

Prospector-owners who carried on development include: E. Emilson and partners, of Ymir, at the *X-Ray* east of the *Ymir* mine on the North fork of Wild Horse creek (see Report of the Minister of Mines for 1930); C. Fresu at the *Lucky Day* on Wild Horse creek near Ymir; D. Darragh at the *Picadore* on Porcupine creek.

Tamarac. At this property, situated on the south-western slope of Elise mountain, north of Ymir, work was started in November by A. T. Powell, of Nelson, with a small crew. Old workings were reconditioned, accommodation provided, and ore extracted for shipment early in 1933. The mine had previously been idle since 1905, when short-lived leasing activity occurred. Former development, aggregating about 1,600 lineal feet of underground work, was done between 1897 and 1902. Accurate figures of past production are not available. Some ore, not exceeding a few hundred tons, is known to have been shipped to the Hall Mines smelter at Nelson and to reduction-works in the Boundary, these plants having long since been dismantled.

The history of the property and the geology of the *Tamarac* deposits is described in Geological Survey Memoir 94, their general situation being shown on the accompanying Map 175A. The elevation of the workings is 4,600 feet, or about 2,300 feet higher than the Great Northern Railway tracks in the valley below. Briefly recapitulating previously published information, the country-rock is composed of spotted granite porphyry, attributed to the Jurassic age, which intrudes schistose eruptive rocks of the Rossland volcanic formation. The vein, from 1 to 4 feet wide, is a curving quartz-filled fissure striking from northerly to easterly, the dips being to the east and north respectively at angles varying from 30° to 50°.

The principal group of workings consists of a crosscut tunnel leading to a drift in which two ore-shoots have been partially explored by raises and winzes, the latter being temporarily inaccessible for water, and a shaft sunk from the surface through the second, or easterly, ore-

shoot to the tunnel-level. Most of the past production was from these workings. The ore consists of quartz containing masses of pyrite and arsenopyrite more or less decomposed and oxidized. In the aggregate there are probably several thousand tons of this material available. The assay results of some samples taken by the writer are quoted in the Annual Report for 1928, but average values of the ore in bulk could only be determined by large-scale sampling operations. The gold values are apparently chiefly associated with the arsenopyrite. The present operators have largely confined their attention to the higher-grade ore in the prospect-shaft, the collar of which is situated about 125 feet northerly from the portal of the tunnel-workings and at approximately the same elevation. This old shaft was not mentioned in previous reports, the opening being obscured by dense brush. It is sunk about 35 feet on the vein, which locally strikes N. 5° E. and dips at from 30° to 35° to the east. At about 12 feet down short drifts extend to north and south and at 35 feet another short drift has been run to the north. Two car-loads of ore were extracted from the upper level where the vein is from 3 to 4 feet wide, containing oxidized and decomposed bands of ore from 1 to 2 feet wide. Quartz, occasionally containing visible gold, is found in spots, but the ledge-filling is chiefly iron-stained decomposed granitic rock. In the shaft below this level and in the lower drift, iron sulphides, said to contain fair values, make their appearance. Early in 1933 the first lot of about 22 tons was shipped to the Tacoma smelter from these prospect-workings, the assay and analysis being as follows: Gold, 1.515 oz. per ton; silver, 0.27 oz. per ton; copper, 0.05 per cent.; antimony, 0.85 per cent.; arsenic, 6.31 per cent.; silica, 46.8 per cent.; iron, 17.8 per cent.; lime, trace; sulphur, 1.4 per cent.; alumina, 1.4 per cent. Subsequently 40 tons of similar ore was extracted and is awaiting shipment. About 1,000 feet northerly from the prospect-shaft 110 feet of crosscutting was done to test a surface showing, on what is believed to be the same vein, by D. T. Graney, of Ymir, on the *Pathfinder* claim, which has since been acquired by the *Tamarac* operators.

**Clubine-
Comstock
Gold Mines.** On Boulder creek, north of Salmo, work was continued throughout the year under the direction of L. R. Clubine, of Salmo. General conditions at this gold prospect are described in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia." Shipments of sorted ore made during 1932 total about 169 tons derived from the three closely spaced drift-tunnels comprising the upper workings. Net smelter returns (freight and treatment charges deducted) for the six cars shipped totalled \$4,816.55, or \$28.50 per ton. The new workings aggregate over 500 lineal feet of development, of which the upper (or No. 1) tunnel is in 50 feet. The Nos. 2 and 3 tunnels, connected by a 78-foot raise, have been driven 190 and 180 feet respectively. Improvements made during the period under review include completion of the road connecting the new ore-bin with the main road and construction of blacksmith-shop and compressor-house.

SHEEP CREEK CAMP.

Evidence is accumulating to the effect that this area has decided potentialities for a number of comparatively small producing mines. Specific suggestions for systematic exploration, indicated through the geological investigation of the Salmo Map-area by J. F. Walker, to be made available by the Geological Survey of Canada, have already given results as exemplified by the interesting discoveries made on the property of the Gold Belt Mining Company, Limited (N.P.L.). The general geology of the area, by the same author, is described in the Summary Report, 1929, Part A, Geological Survey of Canada. The northerly extension of the quartzites, favourable hosts to the gold-deposits, has been essentially unprospected. These rocks pass easterly from the *Howard* property on the South fork of Porcupine creek through an area formerly difficult to prospect, but now largely denuded by forest fires. To the south they extend across the head of Wolf and Lost creeks to the International boundary. The same quartzites, through anticlinal folding, also reappear to the east of the Sheep Creek gold camp proper in an area known to contain some east-west-striking veins and fissures, to which little attention was paid in past years. The eastern side of the structure is largely covered with overburden, which may account in part for the lack of discoveries. The *Silver Hill* and *Mountaineer* prospects, specifically described hereunder, are in exposed rocky areas in this eastern belt.

**Gold Belt
Mining Co., Ltd.** The property of this company comprises a group of eleven mineral claims centrally located between the *Reno* property to the north and the *Queen* to the south. On the east the *Nugget-Motherlode* group, recently acquired by the Reno Gold Mines, Limited, adjoins the Gold Belt holdings, which consist

of nine Crown-granted claims—the *Joint*, *Double Joint*, *Bluebird*, *Shamrock*, *Golden West*, *Dominion Fraction*, *Sunbeam Fraction*, *Bruce Fraction*, and *Navada*—and two claims held on location. Access to the ground is afforded by a branch road from the *Reno* mine road, the total distance being 14½ miles from Salmo, on the Great Northern Railway.

The general geology of the Sheep Creek district is described by J. F. Walker in the Summary Report of the Geological Survey, 1929, Part A. The greater part of the area is underlain by sedimentary rocks (tentatively assigned to the late pre-Cambrian) folded into a series of northerly-striking anticlines and synclines and intruded by younger granitic rocks. The gold-deposits occur in quartz-filled fissure-veins cutting quartzites and schists. These rocks strike from north to N. 15° E. and dip from 50° to the east to vertical and steeply west. The fissures strike from east to N. 60° E. and the dips vary from steeply to the south to vertical. As in the gold-bearing area the ore-shoots have largely been localized where the fissures cut the quartzite and harder argillaceous rocks, the important economic features are the three quartzite-belts which for convenience are herein described from west to east as the "Reno," "Nugget," and "Motherlode" quartzites (refer to illustration, page 93, Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia"). The first mentioned contains the *Reno*, *Gold Belt*, and *Queen* deposits in order from north to south. The "Nugget" quartzite-belt in the same order contains the *Nugget*, the western ore-body of the *Motherlode*, and the *Kootenay Belle* deposits. The "Motherlode" quartzite contains the eastern ore-body of the *Motherlode* vein. These quartzite-belts are separated by areas of schists, and in this formation, between the "Reno" and "Nugget" quartzites, an aplite-porphry dyke extending the full length of the gold-bearing area is believed to be genetically connected with the ore-deposition of the camp. The "Reno" quartzite where it traverses the *Gold Belt* property has a width of 750 feet, measured stratigraphically, and a width of 1,100 feet measured along the strike of the vein-fractures. These are filled with quartz and crushed country-rock and the ore consists of pyrite, galena, and sphalerite sparingly distributed through the quartz, with free gold visible in numerous specimens. Unlike the extensively oxidized condition which prevailed in the upper parts of ore-bodies in other mines of the camp, such as, for instance, at the *Reno* and *Nugget* properties, oxidation is very shallow or entirely absent, primary ore being exposed at the surface as in the "C" vein-outcrop referred to hereinafter.

Under the supervision of H. Lakes, preliminary work started towards the end of June, 1932, included construction of temporary camps, building of road and trail connections, and recon-ditioning of the *Joint* shaft, situated in the limestone area lying west of the "Reno" quartzite. This was followed by systematic prospecting to test the westerly extension of the *Motherlode* vein system (specifically the *Clyde-Belt*, *Golden Belle*, and *Motherlode* veins) on the ground covering the "Reno" quartzite. Some 3,000 lineal feet of trenching and stripping was accomplished, resulting in the uncovering of three veins, which from north to south have been temporarily named the "A," "B," and "C" veins until they are definitely correlated. Farther south the westerly extension of the *Bruce* vein was uncovered for 250 feet along its strike. Including the *Joint* vein, this makes five known veins in this section of the property at the present time. In addition, there is the vein on the *Navada* claim, some distance to the south, developed by old superficial workings from which, in past years, some ore was extracted and milled in the old *Kootenay Belle* mill. Prospecting for the westerly extension of the *Nugget* vein system was not attempted, but is to be undertaken next summer. Brief particulars regarding the new vein-exposures are as follows:—

Vein and Width.	Elevation of Outcrop.	Horizontal Distance to Next Adjoining Vein measured Southerly.	Length of Trenching along Strike.	Remarks.
	Feet.	Feet.	Feet.	
Vein "A," up to 4 feet, including sheared country-rock	5,543	600	400	Believed to correspond to <i>Motherlode</i> vein.
Vein "B," from streak to 20 inches	5,394	100	600	
Vein "C," 1 to 3 feet.....	5,358	375	650	Believed to correspond to <i>Golden Belle</i> vein.
Vein "Bruce," 30 inches.....	5,232	.....	250	

The major discovery is the "C" vein, which is a well-defined vein, of a consistent width averaging at least 2 feet, traced for 650 feet, of which over 300 feet is stripping along its outcrop. The ore-shoot, stripped in one continuous cut for a length of 230 feet, gives assays from \$4 to \$112 per ton across pay-streak widths from a few inches to 3 feet. Free gold is visible in specimens at numerous points for a length of 130 feet of the ore-shoot, and in this section a grab-sample, from which obviously rich specimens were excluded, assayed: Gold, 1.44 oz. per ton; silver, 0.6 oz. per ton; lead, trace; zinc, 1 per cent. Next in apparent importance is the *Bruce* vein, which was slightly explored by old workings, including a 23-foot shaft, at the bottom of which is a 12-foot drift to the east. This is a strong quartz vein which, according to the management, gives fair assays.

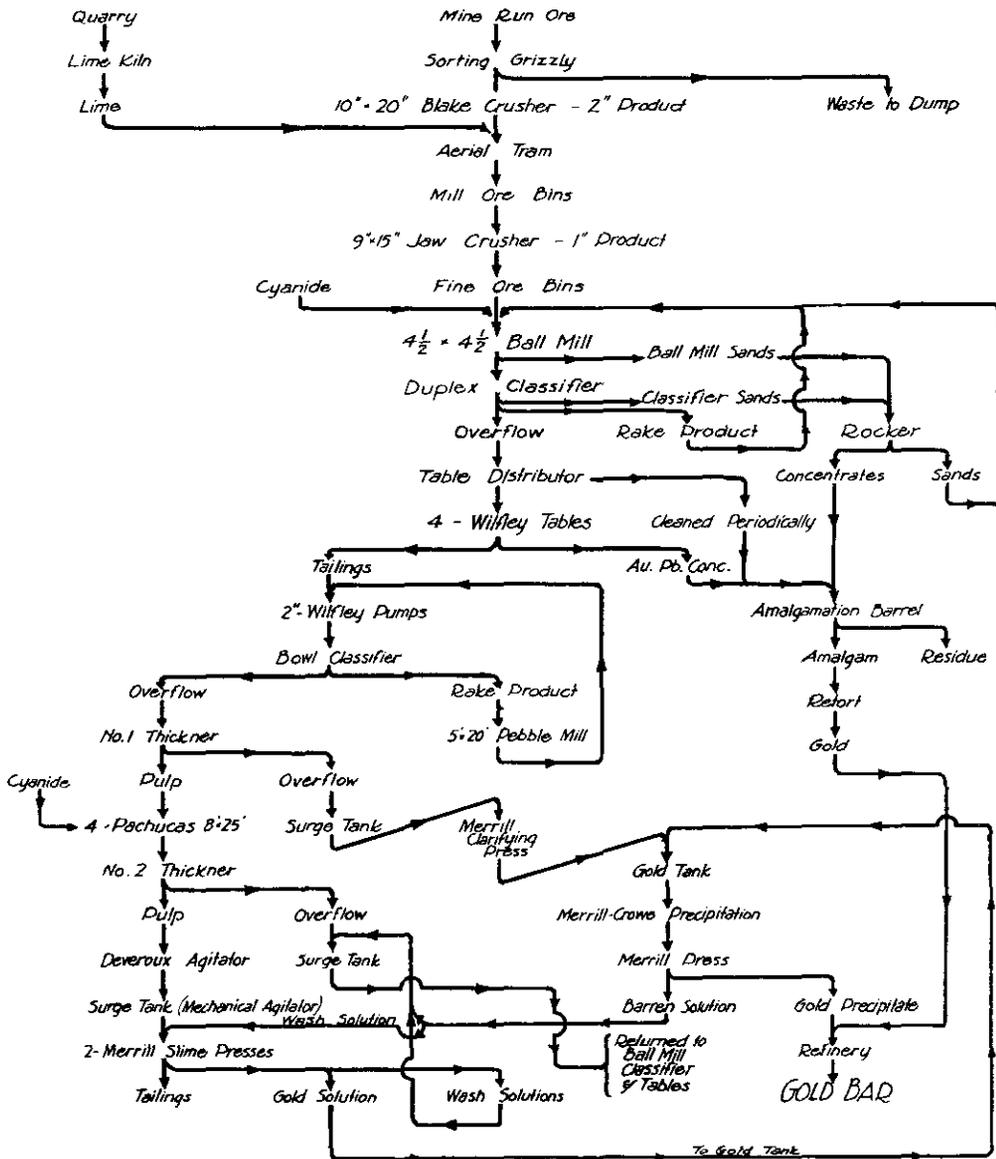
The "A" and "B" veins have shown good values in places, but no continuous ore-shoot has been exposed as yet. In general the surface showings compare very favourably with the outcrop-exposures of the camp, such as at the *Reno* property, where consistently better conditions were found at depth and continuous ore-shoots were not found in general to extend to the surface.

A tunnel-site on the Sheep Creek slope has been chosen, situated about 3,200 feet north-westerly from the new *Reno* mill and at about 1,300 feet higher elevation. The tunnel-site is at 4,800 feet elevation and the new *Reno* mill at 3,500 feet elevation. Plans call first for a crosscut tunnel about 1,300 feet long to test the *Bruce*, "C," and "B" veins at vertical depths of 432, 558, and 594 feet below their respective outcrops. The projected intersection of these veins in the same order would be 780, 1,125, and 1,225 feet respectively. "A" vein will be tested further by drifting at shallow depth below its outcrop, and if results are satisfactory the deep tunnel will be extended about 600 feet to test this vein at a depth of 743 feet. Tentative plans also include a possible adit crosscut tunnel situated in an intermediate position between the deep tunnel and the vein-outcrops. In addition to the proposed deep testing of the veins mentioned, interesting exploratory possibilities for future attention include the possible westerly extension of the *Nugget* vein system into the "Reno" quartzite and the easterly continuation of the vein on the *Joint* claim from where it has been explored in limestone into the same quartzite area. This is one of the oldest locations of the camp, and the old superficial workings, including a 96-foot, 75° inclined shaft, develop an easterly-westerly-striking quartz vein for a length of several hundred feet. This vein is of good mining width, the filling consisting of quartz containing irregular disseminations of galena, sphalerite, and pyrite, with streaks of oxidized material on both walls. With the exception of this oxidized ore, which gives fair assays in gold and silver over narrow widths, values are spotty and not commercial. However, this vein is quite attractive and may contain more consistent gold values in the favourable quartzite formation to the east. In the limited amount of trenching done by the present operators easterly from the old workings, still in limestone, this vein shows a decided tendency to strike north-easterly. The possibilities of the north-easterly-striking *Columbia* vein on the *Navada* claim are also not exhausted, as has been demonstrated by recent work which opened up some high-grade ore over narrow widths. In former years a small amount of stoping was done from a shallow tunnel on this vein.

The new camp at the deep tunnel-site has been completed. This includes boarding and bunk houses accommodating twenty men, blacksmith-shop and compressor-room, and water system for domestic and mine use. A transmission-line 3,000 feet long has been constructed to connect with the *Reno* power-line preparatory to installing electrically driven compressor and machinery for carrying on the initial programme of development-work. At the time of writing the tunnel has been driven 100 feet by hand, a portable compressor is being installed, and heavy compressor equipment is on the way. This includes a Sullivan angle compound compressor of 1,235 cubic feet rated capacity, 150 horse-power motor, drill-steel sharpener, and oil-forge. Arrangements have been made with the *Reno Gold Mines, Limited*, to mill ore on a customs basis if required.

Production from this mine, in abeyance since the original cyanide-mill on Fawn creek burned down on February 25th, was resumed on December 19th on completion of the new construction programme which was initiated following the acquisition of the *Nugget-Motherlode* properties, and *Motherlode* mill on Sheep creek. The aerial tram, of rebuilt Leschen type, with fixed buckets, was constructed under contract by the A. H. Green Company, Limited, of Nelson, which also supplied the designs of all structures. Work was started August 1st and completed December 15th. It is 12,800

FLOW SHEET OF THE RENO-MOTHERLODE MILL,
SHEEP CREEK, NELSON MINING DIVISION.



Flow sheet by J. Mateer, Mill Supt.

With report by D.T. O'Grady, 1932,
 Resident Mining Engineer,
 Nelson, B.C.
 B.C. Bureau of Mines

feet long from the mine to the new mill, the difference in elevation between terminals being 2,413 feet. The tram crosses the summit between the Sheep and Fawn Creek basins at an elevation of 2,784 feet above and at a distance of 4,685 feet from the lower terminal. A deflection angle of 38° 30' is absorbed by a summit angle tower 100 feet in length of heavy timber construction on concrete footings. Tower-construction, of local timber, includes eight single-cap towers, four double-cap and one triple-cap tower. There are two tension and anchor and one double-anchor station. The standing cables, varying in size from 1¼ inches to ¾ inch, were supplied by the Anglo Canadian Wire Rope Company, Limited, and the ¾-inch traction-cable was supplied by the Wrights Canadian Rope, Limited. The tram, operated by gravity, is designed for a speed of 250 feet per minute, with a capacity of 15 tons per hour.

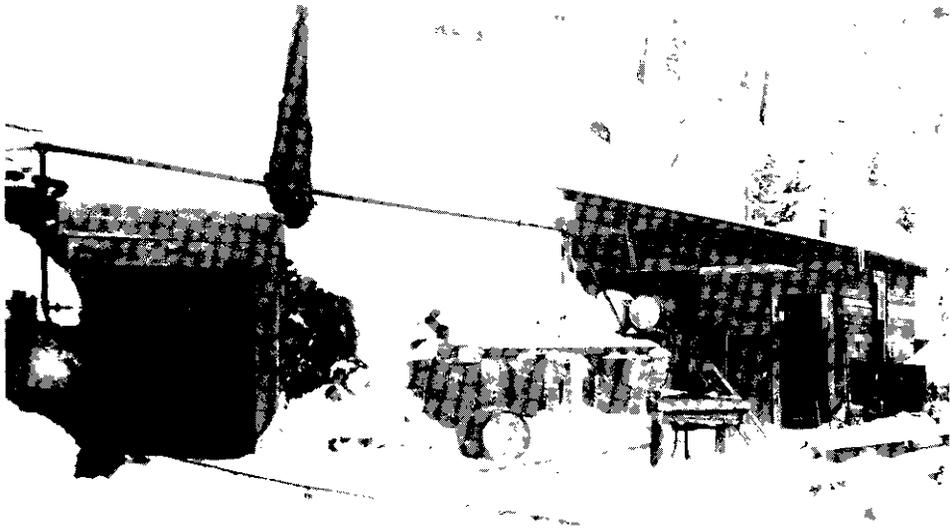
Work on the new power plant, also constructed under contract by the A. H. Green Company, was started in July and completed in November. The dam is located above the mouth of Fawn creek, about 2 miles below the mill-site. A cedar flume, 24 by 42 inches, on a grade of 0.0015 per cent. and 17,000 feet in length, delivers the water into a 22-inch wood-stave pipe. Flume and pipe are designed to deliver not less than 18 cubic feet of water per second, with a nozzle-pressure of 198 lb. per square inch. The generating equipment consists of a Canadian General Electric 3-phase, 60-cycle generator operating under a speed of 459 r.p.m. and developing 665 k.v.a., voltage 6,600. It is directly connected to an impulse water-wheel designed and constructed by the Nelson Iron Works. The wheel is controlled by a Lombard governor equipped for remote control of deflectors, the plant being automatic and fully equipped for semi-remote control. Power is conveyed to the mill over a line 4½ miles in length and thence to the mine over a secondary line 2½ miles long.

The *Motherlode* 100-ton-capacity mill has been remodelled and adapted to treat sulphide ores by the introduction of new machinery, and provision has been made for enlargement to take care of customs ores when necessary. The accompanying illustration shows the changes made to the flow-sheet of the original cyanide-treatment plant. Coarse crushing is done at the mine, the ore being delivered at the mill to a fine cone crusher and then ground in a ball-mill in close circuit with a 6-foot Duplex classifier. The product is passed over four Wilfley tables and fine grinding is carried out in a 5- by 20-foot tube-mill in close circuit with a 6-foot Dorr bowl classifier. The overflow passes to a primary thickener, thence to four Pachuca agitators, and thence to the secondary thickener. This product is again treated in a Devereaux agitator and then by mechanical agitation, the solution passing to a Merrill-Crowe precipitation unit. All tanks are of steel construction and duplicate pumps are installed at all stages. All mill units are operated by individual electric motors, but any part can be switched to water-power by means of auxiliary Pelton wheels. The mill is equipped with a complete machine-shop and heating plant. Handicapped by severe winter conditions, the mill, gradually stepped up, has been averaging 65 tons per day. According to the management, 1,664 tons were treated during the first month and an average extraction of 95.1 per cent. was made from mill-heads, assaying about \$20 per ton. A gold brick approximating \$20,000 in value was shipped to Vancouver early in 1933, but detailed production figures are not yet available.

During construction of the new power plant mine-development was continued on a reduced scale compatible with the then limited power facilities available. The No. 5 tunnel was extended to 1,600 feet in from the portal. It still has to go about 200 feet to get under the western extremity of the 424 ore-body on the level above. The 514 raise was put up connecting the No. 5 and No. 4 levels, which are 277 feet vertically apart.

Referring to the illustration on page 107, Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia," this raise develops the ore-shoot, on which a limited amount of stoping has been done for a length of about 220 feet on the No. 5 level, and connects with the No. 4 tunnel opposite the 424 stope. This ore-body, of irregular lateral extent, has been persistent throughout the five levels of the mine and on No. 5 level has reached its maximum width. Assay details of this deepest showing along the drift from west to east, as taken from the company's assay-plans, are:—

Length (Feet).	Width (Feet).	Average Assay (Gold).
68	1.76	\$65.80
36	0.91	6.70
112	3.71	35.00
88	1.26	15.48



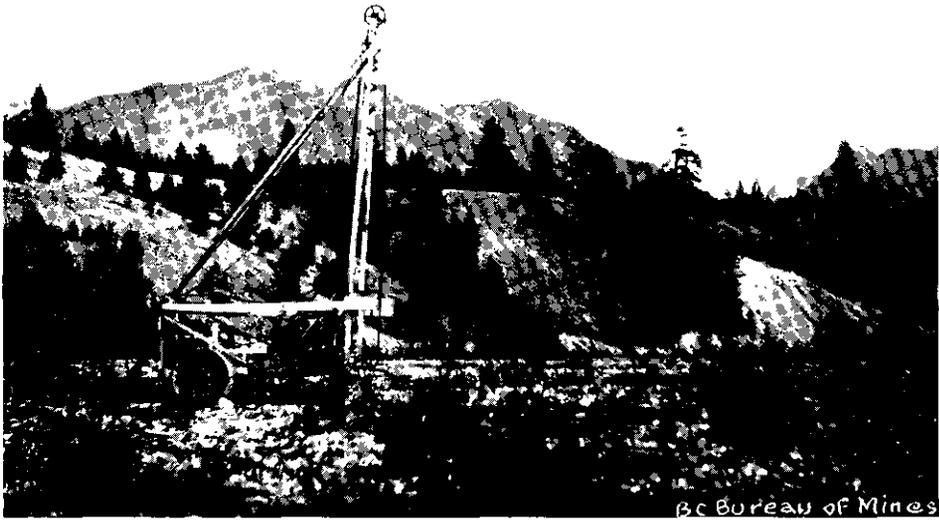
B.C. Bureau of Mines

Gold Belt Mining Co., Ltd.—Portal.



B.C. Bureau of Mines

Reno Gold Mines, Ltd.—Taking up Aerial Tram Cable.



Wild Horse River, Fort Steele—A Keystone Drill.



Sullivan Mine—Crushers at Portal of Main Tunnel.

Over the total length of 304 feet the average width is 2.23 feet and average value \$35.90 per ton. Further, according to the company's assay-maps, the 434 ore-shoot on No. 4 level, not yet reached in No. 5, has an uninterrupted length of 383 feet, averaging 1.89 feet in width and assaying \$47.60 per ton. About 25 feet easterly from the end of this long shoot in No. 4 tunnel-drift the ore comes in again for a length of 57 feet, averaging 1.34 feet in width and assaying \$21 per ton. Prior to the recent resumption of operations about 25,000 tons of ore had been stoped above No. 4 level, having an approximate gross value of \$400,000. Estimates of ore reserves are difficult to arrive at owing to the irregular outline of the ore-bodies. An analysis of the company's plans and sampling data before the new raise was put through indicated 50,000 tons (including dilution) of \$18.20 ore partially blocked out, with an additional equal amount of possible ore, based on the speculative assumption that the eastern ore-shoot on No. 4 level will prove equally good on the No. 5 horizon and that both ore-bodies will extend to the 6,000-foot horizon. Stopes have been opened up in No. 5 tunnel and ore is now being stoped on Nos. 3, 4, and 5 levels.

Compressor equipment provided for the mine includes a Sullivan angle compound compressor of 1,845 cubic feet per minute capacity, powered by a 300-horse-power synchronous motor. Total air now available is 2,368 cubic feet. The 1933 plans include resumption of development-work in the *Nugget-Motherlode* mine-workings with a view to assuring additional ore reserves for the milling of increased tonnage.

Queen. At this well-known property on Wolf creek, formerly the leading gold-producer in the Sheep Creek camp, activity was initiated in July by C. E. Witter, of Moscow, Idaho. The mill was operated intermittently on ore from the *Alexandra* workings and *Queen* mine stope above the flooded level. The *Alexandra* No. 3 tunnel was extended 100 feet. At the end of the year the No. 4 level of the *Yellowstone* was being driven ahead. The property is described by J. F. Walker in the Summary Report, 1929, Part A, Geological Survey of Canada, "Mineral Developments in Salmo Map-area," since when conditions are not materially changed.

Vancouver. At this prospect, adjoining the *Queen* holdings on Wolf creek, owned by Frank Unfried, of Nelson, lessees were active throughout the year. Latterly, V. Anderson, of Salmo, with six men, has been stoping ore in the winze on the lower level. Total shipments for the year amounted to 113 dry tons containing 205.29 oz. of gold and 84 oz. of silver. In addition to the potentialities of the small high-grade ore-shoot at depth, the easterly extension of the *Vancouver* vein into adjacent ground is considered to have interesting possibilities. In this connection J. F. Walker's full report on the Salmo Map-area is awaited with interest. The present ore-shoot occurs in an easterly-striking section of a sinuous fissure along which movement has caused intense compression, whereby the more northerly-trending parts of the vein are tightened, with a resulting tendency for the easterly-striking portions to open. In the drift-workings beyond the ore-body the vein is tight where it strikes more northerly. There is a possibility that as these tunnels are advanced conditions will be repeated and the fissure reopen and make ore. Similar, but more complicated, structural conditions may govern ore-deposition in the vertical section.

Columbia. From this prospect on the northern side of Sheep creek, opposite the *Queen* mill, J. Sapples and W. Devlin, both of Salmo, shipped about 19 tons of sorted ore. This small vein, paralleling the other easterly-striking veins of the camp, cuts "Reno" quartzite. The ore was extracted from workings thought to be on the *Nuvuða* claim of the Gold Belt Mining Company, with which an arrangement is understood to have been made.

Kootenay Belle. From this property on the southern side of Sheep creek, easterly from the *Queen* mine holdings, 236 tons of ore was extracted from the No. 2 level and shipped to the Trail smelter. The gross value of past production from the limited workings is \$118,869.28, of which crude (sorted) ore shipments amounted to 721 tons, valued at \$34,882.44, or an average of \$48.38 per ton. The mine-workings and geological conditions are described by J. F. Walker in the Summary Report of the Geological Survey, 1929, Part A, under "Mineral Developments in Salmo Map-area." The property, consisting of seven Crown-granted claims and a mill-site, is very conveniently situated in regard to transportation, the No. 2 tunnel being connected by light aerial tram to an ore-bin on the Sheep Creek road 750 feet below. The abrupt slope of the mountain-side permits of exploration to considerable

additional depth by comparatively short crosscut tunnels. Equipment at the mill-site adjoining the road includes a 50-horse-power semi-Diesel engine, connected to a 12 by 14 Ingersoll-Rand compressor with two air-receivers and 5¾-inch pipe-line to the workings, where two Waugh drills are operated. The ore shipped in 1932 was during the last four months of the year, when development-work was being done on No. 2 level with a crew of men under the supervision of Frank Phillips, of Nelson. The Kootenay Belle Gold Mines, Limited, was recently incorporated to take over the operation, which with adequate development, as planned, is expected to expand.

Bonanza. At this prospect on the western side of Wolf creek, a short distance southerly from the *Alexandra* claim of the *Queen* property, development was carried on for a short period by M. C. Donaldson, of Salmo. The vein, a well-defined fissure, cuts hard quartzites corresponding to the southerly extension of the formation containing the *Nugget*, *Kootenay Belle*, and *Alexandra* veins.

Mountaineer. This group of claims, extending along the south side of Gamble creek, a tributary of Sheep creek from the east, has been reacquired by E. C. Wragge, of Nelson, who, with former associates, prospected the ground about twenty years ago, when it was known as the *Heather* group. The claims, reached by trail 4½ miles from the *Motherlode* mill, extend along the bluffs forming the northern escarpment of the Middle Sister ridge, where the "Reno" and "Motherlode" quartzites are repeated on the eastern limb of a large anticlinal structure. Snow on the rocks when the property was visited late in the fall prevented a detailed examination of conditions. Towards the western extremity of the area there is a fractured zone, 15 feet wide, striking S. 70° E. (up the hill), with approximately vertical dip, cutting quartzite which strikes about N. 17° E. and dips about vertical; this prominent feature being traceable for several thousand feet to the east. Some quartz-stringer mineralization is in evidence between the walls of the zone, which towards its southern side contains a narrow lamprophyre dyke with similar trend and dip. Grab-samples of selected material assayed up to \$2.40 in gold per ton. Farther east a northerly-trending dyke, 6 to 13 feet wide, of highly altered porphyritic rock, was investigated during the years 1919 to 1923. At about 6,000 feet elevation a tunnel, temporarily inaccessible from caving at the portal, was driven 60 feet southerly along the dyke, which was found to contain interesting gold values in places where shearing and silicification had occurred along the walls. Quoting a letter to the former owners from the late G. A. M. Young, of Creston, values obtained from such material, no widths being given, were from 0.22 to 2 oz. gold per ton; and quartz stringers within the dyke itself showed appreciable values, visible gold having been noted. Plans for future exploration include investigation of the possible occurrence of a definite ore-body at the intersection of the dyke with the easterly-striking zone of fissuring.

Silver Hill. Prospecting was continued by J. C. Hansen, of Sheep Creek, on this group of three claims on South Sister mountain, adjoining the trunk trail 4½ miles north-easterly from the end of the road at the *Motherlode* (now *Reno*) mill. Open-cuts and stripping develop two parallel fissures striking about N. 50° E. and dipping up to 50° to the south-east, in northerly-striking, vertically-dipping quartzite. This is one of the series of country-rocks to the gold veins of the Sheep Creek camp, repeated in the Three Sisters Mountain area to the east by folding. The superficial workings examined are situated at an elevation of about 6,425 feet in the rock bluffs on the southern side of Bayonne creek at the top of a big rock-slide. The lower vein, up to 12 inches wide, has been stripped and traced for a combined length of about 200 feet. Light oxidation, indicating the presence at one time of sulphides, is in evidence in places, but no measurable mineralization is exposed in the very limited amount of exploration along this vein. Just below the showings a crosscut, about 160 feet in, has not yet reached the projected position of the vein at this depth. About 100 feet higher up in the bluffs some work has been done on another fissure said to be up to 6 feet wide, including some quartz, but the snow on the rocks when the property was visited late in the fall prevented inspection.

Wolf Lake. At this group of claims at the head of Wolf creek, owned by B. M. Wilson, of Chewelah, Wash., a small crew carried on development for a period during the summer. A description of conditions by J. F. Walker will be contained in the Salmo Map-area report to be published by the Geological Survey of Canada.

ERIE CREEK.

Intermittent activities occurred in connection with: The *Second Relief*, by A. Sostad, of Vancouver, on behalf of the Relief-Arlington Mines, Limited; the *Keystone*, by A. E. Bostrom, of Spokane, and associates; and at the *Arlington*, where G. Birtsch, of Nelson, leased for a short period and made a small shipment. For information concerning these properties refer to Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia."

LOST CREEK.

Jumbo. A trip was made to this prospect on the southern slope of Nevada mountain, north of Lost creek, in connection with a proposed undertaking when the Jumbo Gold, Limited (N.P.L.), was incorporated early in 1932. While no permanent activity materialized, the following notes are submitted for purposes of record. The property, which it was proposed to acquire from J. Waldbeser, of Spokane, and associates, consists of the *Jumbo No. 1*, *Jumbo No. 2*, and *Boncheer* Crown-granted claims, together with the adjoining *Jumbo Fraction* and *Climax* mineral claims. The workings extend along the westerly contact of the Lost Creek granite-mass with the Pend d'Oreille sediments, or the northerly extension of the formation in which occur the deposits of the *Molly Molybdenite* south of the same creek. At 5,180 feet elevation a tunnel, comprising 230 lineal feet of work, includes a drift along a northerly-striking quartz vein up to 4 feet wide in granite and two short branch tunnels driven westerly to the contact with the schists. Along this contact some silicification is apparent, but no definite mineralization. The quartz vein, lying west of a mica-lamprophyre dyke, contains scattered aggregates of light-coloured pyrite, and four samples, across widths of 2 feet and less, gave gold values of 0.30 oz., 0.19 oz., 0.02 oz., and trace per ton respectively. At the inner extremity of the tunnel where the fissure joins the contact, which strikes N. 15° E., a winze, said to be down 30 feet, is partly filled with water and not conveniently accessible. Specimens on the dump at the tunnel portal contain pyrite, molybdenite, galena, and sphalerite in vein material, molybdenite being also found in fragments of contact-granite. A specimen showing pyrite and sphalerite assayed: Gold, 0.10 oz. per ton; silver, 2.4 oz. per ton. At 5,000 feet elevation a tunnel driven northerly along the same contact is caved at the portal. In the granite at 4,900 feet elevation a 10° sloping tunnel, with open rock approach, has been driven N. 26° W. along a sheared, rotten mica dyke about 4 feet wide and vertical. A glassy quartz vein is exposed in the wall along the eastern side of the dyke. Samples of the quartz, which is honeycombed and iron-stained in places, showed no values of interest. Above and westerly from the last-mentioned working three contiguous shallow cuts expose barren quartz in schist. Other surface workings said to be situated on the mountain above the upper tunnel could not be inspected for snow remaining at this altitude when the property was visited early in the spring.

EAST SIDE OF KOOTENAY LAKE.

Sanca Mines, Ltd. Near Ghols Landing, W. Frampton and associates have carried out some construction, including a double-track pole chute operated by hoist, connecting the southerly workings on the *Valparaiso* vein with a new ore-bin at the main road. On the bench above the road and at the foot of the mountain a 3,000-foot light steel-lined chute connects with a "mill," which includes a Pulmac crusher, riffle-boxes, classifier, Wilfley-type table, and gas-engine; the whole constituting an example of original "home-made" mechanism. It is understood that this equipment has been provided in connection with the Canada Smelters, Limited, a subsidiary of the Sanca Mines, Limited.

MISCELLANEOUS.

Molly Gibson.—At this silver-lead-zinc mine on Kokanee creek a limited amount of development work was carried on during the summer by the Consolidated Mining and Smelting Company. The low-level crosscut tunnel was advanced, being now in over 1,850 feet.

Lakeview. This prospect, adjoining the highway north of Sanca creek, on the east side of Kootenay lake, and owned by E. G. Timmons, has been taken under option by F. Staples, of Creston, who plans to install a compressor and drive 300 feet of crosscut tunnel as an initial programme of development. Work done by the owner includes a 30-foot vertical shaft sunk on a vein containing massive lead-zinc sulphide ore. The deposits

are situated in an area of metamorphosed sediments of late pre-Cambrian age circumscribed by granitic rocks.

Near Deer Park, on the Lower Arrow lake, minor prospecting activities include those by F. G. Hamblin at the *Chin-Chin* and P. Knabe at the *Two Fools* and *Lake Shore*. The *Chin-Chin* and *Two Fools* are about a quarter of a mile apart on the mountain-side easterly from Deer Park, from 1,000 to 1,600 feet in elevation above the lake. Iron sulphides, galena, and sphalerite are found in the fractured zone on either side of the contact of the granitic rocks and schists of the Rossland volcanic formation. Shallow prospect-workings have not yet exposed any mineralization of appreciable extent.

TRAIL CREEK MINING DIVISION.

The Consolidated Mining and Smelting Company of Canada, Limited, in consideration of numerous requests received from miners now living in Rossland, has decided to lease sections of its Rossland mines. In the statement given out by the company the following conditions governing the treatment of ore from such leases were set forth:—

“Owing to the absence of other copper tonnage and the very low price of that metal, the company states it will not be possible to operate a copper-furnace, but an endeavour will be made to handle production from the Rossland leases in the lead-furnace.

“Payments will be made for gold and silver as in Schedule ‘J’ for lead ores, with adjustments for premium on Canadian funds as per Supplement 170. A treatment rate of \$5 per ton of 2,000 lb., in minimum lots of 20 tons, will be charged. The 2-per-cent. Government tax will be payable by the lessees, while royalties based on the net smelter returns will be deducted by the company on the following scale: 10 per cent. on ore not exceeding \$15 per ton in value; 15 per cent. on ore over \$15 per ton and not exceeding \$25 per ton in value; 20 per cent. on ore over \$25 per ton in value.

“A reasonable amount of assaying will be done by the company free of charge.”

This is a very gratifying decision on the part of the company and should result in increased activity in the Rossland area.

During 1932 there was increased activity by lessees and prospector-owners in connection with the small gold properties on O.K. mountain, with very encouraging results in some cases. Shipments were made from the *I.X.L.*, *Midnight*, *Gold Drip*, and *Snowdrop*; development being also carried out at the *O.K.*, *Golden Butterfly*, and *Norway*.

Renewed success is being realized by Ole Osing and associates of the *I.X.L.* Syndicate, who shipped 98 tons of ore, including lots of from 900 to 1,700 lb. assaying up to 367 oz. gold per ton. The ore is derived from a new discovery, or “B” vein, which, first found on the surface, has been followed and worked on Nos. 1, 2, and 3 levels through a total vertical range of 112 feet. The vein is from a few inches up to 2 feet wide, the pay-streak averaging about 8 inches in width. The ore contains free gold, sometimes quite coarse, with iron and copper sulphides, galena, and the copper carbonates, in a siliceous gangue. The formation of the area in which the *I.X.L.*, *O.K.*, *Midnight*, and other fissure-veins occur is composed of basic fine-grained eruptive members of the Rossland volcanics overlying serpentine which is probably an altered augite-porphyrity stock. The *I.X.L.* fissures strike a little south of west, with dips to the south from 35° to 60° and steeper. Numerous dykes and faults offset the veins, calling for a high degree of efficiency in following the ore and avoiding dead-work. On the lowest level of the *I.X.L.*, reached from the *Midnight* tunnel below, a winze was sunk 60 feet on the main (or “A”) vein to where it pinched out on entering the serpentine. An area between the present faces of the tunnels and the *O.K.* boundary-line, about 130 feet long following the strike of the veins to the south-west, remains to be explored. The property is equipped with portable compressor and raising is in progress on Nos. 2 and 3 levels, with a machine in each face. Seven men are employed, with Ole Osing, long connected with successful leasing operations at the property, in charge. Shipments of high-grade ore are being maintained and a dividend was recently distributed to the fifteen participants in the lease.

Midnight.—At this property, adjoining the *I.X.L.* to the east, M. Dally, of Rossland, and associates have been developing a wide quartz vein containing iron-sulphide mineralization, average values being low grade. A mill to treat 8 tons in 24 hours is being installed.

At the *O.K.*, adjoining the *I.X.L.* to the west, development-work is being continued by J. Hendrickson and associates on the lower level, where the downward continuation of “B” vein is being sought in a faulted area.

Other activities in the vicinity include those by: C. Penney and associates, at the *Gold Drip*; M. Ellison and partner, at the *Golden Butterfly*; M. Dally and associates, at the *Norway*; Snowdrop Leasing Syndicate, at the *Snowdrop*. Altogether about thirty men are employed on the O.K. Mountain properties.

Evening Star. At this property, 1 mile by road northerly from Rossland, C. E. Fraser and three associates have accomplished a substantial amount of work and shipped 80 tons of ore. The history of past operations and geology of the deposits are described by C. W. Drysdale in Geological Survey of Canada Memoir 77, "Geology and Ore Deposits of Rossland." The ore shipped consists of oxidized siliceous material containing iron sulphides, including arsenopyrite. Values are in gold, with minor amounts of silver. The last car-load, shipped in December, consisted of 27.36 tons, which assayed 1.49 oz. gold per ton, the total gross value being \$779.11.

Velvet. At this property, adjoining the Rossland-Cascade highway 12 miles from Rossland, new activity was initiated in the fall of the year by G. Coryell, Jr., of Seattle. Subsequently the Velvet Gold Mining Company, Limited, was incorporated to finance the undertaking. Preliminary work done included the renewal of the old water-supply, branch road improvements, cleaning-up, repairing buildings and equipment. Mining was carried on in the shaft-workings on the Nos. 1, 3, and 4 levels, from which two car-loads of sorted ore, aggregating about 80 tons, were shipped early in 1933 to the Tacoma smelter. This was not found profitable and concentration will probably be resorted to before further shipments are made. In this connection machinery from the mill of the Surprise Mining Company at Rosebery has been acquired. The ore contains gold, silver, and copper. Shipments of crude ore by past operators between 1901 and 1927 (including a small production from the *Portland* workings) total 7,796 tons, which contained 6,070 oz. gold, 6,612 oz. silver, and 594,803 lb. copper. Information concerning the geology of the deposits and history of past operations is contained in Geological Survey of Canada Memoir 77, "Geology and Ore Deposits of Rossland," by C. W. Drysdale, published in 1915. Since then the property was worked intermittently. In 1925 and 1926 a long tunnel, driven by a Rossland syndicate, effectively drained the flooded workings of the 600-foot vertical shaft, but no further work of importance was done at the property until the present operators took it over.

Albion. At this group of eight claims, near Paulson, prospecting was continued by J. Kloman. A summary of conditions in this gold area is contained in Bulletin No. 1, 1932, "Lode-gold Deposits of British Columbia." The cabin, at about 5,850 feet elevation, is 5 miles by road from Paulson. The property includes the following Crown-granted claims: *Albion No. 2*, *Albion Fraction*, *Duluth*, *Duluth Fraction*, *Bonanza No. 2*, *U.S.*, and *B.C.*; and the *Amazon* and *Beaver* mineral locations. Gold values are contained in quartz-filled fissures traversing the syenitic country-rock which underlies most of the area and extending into the adjoining eruptive rocks of the Rossland volcanics. Most of the work has been done on the *Albion No. 2*, *Albion Fraction*, and *U.S.* claims. On the *U.S.* claim, at 5,650 feet elevation, an inclined shaft has been sunk about 20 feet on a quartz vein containing iron sulphides, which widens from 18 inches at the top to 7 feet at the bottom. The country-rock here is an andesite. The vein strikes north, with a dip varying from 60° to 70° to the west. On the side-hill, about 75 feet in elevation below the collar of the shaft, a tunnel 124 feet long cuts the apparent downward continuation of the vein, which has been drifted 20 feet to the north and 25 feet to the south. In these workings the vein splits into bunches of quartz. On the *Albion No. 2*, at 5,975 feet elevation, a deep rock-cut exposes a vein 6 feet wide, mineralized with disseminated iron sulphides, striking north in syenitic country-rock. Twenty-five feet south of the cut, throughout which space the vein has been stripped, a timbered inclined shaft has been sunk 40 to 50 feet on the vein, which dips 67° to the east. At the bottom of the shaft a tunnel, caved at the portal, has been driven southerly along the vein to the surface. Throughout the shaft the quartz is rusty and contains bands of iron sulphides, with average values said to be about \$8 per ton, but the vein, 6 feet wide at the top, gradually narrows down to a streak of gouge at the tunnel-level.

On the *Albion Fraction*, at a slightly lower elevation, shallow workings include a 12-foot inclined shaft sunk on a vein, 7½ feet wide, striking north and dipping 68° to the east. The country-rock here is also a syenite. This vein, which is filled with rusty quartz containing disseminated iron sulphides, is roughly in line with the vein system of the *Cascade-Bonanza*

in the Iron Creek valley to the south. On the *Duluth* claim, in syenite, an open-cut exposes a 4-foot quartz vein, containing streaks of iron sulphides, striking north, but, unlike the other veins, dipping to the west. A large amount of sampling would be necessary to determine average values in the several quartz veins. Iron sulphides carry good values in places, as evidenced by a recent sample of selected sulphide ore which, assayed for the owner, gave: Gold, 4.8 oz. per ton; silver, 45 oz. per ton.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA.

Smelting Operations.

During 1932 there was no new construction of any importance, the only addition to the plant being the building of a small reverberatory furnace to act as a holding furnace for the charge to the slag-fuming furnace. Trail practice for the recovery of zinc and lead from blast-furnace slag is described in detail by G. E. Murray, assistant smelter superintendent, in the April, 1933, bulletin of the Canadian Institute of Mining and Metallurgy. The lead-smelting plant did not operate at full capacity, but was run on a three-furnace basis for a total of 1,122 furnace-days, as against 1,175 in 1931. Stimulated by the low metal prices prevailing throughout the year, a great deal of attention has been paid to increased efficiency in the various divisions of the plant with gratifying results. A considerable amount of research and experimentation has been carried on in connection with sintering, the distribution of the charge and the regulation of air to the blast-furnaces, with beneficial results, and a large amount of valuable data collected. The progressive improvements in metallurgical technique, recorded in past Reports of the Minister of Mines and in the technical press, have contributed to an important degree in enabling this great industry to carry on under very adverse conditions.

Chemical and Fertilizer Department.

Detailed information concerning this potentially important branch of the company's activities is contained in the Annual Report for 1931. Sulphuric-acid-plant operation on zinc-plant gases developed satisfactorily, and most of the smoke was controlled in this way, and the sulphuric acid made went into the production of either ammonium sulphate or phosphate fertilizers, or was marketed as acid. At the end of 1932 the hydrogen, nitrogen, ammonia, and ammonium-sulphate plants were brought up to capacity production, but owing to the serious Prairie conditions caused by low wheat prices, the company's phosphate programme was somewhat curtailed and the production of phosphate fertilizers was on a lower scale than expected.

WESTERN MINERAL SURVEY DISTRICT (No. 6).

REPORT BY GEORGE A. CLOTHIER, RESIDENT MINING ENGINEER (HEADQUARTERS, WORKMEN'S
COMPENSATION BUILDING, 411 DUNSMUIR STREET, VANCOUVER).

INTRODUCTION.

The Western Mineral Survey District includes the following Mining Divisions of the Province: Victoria, Alberni, Clayoquot, Quatsino, Nanaimo, Vancouver, New Westminster, and Lillooet. The Lillooet Mining Division was added to District No. 6 in 1932. The district covers all of Vancouver island; the Mainland coast south of Seymour inlet and east to the summit of the Coast range; and the Lillooet Mining Division east of the Coast range. The geological, geographical, and other features of this district have been described in some detail in former Annual Reports.

The predominating geological feature is the great granodiorite Coast range, having a width of over 100 miles. On either side of this main range is a wide belt of more or less altered formations overlying and intruded in many places by the granodiorite. There are therefore three immense belts containing every geological condition conducive to mineral deposition.

The reader is referred for the geology of District No. 6 to the Vancouver Sheet No. 196A, issued by the Geological Survey of Canada, and obtainable at the western office in the Winch Building, Vancouver, B.C. Also to a list of references on page 358 of the 1928 Annual Report and on page 158 of the 1931 Annual Report. The following references are given for the Lillooet Mining Division:—

G.S.C., 1912, Part A: Exploration between Lillooet and Chilco Lake, by A. M. Bateman.
G.S.C., 1915, Part A: Bridge River Map-area, Lillooet Mining Division, by C. W. Drysdale.

G.S.C., 1918, Part B: Copper Mountain, Gun Creek, by C. Camsell.

G.S.C., Memoir 130: Geology and Mineral Deposits of the Bridge River Area, by W. S. McCann.

G.S.C., 1931, Part A: Part of Cadwallader Creek Gold Mining Area, Bridge River District, by W. E. Cockfield.

The reader's attention is particularly directed to the reference lists of claims under the different Mining Divisions. These lists give the names of the claims, groups, and companies contained in the Annual Reports for many years back and the year of the Annual Report in which they are described.

GEOLOGICAL SURVEY OF CANADA.

The geological survey of the northern portion of Vancouver island was continued by H. C. Gunning. The area covered extends across from Nimpkish lake to the west coast, taking in particularly the valley of the Zeballos river and north to Artlish river. (See under "Zeballos River" in this report.) W. E. Cockfield and J. F. Walker extended the survey of the Bridge River area, which will furnish much-needed geological information of that very promising gold-producing section.

"IRON-ORE SUPPLY ACT."

Under the provisions of this Act the Government of British Columbia in 1932 furnished the Ore Testing Laboratories of the Mines Branch at Ottawa with a car-load, of about 30 tons, of magnetite ore from Texada island for further experimental work.

ESQUIMALT & NANAIMO RAILWAY BELT, VANCOUVER ISLAND.

Because of the many inquiries regarding the conditions pertaining to prospecting and mining in this belt I deem it advisable to give the following information: The Railway Belt, shown on all maps, covers about one-quarter of the area of Vancouver island, and includes the eastern half of the island from the south end to Campbell river.

All the base metals, copper, lead, and zinc, within the area belong to the Esquimalt & Nanaimo Railway Company, leaving only the precious metals, gold and silver, belonging to the Government. The area is, however, open for prospecting and the staking of mineral claims under the regulations of the "Mineral Act," but subject to the regulations of 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 per acre, which would be about \$250 for a full claim; also, the timber to be used for mining purposes and not to be removed from the claims may be purchased at \$1.50 per thousand feet in excess of 8,000 feet per acre. The royalties placed on the base metals are on a sliding scale and are not prohibitive. A copy of the regulations may be procured from the Land Agent, Esquimalt & Nanaimo Railway, Victoria, B.C.

ROADS AND TRAILS.

The policy of the Government in assisting toward the construction and improvement of mining roads and trails cannot be too highly commended. It has, more than anything else, encouraged the prospector to explore new territory, helped him to make his property accessible for assessment, development, and examination work. During 1932 over \$4,000 has been appropriated in small amounts for trail-building and improvements throughout this district, benefiting about twenty-five individual mining properties and several mineralized areas. Any one interested in any section of the district can obtain information on and sketches of the trails in that particular area by applying to this office.

PROSPECTING.

The depression has had at least one beneficial effect, in that it has turned a lot of men to the hills, some of whom are bound to eventually make good prospectors. I doubt if there has been for years as much prospecting done as during 1932. Because of the market conditions of the base metals and silver, prospecting is concentrated on gold, with the result that discoveries are being made in new areas, old areas and properties are being revived, several new properties have come in, and men are becoming interested in gold properties who have never invested in mining before. British Columbia mining companies realize that only gold can be worked and are therefore giving more attention to gold properties, and outside companies are taking up gold properties with substantial payments, all leading up to strong indications of an outstanding drive in gold-mining in 1933.

For prospecting there are many attractive areas in this district. It has long been known that there are gold possibilities on the west coast of Vancouver island and considerable encouragement has been given this year in showings up Kennedy river from Kennedy lake; at the head of Bedwell river up from Bedwell sound; prospects at different places along the coast; and developments and indications in the Zeballos River valley. The old placer-workings on the Leech river, near Victoria, suggests the probable gold source as gold-bearing quartz veins. Also placer gold in the Jordan, Loss, Sombrio, and San Juan rivers on the west coast would indicate gold-bearing veins at the headwaters of these rivers. Placer gold in the Nanaimo river and branches, in China creek, flowing into the head of Alberni canal, and gold-bearing quartz veins at the headwaters of these rivers and tributaries show possibilities in that area from the head of the Koksilah river north-west along the main range to the head of Alberni canal.

Promising discoveries of chalcopyrite have been made in the area between Cowichan lake and Alberni canal. The north end of the island in the Nahwitti Lake and Nimpkish Lake areas have attractive surface showings of galena-zinc and copper ores respectively.

On the Mainland the included belts in the granodiorite, as indicated on the geological map of the district, the Vancouver Sheet, are worthy of more thorough prospecting than they have yet received. These belts may contain gold-bearing quartz veins as shown in the Shoal Bay area. There is a similar field at the head of Fire creek, north-west of Harrison lake. The borders of a diorite-mass on Pierce mountain and eastward along the south side of Chilliwack river is a favourable gold formation. Several belts traversed by the Pacific Great Eastern Railway are worthy of investigation.

The interior, represented by the Lillooet Mining Division in this district, in the Bridge River area especially, is proving a wonderful gold-producer. Discoveries this year on Cadwallader and Truax creeks and other localities prove that there is a big country along the contact-belt east of the granodiorite Coast range that contains unlimited inducements for prospecting.

DEVELOPMENT.

This branch of mining has been rather limited during 1932 on Vancouver island and the Mainland coast. Outside of the gold properties, the *Britannia* is the only property to carry on any important development-work, and even this was curtailed during the last half of the year.

The greater part of the development for the year was in the Bridge River section, where both lode and hydraulic placer-mining were very active.

Placer-mining in the Leech River area was given a pretty fair tryout by a number of operators, the most extensive being that of Butterworth and associates.

In the Cowichan Lake area the *Patnt Pot* and *El Capitan* had further work done on them, and the owners of the copper-showings around Nitinat lake and river also were busy on their claims during the summer.

The *W.W.W.*, on the North fork of Franklin creek east of Alberni canal, was bonded and is now in operation. The sinking of the shaft on the *Leora* up Elk river from Kennedy lake was continued, and J. B. Woodworth put the *You* group up from Bedwell sound in shape to proceed in the spring. The *Ormond*, on Flores island, had further work done on the surface tramway.

The *Tagore* and *Marks* properties, on Zeballos river, were operated this year. The owners of the *H.P.H.* group, near Nahwitti lake, improved the surface showings on their property.

Considerable development was done on the *Martie* and *Hayden Bay* claims on Loughborough inlet. It is reported that work will be resumed in the spring on the *Doratha Morton*, on Phillips arm, by the Hercules Consolidated Mining, Smelting, and Power Corporation.

On Texada island O. B. Bush has continued work on his property on the west coast, and the owners of the B.C. Gold Mines have also done considerable surface work.

The radium mineralization on Quadra island was tested by electroscope this summer.

The Pacific Gold Mines, Limited, has been developing the *Venus* and *Juneau* groups on Lasqueti island.

The *Golden Coin*, on Ashlu creek near Squamish, produced a small tonnage this year.

The Lillooet Mining Division has probably been the busiest portion of the Province this year, due to the activities in the Bridge River section in both lode- and placer-gold developments. The *Pioneer* and *Bralorne* have been the major operations. Above the *Pioneer*, on Cadwallader creek, a number of properties—the *Royal* group, the *Red Hawk*, the *Dan Tucker*, the *I.X.L.*, *Pioneer Extension*, and others—have all been carrying on development-work during the summer season, with a few continuing through the winter. Below the *Lorne* the *Why Not*, *Forty Thieves*, *Arizona*, and *California*, operated by the Bridge River Exploration Company, have been steadily developed, the *California* development continuing throughout the winter. Work was continued on the *Veritas* group on Little Gun lake and some development was done on the Gun Lake Gold Mines, Limited, showings.

Farther down Bridge river the *Golden* group and *Alpha* group were further developed. The *Mary Mac* group, on Truax creek, is probably the outstanding discovery this year in that section.

PLACER-MINING.

Outside of the Lillooet Mining Division, now included in this district, placer-mining is hardly worth considering. So far as Vancouver island and the Mainland coast are concerned, the majority of the creeks carry "colours," but there is no record of any of them paying except the Leech River area, which produced about \$100,000 in the early days. A few men have been making a living on Wreck bay, on the west coast of Vancouver island, and considerable prospecting has been done, but I have not heard of anything worth while being found.

In the Lillooet Mining Division a number of creeks are being worked by individuals, but so far as I can learn they are making only a living. A number of men are working on McGillivray creek at the foot of Anderson lake, Cayoosh creek at the head of Seton lake, Fraser river below Lillooet, and on tributaries of Bridge river—Tyaughton, Gun, Marshall, and Hurley creeks.

There are, however, several larger operations that give promise of becoming important undertakings. These consist of a drag-line scraper equipment on Hurley creek just below the *Bralorne* mine, two hydraulicking outfits on Tyaughton creek, one on Marshall creek, and one on the Lower Bridge River Placers ground.

VICTORIA MINING DIVISION.

This Division comprises the south end of Vancouver island. There has been comparatively little mining activity in the Division this year. A little placer-mining in the Leech River area; prospecting around the headwaters of the Jordan and San Juan rivers and in the Nitinat River

country; some development of properties north of Cowichan lake; and placer stakings at the mouth of Jordan river about covers the mining for the year.

References.—*Alpha-Beta*, 1931; *Blue Grouse*, 1931; *Crown*, 1931; Gabbro Copper Mines, Limited, 1931; *Kitchener*, 1931; *Margaret*, 1931; *Paint Pot*, Bulletin No. 1, 1932; Sombrio Placers (Kootenay Central Mining and Development Company, Limited), 1930; *Southern Cross*, 1931; Sunloch Mines, Limited, 1931; *Tyce*, 1931; *Willow Grouse*, 1931.

LEECH RIVER.

Efforts were made this year by three or four parties to find some placer-diggings on Leech river, but so far as I know none were very successful. The creek was tried out from its junction with Sooke river up to the forks, a distance of 4 or 5 miles, and some work was also done at the mouth of Martin's gulch.

Hydraulicking.—A couple of years ago several placer leases were taken up by E. Butterworth, of Victoria, and associates. Last year a small hydraulicking plant was installed, and water procured from McDonald lake by ditch to a penstock, from which a 10-inch pipe-line gives a head of about 125 feet at a 4-inch monitor at the river. A cut was made starting from Leech river back through the gravel bench in search of bed-rock or a possible old channel. Rim-rock was found about 100 feet from the river and followed on an up-slope for a couple of hundred feet to what is probably the rim of an old shallow channel. A cut across this shows the old river-bed to be about 50 feet wide between rims and from 6 to 8 feet deep, of somewhat cemented gravel, above which is about 10 feet of loose barren gravel to the surface. This cut showed some fairly coarse gold, but on account of lack of water and poor grade for the sluice-boxes not enough yardage could be worked to prove whether it is pay-ground or not.

This year the water-supply was improved by diverting Humbug creek into McDonald lake by a ditch and raising the dam at the lower end of the lake. At the creek workings a cut was put through the lower rim and sluice-boxes installed in a good grade to dump into the present river.

Late this fall, as the water-supply improved, some further sluicing was done of the gravels from the old channel, under the supervision of A. S. Bennett. I am informed that encouraging gold returns have been obtained from this gravel; however, only the sluice-box gold-recovery from several thousand yards of the general run of gravel can determine whether it will pay or not.

(See Bulletin No. 1, 1932.) This group is situated at the head of Cottonwood creek, which empties into Cowichan lake on the north side. Some further assistance was granted by the Department of Mines this year toward improving the old logging-road grade from the Canadian National Railway to the foot of the mountain.

The property was leased by the owning syndicate to Messrs. Lomas and Powell, who got started too late in the fall to accomplish much before the heavy snows started. They began driving a tunnel on the west or Cowichan Lake side of the mountain, about 150 feet lower than the lower tunnel on the east side. About 15 feet was driven in overburden without reaching bed-rock. Their agreement, I understand, calls for about 100 feet of work, which will be again started as soon as weather conditions will permit.

NITINAT SECTION.

This copper-bearing section lies between the north-west end of Cowichan lake and Alberni canal. It is traversed by the old grade of the Canadian National Railway, which is pretty badly overgrown and hard to get through. The better way to reach the portion south of the railway-grade is from the west coast, up Nitinat lake. The northerly portion has been made accessible by the building of a trail starting from the railway-grade about 4½ miles from Cowichan lake. The grade has been cut out from the lake to that point and is in good shape. From the grade the trail follows the old tote-road to near the Big Nitinat river; it then branches to the right and leads down to a cableway across the river. From there a trail has been slashed straight across country to the railway-grade south of Francis lake. From that point to Alberni canal there is a good foot-trail. The cabin of the *Southern Cross* group is about half-way across between leaving the grade at the Nitinat and reaching it at the Little Nitinat river. A branch trail just west of the *Southern Cross* cabin runs north to Tuck lake. The total distance from grade to grade is about 7 miles and from Cowichan lake to Alberni canal 25 miles. Indications of large bodies of chalcopyrite have been discovered, but at present are dormant.

ALBERNI MINING DIVISION.

This Division covers the drainage areas of Barkley sound, Alberni canal, Sproat and Great Central lakes. Port Alberni, at the head of Alberni canal, is the distribution-point, and is reached by the Esquimalt & Nanaimo Railway, the British Columbia Coast Steamship service, or by stage from Nanaimo. Boats are available on Sproat and Great Central lakes, and at Port Alberni for down-the-canal points. There is a mail-boat service twice a week to Ucluelet, on the outer coast, from which point one can go by automobile to Long beach and thence to Tofino by boat. There is telephone service all along the west coast. The foot-trail from the head of Sproat lake up Taylor river, across the divide and down Kennedy river to Kennedy lake, gives access to a promising country containing gold-bearing quartz veins. The trail has also been continued up Taylor river for prospecting purposes.

References.—Alberni Mines, Limited (*Three Jays*), 1928; *Big Interior*, 1931; Canadian Quicksilver Company, Limited, 1931; *Copper King*, 1928; *Dauntless*, 1931; *Edith*, 1931; *Happy John* and *Monitor*, 1916; Island Copper Company, Limited, 1931; *Klanawa* and *Canyon*, 1931; *Morning*, Bulletin No. 1, 1932; *Rainy Day*, 1928; *Regina*, Bulletin No. 1, 1932; *Sunshine*, 1928; *Thistle*, 1927.

ALBERNI CANAL SECTION.

(See Bulletin No. 1, 1932.) This property of four Crown-granted claims, **W.W.W.** *W.W.W. Nos. 1, 2, 3, and 4*, is situated on the Franklin river, about 12 miles east of Alberni canal. It is owned by A. James, of Vancouver, but is now under option to Alex. Robinson and associates, of Vancouver. The lower end of the old trail has been abandoned and the logging-road of the Alberni Pacific Lumber Company is now being used for the first 5 miles from the beach, and from there a new trail of about a mile has been built to connect with the old Franklin River trail. The old camp was rebuilt and accommodations provided for a crew of four men for the winter.

The showings consist of two gold-bearing pyritized quartz veins on which two tunnels have been driven, and from which a small shipment of high-grade gold ore was made many years ago. The gold is found in iron sulphides which occur in small lenses. The present work consists of drifting on the vein and exploring by raising and sinking on the showings of sulphides found. Mr. Robinson states that he thinks sufficient ore can be sorted to make regular small shipments.

SPROAT LAKE SECTION.

This group of three claims was staked by J. Ferguson in 1931. The claims, **Ferguson.** *Cady, Evans, and Ferguson*, are situated on the beach on Two Rivers arm of Sproat lake. The showings consist of several small quartz veins in a volcanic country-rock. The first vein up the hill, striking S. 50° W. into the hill, has been opened up by several open-cuts and stripped for a length of 300 to 400 feet. This vein is, in places, 4 feet between walls, but the quartz portion is confined to probably an average of 1 foot in width along the hanging-wall. This quartz is mineralized in places with pyrite, galena, and zinc-blende, where it carries fair gold values, up to \$15 per ton. A sample taken across the deepest cut at that time for a width of 2 feet assayed only 80 cents gold per ton and a trace of silver.

Above this a short distance is a parallel vein of about 2 feet in width, partly quartz, from which a sample assayed 40 cents gold per ton. Farther west a small cross-vein of about 12 inches in width assayed 80 cents gold per ton. A small compressor was installed and a fair amount of shallow work done on the veins, which, however, showed them to be small and the sulphide content, which carried the values, rather meagre and erratic. A crosscut tunnel from the beach would cut the different veins at, I judge, about 100 feet depth in a distance of 200 to 300 feet, but it is doubtful whether the surface exposures justify such work.

CLAYOQUOT MINING DIVISION.

This Division occupies the central western half of Vancouver island from Barkley sound north to Esperanza inlet. It is served by the Canadian Pacific Railway coastwise boats calling at Tofino and other points. Also there is an auto-road from Ucluelet to the head of Long beach, from which point Tofino is reached by launch from Mill bay. The proposed road from Alberni to Tofino via Sproat lake and Kennedy river would certainly be of great benefit to the west coast.

References.—*B.C. Wonder*, 1931; *Copper King*, 1931; *Craigellachie*, 1928; *Douglas*, 1930; *Indian Chief* (Pacific Tidewater Company), 1931; *Jo Jo*, Bulletin No. 1, 1932; *Rose Marie*, Bulletin No. 1, 1932; *Shannon*, 1928; *Star of the West*, 1928.

CLAYOQUOT SOUND SECTION.

Leora. The reader is referred to Bulletin No. 1, 1932, for a short description of this property. This year W. W. Gibson, of San Francisco, who operated the property twenty-five years ago, reconditioned the old camp and trail, and installed a small compressor plant driven by water-power for the purpose of sinking a new shaft. Considerable ore was taken out in the earlier operations at shallow depths, but the work was handicapped by water. To avoid this the new shaft is being sunk on the hanging-wall side of the vein to cut the vein at a depth of about 150 feet. Present work has been retarded by lack of water for power, but I understand is being continued.

You. (See Bulletin No. 1, 1932.) This property, on Bedwell river, about 13 miles from the head of Bedwell sound, is owned by J. B. Woodworth, of Vancouver. This year the old road and trail from tide-water was cleared and cableways put in across the main river where the bridges had gone out. Mr. Woodworth, with a small crew, worked a couple of months in the renewing of the old camp and reconditioning the small mill on the property. Test runs showed that satisfactory recoveries can be made by concentrating and cyaniding. The old workings, consisting of a 300-foot tunnel on the vein and open-cuts, were cleaned out and everything made ready to resume operations in the spring. Mr. Woodworth states that the tunnel-work has exposed a 10-inch vein of \$40 gold ore and there is sufficient tonnage in sight to make the property a profitable producer, with favourable possibilities of expansion of operations.

Ormond. (See 1931 Report.) This group, on Matilda creek, Flores island, is under option to J. Hodgkinson. The only work done in the last three years has been the partial construction of a surface tramway from the beach to the showings, a distance of about 1½ miles. About half the distance has been cleared and graded and this year about 1,000 feet of 8-lb. rails were laid.

Herbert Arm.—Discoveries were made this year of placer gold and gold-bearing quartz veins in a small creek at the head of Herbert arm. Investigation showed that the quartz veins were too small and low grade to be of importance, but further prospecting is warranted. Fair colours were found in the gravel near the mouth of the creek, and it was recommended that some testing be done at different places on the rather extensive flat along the beach in the hope of finding something that might pay even in a small way. No information is at hand as to results.

ZEBALLOS RIVER AREA.

This area is reached by Canadian Pacific Railway coast boats to Ceepeecee or Hecate canneries and from there by small boat to the head of Zeballos arm, about 12 miles. There is a fair foot-trail from the head of the arm to *Marks* camp at the forks, a distance of about 7 miles, passing the *Tagore* camp at about 3 miles up from the beach.

The Geological Survey of Canada, under H. C. Gunning, made a preliminary survey of this area during the past season. Some advance notes have been given out by Dr. Gunning, from which the following excerpts are taken: "Several quartz veins carrying sulphides of iron, copper, lead, and zinc, and containing good gold values, have been found in the valley of the Zeballos river and its North fork for about 8 miles above the mouth. . . . Prospecting has been confined principally to the main valley and the immediately adjoining lower slopes of the mountains, and numerous other gold values, all much lower grade, have been reported. Very little active prospecting is being done at present. A mineralized belt, not definitely known to contain valuable deposits, extends north-west from the forks of the Zeballos river for about 10 or 15 miles, crossing Artlish river about 7 miles above its mouth. It has not been prospected for more than about 2 miles from Zeballos river, but the country is very rugged and much of it is heavily timbered. It is difficult to prospect."

Coarse placer gold has been found in spots on the North fork and below the forks, but none on the South-east fork. This gold has no doubt had its origin in the small quartz veins which carry very high gold values where mineralized with zinc-blende.

Tagore.

This group lies about 2 miles up from the mouth of the Zeballos river. There are three claims in the group—*Tagore*, *Tagore No. 2*, and *Tagore No. 3*—owned respectively by M. Malmberg, Geo. Nordstrom, and Joe Staller, of Quatsino.

The trail up the river to the *Marks* property passes the camp. The showing consists of a quartz vein varying from an inch to about a foot in width, in which are patches and small stringers of sulphides of iron, lead, and zinc, carrying in places very high gold values. A small shipment sorted and shipped in 1929 gave smelter returns of \$400 per ton.

Six men have been working on this vein this summer; in a length of about 60 feet about 5 tons of ore was mined, mainly from an open-cut about 20 feet deep. At the time of my trip, the middle of October, they had packed to the beach about 5 tons, of which 2 tons was shipped to the smelter, giving returns of \$50 per ton. Another shipment was made later, but no returns have been received as yet. In sorting, it must be remembered that the gold values are confined to the galena and zinc-blende, the latter probably being the richer.

The property has recently been bonded to Conrad Wolfe and associates, of Seattle, Wash., who have taken up other claims and plan extensive prospecting and development for the coming year.

Marks.

There are two groups—the *Ehatset* group consisting of thirteen claims, *Ehatset Nos. 1 to 13*, inclusive, and the *Yauco* group of eleven claims, *Yauco Nos. 1 to 11*, inclusive, situated at the forks and up the North fork of Zeballos river, about 7 miles from the mouth. These groups were formerly held by the Marks Gold and Copper Mines, Limited, which was incorporated in 1928 with a capitalization of 3,000,000 shares at \$1 per share. This company was dissolved under the "Companies Act" in November, 1932, and the property is now being developed under T. J. Marks, the original staker and owner, by Vancouver interests.

The mineral-showings are mainly iron and copper sulphides occurring in lenses and small veins within a wide belt of shearing of the Vancouver volcanics along its contact with a belt of crystalline limestone following the North fork of the river. Numerous small quartz veins from 1 to 6 inches wide are also exposed within the belt, mineralized in places with sulphides of iron, lead, and zinc, which carry high gold values. Little attention was given these quartz veins until the price of copper made it useless to develop the copper-showings.

This season a crosscut tunnel was driven for the purpose of obtaining some depth on the best of the gold-bearing quartz veins. This tunnel was driven a distance of 85 feet, encountering the first quartz vein at 75 feet from the portal at a depth of about 80 feet from the surface. This vein widened from about 2 inches in width in the roof to about 5 inches in the bottom of the tunnel. Within a width of 6 feet four other smaller quartz veins were cut at intervals of from 12 to 15 inches. The intervening rock between the quartz veins is full of small veinlets of quartz and carries some gold values, \$1.20 per ton. A drift was run south on the 6-foot belt for 15 feet, encountering a cross-fracture or dyke which cut the veins off, except in the west side, where one appears to swing and continue. Some further work will be done here to find out what happens.

These small veins carry gold values where the sulphides occur, which is rather irregular, the higher values probably favouring the zinc-blende. The sulphides ground up and panned show free gold. Samples taken by Mr. Marks from the quartz veins in the tunnel assayed from \$26 to \$54 gold per ton. If an average of \$40 per ton be taken for the quartz veins and distributed across the 6 feet, which will have to be mined to procure the quartz, it will give an average of about \$12 per ton. About 3½ tons would have to be mined to procure 1 ton of quartz. Sufficient quartz has not been exposed to tell what the ratio of concentration of the sulphides would be. It is a very encouraging showing that might easily develop a tonnage of good-grade milling-ore. Drifting to the north will be done on the belt, which will determine future development.

In addition to these quartz veins, indications of a large body of low-grade gold ore have been found in the limestone-belt east of and bordering the sheared volcanics. No work has been done on this, but it is planned to do considerable exploratory work this coming season.

QUATSINO MINING DIVISION.

This Division is the western half of Vancouver island north of Esperanza Inlet. It is reached by the west-coast boats from Victoria, or from Port Hardy, on the east coast of the

island, by good auto-road to Coal Harbour, on Quatsino sound, from which point the mail-boat runs to several places, or launches are available. There is a hotel at Coal Harbour and Quatsino village.

H. C. Gunning, of the Geological Survey of Canada, states that there is a promising prospecting area on the continuation of the Quatsino limestone-belt south-east of Elk lake. This limestone-belt in all probability continues from Elk lake up the Raging-Tahsish valley and on to the Zeballos and Tasis rivers. Between the Quatsino limestone and Nimpkish valley is a great assemblage of volcanic rocks which, so far as he knows, does not appear to offer much encouragement for prospecting. As this Mining Division is essentially a copper-bearing area, present conditions have killed practically all mining activity.

References.—Canada Copper Company, Limited, 1930; Coast Copper, Limited, 1931; Copper Cup Mines, Limited, 1930; *June*, 1931, and G.S.C. Summ. Rept., Part A, 1929; *Marble Creek*, 1930; *Millington*, 1927-28-29, and G.S.C. Summ. Rept., Part A, 1929; Quatsino Gold-Copper Mines, Limited, 1931; *Quatsino King* (Teta River Gold), 1931; *Yreka*, 1928, and G.S.C. Summ. Rept., Part A, 1929.

This group consists of seven claims—*Alice Lake*, *Lucky Strike*, *Cedar*, *Hornet*, **Alice Lake**, *Iron Knob*, *Galena*, and *Paystreak*—owned by Wm. Clancy and W. D. Kinsey, of Quatsino. The property is situated about 4 miles from June Landing, a port of call of the west-coast boats, about half a mile by foot-trail off the main road to the Coast Copper property.

The general rock formation is crystalline limestone, the belt being from 3 to 4 miles wide. The mineralization consists of galena, zinc-blende, pyrite, and a little chalcopyrite, carrying gold and silver values. It occurs as a replacement in the limestone in the form of a chimney or a long pipe of ore. Development simply means following the ore, which averages about 18 inches in width. About 100 feet of tunnel has been driven. This spring about 200 lb. of ore was shipped to the Ore Testing Laboratories of the Mines Department at Ottawa. The samples assayed: Gold, 0.335 oz. per ton; silver, 3.23 oz. per ton; copper, 0.14 per cent.; lead, 5.76 per cent.; zinc, 6.38 per cent. Exhaustive tests were made which showed that the gold was carried in the pyrites and galena, and the silver altogether in the galena. A lead concentrate was made assaying: Gold, 0.76 oz. per ton; silver, 14.00 oz. per ton; copper, 0.72 per cent.; lead, 31.26 per cent.; zinc, 4.3 per cent. A pyrite concentrate assayed: Gold, 0.42 oz. per ton; silver, 0.84 oz. per ton; copper, 0.09 per cent.; lead, 0.38 per cent.; zinc, 0.88 per cent.; with iron, 43.2 per cent., and sulphur, 44.4 per cent. The pyrite concentrate was treated with cyanide, but there was practically no gold-extraction. A bulk iron-lead concentrate contained 98 per cent. of the lead, 91 per cent. of the silver, and 68 per cent. of the gold.

NANAIMO MINING DIVISION.

This Division includes the eastern half of Vancouver island and the west coast of the Mainland from the south end of Texada island north to Seymour inlet. Its recording office is at Nanaimo, which is rather out of the way for records of Mainland stakings. It is one of the largest Divisions and, because of the diversity of its products, one of the most important in the Province. It contains all the coal-mining on Vancouver island; has distributed iron-ore bodies, lead, and zinc; distributed gold, silver, and copper ores; and distributed non-metallic products such as lime, cement, brick, sand, gravel, crushed-rock materials, building-stone, etc.

References (Vancouver Island).—*Big G.*, 1916; *Caledonia*, 1927-28-29, and G.S.C. Summ. Rept., Part A, 1929; *Jubilce*, 1930; *Kinman* group, 1929-30; *Lucky Jim*, Bulletin No. 1, 1932; *Lyna*, 1927-30; *Maple Leaf*, 1930; Paramount Mining Company, 1920; *P.D.*, 1927; Price Creek Mining Company, 1929; *Robbins*, 1930; *Silver Leaf*, Bulletin No. 1, 1932; *Sumpter*, 1929; *Smith Copper*, 1931.

References (Mainland).—Alexandria Gold Mines, Limited, Bulletin No. 1, 1932; B.C. Gold Mines, Limited, Bulletin No. 1, 1932; *Blue Bells*, Bulletin No. 1, 1932; Cambria Copper Company, Limited, 1928-29; Central Copper and Gold Company, Limited, 1928-29; *Colossus*, 1929; *Copper Bowl*, 1928; *Doratha Morton*, Bulletin No. 1, 1932; *Douglas Pine*, 1930; *Geiler*, Bulletin No. 1, 1932; *H.P.H.*, 1930-31; *Inca*, 1929-30; *John Bull*, 1926; *Julle-Enid*, Bulletin No. 1, 1932; *Juneau*, Bulletin No. 1, 1932; Lasqueti Mining Company, Limited, Bulletin No. 1, 1932; *Lucky Jim*, 1916, and Bulletin No. 1, 1932; Malaspina Mines, Limited, 1927-28; *Marjorie*, Bulletin No. 1, 1932; *Nancy Bell*, 1927; Romana Copper Mines, Limited, 1928-29-30; Santanna Copper Syndi-

cate, 1929-30; *Solyman and Freya*, 1930; Sonora Gold Mines, Limited, Bulletin No. 1, 1932; *Stromberg*, 1927; Tatlayoko Lake Gold Mines, Limited, Bulletin No. 1, 1932; Thurlow Gold Mines, Limited, Bulletin No. 1, 1932; *White Pine*, Bulletin No. 1, 1932; *Wyho*, 1927.

NAHWITTI LAKE SECTION.

(See 1931 Annual Report.) The owners of this group, Frank Hicklenton, of **H.P.H.** Port Hardy, and associates, continued work on this property this year. The claims were staked in 1930 on extensive and very promising-looking galena-zinc outcrops. Exploratory work, however, failed to find any extension downward of the showings, and the theory of a flat-lying pipe or chimney of ore which had been almost entirely removed by erosion was suggested. The strike of the croppings indicated that such a chimney had probably come up farther west. The owners prospected in that direction this year and report that at a distance of about 2,000 feet a promising body of ore was discovered and partly opened up.

This is a promising prospecting area, particularly for lead and zinc, along and near the limestone-volcanic contact. It is reached from Port Hardy by an old foot-trail to Kains lake, about 12 miles; up the lake by boat 3 miles, and from the head of the lake to the *H.P.H.* camp is about 6 miles. Other trail routes have been selected and eventually prospectors' trails will be built.

NIMPKISH LAKE AREA.

There has been only a small amount of prospecting in this area during the year. The reader is, however, referred to the 1929 and 1930 Annual Reports and H. C. Gunning's report in the G.S.C. Summary Report, Part A, for 1929. Some of the largest copper-ore croppings in the Province have been found in this section, and Dr. Gunning, who has had two seasons in that vicinity, expressed the opinion that there are many localities along the Nimpkish or Klačanch river, and between it and the east coast, as well as on both flanks of the main range south to the west side of Ruttle lake, in which there are excellent prospecting chances. Nimpkish lake is reached from Englewood, on the east coast. There is a good foot-trail for 12 miles up the Klačanch river.

SHOAL BAY SECTION.

This section, reached by steamships to Shoal Bay, on Thurlow island, contains a number of gold prospects that I think warrant development. The only property on which any appreciable depth has been obtained is the *Alexandria*, on Phillips arm, on which there is a shaft 200 feet in depth. The small amount of work done on this level gives little information and is certainly not conclusive. (See Bulletin No. 1, 1932.)

This property was operated many years ago, when 10,000 tons of ore was **Doratha Morton.** cyanided, yielding 4,434 oz. of gold. Comparatively little exploratory work was done. I am informed that work is to be resumed on the property next spring under an option held by the Hercules Consolidated Mining, Smelting, and Power Corporation, Limited, holding both Dominion and British Columbia charters. Other properties in this vicinity, such as the *White Pine*, *Thurlow Gold*, *Douglas Pine*, *Sonora*, *Blue Bells*, etc., justify more extensive exploration.

These old reverted Crown-granted claims, situated at Hayden bay, on Lough-**Martle and** borough inlet, were leased by Geo. Kerr, of Vancouver, and turned over to **Hayden Bay.** Messrs. Fraser, Duffus, and Lee, who have done an appreciable amount of work on them this year. The showings consist of a pyritized quartz vein carrying gold values, contained in a dioritic country-rock and probably not far distant from the granodiorite.

Two cabins had been built and some work done at the beach on both sides of Hayden bay. On the south side the cut shows a small, sparsely mineralized quartz vein, carrying little values, and not at all promising-looking. On the north side, just west of the camp, an open-cut starting at the beach and extending to a cross-tongue of granodiorite showed some ore in short lenses. At one place the ore was 2 feet wide of heavily pyritized quartz, the best of which assays up to \$30 gold per ton. I am informed that the open-cut was extended through the granodiorite, picking up the vein on its upper side. Lenses of ore were found in this work and it may be made profitable in a small way. There is said to have been considerable work done on this claim

higher up the hill in early days. Prospecting has discovered several quartz-outcrops, but where the work is being done the mineralization appears to have more continuity and more ore.

GRANITE BAY SECTION.

Geiler. There are two claims in this group, the *Geiler* and *Copper Hill*. These and several other claims in that vicinity are owned by Thos. Noble, of Quathiaski Cove. The showings on the *Geiler* claim lie along a belt of limestone between two porphyritic dykes about 30 feet apart. The limestone is up to 20 feet wide in places, the balance consisting of a breccia of quartz and country-rock, and an altered volcanic containing small veinlets of quartz. Outside of the limestone the "vein" is sparsely mineralized with iron sulphides. Several open-cuts have been made across the mineralized portion and it has been traced for several hundred feet on the surface.

The topography is flat and any depth must therefore be obtained by sinking. Samples taken across the brecciated portion and panned gave from a colour or two up to twenty-five colours, indicating gold values up to \$6 or \$7 per ton. In view of this, I think it worth sinking, say, 25 feet in the breccia and possibly some drifting at that depth to find out if there is any improvement over the surface.

About 600 feet easterly from this vein an open-cut across a soft schist-belt of 30 feet in width has found an occasional small lens of decomposed arsenopyrite that assays high in gold, but so far as shown there is no vein to follow. The gold values in this vicinity would suggest the desirability of close prospecting.

Radium Mineralization.—The radioactive area on Quadra island has been known for many years, but only in the last year or two has anything been done toward making any investigation. Early this year the area was covered by sixteen claims staked by R. Crowe-Swords. Later in the season an electroscopic survey was made by Professor Seyer, of the University of British Columbia, which succeeded in establishing several points of strong radioactivity, indicating possible radium-bearing minerals at greater depth. Small seams of carnotite were found on the surface, varying from a knife-blade seam to a couple of inches in thickness. Analyses of this material by the University of British Columbia, and also of samples submitted to the Metallurgical Division of the Department of Mines, Ottawa, gave assays of 27.7 per cent. and 28.9 per cent. respectively of uranium oxide, which is radium-bearing. These seams occur in the joints and fractures of amygdaloidal volcanics, termed by J. A. Bancroft as the Valdez formation. This property was examined in the fall by H. C. Gunning, of the Geological Survey of Canada.

Subsequently a company was incorporated called the Radium Explorers, Incorporated, which acquired eight of the claims showing the most encouraging indications of radium. The capitalization of the company is \$1,000,000, divided into 1,000,000 shares of \$1 par value, of which 400,000 shares were allotted for the purchase of the property, etc., and 600,000 placed in the treasury. Captain W. M. Crawford is president, and the late W. A. Bower was manager and secretary. No development-work of any kind has been done to date.

TEXADA AND LASQUETI ISLANDS SECTION.

This section has had very little mining activity this year. The copper investigations that had been carried out for several years have had little incentive to continue. The gold-showings have in so many cases proven erratic and unprofitable that not much attention is given them. O. B. Bush has been carrying on work on a small scale on his property near Davis bay, on the west coast, with the hope of proving more favourable structural conditions than heretofore found. On the B.C. Gold Mines property the owner, R. A. Logan, has done some prospecting and surface exploration.

Pacific Gold Mines, Ltd. This company was incorporated in June of this year with a capitalization of \$1,000,000, divided into 1,000,000 shares of \$1 each. The head office of the company is at 914-915 Hall Building, Vancouver. The company acquired the *Venus* group of claims, owned by the Lasco Development Company, and the adjoining *Juneau* group, owned by Khurtzhals Bros., of False Bay. These groups are situated on the north end of Lasqueti island and reached from False Bay. The reader is referred to the 1927 Annual Report and Bulletin No. 1, 1932, for reports on the *Venus* group under the heading of the Lasqueti Mining Company, and to the 1926 Annual Report for a description of the *Juneau* group. The present company reconditioned the camps, installed a small compressor plant, and has advanced the *Venus* tunnel at the beach to 500 feet.

I have not examined the property since this work was started. The management reports that some ore has been encountered and that drifting will be continued. If this proves satisfactory, development will be undertaken from the bottom of the 100-foot shaft. The ore is chalcopyrite carrying substantial gold values. An ore-shoot encountered a short distance in this tunnel some years ago produced about 300 tons of ore netting about \$25 per ton, of which from \$6 to \$15 per ton were gold values.

VANCOUVER MINING DIVISION.

This Division includes the drainage areas of Jervis inlet, Howe sound, and Burrard inlet, and extends up the Pacific Great Eastern Railway to Alta lake. It therefore is wholly within the Coast Range granodiorite batholith containing many belts of mineral-bearing metamorphosed sedimentaries and volcanics. The potentialities of these belts is exemplified in the *Britannia* mine, one of the great copper-producing properties of Canada.

References.—*Astra and Doffoffy*, 1930; *Belle*, 1931; *Blue Jack*, 1927-30, and Bulletin No. 1, 1932; Bowena Copper Mines, Limited, 1929; *Brandywine*, 1927, and Bulletin No. 1, 1932; Britain River Mining Company, Limited, 1928; *Bulliondale*, 1931; *Fitzsimmons*, 1928; *Golden Coin*, 1930, and Bulletin No. 1, 1932; *London*, 1930; *McVicar, Manson, and Tocher*, 1929-30; Mount Diadem Mines, Limited, 1931; Pacific Copper Mines, Limited, 1931; Radiant Copper, Limited, 1928-29.

HOWE SOUND SECTION.

(See previous Annual Reports.) This company has a capitalization of **Britannia Mining and Smelting Co., Ltd.** \$2,500,000, divided into 100,000 shares at \$25 each. It is a subsidiary of the Howe Sound Mining Company, Limited, capitalized for 600,000 shares of no par value. The Britannia holdings consist of about 25,000 acres of mineral claims situated on the east side of Howe sound contiguous to Furry creek.

At present there is boat service by the Union Steamship Company four days a week from Vancouver. The Britannia Company has this year curtailed all operations to the minimum, and at the close of the year the mine was working approximately three-quarter time, with staggered employment for underground workers. The mill is operating about ten days per month. An average of 548 men has been employed throughout the year in all operations.

Development-work amounting to 9,362 feet was done, besides the advancement of the 4,100-foot level haulage-tunnel for 1,500 feet, the latter work being suspended on July 1st. The ore mined and milled totalled 809,259 tons, most of which was taken from the *East Bluff* deposit because of the slightly higher gold values, amounting to less than \$1 per ton. The mill produced 11,496,888 lb. copper, 8,868 oz. gold, and 59,347 oz. silver. The copper concentrates were shipped to Tacoma, but the operation of the United States copper tariff of 4 cents per pound after June 21st necessitated shipping the concentrates in bond after that date. The position taken by the British Government in disallowing the 4 cents per pound preference for Canadian copper not treated in Canada has placed the *Britannia* in a very serious position and may result in the closing-down of the property, a disaster under present conditions.

During the year 15,481 tons of pyrite concentrate was produced having a sulphur content of 50.65 per cent. Only a portion of this product was sold. The exploration department, under C. V. Brennan, has had an active season in the investigation of gold prospects. The staff personnel remained unchanged.

PACIFIC GREAT EASTERN RAILWAY SECTION.

(See Bulletin No. 1, 1932.) This group (formerly called the *Golden King*) **Golden Coin.** has eight claims in it, situated up Ashlu creek, a tributary of the Squamish river. It is owned by C. Anderson, of Cheekye; R. J. Carson, Squamish; and K. J. Robinson, Vancouver; and others. The showing consists of a gold-bearing pyritized quartz vein lying along the contact of an intrusive dyke of diabase in granite. A tunnel has been driven on the foot-wall of the vein a distance of 300 feet. Two raises cut through the vein, which dips west at about 45°, each showing sulphides in the quartz carrying fair gold values. Apparently the values are confined to the sulphides.

This year C. Anderson, one of the original owners, mined and shipped to the Tacoma smelter about 4½ tons of ore taken mainly from the tunnel at about 250 feet in from the portal.

The shipment assayed 4.85 oz. gold per ton, 5.15 oz. silver per ton, and 1.41 per cent. copper, netting after smelter deductions and treatment, \$88.15 per ton. The packing from the mine down to the river, from which point it was hauled by truck to Squamish dock, was the heavy expense. The shipment, however, demonstrates that a good grade of ore can be made by milling and that the vein deserves more development.

(See Annual Reports, 1927-30.) This company was incorporated in 1932 with **Blue Jack Mines, Ltd. (Blue Jack Group)**, a capitalization of \$15,000, divided into 15,000 shares, with its head office at 410 Seymour Street, Vancouver. The holdings consist of the *Blue Jack* group of eight mineral claims, situated on Brandywine creek, about a mile from McGuire Station on the Pacific Great Eastern Railway. The mineral-showings consist of quartz-lenses in a greenstone-schist belt of about 24 feet in width. The quartz is mineralized with sulphides of iron, lead, and zinc, carrying up to \$6 to \$8 in gold and silver values. Considerable work has been done, but so far has not found any ore-body of much size. The claims are in a gold-bearing section and therefore deserve prospecting.

These groups adjoin the *Blue Jack* and have much the same mineral-showings; that is, lenses of quartz carrying pyrite, galena, and zinc-blende in a schist formation. The owners, B. A. Falconer and Frank Price, 3113 Royal Oak Avenue, New Westminster, have done a lot of prospecting and exploratory work on the claims, showing considerable widths of low-grade ore in the schist-belts.

NEW WESTMINSTER MINING DIVISION.

This Division is comprised of the drainage area of the Fraser river to near Hope. On the north side of the river it includes the Pitt, Stave, and Harrison Lake areas and on the south side extends to the International boundary. Other than some prospecting there has been no mining activity in the Division this year.

References.—*Barkoola*, 1930; *Blue Leaf*, 1930; *Cox* claims, 1928; *Dandy (Mayflower)*, 1930; *Empress*, 1931; *Faith* (Silver Chief Mining Company, Limited), 1923-30; Harrison Gold Mining and Development Company, Limited, Bulletin No. 1, 1932; *Lucky Four*, 1931; *Money Spinner*, 1930; *Mountain Gout*, Bulletin No. 1, 1932; Pitt Mining Company, Limited, 1930; Sleese Creek Mining and Development Company, Limited, 1929; *Wissota* and *Zenith*, 1929.

LILLOOET MINING DIVISION.

This Division covers the drainage area of Lillooet lake and river east of the summit of the Coast range at Alta lake and north of the southerly end of Lillooet lake; the drainage areas of Anderson and Seton lakes; and the drainage area of the Fraser from McGillivray creek, between Lytton and Lillooet to Moran, on the Pacific Great Eastern Railway. It was included in Mineral Survey District No. 6 early in 1932. Due to the success of the *Pioneer* and *Bralorne* mines in the Bridge River section, this Division has probably been the most active lode-mining portion of the Province throughout the year. This is verified by the Government office statistics, which show 826 mineral claims recorded, 34 placer leases, and 39 placer claims. Over 500 certificates of work were issued. The following list gives the names of all the claims, groups, and companies reported on since 1916 in this Division, and the Government report in which each can be found.

References.—*Alpha*, 1930, and Bulletin No. 1, 1932; Anderson Lake Mining and Milling Company, Limited, Bulletin No. 1, 1932; *Arla*, 1918; B.C. Alluvials, 1927; Cayoosh creek (Enterprise Mining Partnership), 1927; *Cinnibar King*, 1931; *Copper Bear*, 1927-28; *Copper Mount*, 1929-30; *Copper Mountain*, 1917-18; *Copperplate*, 1918; Copper Queen Mining and Smelting Company, Limited, 1916-28; *Coronation*, 1923-25-27; *Countless*, 1923; *Crown*, 1923-25; *Eureka*, 1928; *Eva (Moffatt)*, 1918-23-25-26; *Forty Thieves* (Bridge River Consolidated), 1916; *Gold King*, 1923-27-30, and Bulletin No. 1, 1932; *Griswold*, 1929-30; *Index*, 1916; *Iron Ridge*, 1924; *Lil-t-keel*, 1923-25-27; *Lorne (Bralorne)*, 1916-18-23 to 31, and Bulletin No. 1, 1932; Lower Bridge River Placers, 1931; *Lucky Jem*, 1924-31, and Bulletin No. 1, 1932; *Marion*, 1927-29; *Moffatt (Eva)*, 1923; McGillivray Gold Mines, Limited, 1929; *Native Son*, 1924-25; Nobb's placer claim, 1922; *Paymaster*, 1930; P.E. Gold Mines, Limited, 1929; *Pioneer*, 1916-18-22 to 31, and Bulletin No. 1, 1932; *Regal*, 1918; *Shulap*, 1925-26; *Silver Bell*, 1923-25-26; *Thelma Maud*, 1918; *Tyauhton*, 1927; Universal Mining and Milling Company, Limited, 1925; *Wayside*, 1927.

PEMBERTON SECTION.

Assessments were done on several groups in the vicinity of Tenquille lake.

Gold King. This property, situated in Tenquille basin, is reached from the Lillooet river above Pemberton meadows by a horse-trail which the Department of Mines assisted in repairing early in the year. The property is owned by C. Barbour, of Pemberton, and is described in previous Annual Reports. (See reference list.) The showings may be briefly described as a vein of massive pyrrhotite 11 feet wide occurring in roof-pendant rocks at an elevation of 6,300 feet. Open-cutting has exposed the mineral for several hundred feet in length, and a depth of 25 feet shows increasing indications of lead and zinc carrying gold values. This year an option was taken on the property by the Kamorley Oil Company, of Kamloops and Calgary, and some diamond-drilling done under the supervision of H. G. Nichols, of Kamloops. This work proved disappointing, in that it demonstrated that the ore-showings exposed on the surface do not extend to any appreciable depth; consequently the option was relinquished.

ANDERSON LAKE SECTION.

Considerable staking has been done this year around the headwaters of McGillivray creek and across to the head of Cadwallader creek, on the assumption of the continuation south of the Cadwallader Creek augite-diorite belt. Several placer-miners are working on McGillivray creek, but I have no information as to what success they are having.

This company was organized in December, 1932, with a capitalization of **National Gold Mines, Ltd.** \$1,500,000, divided into 1,500,000 shares, with its head office at 901 Vancouver Block, Vancouver. The company's holdings consist of the *National* group—*National, National Nos. 1 to 4, inclusive*—situated at the headwaters of the South fork of McGillivray creek, which empties into Anderson lake. I understand that the main object of the company is to acquire and develop the property of the Anderson Lake Mining and Milling Company, Limited. This property is situated about 3 miles up McGillivray creek from Anderson lake, at about 3,500 feet elevation, and is one of the old locations in the Lillooet country. An extensive amount of development-work has been done and at one time a 10-stamp mill was in operation. The vein is quartz mineralized with iron sulphides, up to 20 feet in width, with high-grade streaks, but generally of average low-grade values. It occurs in an argillite formation.

I am informed that financial arrangements are satisfactory, a compressor plant is being taken in, and further extensive exploration is planned. Thos. Brett, one of the original owners, is supervising the work. A small grant was made by the Department of Mines to assist in repairing the lower end of the trail to facilitate the transportation of machinery, etc.

CAYOOSH CREEK.

This creek empties into Seton lake just below the east end. There is a good road from Craig Lodge up the creek for about 8 miles, from the end of which a trail continues to the old *Golden Cache* mine. Cayoosh creek has been a prolific placer-gold producer, estimated in the hundreds of thousands of dollars, and was extensively worked by the Chinese in the early days. Much capital has been expended in efforts to reach bed-rock at different places. This year there were about a dozen men working steadily from the falls up the creek. Several have built cabins and are wintering there. My information is that small wages are being made.

Golden Cache. This property was first worked in 1896 and was a year or two later equipped with a stamp-mill. There was some production from the mine, but the average grade of the ore was apparently low and the ore-bodies somewhat erratic in occurrence. Spectacular specimens of free gold were obtained. An option was taken on the property a couple of years ago by Vancouver interests, but nothing has been done towards reopening it.

This company was incorporated in July, 1932, with a capitalization of \$100,000, divided into 10,000 shares of \$10 each, with its head office at 308 Pemberton **Lillooet and Cariboo Gold Fields Syndicate** Building, Victoria. The company acquired the *Ample* group of six claims, consisting of the *Ample, Whale, Monarch, Stanley, Willand Vale, and Gem. (Ample Group)*. They are situated on the west side of Cayoosh creek, about 6 miles by good road from the main road at Craig Lodge, on the east end of Seton lake. The trail to the showings, at 3,250 feet elevation, branches from the Cayoosh Creek road. The old camp is at 3,150 feet elevation, about 800 feet higher than the road and 1,600 feet above

the creek. It is an old property staked the same year as the *Golden Cache*, 1895. Considerable work has been done in tunnelling and open-cutting, and at one time there was a mill down on the creek connected with the mine by an aerial tramway. The mill was burned and the tramway is dilapidated.

The general rock formation consists of the altered sedimentaries and interbedded volcanic rocks, comprising the Bridge River series. On this property four parallel quartz veins can be seen within a width of about 100 feet, conforming with the strike and dip of the formation. One of these veins has been developed by a number of tunnels and open-cuts in a longitudinal distance of about 400 feet. The vein is a hard, cherty quartz, varying up to 8 feet in width so far as exposed, and sparingly mineralized with iron sulphides. It strikes along the mountain about east-west (mag.) and dips into the hill at from 20° to 25° N.

Two of the tunnels follow the vein on its dip and are therefore incline shafts. The No. 1 tunnel or incline shaft, the most westerly of the development-work, is said to be 240 feet long, but only about 100 feet was clear of water at the time of my examination. The water was just below two short drifts driven each way from the shaft. Five channel samples were taken across the vein, at 12-foot intervals, from the surface to the drifts, which gave an average of \$1.77 in gold per ton across an average width of 5 feet. Three samples were taken in the east drift, which is 25 feet long, giving an average of \$2.20 in gold per ton across 4 feet 8 inches. Two samples taken about 20 feet west of the entrance of No. 1 shaft gave \$1.20 in gold per ton across 2 feet of the hanging-wall portion of the vein and \$1.20 in gold per ton across 3 feet of the foot-wall of the vein, an average of \$1.20 across the vein-width of 5 feet.

Another tunnel was driven about 90 feet east of No. 1 incline. This was run about 12 feet and a raise of 26 feet put up, cutting the vein. A sample taken just east of the top of the raise gave 80 cents in gold per ton across 2 feet 10 inches of vein.

About 200 feet farther east another tunnel was driven about 20 feet on the vein. A sample taken just west of the mouth of the tunnel across the vein of 3 feet in width at this point gave \$4 in gold per ton. Another sample at the west side of the face of the tunnel assayed \$1.20 in gold per ton across 4 feet 4 inches.

About 40 feet east of this another crosscut and incline shaft, called No. 6 tunnel, has been driven, which is open for about 60 feet to the water. A chamber about 40 feet square was mined out and probably sent to the mill, as there are the remains of an ore-chute from the tunnel down to the head of the tramway. The vein here shows a width of about 8 feet, of which 14 inches on the hanging-wall is slightly pyritized quartz and the balance a mixture of quartz and country-rock also slightly mineralized. The flat dip of the vein gives the appearance of a width of 25 feet or more across the back of the chamber.

Samples were taken where the approximate full width of the vein was exposed. A sample of the hanging-wall quartz vein of 15 inches width gave 80 cents in gold per ton, and another, 12 feet west, across the same vein 14 inches wide gave \$1.60 in gold per ton. A sample across 6 feet 8 inches gave \$1.20 in gold per ton and another across 4 feet 4 inches of the foot-wall portion gave \$1.60 in gold per ton.

The average of all the samples shows a vein-width of 54 inches and an average gold value of \$1.75 per ton.

Below and a little west of the No. 6 tunnel another crosscut tunnel was driven, but I think it is still in the foot-wall formation. A survey would have to be made to ascertain how far it would have to be extended to encounter the vein.

The sampling covers mainly the underground exposures of the vein, and I presume that these places on the surface were selected as the most favourable for development-work. A systematic sampling along the vein-outcrop might disclose better possibilities. No underground drifting on the vein has been done other than the two short drifts in No. 1 tunnel and the width of the chamber in No. 6. It is a matter of opinion whether or not present indications justify further development.

BRIDGE RIVER.

This area has been brought into prominence because of the success attained by the *Pioneer* and *Bralorne* mines. This year it has been the centre of great mining activity, resulting in a large amount of prospecting, staking, and development-work being done, and the production of a very substantial amount of gold. The season's work shows that the gold-bearing area is much more extensive than preliminary work indicated and has greatly increased the poten-

tialities of this section. Development-work is not only enlarging the ore reserves in the producing properties, but is demonstrating that there are a number of prospects that give every promise of becoming producers.

The reader is referred to Memoir 130 of the Geological Survey of Canada for geological information of the area. Briefly, it may be stated that the well-defined, gold-bearing veins have so far been found only in an extensive augite-diorite belt extending along Cadwallader creek. This belt probably emanates from the main granodiorite batholith and intrudes the Cadwallader and Bridge River series. The belt outcrops in many places northward and no doubt it will be found that on either side there are outcropping offshoots, any of which may contain important gold-bearing quartz veins. The late discoveries this year on Truax creek are probably associated with an outlying intrusion of diorite. The importance not only of this area but of the whole contact-belt east of the granodiorite range cannot be too strongly emphasized as a mineral-belt, nor too strongly recommended as a prospecting area.

The lower portion of Bridge river to the Horseshoe bend is reached by road from Lillooet. The upper portion is accessible by an excellent auto-road from Bridge River or Shalalth Stations on the Pacific Great Eastern Railway on Seton lake. There is an excellent passenger auto service and "Curley" Evans has inaugurated an aeroplane service from Vancouver to Seton lake. It is about 55 miles to the end of the road at the *Pioneer*, which is continued as a good foot-trail on up Cadwallader creek to the summit, across the divide, and down McGillivray creek to the Pacific Great Eastern Railway at McGillivray Lodge on Anderson lake. There are branch trails from the main road up Marshall creek, Tyaughton lake (auto-road), Gun creek through to the Taseko River section, Gun lake, main Bridge river, Hurley river, and Cadwallader creek; making this whole area very accessible for prospecting and operating purposes.

So far as placer-mining is concerned, the Bridge River area is not an attractive one for the individual placer-miner. There are probably spots along the South fork and main river where wages can be made during low water, but it has been pretty thoroughly prospected and worked over. However, I think there are opportunities for hydraulicking operations on the benches of the main river and several of the larger tributary creeks. This season a number of plants are being installed, such as Fraser's below the *Bralorne*, two on Tyaughton creek, one on Marshall creek, and one on the lower Bridge river. Next season will see these in operation.

The Government office is at Lillooet, with a sub-recording office at Haylmore, at the junction of the South fork and main Bridge river.

Lower Bridge River Placers, Ltd. This company was incorporated with a capitalization of \$1,000,000, divided into 2,000,000 shares of 50 cents par value, of which 1,600,000 shares have been issued. Wolverton & Co., 553 Granville Street, Vancouver, is the company's head office. The holdings consist of sixteen river leases and six bench leases

contiguous to the river leases, two on the south and four on the north side of the river. They are situated about 12 miles from Lillooet and just below 7-Mile creek, from which water is taken for hydraulicking operations. The working of the sixteen river leases, covering 8 miles of river-bed, depends wholly upon the construction of a dam by the B.C. Electric Company for the diversion of the Bridge River water through the tunnel now completed through to Seton lake. This may not be done for several years. Tests were made by drilling along the banks of the river leases and the company reports an average depth of gravel to bed-rock of 14 feet, with indicated values of \$1.65 in gold per yard. Drilling was also done on the two south benches, the company reporting 24 feet of gravel averaging \$1.17 per yard. The bench-ground on the north side was tested by means of shafts, pits, and trenches, the gravel from which was sluiced, giving a reported recovery of \$1.23 in gold per yard.

This year, under the efficient supervision of Major J. Hartley, a very substantial hydraulicking plant has been installed, utilizing the water from 7-Mile or Michel creek. This entailed the construction of a ditch-line from an intake on the creek over a mile from the river for a distance of 3,800 feet to a penstock at an elevation of 437 feet above the river. From the penstock a pipe-line was put in ranging from 36 inches at the pressure-box to 15 inches at the monitors, of which there are three on the ground, 8-inch, 6-inch, and 4-inch. A 48-inch sluice-box was constructed and sluicing started in the latter part of July. It was demonstrated in a short distance that bed-rock, instead of rising as expected in going back from the river, was dipping downward, and consequently all gravel piped into the sluice was washed over the loose gravel, which was detrimental to gold-recovery.

In addition to this unexpected condition, a horizontal stratum of hard, cemented gravel several feet thick was encountered lying about 10 to 12 feet above the river-level. As it was impossible to break this other than by drilling and blasting, it necessitated raising the level of the sluice-line to conform with the height of the conglomerate-bed, causing further delay. By the time the change had been made in the sluice-box the water-supply from 7-Mile creek was too low to give the required efficiency and operations were closed for the winter.

It was unfortunate that a sufficient yardage of gravel could not have been worked to furnish more conclusive information as to the values, for at best the testing of such a gravel bench by shafts, pits, and open-cuts, etc., is incomplete and only indicative of the gold content. The sluice-box recovery from a representative yardage tells the real story. The company has carried out the work in a very commendable manner, and apparently has done everything possible to develop a successful operation. It should take a comparatively small amount of work in the coming spring to get piping into the sluice-box under way.

Horseshoe Bend, Bridge River.—This is about 20 miles from Lillooet and has been the scene of placer operations for many years. I understand that further work was done this year, but time did not permit of an examination.

Marshall Creek.—This is a tributary emptying into Bridge river from the north just above Rexmouth. Bob Colvin and Miller Bobb hold two creek leases and have been carrying on hydraulicking operations in a small way for several years. Although their outfit has been inadequate for the extent of gravel, they have been getting fair returns for their work. This year Robt. Warren was taken into the partnership and with three more men and a cook have been constructing a different system that will move a much larger yardage of gravel to the sluice-boxes. At the upper end of the lower lease they have built a dam about 100 feet long in which are two gates, one, about 8 feet wide, is an ordinary lift-gate and the other, about 10 feet wide, is an automatic gate which holds and spills the water without any attention whatever. It consists of a gate hung on axles two-thirds of the distance from the top. When closed the gate lies at an angle of 45° down-stream and is held by the water-pressure until the water-level reaches within a few inches of the top, when the pressure on the upper two-thirds tips it down to a nearly horizontal position, releasing the water above and below. When the pressure and suction is on the lower one-third the gate is forced up to its first position again. It took about twenty minutes to fill the dam with the flow of water in August and about four minutes to empty. During the filling period the opportunity is taken by the men to remove the larger boulders from stream-bed, thus increasing the effectiveness of the next rush of water.

The water is diverted to any desired direction or point by means of "shears." These consist of three 1½-inch planks 12 feet long nailed to two 2- by 4-inch strips, and when used are nailed to two tripods sloping back at about 60° from the water-flow. The tripods are about 4 feet long of pointed poles, well braced and constructed so that heavy boulders can be piled on them to hold them in place. The "shears" are used in many ways; two rows form a flume for concentrating the rushing water on a particular piece of stream-bed, or they can be placed to divert the whole force of the water into a bank of gravel to tear it out and carry it on down-stream towards the sluice-line. A start is to be made on one rim and gradually carried across the whole river-bed, about 200 feet in width, the larger boulders removed being piled behind the shears as the work advances. Sluice-boxes can be put in at the foot of any channel and the gravel diverted from one to another while cleaning-up. To facilitate the flow of gravel into the sluices a light monitor is used at the head of the sluice-box.

This method has the advantage of not only having the full force of high water, but an interval between rushes for clearing the boulders and shifting the "shears." By locking the automatic gate the lift-gate can be used to allow the normal flow of the creek. It would seem to be a very mobile and efficient scheme. Mr. Warren states that the present dam can be used to clean out half a mile of bed-rock, which will mean several years' work.

Ten lengths of sluice-boxes will be installed, dumping at the head of a canyon. Iron cross-riffles will be used in the first two boxes and pole riffles in the balance. The amount of gold recovered by Messrs. Colvin and Bobb in their many years of limited gravel-handling capacity would seem to assure a successful operation for the future on the larger scale.

Tyughton Creek.—This creek empties into Bridge river from the north, about a mile above the Williams ranch. Considerable gold was taken out by hand methods for many years, the

old-timers terming it the "grub-stake" creek. There are several individual placer-miners on the upper end above Tyaughton lake and a few on the lower portion of the creek this year.

W. Gorelli has some ground down the creek from the Tyaughton Gold Placers, Limited, holdings, on which he has driven a couple of tunnels on the rim about 30 feet above the river. He gets fair pans and the bench might well be worth some exploratory work, with the possibility of a large operation. Besides this, there have been two major operations, the Tyaughton Creek Gold Placers, Limited, and Grant White and associates.

Tyaughton Creek Gold Placers, Ltd. This company was organized in December, 1931, with a capitalization of \$125,000, divided into 125,000 shares, with its registered office at 908-9, 465 Howe Street, Vancouver. The head office is now at 118 Vancouver Block. The holdings of the company consist of three creek leases, situated below the

mouth of Liza creek and about 4 miles up Tyaughton creek from Bridge river. The leases cover extensive gravel benches on both sides of the river, furnishing ample material for a long operation, and are very amenable to hydraulicking. The company claims that the preliminary testing of the ground has indicated a profitable gold content.

The construction of the plant this year has been under the direct supervision of E. H. Vaughan, assisted by A. D. Estabrook. The work has been well planned and well carried out and is very substantial. It necessitated the construction of about 7 miles of new trail from the main road to Liza creek. The trail was made about 4 feet wide to use a "go-devil" for hauling in the plant by single horses. As the plant was assembled a dam was constructed on Liza creek for the intake, from which a 36-inch pipe-line leads to the flume. This is about 300 feet in length to the head of the ditch-line, and has been made by splitting 36-inch galvanized-iron piping and is supported on trestle-work, making a good metal flume at low cost.

The old ditch-line was cleaned, enlarged, and repaired for 3,700 feet to penstock No. 1, from which a 22- to 18-inch pipe-line about 300 feet long was laid down the hill, a vertical distance of about 175 feet, to penstock No. 2, which is at the head of another ditch 600 feet long to penstock No. 3. From penstock No. 3 to the 4-inch monitor on the creek is 18- to 16-inch pipe, with a head of 165 feet fitted with a "Y" above the monitor to divide the water-supply for piping and by-wash to the sluices.

A bridge was constructed across Tyaughton creek to carry the pipe-line to the proposed starting-point in the gravel bank on the south side. Mr. Vaughan states that two or three weeks' work in the spring will complete the installation of the plant, and he is confident that its operation will prove a profitable enterprise. The first pit will be taken out probably just below the No. 3 penstock, and if this proves up to expectations it is planned to extend the high ditch-line another 1,000 feet and put a pipe-line down to the lower end of the old Chinese workings farther down the creek and work up-stream from that point. This is a very serviceable installation, with apparently an adequate water-supply in Liza creek, which drains Liza lake, where storage could be developed if required. Whether the testing of the ground has been sufficient will be demonstrated by the sluice-box returns.

Grant White and Associates. This partnership owns two creek leases on Tyaughton creek, about 6 miles up from Bridge river. They are owned by Grant White, of Bridge River, one of the "old-timers" in that section, and Vancouver associates. I did not get up to the property this year, but the following information was obtained from Grant White, who has been working with a crew of six men and succeeded in bringing the property to the production stage just before the freeze-up. The work consisted of diverting the main creek to permit the working of the creek-bed. This necessitated digging several hundred feet of ditch from 6 to 8 feet deep, sufficiently large to carry the entire creek-flow, and the building of a wing-dam across the creek to divert it into the ditch. This drained about 200 feet of creek-bed, which is to be worked by drag-line scraper. Provision has been made to use the main river-water for sluicing. A pumping plant has been provided to keep the pits clear of water, an absolute necessity in drag-line operations in bouldery ground, for the reason that as the pit is dug the boulders naturally roll into it from the sides and unless removed eventually prohibit the use of the scraper. If the pit is under water no access is had to the boulders to break them for removal.

This work was accomplished by late in the summer and the drag-line put into operation with the expectation of getting some gold returns before the freeze-up. Unfortunately, a layer

of cemented gravel was encountered which delayed sluicing. However, before closing down for the winter some gravel was obtained below the cemented layer and, I am reliably informed, gave satisfactory gold returns. The outlook would therefore seem to be rather promising when work is resumed in the spring. I understand that there is an extensive yardage of gravel available.

This group of eight claims was staked this season by George and Jack **Mary Mac.** Morrison, of Vancouver. The claims are situated about 4 miles up Truax creek, which empties into Bridge river from the south about opposite Bert Williams' ranch. A winter trail about a mile in length has been cut from the ranch to Bridge river, which is crossed by a first-class cableway and cage, built by the Department of Mines. On the Truax Creek side there is a foot-trail to the head of the creek about 12 miles to Andy Bergenham's claims. Horses are taken as far as the *Mary Mac* group camp at about 4,200 feet elevation, and through the Truax canyon "switchbacks" are required to lessen the grade.

Late in the season the Cadwallader Gold Mines, Limited, acquired this group, the adjoining *Highland Girl* group of eight claims, and three other claims. The company's holdings therefore consist of nineteen claims, as follows: *Mary Mac, Royal, Hazel No. 2, Mary, Golden Dream, Mary No. 4, Hazel, Log Cabin, Mary No. 2, Mary Ann, 6500, Dunbar, John, Haymore, Morrison, Brown Bear, Grizzly, Seven-mile, and Six-mile.*

The Cadwallader Gold Mines, Limited, was incorporated as a private company in February, 1932, with a capitalization of \$12,500, divided into 250 shares, with its registered office at 410 Seymour Street, Vancouver, for the purpose of developing the *Royal* group on Cadwallader creek. (See this report.) A new company will be organized, called the Truax Gold Mines, Limited, to take on the development of the property. The controlling interest in this company will be held by the Cadwallader Gold Mines, Limited.

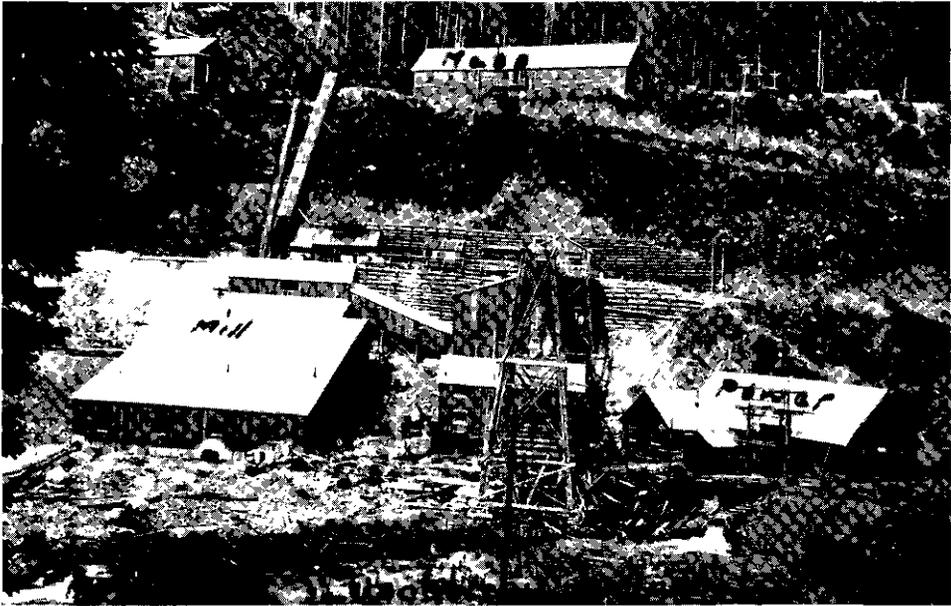
The showings on the property consist of, so far as known, two quartz veins apparently associated with a basic intrusive rock which is probably the extension of the outcropping of augite-diorite indicated on the Geological map accompanying Memoir 130, by W. S. McCann, G.S.C., cutting across Bridge river about 2½ miles above the mouth of Truax creek. The vein matrix is mineralized with arsenopyrite, pyrite, antimony, and magnetite, carrying gold values. The No. 1 vein strikes N. 50° W. (mag.) and dips east at a high angle, and is the main vein, following the strike of the general formation. The No. 2 vein is a cross-vein striking east-west (mag.) and dipping at about 45° where exposed in the west bank of the creek.

The No. 1 or main vein has been exposed by an open-cut just above the creek on the east bank, showing up to a foot of banded quartz on the hanging-wall; then 2 to 4 feet of magnetite with some pyrite; then 2 feet or more of quartz on the foot-wall mineralized with pyrite and antimony. There would therefore seem to be three distinct mineralizations in the vein. A general sample across 70 inches in the bottom of this cut assayed \$18 in gold per ton. It is probable that the ribbon-quartz on the hanging-wall which carries the arsenopyrite may carry high gold values in places. The magnetite and pyrite is a medium-grade gold ore and the quartz and antimony is a low-grade gold ore. This is a very promising showing and a tunnel will be started on it as soon as camp arrangements are completed.

On the strike of the No. 1 vein, about 2,500 feet south of and 800 feet higher than the lower open-cut, some stripping has been done, exposing an area about 9 feet wide and 15 feet long. A sample across 8 feet 6 inches at this point assayed \$17.60 in gold per ton. The snow was too deep at the time of examination to gain much idea of the country-rocks. This upper showing might be the extension of the vein exposed in the lower cut, but, whether or not, it is an attractive outcropping.

The No. 2 vein had not at the time of examination been opened to any extent. It shows from 2 to 4 feet of vein on the hanging-wall, badly shattered, and about 4 feet under that of more solid vein. The upper portion assayed 80 cents in gold per ton and the lower \$1.20 in gold per ton. This vein has been picked up across the creek and some drifting done on it. It here shows a width of about 8 feet of sparsely mineralized quartz in which are narrow bands of country-rock. The whole is said to carry a fair gold value.

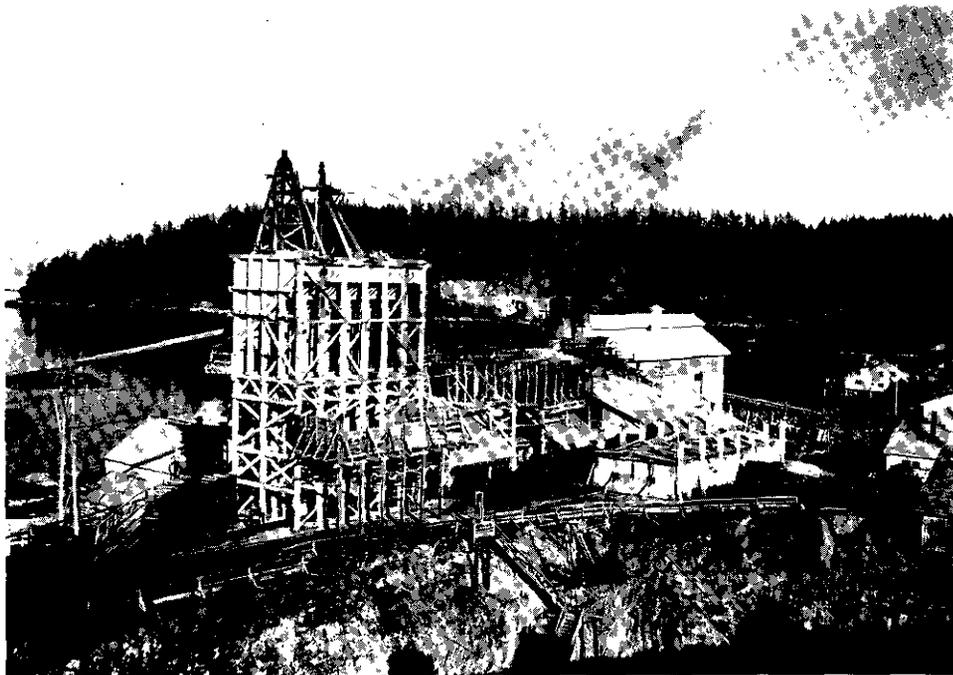
Gold can be panned on the surface and in the creek below the veins and altogether the property is a very promising prospect. Drifting will be done on both veins this winter, but it will probably be necessary next season to do extensive surface work in open-cuts, stripping, etc., to trace out the veins.



Bralorne Mines, Ltd., Cadwallader Creek, Lillooet M.D.



Marshall Creek, Bridge River—A Boomer Gate in Operation.



Pacific Lime Co., Ltd., Blubber Bay, Texas Island.



Newcastle Island—Pulp-stones quarried by J. A. and C. H. McDonald.

There is a big country tributary to Truax creek, and should this property develop successfully it will open a great prospecting-field in the Bridge River formation.

These claims, owned by Andrew Bergenham and associates, are situated at the head of Truax creek, about 12 miles from Bridge river. There is a fair foot-trail from the *Mary Mac* group. The camp-site is at 6,000 feet elevation.

**Bergenham's
Claims.**

I went up to make an examination of the property, but there was a heavy snowfall during the night, and as there were no accommodations I did not wait for the snow to go. Mr. Bergenham states that there are several exposures of quartz mineralized with antimony and iron sulphides. Some samples of realgar have been brought out. The property is listed for an early examination.

This group is owned by Wm. Davidson, Bridge River, and is situated on the main highway about 2 miles below the mouth of Gun creek. In 1931 the Consolidated Mining and Smelting Company secured an option on the property and drove a tunnel 400 feet long, starting just above the river-level. This tunnel followed a shearing in the sedimentaries along a feldspathic dyke. The ground is very broken and clayey and nothing with any possibilities was found. The tunnel has a bearing of N. 35° W. (mag.). A crosscut has been driven 55 feet from the end of the tunnel on a S. 80° W. (mag.) bearing, but also failed to encounter anything of promise. My time was limited for the examination of this group; consequently I did not see the upper tunnel or the surface showings.

This group consists of eight claims—namely, *Golden King*, *Golden Queen*, *Golden Prince*, *Golden Princess*, and *Excessible 0, 1, 2, and 3*—owned by

Golden.

H. E. Rines, of Vancouver. They are situated about three-quarters of a mile below Gun creek along the main road. The surface showings are about 400 feet above the road, in the Bridge River formation. They consist of a number of outcrops of oxidized material across a width of from 30 to 40 feet. The west cropping is from 2 to 4 feet wide and carries gold values up to \$5 per ton; at one place there is about 5 feet in width of heavy iron sulphides. About 10 feet east of this another oxidized cropping has been broken into in a couple of places and is said to carry some gold values. Between these croppings is a limy rock fairly well mineralized with pyrites.

There is another outcrop of oxides about 30 feet above these, and again in the bluffs above. The ribs of sulphides within these oxides assay up to \$6 in gold per ton. These showings are in the Bridge River series of rocks, in a brownish soft country-rock which is probably an altered argillite with siderite. The veins strike N. 20° W. (mag.) and dip about 70° W. (mag.).

A depth of about 75 feet under the oxidized croppings could be obtained by a short crosscut tunnel, and I think it would be the best possible prospecting. The only difficulty with this work would be to dispose of the rock taken out, as at present it would block the main road below. However, a crib-work could probably be put in to hold the dump. As these showings are in the Bridge River series their exploration will be interesting.

This is a group of six claims, situated about half a mile up Gun creek, on the right-hand side going up-stream, owned by T. Turner, of Bridge River. The claims are *Stibnite Nos. 1, 2, 3, and 4*, and *Turner Nos. 1 and 2*. The general rock formation is the sedimentaries of the Bridge River series. The steep walls of the creek show that the sedimentary beds are masses of twisted and jumbled-up argillites and hard, cherty quartzites.

On the claims the structure is somewhat more regular and consists of a bed of argillite between two beds of quartzite. On the lower side of the argillite-bed there are in places widths of quartz up to 2 feet mineralized with pyrite and stibnite and carrying gold values up to \$7 per ton. The occurrences of the mineralized quartz are small and very irregular, and so far as shown along the surface for several hundred feet would hardly be worth while trying to develop. Higher up in the bluff small stringers and lenses of ore can be found along the bedding of the argillite and quartzite.

This company was organized with a capitalization of \$2,000,000, divided into 4,000,000 shares of 50 cents each par value. The registered office is at 303 Crown Building, Vancouver. The property is situated on the main road about 2½ miles below Haylmore at the South fork. It was originally owned by O. Fergusson, of Bridge River, and associates, and during that time had a consider-

**Wayside
Consolidated
Gold Mines, Inc.**

able amount of surface and underground work done. This was described in the 1927 Annual Report, since which time, although further work has been done, the situation has not been materially altered. I therefore did not make a detailed examination of the property this year.

The general rock formation is a belt or mass of augite-diorite similar to that on Cadwallader creek containing important gold-bearing quartz veins. Within the diorite there is apparently a zone of parallel fractures varying up to 6 feet in width and, so far, of unknown length. These fractures are filled with gold-bearing quartz. Seven tunnels and a number of open-cuts have been made on these veins; the longest tunnel, in the hanging-wall and east of the zone, follows a fracture for nearly 1,000 feet, which showed a width of quartz 6 feet wide in one place and values up to \$6.60 per ton, indicating the possibility of a workable body of low-grade ore. The remaining tunnels have been driven on quartz veins at different levels, from 2,228 to 2,800 feet elevations. No connections have been made through to determine whether they follow one or more veins. This work covers a distance of 1,000 feet along the strike of the veins and about 600 feet of vertical depth.

The property has been thoroughly sampled by the company, as well as several examining engineers, and the results are set out on the assay-map of the company. These samplings roughly work out to an average width of about 20 inches, with values of \$12.50 in gold per ton. There are, of course, ore-shoots up to 60 to 70 feet long that will average higher. The No. 1 tunnel, for instance, will average about 15 inches of \$25 ore for a length of 60 feet, and the No. 4 west tunnel also has an ore-shoot about the same length that averages over 2 feet of \$14 ore. Such ore-shoots would in themselves make a profitable small mine and, in conjunction with the lower-grade showings, offer attractive possibilities. The extension of the No. 2 tunnel and diamond-drilling or crosscutting both ways from it would cheaply prove the merits of the property.

This company was incorporated in December, 1931, with a capitalization of **Gun Lake Gold Mines, Ltd.** 120 shares of no par value. Its registered office is at 425 Howe Street, Vancouver. The company acquired three groups of mineral claims on Gun lake—the *Ypres* group of eight claims and the *Avalon* group of eight claims on the north side, and another group about opposite on the south shore, a total of twenty-three claims. These claims cover an isolated belt of augite-diorite some 2,000 to 3,000 feet wide. They were originally owned by Messrs. Ferguson and Walker.

Gun lake is reached by good foot-trail either from the South fork or by the one crossing the *Wayside* property. The camp is on the north side of the lake and the work so far has been done on the *Ypres* claims. This work, under the able supervision of O. Fergusson, consists of ground-sluicing off the overburden in search of gold-bearing quartz veins in the diorite. Water was diverted from a small creek above the camp and the water taken by a small ditch-line across the belt. Branch ditches were taken from this for sluicing out bed-rock cuts. By this method some 800 feet across the belt has been prospected. To proceed with this work will necessitate going higher up on the creek for water and digging a ditch-line practically across the belt. The first open-cut from the camp shows a quartz vein about 3 feet wide striking east-west (mag.). The second shows several small parallel quartz veins across a zone of altered diorite and a third cut has also exposed a small quartz vein. Only small gold values have been obtained from these veins, but practically no work has been done on them either by way of exposing them along the surface or drifting. I suppose there can be no guarantee of finding ore-shoots in these quartz veins, but they deserve some exploration after the expense of locating them.

Matt Foster, of Bridge River, owns ten mineral claims—namely, *Veritas, Veritas Group, Veritas Nos. 1 to 6, Ranch, Reno, and Eve*, of which the *Ranch, Veritas, and Veritas Nos. 1 to 4* are Crown-granted. They are situated on Little Gun lake, where Mr. Foster has a beautifully located ranch, reached either from Gun lake or by trail from the main road at the South Fork bridge.

He has done about 1,000 feet of underground work in three tunnels, developing a small quartz vein in augite-diorite formation. The vein has been traced a couple of thousand feet on the surface by open-cutting and stripping. In places on the surface he finds high gold values, but the upper tunnel has not been advanced far enough to get under these points. The vein so far as exposed underground has shown encouraging values only in a few places. It strikes east-west (mag.) and dips north at about 80°. As a rule the hanging-wall is diorite and the foot-wall an altered diorite showing serpentine and albite. The work consists of three tunnels;

the lowest, at 2,985 feet, is about 20 feet above the lake and has been driven 275 feet, of which 102 feet is through the overburden, necessitating close timbering. It was swung to the left and is therefore approaching the vein slowly at an angle. The No. 2 or middle tunnel is at 3,060 feet elevation and 300 feet long. It was driven in the foot-wall and has three crosscuts to the north cutting the vein. Samples of the vein at these points gave only low gold values. The No. 1 or upper tunnel at 3,170 feet elevation is 240 feet, with a 28-foot winze 40 feet back from the face and a short raise above it. Here the vein is about 2 feet wide and carries some gold values, but not sufficient to make a workable ore. This tunnel is in the vein all the way, but the average values are low.

The places on the surface where high values have been found are beyond the face of the upper tunnel, and I therefore suggested the extension of that tunnel with the hope of encountering a pay-shoot, rather than the work in the lower tunnel to obtain more depth on the vein. If perseverance has any reward in mining, Mr. Foster should get it.

South Fork.—Mr. Bishopric brought in a Keystone drill from the upper Cariboo country to his ground just below the South fork on Bridge river. Four or five holes were drilled to bed-rock on a small island, with satisfactory results reported. Nothing further, however, has been done.

Cadwallader Syndicate Placers, Ltd. This syndicate was organized early in the year, with its office at 413 Granville Street, Vancouver. It acquired a creek lease and a bench lease held by Carl Wikhsne, of Bridge River, situated on Cadwallader creek, a short distance below the *Lorne* mine. Operations were under the supervision of Horace Fraser and a crew of six to ten men was employed during the summer season.

A good camp was established on the ground and a road built down to the camp, branching from the road to the *Pioneer* dam on Hurley creek. Also a bridge was built across Cadwallader creek for convenience to the main highway. The ground is on the west side of Cadwallader, extends half a mile up the creek from the canyon, and is estimated to contain approximately 350,000 yards of gravel. Tests made by Mr. Fraser indicated about \$1 per yard gold content.

The plant consists of a drag-line scraper on a 45-foot boom, operated by donkey-engine for digging and auxiliary engine for swinging. It is of heavy construction throughout, capable of handling boulders up to 4 to 5 tons. The plan of operation was to leave a dyke along the river for protection and work from there to rim. The flume and sluice-line were therefore built along the bank of the river. It required an intake dam, 500 feet of metal flume laid on one-half of 1-per-cent. grade, followed by 400 feet of sluice-line on a 3-per-cent. grade, fitted with pole riffles. A grizzly on a movable frame that could be placed to conform with the position of the machine was so arranged that the "through" material went to the sluices and the boulders and coarse gravel were dumped into the creek.

• Work was started at the lower end of the bench and during the season progressed about 400 feet up-stream and about 7,000 yards of gravel removed. It was found that a bed of clay had been deposited in the back eddy above the canyon-wall. This was only a foot or two at the lower end, but had attained a thickness of about 12 feet in a distance of 400 feet. The clay, of course, carries no values. Some gold was recovered from the top gravel, which is about 6 feet deep. Below the clay is a loose gravel. Bed-rock was not followed. It was found to be about 10 feet below the clay at the upper end of the pit. The results of the season's work were disappointing so far as gold-recovery is concerned.

As there is ample yardage of gravel above, it is planned for next season to sink several shafts along the rim above and to bed-rock, and future operations will, of course, depend on the information gained.

Bridge River Consolidated Mines, Inc. This company was incorporated in 1928 with a capitalization of \$3,000,000, divided into shares at \$1 par value, with its office at 410 Seymour Street, Vancouver. The company's holdings consist of the four Crown-granted claims—*Ural*, *Forty Thieves*, *Elephant*, and *Why Not*—situated on the north-east side of Hurley river (South fork), and a number of other adjoining claims.

The Bridge River Exploration Company, Limited, took an option on the balance of the Bridge River Consolidated treasury stock, approximately 400,000 shares at 10 cents per share, and undertook the development of the above property. A mill was to be erected by the Exploration Company in the event of the development proving satisfactory. Work was carried out in 1932 on two of the Crown-granted claims.

On the *Why Not* some work was done at the intersection of the *Why Not* and *California* veins in the face of a bluff at 3,500 feet elevation. Open-cutting along the vein showed spots of free gold, and a short tunnel about 20 feet was driven on the *Why Not* vein at this point without encountering anything indicating importance. The vein strikes about N. 30° W. (mag.) and dips 55° N.E. The hanging-wall is diorite and the foot-wall altered diorite. The *Why Not* vein was traced down the hill and another tunnel started at 3,300 feet elevation. This has now been driven over 600 feet, following a lean quartz vein that shows medium values in places. At my last examination at the end of August drifting was being done on a mineralized cross-fracturing with a bearing of S. 35° W., which shows a little better values. Altogether the exploratory work so far has not given much encouragement.

On the *Forty Thieves* group work was continued in driving the crosscut tunnel which was previously started just above the river at 2,800 feet elevation, about 300 feet below the bench at the top of the escarpment above the river. The vein can be traced for several hundred feet down along the face of the steep bluffs and shows a strong, well-defined vein up to 5 feet in width. Sections of the vein are stated to carry fair gold values. It has a strike of N. 60° to 70° W. (mag.) and dips about 45° N. The tunnel is driven on a bearing of N. 50° E. (mag.) and encounters the first vein at 100 feet from the portal. This vein was drifted on for 250 feet. In this drift, at 75 feet from the main tunnel, a crosscut was driven which intersected a small ribbon-quartz vein at 40 feet in a very hard diorite. The second vein would therefore be about 150 feet from the collar of the main tunnel. The first vein does not resemble the vein in the bluff, in that it has a strike of about east-west (mag.) and dips from 45° to 55°. No values of any account were found in it.

At a point on the surface about 80 feet above the main tunnel a short tunnel was driven on the vein, which here is strong and well defined. Below this it is seen to dwindle to a small seam of quartz, and it seems very probable that the main tunnel is too low to cut the vein where it is full width. The second (small) vein in the tunnel would correspond to the pinched portion of the vein on the surface. It might improve with drifting east. It would be good prospecting to drive in on the vein from the surface where the best values are found.

**Bridge River
Exploration
Co., Ltd.**

This is a private company incorporated in June, 1931, with a capitalization of 450,000 shares of no par value. Its office is at 640 Pender Street West, Vancouver. The holdings of the company consist of the *Shepherd*, *Portal*, and *Shepherd-Wihksne* groups, comprising thirty-eight claims and fractions, situated on the north-east side of Hurley river up from its junction with the main Bridge river. This year the company had an option on the balance of the Bridge River Consolidated Mines, Incorporated, treasury stock and took on the development of that company's property on the *Why Not* and *Forty Thieves* claims. (See text.) Earlier in the year the company's *Arizona* claim was also developed to some extent by a small crew. The work on this claim consisted of a tunnel at 2,900 feet elevation. It was driven 185 feet, following a rather irregular, flat quartz vein mineralized with grey copper, galena, zinc-blende, and pyrite, carrying mainly silver values on the surface, but with more indications of gold as more depth was attained. The values depend on the grey-copper content and are therefore erratic, and the vein is, so far, too small to give much encouragement. The vein, striking about N. 60° W., has, generally, diorite on the foot-wall and serpentine on the hanging-wall, but in places lies wholly in the diorite, which does not affect the size or mineralization to any extent.

Later in the season work was undertaken on the *California* vein. This tunnel at 3,700 feet elevation had previously been driven about 40 feet, showing its strike at N. 60° to 70° W. and a dip of about 55° N.E. The vein is composed of a breccia of quartz and country-rock on a diorite-greenstone contact. The face of the tunnel at 40 feet from the collar showed 6 feet of vein, mainly quartz with rock enclosures; the quartz is mineralized with iron sulphides and stated to average from \$4 to \$5 gold per ton across the 6 feet. The vein has been traced, by open-cutting, on the surface for a couple of thousand feet up to 4,000 feet elevation.

E. Shepherd, superintendent, states that since resuming work the tunnel has been extended to about 500 feet, with several cuts across the vein. At 100 feet in from the portal the vein has widened to about 12 feet; at 250 feet it is 18 feet, at 350 feet it is 27 feet between walls, and at the face 18 feet. I have not sampled it, but it is stated to be a possible milling-ore throughout. It is now proposed to move the plant down another 200 feet vertically and drive another tunnel.

This is a showing with considerable possibilities; there is every indication of a very large tonnage of ore, and with sufficient values for milling it would develop into a major operation.

These consist of seventeen claims north of and adjoining the *Bralorne* holdings **Taylor Groups**, and three claims above and adjoining the *Pioneer* ground. They are owned by J. M. Taylor, of Vancouver. The lower groups cover the diorite-belt north of the *Bralorne*, and during the past five years Mr. Taylor has done considerable exploratory work in that area. Lack of water for ground-sluicing purposes has necessitated much open-cutting to bed-rock, followed by some underground work. Several quartz veins have been found by this work, but no ore-shoots of commercial importance have been exposed. These claims are favourably located so far as the geological features are concerned, and for that reason are worth extensive prospecting.

This company was incorporated in April, 1931, with a capitalization of **Bralorne Mines**, 1,000,000 shares of no par value. The head office of the company is 555 **Ltd. (Lorne** Burrard Street, Vancouver. The property, the title of which is vested in **Gold Mines,** this company, consists of fifty-two claims situated on Cadwallader creek, a tributary of Hurley river (South fork of Bridge river), about 52 miles by **Ltd.)** good auto-road from Shalalth, on the Pacific Great Eastern Railway at Seton lake. The Lorne Gold Mines, Limited, was the previous owner of the property and was organized in 1928 with a capitalization of 3,500,000 shares of \$1 par value. Extensive work was done on the property by this company up to 1930, when the failure of the fiscal agents forced it to suspend operations, still owing \$95,000 as final payment on the property. Offers for the property were made by the Pioneer Gold Mines, Limited, and the Bralco Development and Investment Company, and about the middle of 1931 the terms of the latter company were accepted. The Bralco Company agreed to meet the final payment on the property, advance \$50,000 for development, erect a suitable mill, and further equip the property for production, for which it was to receive 60 per cent. interest in the holdings, all moneys advanced for property payments to be returned from the first profits. The 40-per-cent. interest retained by the Lorne Gold Mines, Limited, was equivalent to 400,000 shares of Bralorne Mines, Limited, which had been formed as the holding company. In September, 1932, these shares were distributed on the basis of one *Bralorne* share for eight *Lorne* shares.

The Bralorne Company then proceeded to put the property on a producing basis. It purchased and installed much of the *Dunwell* mine mill, put in a power plant and mining equipment, etc., and in the first week of February, 1932, commenced production, from which time there has been little doubt as to the success of the undertaking. Up to the end of the year 32,657 tons of ore has been mined and milled, producing \$320,255 in gold bullion, and 790 dry tons of concentrates, yielding \$117,474, a total production of \$437,729.

The main working-tunnel from the surface is the eighth level of the mine. The total length of this tunnel is approximately 2,400 feet, roughly paralleling the strike of the veins. From a point 1,900 feet from the portal a crosscut was run north for a distance of 1,260 feet, cutting the *King* vein at about 400 feet and the *Shaft* vein at 900 feet from the main tunnel. A small vein was crossed about half-way between the *King* and *Shaft* veins, which is believed to be the *Woodchuck* vein. A 230-foot crosscut south from the main tunnel at 1,850 feet from the portal picked up the *Alhambra* vein.

The *Shaft* vein was drifted on to the east for over 1,200 feet, encountering places of enrichment but no important tonnage. The *King* vein was drifted on to the west to the main fault and east for several hundred feet. The east side has produced the bulk of the ore milled, stopes being opened up from the eighth, seventh, and sixth levels. In stoping from the sixth level it was found that the ore-shoot raked to the west, and further exploration opened up a fine body of ore. The drift from the old fourth level from the surface was extended west and cut this ore-body, proving it to be about 150 feet long, averaging about 3 feet wide of high-grade milling-ore. Subsequent work has exposed the ore-body upwards, giving every promise of a fine ore-shoot through to the surface.

From the eighth level a shaft has been sunk 270 feet on the *King* vein and two levels opened from it, the ninth at 110 feet and the tenth at 260 feet. Drifting east from the shaft on the ninth level opened up a fine shoot of milling-ore. Drifting east on the tenth level, however, did

not prove so fortunate, as the drift was in a horizontal pinch in the vein. Raises are being put up to prove the ore-body below the ninth level.

At the end of the year the eighth and tenth levels had been extended west through the main fault and a drift to the south-east along the fault had picked up the vein, showing a displacement of about 280 feet. The vein is now being opened up on both levels.

The extent of the company's ground, about 2 miles east and nearly 1 mile west of the eighth level, offers considerable possibilities. The ground west of the main tunnel has not been prospected. In the country on the eastern end of the property the old *Coronation* and *Ida May* showings have only been opened to shallow depths and produced high-grade ore, and therefore hold strong inducements for further development.

The concentrator is situated on the west bank of Cadwallader creek, just below the main working-tunnel, from which the ore is dumped directly into the grizzly over the coarse-ore bin of the crushing plant. The grizzly oversize goes to the jaw-crusher and then to fine-ore bin. From here it is fed by belts to two Hardinge ball-mills, the overflow from which passes through hydraulic traps, the concentrates from which go to jigs and the overflow is returned to the Dorr classifiers in circuit with the ball-mills. The jigs give a high-grade concentrate and a very low tailing, the concentrate being treated in an amalgam-barrel for sixteen hours.

The overflow of the jig tailings goes to waste and the solids are returned to the classifier. The overflow from the Dorr classifiers passes to two blankets of 24 square feet each, with a pitch of 1¼ inches per foot; the concentrate product is returned to the jig and the tailings are further treated over blankets, the concentrates from which go to the jigs and the tails to a 10-cell flotation-machine, eight of which are roughers and two cleaners. The flotation concentrates go to a thickener and Oliver filter, are sacked and shipped to the smelter.

The total mill recovery is approximately 94 per cent. of the total gold content of the ore, of which from 75 to 80 per cent. is free gold. About 50 per cent. of the gold is recovered in the hydraulic traps and about 25 per cent. on the blankets, leaving about 20 per cent. recovery in flotation. Eventually it may be decided to cyanide the flotation concentrates. At present about 2½ tons of flotation concentrate are being produced per day. The mill has averaged about 100 tons per day since starting on February 8th.

The staff personnel consists of H. Bosustow, general superintendent; R. Chenoweth, mine foreman; Fred Grey, mill foreman; Don Matheson, engineer; and Charles Broad, chief accountant.

There are four claims in this group, situated at an elevation of 1,200 feet above the *Pioneer*, or 5,200 feet elevation. The claims are owned by F. W. Holland, Pioneer Post-office, and associates. The showing is a quartz vein up to 2 feet wide occurring in an argillite-bed of the Bridge River formation. The vein conforms with the strike of east-west (mag.) and dip of 40° to 50° N. of the sedimentaries. Only a few shots had been put into the vein where it was exposed for about 50 feet. I took a general sample from each place the vein had been broken into, which assayed only a trace in gold per ton. The quartz is lightly mineralized with iron sulphides which probably carry any gold values there may be. Some depth could rather easily be obtained by crosscutting. The claims are reached by a slashed-out trail from the *Pioneer* wood-road above the camp.

This company was incorporated in March, 1928, with its registered office in the Rogers Building, Vancouver. It is capitalized for \$2,500,000, with shares at \$1 par value. The company's holdings consist of eighteen claims and fractional claims on Cadwallader creek, 55 miles by good road from Shalalth, on the Pacific Great Eastern Railway. The camp is at 4,000 feet elevation. This property, rapidly approaching the position of the greatest gold-producer in the Province, was staked in 1897. During the following years much surface work was done and a shaft sunk to 250 feet depth. This work exposed short shoots of very high-grade ore in places. Little further work was done until 1923, when David Sloan, the present managing director, dewatered the shaft, made an examination of the property, and presented the proposition to Eastern interests, who, after a brief investigation, turned it down. Shortly afterwards Sloan took over the property from the owners on a development agreement and in Vancouver raised sufficient funds to pay off some indebtedness and start work; and steady progress has been made ever since. The first mill, erected in 1924, consisted of a crusher, Bryan mill and plates, and was operated until 1928, when a 100-ton cyanide plant was installed by the present company. Since then the

property, still under the efficient management of David Sloan, has been developed to its present standing.

The *Pioneer* veins are quartz-filled, persistent fissures in an extensive stock of augite diorite which extends, so far as now known, from the head of Cadwallader creek north to beyond Gun lake, a distance of about 20 miles, and varies up to 2,000 feet or more in width. Three veins have so far been exposed in the underground workings, only one of which has been developed, the main vein. In sinking the new shaft another vein was crossed a short distance below the surface, of good width and carrying gold values. No development has been done on this vein as yet. At 1,560 feet depth in the new shaft a third vein was cut and again exposed in cutting the station at the 1,625-foot level at the bottom of the shaft. It carries milling-grade gold values, but has not been developed to any extent.

The mine is opened by a vertical shaft completed this year to the 1,625-foot level, No. 14. Below the 500-foot level the levels are at 125-foot intervals. The new shaft crosses the vein just above the 500-foot level and is, from there down, in the foot-wall. Crosscuts have been driven from the shaft to the vein below the No. 9, which is the lowest developed level. This has been drifted for about 700 feet east and 1,200 feet west, showing a practically continuous ore-shoot throughout.

The west drifts on all the levels produce high-grade ore as the south limit of the diorite-belt is approached at its contact with serpentine. Extremely rich ore was found above the seventh level and recently the downward extension of this shoot was encountered in the eighth level stope, from which some bonanza ore was taken. Two tons alone produced nearly \$200,000 worth of gold, increasing the output of the mine for the last two weeks in December to 400 lb. of gold. Another pocket taken out later produced nearly 400 lb. of gold from 900 lb. of ore, which is probably the richest half-ton ever mined in the Province, if not in Canada. The west drifts from the shaft are increasing in length to the contact as depth is reached, due to the north dip of the vein and the south dip of the diorite.

What promises to be a strike of major importance to the mine has recently been made in drifting east from the shaft on the seventh level. At about 800 feet from the shaft a fault was encountered and the vein picked up on its east side. Some drifting was done, but the vein was narrow and low grade and work was suspended at this point for some time. Recently, however, drifting was resumed, and at about 400 feet from the fault an ore-shoot was entered varying in width from 2 to 5 feet and in values from \$20 to \$100 per ton. The latest report states that this ore-body has been drifted on for about 300 feet, with every indication of its continuation. This ore-body lies about the centre of the diorite-mass and, on the strike of the vein, is over half a mile from the north limit of the diorite and therefore holds immense possibilities.

Stoping is now being done on all the levels above the ninth to the fifth, above which the ore has been exhausted. An ore-pocket and loading-chutes have been built below the ninth station and all ore-hoisting is done from that level.

The shaft is 3-compartment; two skipways and a manway. It is equipped with skips of 1½ tons capacity, hung below the cages; the pocket chutes are of the same capacity and are electrically operated. The hoist is a double-drum electric hoist of 350 horse-power, with a speed of 1,000 feet per minute running counterbalanced. The head-frame is 65 feet high and contains a 150-ton ore-bin, from which the mine ore is belt-fed to a gyratory crusher in closed circuit, with a Hummer screen giving ½-inch product going to the fine-ore bin. From there the ore is delivered to a 500-ton ore-bin at the head of the mill by a jig-back tramway with ¾-ton buckets.

The addition this year of a 200-ton unit to the concentrator will increase the capacity to at least 300 tons per day. This unit was put into operation in September. The crushed ore from the mine is dumped into a chute which delivers to the mill-bins at the head of each unit. The ore is sampled after crushing at the upper end of the mill tramway. In the new unit the ore is belt-fed from the storage-bin to a Marcy ball-mill, in which the ore is ground in cyanide solution in closed circuit with a Dorr duplex classifier. The overflow from the classifier goes to a sump, from which it is pumped to a Dorr bowl classifier in closed circuit with a Traylor ball-mill. The overflow from the bowl classifier, about 80 per cent. minus 200 mesh, goes to the primary thickener; thence to three agitators, to four secondary thickeners, to filter, to waste. The gold solution, amounting to 3 tons per ton of ore milled, is clarified and precipitated in a Merrill-Crowe low-level vacuum leaf filter. The precipitate is dried by air-blast, melted, and

refined to about 90 fineness and shipped to the Mint at Ottawa. The mill recovery is from 95 to 96 per cent. of the gold. The consumption of cyanide is about $2\frac{1}{4}$ lb. per ton of ore. About $2\frac{1}{4}$ lb. of quicklime per ton is used. The company burns its own lime in a rather ingenious furnace built in a cave in a limestone-bed about 3 miles from the mine. A raise through the limestone-bed to the surface is the furnace-flue. As limestone is needed for the furnace it is mined directly into the flue at the surface.

Water for power and milling purposes is taken from Cadwallader creek, about a mile above the mill, by a 36-inch stave pipe. About 600 horse-power is developed at this plant. A supplementary plant was built two years ago on Hurley creek, with the power plant at the junction of that creek and Cadwallader creek 4 miles below the mine. About 750 horse-power is generated at this plant.

To meet the expansion of the property in mining and milling has necessitated a large amount of surface construction and improvement during 1932. This has included a new 3-story office building; a modern mess-house with rooms above; a bunk-house; dry and change house; several new dwellings; extension to blacksmith and machine shop; a store and post-office building (last year); and a new townsite has been cleared, etc. The company's sawmill provides all lumber and dimension stuff required around the plant. A school was opened some time ago and recreation-grounds are being cleared and levelled. A doctor is in residence at the *Bralorne* mine.

In 1932 50,000 tons of ore was mined and milled, producing 41,413 oz. of gold by cyanidation, and on refining gave 38,705 oz. of gold and 6,290 oz. silver, having a value of \$804,261, to which add \$103,934 premium for a total of \$908,195. An average of about 200 men was employed throughout the year.

The staff personnel at the mine consists of David Sloan, general manager; H. J. Cain, general superintendent; Robt. Sloan, mine superintendent; H. T. James, engineer; Paul Schultz, mill superintendent; and Ross Thompson, chief accountant.

This company was incorporated with a capitalization of \$2,000,000, divided into 2,000,000 shares of \$1 par value. The registered office of the company is 206 Vancouver Block, Vancouver. The holdings consisted of about twenty-one mineral claims and fractions south and east of and adjoining the *Pioneer Gold Mines* property. This year another group of eight claims, the *President* group, was acquired, which is situated south of and adjoining the westerly claims of the *Pioneer*, making a total of about thirty claims. This ground completely covers the easterly extension of the augite-diorite belt which is proving so prolific of gold-bearing quartz veins.

There is an old road from the *Pioneer* camp to the dam, about a mile, from which the trail to the camp, at 4,350 feet elevation, is only a short distance. This road will be improved next spring to enable trucks to deliver supplies to a central warehouse, about half a mile up from the *Pioneer*, for the upper Cadwallader Creek properties. The road will be extended as developments warrant.

The heavy overburden on this ground necessitates extensive stripping to prospect the surface of the augite diorite. The limits of the diorite-belt have been definitely located; the south limit, contacting with a belt of serpentine, is at 5,500 feet elevation, and the north wall has been exposed just south of Cadwallader creek at a little over 4,000 feet elevation; it has a width here of several hundred feet. A system of ground-sluicing was developed by W. Bosence (in charge of the work) that proved very efficient and economical. A small stream was diverted at 7,500 feet to a ditch extending for a couple of thousand feet diagonally down along the side of the hill. Branches were run from this main ditch to points where trenches were ground-sluiced down to bed-rock. By this means bed-rock was exposed at intervals for several thousand feet along the south contact of the diorite-belt. Although no mineralization of importance was found, some interesting-looking ground was exposed that will be further prospected by open-cuts, etc., or diamond-drilling. Some of these sluiced cuts should be extended right across the diorite-belt. The comparatively even grade of the talus-slope and the lack of outcropping bluffs and timber make very favourable conditions for this kind of work.

The fact of the success of the *Pioneer* in similar formation about a mile distant fully warrants a very extensive and systematic exploration of this ground. The work so far has been well considered, well carried out, and should be extended.

**Paymaster-
Magna Dome
and Lazy Boy
Groups.**

These groups, consisting of eight claims each, are situated on Crazy creek, a tributary of Cadwallader creek from the south, and lying south of and adjoining the westerly claims of the *Pioneer Extension* ground. They are owned by Frank Kirkwood, of Pioneer, and associates. The camp, at 5,000 feet elevation, is reached by the continuation of the trail to the *Pioneer Extension* camp from the *Pioneer* dam. The owner has done considerable work in prospecting, surface-cutting, etc., exposing several small quartz veins. These occur in a wide siliceous belt, probably an altered greenstone dyke in the Bridge River series. This belt has been traced for over 1,000 feet up the hill opposite the camp. Open-cuts show fair-looking quartz veins carrying some gold values. South of this belt at one place the overlying rocks have slid off, showing the underlying diorite, which no doubt extends farther south. It is a matter of exploratory work and assaying to find out whether or not the dyke contains ore-bodies with workable values.

**Dan Tucker
Group.**

There are six mineral claims in this group—namely, *Dan Tucker Nos. 1 to 6*, inclusive. They are located on the west side of Cadwallader creek, about 3 miles south of the *Pioneer*. The claims were staked by Hall Carpenter, one of the present owners, with Wm. McAdams and F. R. Macdonald, of Vancouver. The trail to the property branches at Hawthorn creek from the main trail up the west side of Cadwallader creek. There is a foot-bridge at Hawthorn creek across Cadwallader creek.

The formation structure of the country is fairly well shown on this ground. The Bridge River series extends for several hundred feet up from Cadwallader creek, then a well-defined belt of serpentine about 100 feet wide to the north limit of the augite-diorite belt. Along the border there is a sheared belt in the diorite up to 50 feet in width and above or south of that is the massive diorite-belt. The serpentine-belt north of the shearing forms a distinct ridge extending for several thousand feet, on the south side of which is a ditch-like depression probably caused by the erosion of the sheared diorite. Within the shear-zone are small pyritized stringers and veins of quartz carrying gold values up to \$15 to \$20 per ton, but not in sufficient numbers to constitute a minable grade of ore. Gold can be panned from these stringers for a considerable distance along the depression.

A shaft was being sunk in the shearing when I examined the property in August, which I understand was continued to 60 feet depth. The bottom is in fairly solid but low-grade quartz. This winter a 300-foot crosscut tunnel is being driven through the serpentine-belt to cut the shear-zone below the bottom of the shaft, with the intention of drifting on the quartz vein. Several hundred feet north of the shaft an open-cut on the same belt shows a width of 12 to 15 feet of very oxidized material which pans fine gold. The distributed gold values found wherever this belt has been prospected would seem to justify a considerable amount of development-work.

**Red Hawk
Gold Mines, Ltd.**

This company was incorporated in December, 1932, with a capitalization of \$1,000,000, divided into 2,000,000 shares at 50 cents par value. Its registered office is 712 Stock Exchange Building, Vancouver. The company took over the *Red Hawk* group from the original stakers and owners, Malcolm McKenzie, Harry Kerr, and Joe Marron. There are nine claims in the group—*Red Hawk Nos. 1 to 9*, inclusive, situated about 6 miles south of the *Pioneer* on the west side of Cadwallader creek, adjoining the *Dan Tucker* group on the south. The camp is at 6,000 feet elevation, to which there is a fair horse-trail branching from the main trail up the east side of Cadwallader creek at Hawthorn creek, built early in the season with assistance from the Department of Mines. The claims were staked in 1931 and the owners have been active in prospecting and development-work since. They have succeeded in locating several showings that deserve further development, and I understand that the company is financed to go ahead with work in 1932.

The claims cover a large area of the diorite-belt exposed for a considerable width below the camp and appearing higher up in isolated tongues and masses in a more or less broken-up formation. About 400 feet above the camp a short tunnel has been run on a quartz vein containing small gold values. East of the camp a promising-looking quartz vein has been exposed by stripping and a few shots put in it. It strikes about east-west (mag.) and appears to dip north at a high angle. It is about 10 feet wide, with 3 to 4 feet of sparsely mineralized quartz

carrying only low values in gold. The hanging-wall, so far as can be seen, is apparently greenstone and the foot-wall either altered greenstone or diorite, which shows on the surface north toward the camp. This showing should be explored at some depth, obtainable by a crosscut tunnel. On the opposite side of the gulch from the camp a siliceous dyke containing a network of quartz veins was being uncovered when I was on the property in August. I understand that a tunnel has been driven on this for 50 feet with the intention of continuing it to 70 feet and crosscutting. A lot of open-cutting was done on the north limit of the diorite at and in the serpentine-belt with no very encouraging results. The owners state that another promising showing was found later in the season in the main diorite-belt below the camp. The season's work on this property has given encouraging results. This ground is worthy of pretty thorough prospecting and any quartz-outcrops should be adequately investigated.

These groups adjoin the *Red Hawk* claims on the south and are owned by **I.X.L. and Butte Groups.** A. McGuire, of Vancouver. The *I.X.L.* group consists of the *I.X.L. Nos. 1 to 5* and the *Butte* group of *Butte Nos. 1 to 8*; the latter group is situated on the south side of Copp creek. The camp is on the west bank of Cadwallader creek and reached by a branch from the main trail on the east side of the creek. The rock formation in this section is the Bridge River series intruded by tongues and masses of diorite from the underlying diorite-belt. The diorite itself and the greenstone intrusions of the Bridge River series are so altered that recognition is impossible. Quartz-exposures in this area therefore deserve investigation to determine their possibilities, which means that some depth be obtained and drifting done on the vein.

There is such a situation on this property. A well-defined quartz vein has been cut by a small gulch, but at the time I saw it nothing whatever had been done toward breaking into it. I would suggest a crosscut tunnel to get some depth on the vein and then some lateral work on it. A few thousand dollars so spent should indicate whether or not further development is justified. In the meantime this ground should be closely prospected, as there are no doubt many outcroppings of the diorite-belt which in this area carries the gold-bearing quartz veins. I am informed that the property is being financed in a small way to carry out this preliminary work.

This company was incorporated in February, 1932, with a capitalization of **Cadwallader Gold Mines, Ltd. (Royal Group).** \$12,500, divided into 250 shares at \$50 each par value. The registered office is 410 Seymour Street, Vancouver. The holdings consist of the *Royal* group of ten claims on the east side of Cadwallader creek, about 7 miles from the *Pioneer* mine, and late in the year the company also acquired the *Mary Mac* and *Highland Girl* groups on Truax creek. (See this report.) The main trail up the east side of Cadwallader creek crosses the *Royal* group.

The general rock formation here is probably the altered sedimentaries and volcanics of the Bridge River formation, through which the underlying diorite-belt has intruded in tongues and small masses. This season's work consisted of the establishment of camps, trail-building, and prospecting, with a small crew. Ground-slucing up a small creek that crossed the formation was used to expose the bed-rock. This work succeeded in finding a quartz vein in the diorite, which was then stripped for about 40 feet on the surface, showing low gold values. It was then decided to obtain some depth on the vein by a crosscut tunnel from which to further explore it by drifting. This work is now being carried out. The outlook for the property is encouraging, in that a gold-bearing vein has been found, but the possibilities depend on the results of development.

INSPECTION OF MINES.

REPORT BY JAMES DICKSON, CHIEF INSPECTOR OF MINES.

INSPECTION STAFF.

INSPECTORS.

James Dickson.....	Chief Inspector, Victoria.
James Strang.....	Inspector, Victoria.
Robert Strachan.....	Senior Inspector, Fernie.
John MacDonald.....	Inspector, Fernie.
Henry E. Miard.....	Inspector, Fernie.
Geo. O'Brien.....	Inspector, Nanaimo.
Thomas R. Jackson.....	Inspector, Nanaimo.
John G. Biggs.....	Inspector, Princeton.
Charles Graham.....	Inspector, Prince Rupert.

INSTRUCTORS, MINE-RESCUE STATIONS.

John D. Stewart.....	Nanaimo Station.
John Thomson.....	Cumberland Station.
Alfred Gould.....	Princeton Station.
John T. Puckey.....	Fernie Station.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

James Dickson.....	Chairman, Victoria.
James Strang.....	Secretary, Victoria.
H. E. Miard.....	Member, Fernie.

Messrs. Strang and Miard and the Inspector of Mines of the district in which an examination is being held form the Board for granting certificates of competency to coal-miners. An Inspector of Mines is empowered to grant provisional certificates to miners for a period not exceeding sixty days between regular examinations.

INSPECTION DISTRICTS.

The Province is divided into six Inspection Districts, as follows:—

Inspection District.	Mining Divisions covered by Inspection Districts.
Vancouver Island.....	Victoria, Alberni, Clayoquot, Quatsino, and that portion of the Nanaimo Division situated on Vancouver Island.
Southern Coast.....	Vancouver, New Westminster, and that portion of Nanaimo Division situated on the Mainland.
Northern.....	Atlin, Liard, Stikine, Portland Canal, Nass River, Omineca, Peace River, Skeena, Bella Coola, and Queen Charlotte Islands.
Nicola-Princeton.....	Cariboo, Quesnel, Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, Similkameen, and Osoyoos.
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 the coal-mines, metalliferous mines, and quarries in their respective districts.

PRODUCTION.

The total tonnage produced by the coal-mines of the Province for the year ended December 31st, 1932, was 1,534,975 tons, being a decrease of 172,615 tons or 10.1 per cent. below the production of 1931.

The Coast District, which includes Vancouver Island, Nicola-Princeton District, and Northern District, produced 947,100 tons, a decrease of 99,064 tons or 9.4 per cent. from 1931. Vancouver Island collieries produced during 1932 749,006 tons, a decrease of 82,919 tons or 9.9 per cent. from 1931. The Northern District produced 2,782 tons, an increase of 387 tons over 1931. The Nicola-Princeton District produced 195,312 tons, a decrease of 16,532 tons or 7.8 per cent. from 1931. The East Kootenay District produced 587,875 tons, a decrease of 73,551 tons or 11 per cent. under 1931.

The following table shows the output and *per capita* production daily and for the year of the various mines:—

Colliery and Mine.	Gross Tons of Coal mined during Year.	Days worked.	Total No. of Employees.	Tons of Coal mined per Employee daily.	Tons of Coal mined per Employee for Year.	No. of Employees Under-ground.	Tons of Coal mined per Under-ground Employee daily.	Tons of Coal mined per Under-ground Employee for Year.
No. 1 mine, Nanaimo.....	352,816	205	1,013	1.60	348	707	2.43	498
No. 5 mine, South Wellington.....	112,602	152	297	2.49	379	241	3.07	467
Comox Colliery.....	213,928	206	501	2.07	427	386	2.69	554
Granby Consolidated M.S. & P. Co.....	61,752	152	150	2.70	411	100	4.05	617
Lantzville Colliery.....	4,243	248	21	0.81	202	16	1.07	265
Fiddick mine.....	971	279	9	0.35	108	7	0.49	138
Richardson mine.....	478	49	5	1.93	95	3	3.24	159
Biggs' mine.....	1,379	167	7	1.18	197	4	2.06	344
Little Jingle Pot mine.....	1,337	142	14	0.66	95	7	1.34	191
Middlesboro Colliery.....	20,765	148	89	1.57	233	62	2.37	351
Sunshine Coal Co.....	63	36	4	0.44	16	4	0.44	16
Coalmont Colliery.....	95,903	212	190	2.38	504	113	4.00	849
Tulameen Coal Mines, Ltd.....	52,265	221	176	1.34	297	126	1.87	414
Pleasant Valley Coal Mines, Ltd.....	14,333	176	51	1.59	281	36	2.28	398
Blue Flame Colliery.....	10,910	177	35	1.75	311	24	2.58	454
Bromley Vale Colliery.....	411	76	14	0.38	29	10	0.54	41
Red Triangle Colliery.....	150	28	3	1.79	50	3	1.79	50
North Thompson Colliery.....	512	47	8	1.36	64	8	1.36	64
Bulkley Valley Colliery.....	2,767	280	11	0.89	251	10	0.98	276
Lake Cathlyn Colliery.....	15	.....	9	.....	.....	9	.....	.....
Coal Creek Colliery.....	92,879	76	345	3.54	269	256	4.76	362
Michel Colliery.....	214,305	159	379	3.55	565	282	4.77	760
Corbin Colliery.....	230,691	250	277	4.05	1,013	214	5.24	1,311

COLLIERIES OF VANCOUVER ISLAND INSPECTION DISTRICT.

The output of the Vancouver Island collieries was 749,006 tons. Of this amount, 62,813 tons or 8.3 per cent. was lost in preparation for the market, 81,069 tons or 10.8 per cent. was consumed by producing companies as fuel, and 609,739 tons or 81.3 per cent. was sold in the competitive markets. Of the amount sold in competitive markets, 577,982 tons or 94.8 per cent. of the amount sold and 77.1 per cent. of the total output mined was sold in Canada, 31,149 tons or 5.1 per cent. of the amount sold and 4.1 per cent. of the total amount mined was sold in the United States, and 603 tons was sold in other countries.

COLLIERIES OF NICOLA-PRINCETON INSPECTION DISTRICT.

Of the gross output of 195,312 tons produced by the collieries of the Nicola-Princeton District, 23,347 tons or 11.9 per cent. was consumed by the producing companies as fuel and 171,664 tons or 87.9 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 171,384 tons was sold in Canada and 280 tons in the United States.

COLLIERIES OF THE EAST KOOTENAY INSPECTION DISTRICT.

The output of the collieries of the East Kootenay District was 587,875 tons. Added to this was 1,207 tons taken from stock, making a total tonnage of 589,082 tons handled for the year. Of this amount, 36,050 tons or 6.13 per cent. was lost in preparation for the market, 16,705 tons or 2.84 per cent. was consumed as fuel, 42,536 tons or 7.23 per cent. was made into coke, and 493,791 tons or 83.49 per cent. was sold in the competitive markets. Of the amount sold in the competitive markets, 466,126 tons or 94.3 per cent. of the amount sold and 79.1 per cent. of the total output was sold in Canada, and 27,665 tons or 5.7 per cent. of the amount sold or 4.7 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 five years. Similar figures for years prior to 1928 are available in previous Annual Reports.

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.
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
1931	East Kootenay District..	661,426	1,211	546	909	727
	Coast District.....	1,046,164	2,871	364	2,048	510
	Whole Province.....	1,707,590	4,082	419	2,957	577
1932	East Kootenay District..	587,875	1,001	587	752	781
	Coast District.....	947,100	2,607	363	1,876	504
	Whole Province.....	1,534,975	3,608	425	2,628	584

The following table shows the production and distribution of coal by the various collieries and districts, compiled from returns furnished by the owners:—

COLLIERIES OF BRITISH COLUMBIA—PRODUCTION, 1932.

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 1932.
	In Canada.	In U.S.A.	Elsewhere.						First of Year.	Last of Year.	Added to.	Taken from.	
Vancouver Island District.													
Canadian Collieries (D.), Ltd.—	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
South Wellington, No. 5 mine.....	78,443	10,209	.....	88,652	14,756	.....	6,587	21,343	6,000	8,607	2,607	.....	(2,240 lb.) 112,602
Comox Colliery.....	190,638	2,819	.....	193,457	15,573	.....	6,288	21,861	7,538	6,148	.....	1,390	213,928
Western Fuel Corporation of Canada, Ltd.—													
No. 1 mine.....	249,587	17,343	608	267,538	22,251	.....	63,371	85,622	41,582	40,738	.....	844	352,316
Granby Consolidated M.S. & P. Co., Ltd.....	51,987	778	.....	52,765	10,233	.....	3,737	13,970	4,983	.....	.....	4,983	61,752
Lantzville Colliery.....	3,359	.....	.....	3,359	.....	.....	884	884	.....	.....	.....	.....	4,243
Fiddick mine.....	971	.....	.....	971	.....	.....	.....	.....	.....	.....	.....	.....	971
Richardson mine.....	458	.....	.....	458	.....	.....	.....	.....	.....	20	.....	20	478
Biggs' mine.....	1,379	.....	.....	1,379	.....	.....	.....	.....	.....	.....	.....	.....	1,379
Little Jingle Pot mine.....	1,160	.....	.....	1,160	.....	.....	202	202	25	.....	.....	25	1,337
Totals, Vancouver Island District.....	577,982	31,149	608	609,739	62,813	.....	81,069	143,882	60,128	55,513	2,627	7,242	749,006
Nicola-Princeton District.													
Middlesboro Collieries, Ltd.....	18,977	.....	.....	18,977	.....	.....	1,547	1,547	53	294	241	.....	20,765
Sunshine Coal Co.....	63	.....	.....	63	.....	.....	.....	.....	.....	.....	.....	.....	63
Coalmont Collieries, Ltd.....	84,826	.....	.....	84,826	.....	.....	11,077	11,077	.....	.....	.....	.....	95,903
Tulameen Coal Mines, Ltd.....	44,375	.....	.....	44,375	.....	.....	7,890	7,890	.....	.....	.....	.....	52,265
Pleasant Valley Coal Mining Co.....	12,624	41	.....	12,665	.....	.....	1,668	1,668	.....	.....	.....	.....	14,333
Blue Flame Collieries, Ltd.....	9,667	210	.....	9,877	.....	.....	1,033	1,033	.....	.....	.....	.....	10,910
Bromley Vale Colliery.....	382	29	.....	411	.....	.....	.....	.....	.....	.....	.....	.....	411
Red Triangle Coal Co., Ltd.....	150	.....	.....	150	.....	.....	.....	.....	.....	.....	.....	.....	150
North Thompson Colliery.....	320	.....	.....	320	.....	.....	132	132	.....	60	60	.....	512
Totals, Nicola-Princeton District.....	171,384	280	.....	171,664	.....	.....	23,347	23,347	53	354	301	.....	195,312
Northern District.													
Bulkley Valley Colliery.....	2,767	.....	.....	2,767	.....	.....	.....	.....	.....	.....	.....	.....	2,767
Lake Kathryn Colliery.....	15	.....	.....	15	.....	.....	.....	.....	.....	.....	.....	.....	15
Totals, Northern District.....	2,782	.....	.....	2,782	.....	.....	.....	.....	.....	.....	.....	.....	2,782
Grand totals, Coast District.....	752,148	31,429	608	784,185	62,813	.....	104,416	167,229	60,181	55,867	2,928	7,242	947,100
East Kootenay District.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery.....	61,683	11,394	.....	73,027	.....	14,790	5,607	20,397	545	.....	.....	545	92,879
Michel Colliery.....	179,130	.....	.....	179,130	.....	27,746	7,336	35,082	410	593	93	.....	214,305
Corbin Collieries, Ltd.....	225,363	16,271	.....	241,634	36,050	.....	3,762	39,812	24,206	23,451	.....	755	280,691
Totals, East Kootenay District.....	466,126	27,665	.....	493,791	36,050	42,536	16,705	95,291	25,161	23,954	93	1,300	587,875
Coal.													
Grand totals for Province.....	1,218,274	59,094	608	1,277,976	98,863	42,536	121,121	262,520	85,342	79,821	3,021	8,542	1,534,975
Coke.													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek Colliery.....	2,336	9,773	.....	12,109	.....	.....	.....	.....	269	.....	.....	269	11,840
Michel Colliery.....	14,281	3,082	.....	17,343	.....	.....	.....	.....	.....	362	362	.....	17,705
Total coke for Province.....	16,597	12,855	.....	29,452	.....	.....	.....	.....	269	362	362	269	29,545

COLLIERIES OF BRITISH COLUMBIA—MEN EMPLOYED, 1932.

MINE.	WHITE MEN.																		INDIANS.			JAPANESE AND CHINESE.						Total Men employed.				
	Super- vision 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 District.																																
Canadian Collieries (D.), Ltd.—																																
South Wellington, No. 5 mine.....																																
13	5	18	162		162	1		1	51	22	73	14	12	26			17	17												241	56	297
Comox Colliery.....																																
21	11	32	134		134				11	30	41	50	42	92	28	12	40				26		26	16		16		20	20	386	115	501
Western Fuel Corp. of Canada, Ltd.—																																
No. 1 mine.....																																
36	29	65	239		239				268	98	366	113	68	181	51	33	84								78	78	707	306	1013			
Granby Cons. M.S. & P. Co., Ltd.																																
4	5	9	72		72	20		20		28	28	4	14	18											3	3	100	50	150			
Lantzville Colliery.....																																
2		2	12		12				2	1	3		3	3											1	1	16	5	21			
Fiddick mine.....																																
1		1	3		3	3		3							2		2										7	2	9			
Richardson mine.....																																
1		1	2		2				1	1	2														1	1	3	2	5			
Biggs' mine.....																																
1		1	2		2	2		2		3	3																4	3	7			
Little Jingle Pot mine.....																																
1	1	2	3		3	3		3		2	2		3	3			1	1									7	7	14			
Totals, Vancouver Island District.....																																
79	51	130	629		629	29		29	432	185	617	181	142	323	79	65	144				26		26	16		16	103	103	1471	546	2017	
Nicola-Princeton District.																																
Middlesboro Collieries, Ltd.																																
5	2	7	34		34	9		9	14	9	23		11	11			5	5									62	27	89			
Sunshine Coal Co.																																
			2		2	2		2																			4		4			
Coalmont Collieries, Ltd.																																
12	12	24	59		59				38	32	70	2	30	32	2	2	4							1	1	113	77	190				
Tulameen Coal Mines, Ltd.																																
7	6	13	37		37	38		38	17	26	43	21	15	36	6	3	9										126	50	176			
Pleasant Valley Coal Mining Co.																																
4	2	6	18		18	9		9	5	5	10		5	5			3	3									36	15	51			
Blue Flame Collieries, Ltd.																																
2	2	4	8		8	10		10		4	4	4	3	7			2	2									24	11	35			
Bromley Vale Colliery.....																																
1	1	2	9		9					3	3																10	4	14			
Red Triangle Coal Co., Ltd.																																
1		1	2		2																						3		3			
North Thompson Colliery.....																																
2		2	1		1	4		4				1		1													8		8			
Totals, Nicola-Princeton District.....																																
34	25	59	170		170	72		72	74	79	153	28	64	92	8	15	23										1	1	386	184	570	
Northern District.																																
Bulkley Valley Colliery.....																																
1		1	6		6	1		1	2		2		1	1													10	1	11			
Lake Kathryn Colliery.....																																
2		2	4		4	2		2	1		1																9		9			
Totals, Northern District.....																																
3		3	10		10	3		3	3		3		1	1													19	1	20			
Grand totals, Coast District.....																																
116	76	192	809		809	104		104	509	264	773	209	207	416	87	80	167				26		26	16		16	104	104	1876	731	2607	
East Kootenay District.																																
Crow's Nest Pass Coal Co., Ltd.—																																
Coal Creek Colliery.....																																
11	24	35	141		141				20	6	26	80	57	137	4	2	6										256	89	345			
Michel Colliery.....																																
11	11	22	157		157				37	16	53	75	69	144	2	1	3										282	97	379			
Corbin Collieries, Ltd.																																
11	11	22	119		119	32		32	41	19	60	9	28	37	2	5	7										214	63	277			
Totals, East Kootenay District.....																																
33	46	79	417		417	32		32	98	41	139	164	154	318	8	8	16										752	249	1001			
Grand totals for Province.....																																
149	122	271	1226		1226	136		136	607	305	912	373	361	734	95	88	183				26		26	16		16	104	104	2628	980	3608	

NOTE.—U=Underground; A=Above ground; T=Total.

LABOUR AND EMPLOYMENT.

During 1932 there were 3,608 persons employed in and about the coal-mines of the Province, a decrease of about 11.6 per cent. compared with 1931.

The only labour dispute in the coal-mines developed on November 27th, when the mines of the Tulameen Coal Mines, Limited, and the Pleasant Valley Mining Company in the Princeton area were thrown idle owing to a dispute over wages. The wages had been reduced about 10 per cent. earlier in the year, and a strike was called to enforce the wage scale formerly in force and also to force the recognition of the Mine Workers' Union of Canada. The Tulameen Coal Mines, Limited, conceded the above points and operations were resumed on December 1st. The mines of the Pleasant Valley Mining Company were still idle at the end of the year.

Taking the average of all the mines in Vancouver Island District, about 35 per cent. of the working-days were lost through lack of trade. In the Nicola-Princeton District the different collieries worked from 47 to 73 per cent. of the working-days, averaging for the district about 60 per cent. of the working-days. In the East Kootenay the mines worked from 25 to 83 per cent. of the working-days during the year, and worked, on an average for the whole district, about 54 per cent. of the time.

The table on page 231 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.

FUEL-OIL COMPETITION.

The following table shows the amount of fuel-oil imported and an estimate of the amount produced in British Columbia :—

Year.	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
1931	27,794,000	118,000,000
1932	24,964,000	100,000,000 (est.)

The fuel-oil ex-warehoused, duty-free, in British Columbia ports for shipping during the year totalled 26,289,000 gallons, as compared with 27,794,000 gallons in 1931, while the dutiable fuel-oil imported for use in the Province totalled 24,964,000 gallons. There was imported for refining in British Columbia, in 1932, 151,197,000 gallons of crude oil, duty-free, and it is estimated that 100,000,000 gallons of this reached the market as fuel-oil, making a total of over 150,000,000 gallons of fuel-oil which displaced approximately 1,000,000 tons of British Columbia coal.

COMPETITION OF COAL PRODUCED OUTSIDE BRITISH COLUMBIA.

During 1932 the imports from United States into British Columbia consisted of 2,780 tons of lignite and 2,424 tons of bituminous coal, or a total of 5,204 tons, as compared with a total of 8,718 tons in 1931.

The following table shows the amount of Alberta coal sold in British Columbia during past years :—

Year.	Short Tons.	Year.	Short Tons.
1924	114,186	1929	247,060
1925	117,037	1930	227,385
1926	127,858	1931	193,060
1927	187,028	1932	136,188
1928	262,198		

There was also 8,475 tons of lignite from Saskatchewan sold in British Columbia in 1932. The total tonnage of coal brought into British Columbia during 1932 was 149,867 tons, being a decrease of 56,669 tons.

HYDRO-ELECTRIC DEVELOPMENT.

At the end of 1932 the hydro-electric horse-power in use amounted to 713,792 horse-power. The steadily increasing development of hydro-installations in British Columbia is shown in the following table:—

Year.	Water-power developed.		Year.	Water-power developed.	
	Horse-power.			Horse-power.	
1900	9,366		1925	414,702	
1905	29,334		1926	460,562	
1910	64,474		1927	473,142	
1915	254,065		1928	523,902	
1920	309,185		1929	559,792	
1921	309,762		1930	630,792	
1922	329,057		1931	655,992	
1923	355,718		1932	713,792	
1924	355,718				

For purposes of comparison it may be stated that one developed horse-power per year is equivalent to the power value of 6 tons of coal.

ACCIDENTS IN AND AROUND COAL-MINES.

During 1932 there were 3,608 persons in and around the coal-mines. Eight fatal accidents occurred during the year, as compared with five for 1931.

The ratio of fatal accidents per 1,000 persons employed was 2.21, as compared with 1.22 in 1931. In 1930 the ratio was 11.62; in 1929, 2.38; in 1928, 2.64; in 1927, 2.10; in 1926, 1.88; in 1925, 1.10; in 1924, 1.66; in 1923, 7.32; the average for the ten-year period being 3.47.

The number of fatal accidents per 1,000,000 tons produced during 1932 was 5.21; during 1931 the figure was 2.81; in 1930, 28.64; in 1929, 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; the average for the ten-year period being 8.02 per 1,000,000 tons of coal mined.

The following table shows the collieries at which the fatal accidents occurred during 1932 and comparative figures for 1931:—

Name of Company.	Name of Colliery.	1932.	1931.
Western Fuel Corporation, Ltd.....	No. 1 mine.....	1	1
Canadian Collieries (D.), Ltd.....	Comox.....	1	1
Canadian Collieries (D.), Ltd.....	No. 5 mine, South Wellington.....	1	1
Tulameen Collieries, Ltd.....	No. 2 mine.....	1	1
Coalmont Collieries, Ltd.....	No. 3 mine.....	1	.....
Crow's Nest Pass Coal Co., Ltd.....	Coal Creek.....	2	.....
Corbin Collieries, Ltd.....	No. 6 mine.....	1	1
Corbin Collieries, Ltd.....	No. 4 mine.....	1	.....
Totals.....		8	5

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for 1931:—

Cause.	1932.		1931.	
	No.	Per Cent.	No.	Per Cent.
By falls of roof and coal.....	5	62.5	2	40.0
By mine-cars and haulage.....	3	37.5	3	60.0
Totals.....	8	100.0	5	100.0

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1932 and 1931: -

Cause.	1932.		1931.	
	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.....	5	306,995	2	853,795
By mine-cars and haulage.....	3	511,658	3	569,196
Totals.....	8	191,871	5	341,518

The number of tons mined per fatal accident during 1932 was 191,871 tons, compared with 341,518 tons for 1931. The average for the last ten years was 124,519.

The following table shows the fatalities from various causes in coal-mines during the year 1932, compared with 1931, according to Inspection Districts:—

District.	NUMBER OF DEATHS FROM ACCIDENTS.		TOTAL.		ACCIDENT DEATH-RATE.			
	Falls of Roof and Coal.	Mine-cars and Haulage.	1932.	1931.	Per 1,000 Persons employed.		Per 1,000,000 Tons of Coal mined.	
					1932.	1931.	1932.	1931.
Vancouver Island.....	1	1	2	3	0.99	1.29	2.67	3.60
Nicola-Princeton.....	2	...	2	1	3.50	1.82	10.24	4.72
East Kootenay.....	2	2	4	1	3.99	0.82	6.80	1.51
Northern.....	...	...	...	...	.....	.....	.....	.....
Province (1932).....	5	3	8	...	2.21	.....	5.21	.....
Province (1931).....	...	...	...	5	.....	1.22	.....	2.81

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, 1932:—

District.	No. of Fatalities.	ACCIDENT DEATH-RATE.	
		Per 1,000 Employees.	Per 1,000,000 Tons of Coal mined.
Coast.....	148	4.05	10.41
East Kootenay.....	26	1.91	3.48
For Province.....	174	3.47	8.02

The details regarding the occurrences of the fatal accidents in coal-mines during 1932 are as follows:—

The fatal accident which occurred to Mike Miklucak, timberman, No. 1 East mine, Coal Creek Colliery, on January 19th was due either to striking a timber while riding on a trip or attempting to board the trip while in motion. He was found lying injured beside the track; there were no witnesses to this accident.

The fatal accident which occurred to John Millburn, driver, No. 1 East mine, Coal Creek Colliery, on February 5th was due to his being struck by a runaway trip of four empty cars on a hoisting-slope, receiving injuries from which he died two days later. Employees were not allowed on this slope during hoisting-hours, but the last trip had been hauled from the lower part of the slope, although another trip had to be hauled from a level near the top of the slope. Deceased and others had walked up the slope to this level and were in that vicinity when the runaway trip injured deceased.

The fatal accident which occurred to Saave Tveit, loader, No. 2 mine, Tulameen Coal Mines, Limited, on February 9th was due to a fall of roof at the working-face. Deceased and a miner were loading a car some time after a shot had been fired and the roof had been examined, apparently without detecting any danger.

The fatal accident which occurred to Louie Kulyney, miner, No. 6 mine, Corbin Colliery, on April 20th was due to suffocation caused by being covered by a caving of fine coal. Deceased and partner were engaged in recovering coal by the caving method and had apparently disturbed some timbers and was caught by the falling fine coal.

The fatal accident which occurred to Arnold Bell, switcher, No. 1 mine, Western Fuel Corporation of Canada, Limited, on April 25th was due to his being struck by an empty trip of cars which he had belled into a parting. Deceased had apparently been on the middle of the track when struck, having either misjudged the speed of the trip or failed to hear it.

The fatal accident which occurred to Yong Yee, Chinese timberman, No. 4 mine, Comox Colliery, on July 4th was due to a fall of roof and timber when engaged in retimbering at that point.

The fatal accident which occurred to S. Stowban, driver, No. 4 mine, Corbin Colliery, on August 31st was due to being smothered when some roof-lagging broke between two sets of timber, 3 feet apart, and allowed a quantity of fine coal to cover deceased; the main timbering was not displaced.

The fatal accident which occurred to Victor Marochi, miner, Wilson tunnel, Coalmont Collieries, Limited, on October 24th was due to being buried under rock and coal when the collar nearest to the face broke in half without any warning.

EXPLOSIVES.

The following table shows the quantity of explosives used in coal-mines during 1932, together with the number of shots 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.....	93,158	352,316	171,121	3.78	0.54
No. 5 mine, South Wellington.....	39,475	112,602	49,800	2.85	0.79
Comox Colliery.....	58,721	213,928	83,858	3.64	0.70
Granby Consolidated M.S. & P. Co.....	12,649	61,752	12,649	4.88	1.00
Lantzville Colliery.....	6,500	4,243	5,200	0.65	1.25
Fiddick mine.....	1,000	971	2,150	0.97	0.46
Richardson mine.....	150	478	150	3.18	1.00
Biggs' mine.....	680	1,379	900	2.02	0.75
Little Jingle Pot mine.....	900	1,337	1,400	1.48	0.64
Totals for district.....	213,233	749,006	327,228	3.51	0.65

NICOLA-PRINCETON DISTRICT.

Middlesboro Collieries.....	3,420	20,765	8,150	6.07	0.41
Sunshine Colliery.....	63	63	90	1.00	0.70
Coalmont Collieries, Ltd.....	14,806	95,903	21,500	6.47	0.68
Tulameen Coal Mines, Ltd.....	7,850	52,265	19,000	6.65	0.41
Pleasant Valley Coal Mine.....	3,000	14,333	7,300	4.77	0.41
Blue Flame Colliery.....	3,800	10,910	6,500	3.77	0.58
Bromley Vale Colliery.....	300	411	300	1.37	1.00
Red Triangle Colliery.....	2,150	150	1,900	0.07	1.13
North Thompson Colliery.....	84	512	233	6.09	0.36
Totals for district.....	35,473	195,312	64,973	5.50	0.54

NORTHERN 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.
Bulkley Valley Colliery.....	1,100	2,767	2,150	2.51	0.51
Lake Cathlyn Colliery.....	225	15	175	0.06	1.28
Totals for district.....	1,325	2,782	2,325	2.09	0.57

EAST KOOTENAY DISTRICT.

Coal Creek Colliery.....	636	92,879	859	146.03	0.74
Michel Colliery.....	12,983	214,305	14,179	16.50	0.89
Corbin Colliery.....	24,670	280,691	25,858	11.33	0.95
Totals for district.....	38,289	587,875	40,896	15.35	0.93
Totals for Province.....	288,320	1,534,975	435,422	5.32	0.66

QUANTITIES OF DIFFERENT EXPLOSIVES USED.

Monobel of different grades	Lb. 241,633
Permissible rock-powder	46,687
Total	288,320

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. 12.
Polar Monobel No. 6.	Polar CXL-ite No. 2.

MACHINE-MINED COAL.

During the year 1932 mining-machines produced approximately 324,468 tons of coal, or 21.1 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.	Anderson Boyes.	Little Hardy.	Siskol.	Sullivan.	Ingersoll-Rand.
Vancouver Island	3	26	9	3	....	13	4	....
Nicola-Princeton	....	24	....	....	....	11	....	13
East Kootenay....	....	3	....	....	3	....	....	....
Northern.....	....	....	....	....	....	....	....	....
Totals...	3	53	9	3	3	24	4	13

SAFETY-LAMPS.

There were 3,246 safety-lamps in use in the coal-mines of the Province. Of this number, 255 were flame safety-lamps of the Wolf type and 2,991 were electric lamps of various makes, as follows: Edison, 2,667; Wheat, 303; and Wolf electric, 21.

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.	Naptha Gasoline.	Electricity.
No. 1 mine, Nanaimo.....	38	831	38	831
No. 5 mine, South Wellington.....	15	235	15	235
Comox Colliery	30	380	30	380
Granby Consolidated M.S. & P. Co.....	6	106	6	106
Lantzville Colliery	2	24	2	24
Fiddick mine	2	10	2	10
Richardson mine	1	3	1	3
Biggs' mine	2	8	2	8
Little Jingle Pot mine.....	1	11	1	11
Totals for district.....	97	1,608	97	1,608

NICOLA-PRINCETON DISTRICT.

Middlesboro Colliery	7	70	7	70
Sunshine Colliery	2	4	2	4
Coalmont Colliery	11	245	11	245
Tulameen Coal Mines, Ltd.	7	132	7	132
Pleasant Valley Coal Mines.....	5	73	5	73
Blue Flame Colliery	3	30	3	30
Bromley Vale Colliery.....	1	9	1	9
Red Triangle Coal Co.	1	12	1	12
North Thompson Colliery	1	16	1	16
Totals for district.....	38	591	38	591

NORTHERN DISTRICT.

Bulkley Valley Colliery.....	10	.....	10	.....
Lake Kathlyn Colliery.....	12	.....	12	.....
Totals for district.....	22	.....	22	.....

EAST KOOTENAY DISTRICT.

Coal Creek Colliery	34	330	34	330
Michel Colliery	42	297	42	297
Corbin Colliery	22	165	22	165
Totals for district.....	98	792	98	792
Totals for Province.....	255	2,991	255	2,991

APPROVED SAFETY-LAMPS, ELECTRIC AND FLAME.

A list of the approved safety-lamps, both electric and flame, was published in the 1930 Annual Report. The following lamps, all electric, are now also approved:—

No. 8.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 18 of the United States Bureau of Mines. The only bulb approved for use in this lamp carries the symbol BM-18 and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio.

No. 9.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 18F of the United States Bureau of Mines. This model

of Edison lamp in reality represents an extension of the lamp approval given under Approval No. 18. The only bulb approved for use with this lamp carries the symbol BM-18r and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio.

No. 10.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 18H of the United States Bureau of Mines. This lamp represents an extension of the No. 18 approval of the United States Bureau of Mines. The only bulb approved for use with this lamp carries the symbol BM-18H and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio.

No. 11.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 24 of the United States Bureau of Mines. The only bulb approved for use with this lamp carries the symbol BM-24 and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio. This lamp is known as the Edison Model J lamp.

No. 12.—The electric lamp manufactured by the Edison Storage Battery Company, Orange, New Jersey, U.S.A., under Approval No. 25 of the United States Bureau of Mines. The only bulb approved for use with this lamp carries the symbol BM-25 and is manufactured by the National Lamp Works of the General Electric Company, Cleveland, Ohio. This lamp is known as the Edison Model K lamp.

(Unless otherwise specified, all lamps are cap-lamps.)

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 and in such cases as it is considered advisable to provide flame safety-lamps in addition to the electric safety-lamps.

ELECTRICITY.

Electricity is used for various purposes on the surface at thirteen mines and underground at five 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		1,507
Ventilation		2,240
Haulage		195
Coal-washing		1,472
Miscellaneous		4,490
Total horse-power		9,904
Underground—		
Haulage		1,735
Pumping		1,940
Coal-cutting		170
Miscellaneous		250
Total horse-power		4,095
Total horse-power above and under ground		13,999

Of the above amount, approximately 1,864 horse-power was operated as direct current and 12,135 horse-power as alternating current.

VENTILATION.

The District Inspectors' reports give details regarding the ventilation in the splits and main returns of the various mines. In one or two instances demands had to be made during the year for increases in the amount of air being circulated in a few of the splits in a few mines, but on the whole the provisions requiring adequate ventilation were generally well observed at the different mines.

USE OF THE BURRELL GAS INDICATOR.

The Burrell Gas Indicator is used in practically every ventilating-split at least once a month and continues to be the approved method of determining the CH₄ content in the mine atmosphere where the percentage is too small to be detected by means of the flame safety-lamp.

MINE-AIR SAMPLES.

Mine-air sampling was carried out as usual during the year and 287 samples were collected in the various coal-mines of the Province; of this number, forty-nine 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 and No. 5 mine, Comox, where the gas-inflow 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. Analyses of mine-air samples taken throughout the coal-mines of the Province during 1932 are on file in the office of the Chief Inspector of Mines and copies will be furnished to any one interested.

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 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 explosions 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 1,457 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 the year the following dangerous occurrences were reported from the different coal-mines under the requirements of section 71, subsections (d), (e), and (h), as follows:—

On April 19th a severe "bump" occurred in main counter-level, No. 1 East mine, Coal Creek Colliery, and did considerable damage to the area affected; no person was injured.

On July 5th spontaneous heating was discovered in No. 12 West level, No. 4 mine, Coalmont Colliery; this was dealt with by water and loading out the heated material.

On July 26th an overwind occurred, through error of judgment on the part of the hoisting engineer, at No. 1 shaft, Western Fuel Corporation of Canada, Limited, Nanaimo; timber was being lowered into the mine at this time and the descending cage was considerably damaged. The rope of the ascending cage was released by the automatic detaching device and the cage safely suspended without injury by the safety-hooks. No person was injured.

From July 25th to 28th a number of minor "bumps" occurred at No. 1 East mine, Coal Creek Colliery, but no damage was done to the mine.

On August 5th an outbreak of fire occurred in No. 4 West crosscut, No. 6 mine, Corbin Colliery; this was immediately dealt with.

On August 30th a "bump" occurred in No. 19 East slope, No. 1 East mine, Coal Creek Colliery; no person was injured.

On September 22nd spontaneous heating was discovered in No. 1 slope, No. 3 mine, Coalmont Collieries, Limited; this area was abandoned and sealed off.

On October 4th an abandoned area in No. 1 mine, Western Fuel Corporation of Canada, Limited, was nearly broached by an advancing machine-cut long-wall face; this abandoned area contained a considerable body of water which was later drained off through bore-holes; no person was injured.

On October 11th a severe "bump" was experienced at all the mines of the Coal Creek Colliery; while this was felt over a wide area, the centre of the "bump" was probably some distance from the workings, as no material damage was done.

On October 24th spontaneous heating occurred in workings off No. 15 West level, No. 4 mine, Coalmont Colliery; attempts made to control this heating were unavailing and the whole lower part of this mine was sealed off and water turned in to flood the area. The final sealing required the use of trained men using the rescue apparatus from the Princeton Mine-rescue Station.

On November 23rd a fire was discovered in outcrop coal at No. 8 mine, Michel Colliery, near an old fan-shaft; this fire probably originated from a surface bush fire.

On December 9th spontaneous combustion was discovered in "A" level, No. 4 mine, Corbin Colliery; this was dealt with by water and loading out the heated material.

On December 17th an excessive outflow of methane was encountered when a machine-cut long-wall face met a fault in No. 5 mine, Comox Colliery; the men on the return side were safely withdrawn until the gas bled off.

On December 28th spontaneous heating was discovered in No. 1 incline, No. 5 mine, South Wellington; this was dealt with by loading out the heated material.

An extensive heated area in No. 6 mine, Corbin Colliery, has been dealt with through the year by driving roadways into the heated area, applying water and silt in an effort to cool and isolate the area.

While the above occurrences, all of potential danger, did not cause injury to any person, the information regarding them is of the utmost value to all interested in taking steps, where possible, to prevent recurrences.

THE COAL CREEK SEISMOGRAPH.

The violent local earth tremors known to mining-men as "bumps," and experienced in several mining-fields, have presented a major problem in the operation of the Coal Creek Colliery since the year 1906. Their unexpected occurrence, with potential danger to the miners, together with the extent of the damage for which some of these manifestations are at times responsible, endows them with vast importance from the view-point of safety as well as for economic reasons. While Coal Creek is the only coal-mining centre in which they have so far appeared in British Columbia, they are not uncommon in many other mining districts. They have occurred, with more or less frequency and varying degrees of violence, in some coal-mines of Utah, Washington, Nova Scotia, Lancashire, South Staffordshire, Southern France, Hungary, Silesia, Bavaria, and the Ruhr district. Kindred manifestations, known there as "air-blasts" or "rock-bursts," have been experienced in deep metalliferous mines, such as those of Michigan, the South African Rand, and the Mysore district of India. Voluminous data concerning their characteristic features are available and the most eminent men of the countries affected have studied the problem and tried to solve it.

The occurrence of "bumps" in the mines of Fuveau has been recorded at the astrophysical and seismological observatory of Marseille, situated about 13 miles away. The intensity of the shock recorded in the case of some of them was found comparable to that of the tremor resulting from the firing of a charge of 2 tons of dynamite in the stone-quarries of Lestague, less than 5 miles from the observatory. Phenomena of the same nature have been registered at other European seismological stations, but in all cases the distance separating the detecting

instrument from the seat of the disturbance was too great to permit the observation of the smaller tremors which might have preceded the main shocks.

In coal-mines the occurrence of "bumps" depends on two essential factors—namely, the presence of a massive bed of hard rock resisting deformation and storing stresses after the manner of a steel band, and a sufficient thickness of cover to prevent these stresses from being dissipated. Strata of a more or less plastic nature, yielding before abnormal pressure through deformation, or rocks easily fractured and permitting readjustments, constitute ground usually unfavourable to the appearance of these phenomena. The stresses themselves may be the result of mining operations, an indubitable fact in the great majority of cases, or they may be the remnants of orogenic forces, adding their influence to that of the other factors or acting alone through their sudden release, once the resistance responsible for their accumulation, and by which they had been held in subjection, has been sufficiently weakened as a result of mining activities.

Where the stresses are directly attributable to mining, as in the case of what might properly be termed "weight bumps," a method of working assuring the gradual and regular release of ground stresses affords a remedy advocated by eminent engineers, and one the application of which has often been crowned with success. When tectonic stresses enter into the problem, however, it becomes immediately far more complicated.

The circumstances under which "bumps" have occurred at Coal Creek since 1916 indicate a more complex problem than that usually offering a satisfactory explanation of these phenomena. This led those interested in the subject to agree as to the desirability of securing accurate information regarding the behaviour of the strata involved, over a certain period of time immediately before the occurrence of such disturbances. A research of this kind necessitates the observations of ground-movements much too slight to be perceptible to the human senses, and this led to the installation of a seismograph in the immediate vicinity of Coal Creek Colliery, in which "bumps" have made themselves felt most severely.

The use of a seismograph in connection with "bumps" was one of the recommendations of the Commission, headed by Geo. S. Rice, U.S.A. Bureau of Mines, which inquired into the phenomena of "bumps" and outbursts in 1918, but as certain other recommendations of the Commission were carried out the matter of a seismograph was not acted on.

Among other recommendations of that Commission, an increase of the size of pillars was outstanding, and this has been observed, particularly in No. 1 East mine, since that time, with the result that a large percentage of the coal is in pillars upwards of 200 feet square and no pillars have been extracted in this mine. In spite of this, many serious "bumps" continue to occur in this and other mines of Coal Creek Colliery, and with a view to facilitating the study of "bumps" the Honourable W. A. McKenzie, Minister of Mines, commissioned Napier Denison, Dominion Meteorologist, Victoria, B.C., to design and construct a seismograph suitable for this work.

Mr. Denison, after a study of the conditions under which the seismograph would have to function, built a seismograph of the Milne type which was installed at Coal Creek in July, 1932; this seismograph gives a continuous photographic record of the slightest earth-movements by means of the light supplied by the latest model Edison electric mine safety-lamp, and after the preliminary adjusting period continued to operate until the end of the year.

Every attempt was made to correlate the tremors recorded by the seismograph with observed conditions in the mine, but this work was severely handicapped by the fact that the mines have worked only one or two days per week since the seismograph was installed.

PROSECUTIONS.

During 1932 there were eight prosecutions made for infractions of the "Coal-mines Regulation Act" and special rules, all of which resulted in convictions.

GOVERNMENT RESCUE-STATIONS.

The Department of Mines has now four mine-rescue stations in different parts of the Province and centrally located in the mining districts—namely, at Nanaimo, Cumberland, Princeton, and Fernie. During the year many requests were received from medical men for oxygen and inhalators for use in emergencies, and immediate service was rendered in every case. In the larger coal-mining districts of Crowsnest, Cumberland, and Nanaimo experienced

teams maintain a regular schedule of training throughout the year and so keep ready for any emergency calls.

Members of several fire brigades in different parts of the Province have taken the full training course at the stations, as practically all up-to-date fire brigades are now equipped with gas-masks and oxygen apparatus of the type used in mines. The possibility of having to deal with fires in buildings or plants, such as refrigerators, which may produce or release poisonous gases makes such apparatus a necessity in modern fire-fighting.

The preliminary training course consists of twelve two-hour lessons in the actual use of the oxygen apparatus and Burrell all-service gas-masks in an irrespirable atmosphere and instruction on the approved method of dealing with mine fires and recovery-work. The training itself is strenuous work, and all candidates have to undergo a special physical examination before starting training and must be under 45 years of age.

In addition to the regular teams in training during the year, thirty-nine new men took the full training and were granted certificates of competency:—

Cert. No.	Name.	Where trained.	Cert. No.	Name.	Where trained.
738	Nick Oreskovich.....	Princeton.	758	Frank J. Iacchini.....	Princeton.
739	Thos. M. Anderson.....	Fernie.	759	Francis E. Mottishaw.....	Princeton.
740	Clarence D. Backstrom.....	Fernie.	760	Eli Plecash.....	Princeton.
741	Chas. E. Carlgren.....	Fernie.	761	Nicholas Plecash.....	Princeton.
742	John Henderson.....	Fernie.	762	William Strang.....	Princeton.
743	Jas. S. Massey.....	Fernie.	763	Gabriel R. A. Schull.....	Princeton.
744	Harry Parsons.....	Fernie.	764	Gilbert Wesnedge.....	Princeton.
745	Angus M. Scott.....	Fernie.	765	Robt. Littler, Jr.....	Cumberland.
746	Davidson Stevenson.....	Fernie.	766	Wilfred Littler.....	Cumberland.
747	Thos. Lloyd.....	Princeton.	767	Spencer Morgan.....	Cumberland.
748	James Rintoul.....	Princeton.	768	Peter Mossey.....	Cumberland.
749	Archibald Samuel.....	Princeton.	769	Peter Perozzini.....	Cumberland.
750	William Forsyth.....	Princeton.	770	Fred Dawson.....	Corbin.
751	David M. Francis.....	Princeton.	771	Muir Frame.....	Corbin.
752	Andrew Muir.....	Princeton.	772	Munro M. Gibson.....	Corbin.
753	Jas. W. Muir.....	Princeton.	773	Daniel Iwasluk.....	Corbin.
754	John Hamilton.....	Corbin.	774	Arthur Lancashire.....	Corbin.
755	Daniel M. Waddington.....	Corbin.	775	James Peters.....	Corbin.
756	Cyril Brackley.....	Princeton.	776	Joseph Podgornick.....	Corbin.
757	John Dobrosky.....	Princeton.			

FIRST-AID AND MINE-RESCUE WORK AND COMPETITIONS.

Valuable work was done by the First-aid and Mine Safety Associations in the mining districts by carrying on classes of instructions and also by the trained members of these associations in rendering first aid in actual accidents in mines.

The East Kootenay, Vancouver Island and Coast District, and the Princeton and District Mine Safety Associations, along with the First-aid Associations, have been very active throughout the year in the work of training men and encouraging safety-first practices in mines, while the employees of the Britannia Mining and Smelting Company at Britannia and the Consolidated Mining and Smelting Company at Sullivan have continued to keep up their great interest in first-aid and welfare work. It is interesting to note that over 80 per cent. of the employees at the *Sullivan* are qualified first-aid men.

In spite of the serious depression in the mining industry, the mining companies and Safety Associations have kept up their interest and encouraged first-aid and mine-rescue demonstrations and competitions, realizing that safety-first practices become of even more value when mines are working only intermittently. Competitions were held at Cumberland, Nanaimo, Britannia, Princeton, Kimberley, and Fernie. Those taking part were miners from both coal and metal mines, quarrymen, and loggers. A number of ladies' teams entered the competitions and a large number of young people of school age and upwards took part.

The work is actively supported by the management and officials of the different industries and members of the Inspection Branch of the Department of Mines, which also manifests its support in the shape of financial grants to raise this work to the greatest possible efficiency.

SUPERVISION OF COAL-MINES.

During 1932 twenty-one coal companies operated twenty-three collieries, with forty-eight mines, employing 2,628 men underground. In the supervision of underground employees there were fifteen managers, one safety engineer, eighteen overmen, 111 firebosses and shotlighters, a total of 146, or one official for every sixteen persons employed underground.

"COAL SALES ACT."

This Act was proclaimed in 1931, and during 1932 considerable work was done by the Mines Inspection staff to see that the requirements of the "Coal Sales Act" were observed, particularly in the matter of having all coal sold under its proper registered name and to prevent the substitution of lower-priced and inferior coals where the higher-priced coals are ordered by the consumer.

This is particularly difficult in winter, when the peak demand for coal induces several hundred temporary coal retailers to enter the business for a few months; many of these carry out sharp practices that the regularly established coal-dealers who carry on business throughout the year would find impossible. A large number of inspections of record-books, invoices, and receipts concerning coal purchases and sales were made, and in a number of cases prosecutions followed where it was found that the requirements of the "Coal Sales Act" had not been observed.

LIST OF REGISTERED NAMES OF BRITISH COLUMBIA COALS, APPROVED BY THE CHIEF INSPECTOR OF MINES, IN ACCORDANCE WITH THE PROVISIONS OF THE "COAL SALES ACT."

Registered Name.	District and Colliery.	Producing Co.
Comox Coal.....	Nos. 4 and 5 mines, Comox Colliery (Cumberland)	Canadian Collieries (D.), Ltd.
Old Wellington.....	No. 9 mine (Wellington)	Canadian Collieries (D.), Ltd.
Ladysmith-Wellington.....	No. 5 mine (South Wellington)	Canadian Collieries (D.), Ltd.
Ladysmith-Extension.....	No. 8 mine (Extension)	Canadian Collieries (D.), Ltd.
Nanaimo-Douglas.....	No. 1 mine, Upper seam (Nanaimo)	Western Fuel Corporation, Ltd.
Nanaimo.....	No. 1 mine, Lower seam (Nanaimo)	Western Fuel Corporation, Ltd.
Nanaimo-Reserve.....	Reserve mine (Nanaimo)	Western Fuel Corporation, Ltd.
Nanaimo-Wellington.....	Blend of No. 1 mine, Nanaimo, and No. 5 mine, South Wellington	Western Fuel Corporation, Ltd.
Wellington South, Ida Clara	Ida Clara No. 1 (South Wellington)	Richardson Mine.
Cassidy-Wellington.....	Cassidy Colliery (Cassidy)	Granby Consolidated M.S. & P. Co.
Lantzville-Wellington.....	Lantzville Colliery (Lantzville)	Lantzville Collieries, Ltd.
Biggs-Wellington.....	Biggs' mine (Wellington)	Biggs' Mine.
Fiddick-Douglas.....	Fiddick mine (South Wellington)	Fiddick Mine.
Little Ash, Wellington.....	Little Ash mine (Wellington)	Little Ash Mine.
Jingle Pot, Wellington.....	Jingle Pot Colliery (Nanaimo)	Jingle Pot Mining Co., Ltd.
Bromley Vale, Princeton...	Bromley Vale (Princeton)	Bromley Vale Colliery, Ltd.
Middlesboro.....	Middlesboro (Merritt)	Middlesboro Collieries, Ltd.
Nicola Sunshine Coal.....	Sunshine (Merritt)	Sunshine Coal Co., Ltd.
Coalmont Coal.....	Coalmont (Coalmont)	Coalmont Collieries, Ltd.
Princeton Blue Flame.....	Blue Flame (Princeton)	Economy Production Co., Ltd.
Tulameen Coal, Princeton..	Tulameen (Princeton)	Tulameen Coal Mines, Ltd.
Diamond, Princeton District, B.C.....	Diamond (Princeton)	Pleasant Valley Mining Co., Ltd.
Sunrise, Princeton District, B.C.....	Sunrise (Princeton)	Pleasant Valley Mining Co., Ltd.
Pleasant Valley, Princeton District, B.C.....	Diamond and Sunrise Collieries Blended (Princeton)	Pleasant Valley Mining Co., Ltd.
North Thompson Gem.....	North Thompson (North Thompson)	North Thompson Colliery, Ltd.
Red Triangle, Princeton Quality.....	Red Triangle (Princeton)	Red Triangle Coal Co., Ltd.
Bulkley Valley.....	Bulkley Valley (Telkwa)	Bulkley Valley Mining Co., Ltd.
Crow's Nest, Coal Creek.....	Coal Creek (Coal Creek)	Crow's Nest Pass Coal Co., Ltd.
Crow's Nest, Michel.....	Michel (Michel)	Crow's Nest Pass Coal Co., Ltd.
Corbin Washed.....	Corbin (Corbin)	Corbin Collieries, Ltd.

METALLIFEROUS MINES.

PRODUCTION.

The output from the metalliferous mines for 1932 was 4,340,158 tons, a decrease of 1,208,945 tons from the tonnage of 1931. This tonnage was produced from seventy-five mines, of which twenty-nine shipped 100 tons or more.

ACCIDENTS.

There were eleven fatal accidents in and about the metalliferous mines in 1932, being an increase of five over the figures for 1931. There were 2,255 persons employed in and about the metalliferous mines in 1932. The ratio of fatal accidents was 4.83, compared with 2.61 in 1931. The ratio for the last ten-year period was 2.70. The tonnage mined per fatal accident was 457,175 for the last ten-year period.

The following table shows the mines at which fatal accidents occurred during 1932 and comparative figures for 1931:—

Mining Division.	Mine.	NO. OF ACCIDENTS.	
		1932.	1931.
Vancouver.....	Britannia.....	5	....
Fort Steele.....	Sullivan.....	2	3
Nass River (Northern).....	Bonanza.....	1	....
Nass River (Northern).....	Hidden Creek.....	2	2
Portland Canal (Northern).....	Premier.....	1	....
Portland Canal (Northern).....	Porter-Idaho.....	....	1
Totals.....		11	6

The following table shows the causes and the percentage to the whole of the fatal accidents, with comparative figures for 1931:—

Causes.	1932.		1931.	
	No.	Percentage.	No.	Percentage.
By gases following blasting.....	2	18.19	....	.....
By falling chutes, raises, and shafts.....	1	9.09	2	33.33
Haulage.....	1	9.09	....	.....
By falls of ground.....	4	36.36	3	50.00
By falls of ore from face.....	....	.....	1	16.67
Miscellaneous.....	3	27.27	....	.....
Totals.....	11	100.00	6	100.00

The fatal accident which occurred to Russell Dagg, timberman's helper, *Britannia* mine, on February 15th was due to a fall of ground where deceased and his partner were engaged in timbering; the ground fell when deceased was examining it.

The fatal accident which occurred to H. Sutton, car-repair man, *Britannia* mine, on April 9th was due to the body of a car rolling off its truck while deceased was repairing the car in an underground repair-shop. The shop was equipped with overhead gear for safety lifting and securing car-bodies, but deceased neglected to safeguard himself.

The fatal accident which occurred to Joe Garrastasu and Andrew Livingstone, miners, *Britannia* mine, on April 23rd was due to asphyxiation by gases from a charge of 2,500 lb. of 30 per cent. Polar Forcite Gelatin fired as a chamber blast by deceased; the blast broke the ground to a surface glory-hole, as was intended, but the fumes passed into the mine-workings with sufficient speed to trap the two men. The bodies were recovered within a few minutes after the blast and resuscitation applied, but without avail.

The fatal accident which occurred to Joe Williams, miner, *Britannia* mine, on May 26th was due to his being crushed against his drilling-machine by a large rock in a bulldoze chamber.

Deceased was drilling a hole in this rock when it rotated slightly and crushed his head against the handle of his machine.

The fatal accident which occurred to Iso Hajudovich, trammer, *Bonanza* mine, on June 7th was due to being struck on the neck and jaw by a pinch-bar which he was using to loosen rocks in a chute; a rock struck one end of the bar in such a way as to cause the other end to hit deceased.

The fatal accident which occurred to John B. Dickson and George Brown, miners, *Sullivan* mine, on June 9th was due to a large fall of ground when deceased were engaged in barring down after blasting; deceased had been specially selected, because of their experience, for this work.

The fatal accident which occurred to Norman V. Scott, miner, *Hidden Creek* mine, on July 5th was due to his falling down a stope when engaged in drilling picket-holes for the purpose of relocating a safety-fence in a stope. Deceased was working on a slope of about 40° and was using a safety-rope secured to an anchor-pin inserted in a hole 18 inches deep; this anchor-pin had worked out of the hole and allowed deceased to fall. The anchor-pin had been secured by wooden wedges and apparently deceased had examined the anchor-pin several times during the days preceding the accident.

The fatal accident which occurred to John Hecimovic, surface labourer, *Hidden Creek* mine, on October 12th was due to the breaking of a haulage-rope on a surface skipway on which he and three others were riding. When the rope broke the safety-drag immediately derailed the skip, which displaced one of the supporting timbers of the snowshed over the track; this timber struck deceased, killing him instantly. Notices were in force prohibiting riding or walking on this skipway; the men who were riding with deceased were prosecuted.

The fatal accident which occurred to Mike Jurisich, bulldozer, *Premier* mine, on December 24th was due to an undetermined cause. Deceased was engaged in passing ore from one section of a raise to a lower section through a check-platform; from the circumstances it was concluded that deceased had fired a bulldoze charge on some ore on this platform and that the shot had displaced some of the platform timbers, with the result that when he had returned after the blast, and probably before the smoke permitted good visibility, he fell through the displaced platform on to the ore some 40 feet below; there were no witnesses to this accident.

QUARRIES.

The "Quarries Regulation Act" was passed in 1929 and regulations pursuant to section 6 of the Act were made effective by the Lieutenant-Governor in Council on January 1st, 1931. Both the Act and regulations thereunder were printed in the 1930 Annual Report. The regulations were deemed to be the most necessary to meet the conditions found affecting the safety of persons engaged in quarrying operations, and particularly in incidental operations as apart from actual quarries.

Most of the quarrying operations during the year were of an intermittent nature or else carried on with reduced crews; the safety provisions under the "Quarries Regulation Act" were generally well observed, and no fatal accidents were reported for the year, as compared with six fatalities for 1931.

Particular attention was given during inspections to the better fencing of machinery and approaches to quarry-holes and to dealing with steep or overhanging ground at quarry-faces, and in this work the members of the Inspection Department were generally able to secure the co-operation of those in charge of the different operations.

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.

MINE SAFETY AND GENERAL CONDITIONS AT ANYOX, B.C.

REPORT BY JAMES DICKSON, CHIEF INSPECTOR.

Honourable W. A. McKenzie,
Minister of Mines, Victoria, B.C.

May 8th, 1933.

SIR:

REPORT RE HIDDEN CREEK AND BONANZA MINES, GRANBY CONSOLIDATED MINING,
SMELTING, AND POWER COMPANY, LIMITED, ANYOX, B.C., UNDER SECTION 3,
"METALLIFEROUS MINES REGULATION ACT."

Pursuant to your instructions, I inspected the mines of the Granby Consolidated Mining, Smelting, and Power Company at Anyox on April 18th, 19th, 20th, 21st, 22nd, 23rd, and 24th, and found conditions to be satisfactory and in general accordance with the requirements of the "Metalliferous Mines Regulation Act"; every accessible part of the mines was inspected by District Inspector of Mines Graham and myself.

The main mine, *Hidden Creek*, is situated about 1 mile from Anyox, and the other, *Bonanza* mine, is about 6 miles from the town; the workings of the latter mine are wholly underground, while a large part of the operations at *Hidden Creek* consist of open glory-hole work.

The main entrance to *Hidden Creek* mine is known as the 385-foot level, which also serves as the main transportation tunnel; from this level the main shaft has been sunk to a depth of 1,360 feet, while the upper glory-hole workings have an elevation of several hundred feet above the 385-foot level. The main hoist is electrical and fitted with an automatic controller, while the cages are equipped with an automatic safety device; both are frequently tested. The shaft is provided with several sets of sprinkler-rings as a protection against fire.

In *Hidden Creek* mine the greater part of the ore is at present produced from the recovery of pillars and from the glory-hole work, and in the case of the pillar-work nearly all the ore is blasted by a system where from 200 to over 1,000 shots are fired at one time by a special electric circuit and after all men are out of the mine. The electrical wiring for these large rounds is carried out by competent electricians, and while a large number of these large blasts have been fired, no injuries have resulted; these electrically fired blasts have made unnecessary the large number of individual small rounds formerly required. The application of electricity in firing rounds eliminates much of the uncertainty that obtains when using fuse. The area where these multiple rounds are fired are examined by shiftbosses before any one else is allowed to approach.

The secondary blasting is carried on from reasonably protected points of vantage and the drilling and blasting is carried out by men selected on account of their experience, while the blasting in bulldoze chambers and chutes is carried out by experienced men; all men using explosives hold permanent or provisional blasting certificates.

In the recovery of pillars, conditions may occasionally arise that necessitates a particular method of work to ensure success with the least possible risk, and in such cases the work is carefully planned by the officials in charge.

No loose or apparently dangerous ground was found where men were at work, and the miners and barmen appeared to be efficient and capable of attending to the safety of their individual working-places.

At the time of this inspection there were 378 men employed at *Hidden Creek* mine, seventy-eight on the surface and 300 underground; while at *Bonanza* mine the crew consisted of fifty men. At least 75 per cent. of all the underground employees are now of Anglo-Saxon origin.

While a large percentage of the above men have started work at Anyox since the recent wage dispute, many of them had previous experience in mining, and many of those who had no previous underground experience are at work with experienced men or else at routine work which can be readily learned; the majority of the inexperienced men are under 30 years of age and at a period when they can most easily assimilate, and benefit by, instruction.

It may be pointed out that of the 300 men underground at *Hidden Creek* during this inspection less than 100 are actually engaged as miners, as shown by the following classification:—

Surface—

Office and other	18	
Hoistmen	6	
Crushermen and helpers	6	
Steel-sharpeners and helpers	8	
Blacksmiths and helpers	4	
Machine-shop	15	
Electric shop	4	
Carpenters and helpers	6	
Labourers and tractor-men	11	
	—	78

Underground—

Safety inspector and shiftbosses	10	
Barmen and blasters	5	
Timbermen and helpers	17	
Brakemen and motormen	32	
Miners	97	
Chutemen	26	
King nippers and muckers	91	
Other: 150 level and shaft—Loaders, cage-tenders, pipemen, trackmen, and powdermen	22	
	—	300
		—
Total		378

Every effort is made to make all employees, both old and new, thoroughly conversant with the potential dangers of mining and the necessary precautions, and to make every one understand the safety rules; and on this point may say that I attended a meeting of the employees, numbering between 200 and 300, and, among other speakers, addressed them on the importance of observing all safety regulations and rules, and had a very attentive hearing.

The supervision and discipline exercised by the officials appears to be satisfactory, as the whole crew is carrying on the work in a remarkably efficient manner considering the fact that there are so many new men.

Re Wages.—The different classes of work carry different rates, and the following table shows the number of men at the different rates for the period ending April 15th:—

Rate per Day.	Hidden Creek.	Bonanza.
\$2.40	9	2
2.50	12	2
2.75	79	7
3.00	73	7
3 25	119	7
3.50	7	3
3.75	10	2
4.00	6	....
4.25	3	....
4.50	1	....
4.75	9	1
5.00	1	....
5.25 .....	....	1
	—	—
Totals	329	32

In addition, there were seventeen salaried mine employees.

The following information *re* boarding charges and rent at the mine may be of interest: The rate for meals is \$1 per day and rent-charges in the bunk-houses varies from \$1.50 to \$5

per month, according to the accommodation. The married residences at the mine vary in the number of rooms and rent-charges as follows:—

No. of Residences.	Monthly Rental.	No. of Rooms.	Free Light Allowance (K.W.H.).
12.....	\$6.00	3	25
1.....	7.50	4	25
25.....	8.50	4	25
1.....	10.00	5	25
2.....	10.00	3	25
28.....	13.00	5	30
4.....	23.00	5	45
2.....	4.50	2	All

All residences are equipped with bath, flush-toilet, hot- and cold-water system, and sewage connection. There is no charge for water or garbage-collection and 1 cent per K.W.H. is charged for electric light in excess of above free allowance. Nanaimo-Wellington coal is sold by the company at \$10.25 per ton.

Medical and hospital services are covered by a deduction from wages, under agreement, of \$2 per month in the case of married employees and \$1 per month for single men, and in the case of accident this agreement covers medical, surgical, and hospital treatment, including treatment by specialists, transportation, nursing, medicine.

In the case of sickness or injury not in the course of their regular employment, the agreement provides for medical, surgical, and hospital treatment as can be supplied by the medical men and hospital at Anyox, including free all prescribed medicine and serums and the use of any equipment that is contained in the hospital. This is limited to three months, except where there is a reasonable hope of full recovery by continued treatment for a longer period.

Agreement Benefits to Employees' Families.—Sickness and personal injury—medical treatment same as employees and operations at one-half costs ruling in British Columbia, but hospital services are charged.

Respectfully submitted.

JAMES DICKSON,
Chief Inspector of Mines.

REPORTS OF METALLIFEROUS MINES INSPECTORS.

Throughout the Province many metal-mines formerly operating were closed down during 1932. No mention is made in the Inspectors of Mines' reports of properties formerly operated, but temporarily closed owing generally to metal-price conditions. Many of these properties are in charge of watchmen and in a few instances a little exploration or development has been carried on.

NORTHERN INSPECTION DISTRICT.

REPORT BY CHARLES GRAHAM, INSPECTOR.

Conditions in general at the various operations in the district were satisfactory and in compliance with the provisions of the "Metalliferous Mines Regulation Act." Any suggestions made tending for greater safety were met with ready compliance.

ATLIN MINING DIVISION.

TAKU ARM SECTION.

Engineer.—This mine, operated by the Engineer Gold Mines, Limited, was reopened on July 31st after having been closed down for eighteen months. Only cleaning-up was being done preparatory to an examination by an engineer. Four men were employed.

Atlin Ruffner.—Operated by the Atlin Ruffner Mines, Limited. Underground developments had been suspended for some time to permit diamond-drilling at the face of the 4,100-foot level. This level is in 2,600 feet and is a good piece of tunnelling. Three diamond-drill holes were put in here, two horizontal and one dipping at 50°; each hole was 500 feet deep.

Placer operations on Spruce, Ruby, Boulder, Otter, Gold Run, and McKee creeks, also O'Donnel river, were visited. Conditions in general were found to be good. Underground operations were well timbered and the work was being done in a competent manner. Camp accommodations were fairly good. Very few men engaged in blasting operations were the holders of blasters' certificates. While the most of these men were competent miners, they did not consider that the blasting regulations were applicable to placer operations. A number of blasters' certificates were issued to men engaged in this work.

SKEENA MINING DIVISION.

PORCHER ISLAND SECTION.

Surf Point.—Some surface exploration uncovering known veins has been carried out during the fall. There were four men employed.

NASS RIVER MINING DIVISION.

ANYOX SECTION.

Hidden Creek.—Owned by the Granby Consolidated Mining, Smelting, and Power Company; C. Bocking, general manager; W. R. Lindsay, general superintendent; W. B. Maxwell, assistant general superintendent; F. S. McNicholas, mine superintendent. Operations have been continuous throughout the year. The mine worked 287 days, produced 1,641,037 tons of ore, and 1,673,725 lb. of explosives, 463,600 detonators, 2,646,000 feet of fuse, and 24,238 electric detonators were used. There were 1,088 missed shots reported.

The safety regulations and the "Metalliferous Mines Regulation Act" are well observed. Regular meetings of the operating officials are held, at which any matters relative to the safety of the men are fully discussed. The safety-work is under the supervision of a safety inspector. The shaft is equipped with water sprays for fire-protection and the cages are equipped with safety devices which are tested at regular intervals: the hoisting-ropes are also inspected by the master mechanic.

One of the interesting features of this mine is the method of operation and the large blasts fired. This is known as the long-slope method and is a variation of the former method of spiral stope. It is designed to obviate some of the objectionable features of the spiral-stope method. This method requires the usual development and consists essentially of driving parallel inclined stopes (plus 38°) through the ore-body, parallel to the strike of the ore-body in narrow ore-widths and across the strike in wide ore-widths, leaving a parallel inclined brace over the back of each stope, that it may be mined as one bench by 20-foot holes.

Starting at the top of the ore section, the initial stope is mined to the established ore limits and the back trimmed and arched to give maximum strength and safety. The bottom is then benched in a series of benches. After benching is completed a 30-foot bottom is left under this stope and another parallel stope is driven and benched in similar fashion. The process is repeated until the entire block of ore is prepared, leaving a series of parallel inclined braces. These braces are then mined, starting at the bottom by drilling 20-foot holes downward from the top of the lowest inclined brace and blasted in sections electrically.

During the past eighteen months twenty-three blasts totalling 7,822 20-foot holes, using 112,400 lb. of 50 per cent. gelatine dynamite, have been exploded. Total tonnage broken was 499,200 tons. The largest blast was 1,335 20-foot holes, using 21,800 lb. of 50 per cent. gelatine dynamite, breaking 85,000 tons of ore.

Alternating current of 60 cycles, 220 volts, is used for blasting, and existing power or light lines are not used for this purpose; special temporary firing-lines of proper size for each blast are strung. Only enamelled wired and water-proof blasting-caps are used, and each cap and circuit is tested with galvanometers supplied by the power company. Caps are connected in series, which in turn are connected in parallel to the main leads out of the stope. Each series must contain the same number of caps, and the number of caps connected in each series are the minimum that conditions permit; not more than fifty are used in a series.

After the holes are loaded and primed electricians scrape, test, and connect in the required series; each series is then tested and connected to the leads running out of the stope, where they are ready for connection to the main leads.

A single transformer of suitable capacity is cut into the circuit. The blasting-current is single-phase, 60-cycle, 220-volt. Test-lamps of proper voltage are placed across the secondary leads from the transformer and at the extremities of the main leads to ascertain that proper voltage is available. The blasting-switch is placed on the secondary leads. After testing for voltage the blasting-switch is opened and the connections from the main leads to the stope leads made. After all the men are out of the mine the blasting-switch is closed, firing the shot.

The following data are given on the largest blast:—

Drilling—

Total machine shifts drilling	565
Total nipper shifts	310

Loading holes and carrying powder—

Barmen (shifts)	6
Miners (shifts)	58
Muckers (shifts)	42
Electricians (shifts)	36
Total holes drilled	1,335
Total caps, No. 8; 16-foot wire	1,380
Total cases, 50 per cent. powder (50 lb. per case).....	436
No. 1 copper wire used (feet).....	3,000
No. 4 copper wire used (feet).....	1,000
No. 6 copper wire used (feet).....	1,740
Series of 30 caps each	46
Amperes required	92
Voltage	220
One 40-kw. transformer connected to give on secondary leads 220 volts.	
Amperes available	182
Voltage available	220

Performance—

Holes per machine shift	2.4
Feet drilled per machine shift.....	48
Holes started at 3 inches and bottomed at 2 inches.	
Tonnage broken	85,000
Tons per machine shift	150
Tons per hole	64
Pounds of powder per ton of ore	0.25

Bonanza.—Owned by the Granby Company; W. R. Lindsay, general superintendent; H. E. Doelle, mine superintendent. This mine worked 289 days and produced 99,232 tons of ore, using 93,400 lb. of powder, 22,080 detonators, 165,550 feet of fuse, and 1,345 electric detonators. There were twenty-eight missed holes reported. An average number of forty-one men was employed. There was one fatal accident reported for the year. During my various inspections every assistance has been given by the officials of the company and every effort made by means of notice-boards and bulletins to impress on the employees the principles of "safety first."

PORTLAND CANAL MINING DIVISION.

SALMON RIVER SECTION.

Premier.—Owned by the Premier Gold Mining Company, Limited; D. L. Pitt, general manager; B. Smith, assistant general manager; G. Rudolf, mine superintendent. Operations have been continuous throughout the year with an average employment of 246 men. During the year 314,622 lb. of powder, 132,262 detonators, 670,779 feet of fuse, and 184 electric detonators were used in producing 221,718 tons of ore. No new sections were found containing ore of any consequence, but known ore-bearing sections did give additional tonnage as a result of this development-work. During my various inspections I received every assistance from the management and found them ever ready to co-operate in the prevention of accidents.

MARMOT RIVER SECTION.

Silverado.—Owned by the Silverado Consolidated Mining Company and leased to John Haahti, Stewart. There were four men employed during the summer months on a high-grade lead in this mine, 90 tons of which was brought down and shipped.

Dunwell.—Three groups of two men each were given leases on different claims of the *Dunwell*. They worked on some high-grade shoots and shipped a small quantity of ore.

OMINECA MINING DIVISION.

SMITHERS SECTION.

Jessie.—Owned by the Jessie Gold Mines, Limited; J. G. Stevens, president; L. A. McGill, secretary and manager; Alex. Zobnic, foreman. A tunnel 150 feet long was driven on this property before closing down for the winter. A good bunk-house has been built and it is anticipated that further development will be done during the coming summer.

Silver Lake Group.—Owned by L. S. McGill and P. Schaefer and under option to W. R. Wilson & Sons. Two men were employed on this property from July 28th to September 16th on surface exploration-work.

TELKWA SECTION.

Free Gold Group.—Owned by the Babine Gold Mines, Limited. Nine men were employed at this property during the summer on surface exploration and preparing a camp-site. A contract has been let to drive 300 feet of tunnel on these claims.

QUEEN CHARLOTTE MINING DIVISION.

GRAHAM ISLAND SECTION.

Skidegate-Sunrise.—Owned by Kitsault Eagle Mining Company, Limited; W. G. McMorris, superintendent. Some drifting was done from the main shaft on the 100-foot level to intersect a vein directly underneath an open-cut.

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; C. G. Dobson, superintendent; J. P. Lee, engineer. Due to the low price of copper and the restricted output agreed upon by world copper-producers, the ore production for the year amounted to 836,859 tons, as compared with 2,221,321 tons in 1931. This reduction in tonnage was naturally reflected in the total number of workmen that could be

gainfully employed. Accordingly a scheme was worked out to retain the maximum number of employees, allotting each individual a reasonable number of days' work per month to provide for his family. It is needless to say that the preference was given to married persons. All mining department crews, including those employed on the surface, have been placed in four groups, only three of which are employed during the twenty-four hours. This rotation of shifts gave each person approximately twenty-three shifts per month.

Development during the year consisted of 2,255 feet of drifting, 1,172 feet of crosscuts, 4,677 feet of raises, and 1,258 feet of sinking operations, the total development for the year being 9,362 feet, or 1.75 miles. The mine was operated for 312 days at an average production rate of 2,682 tons drawn per working-day.

Chamber blasts were extensively used to break ore and out of the total tonnage broken during the year 82 per cent. was obtained from twenty-eight blasts; twenty-six of these were in the *East Bluff* mine, one in the *Fairview* mine, and one in the *West Bluff* mine. In order to remedy the smoky condition in the bulldoze chambers drawing the centre stope on 1,200 level, doors were installed on 1,200, 1,400, and 1,600 levels, and a fan installed in 1,200 level to exhaust the air from the working-places. The fire-fighting equipment is in excellent condition and has been overhauled to withstand winter weather.

The 4,100-foot haulage-tunnel was advanced 1,497 feet on part time; work being stopped in the latter part of June. The conditions prevailing at the time this tunnel was being driven were such that a high monthly footage was not essential, the objective being to secure a low cost per foot. The tunnel, 10 by 12 feet in section, has been advanced 6 feet per round on an average cost per foot of \$25.81; included in this figure is \$6.88 per foot of deferred charges arising from the purchase and installation of a special air-compressor, the fabrication of cars and mucking-machines, purchase and installation of 5-inch steel air-pipe, and 22-inch steel ventilation-pipe, together with blower-fans, electrical transformers, and armoured cable to supply power to mucker and fan-motor and other incidental equipment.

The Britannia Mines fourth annual first-aid meet was held on April 15th, when a number of trained first-aid teams competed for the Britannia first-aid cup, and teams of ladies, boys, and girls competed for other prizes and fully demonstrated the efficiency of first-aid training at Britannia. Prizes were provided by the Vancouver Island and Coast District Branch of the British Columbia Mine Safety Association. At the annual spring examination in first aid, eleven boys, five girls, five women, and forty-four men passed the St. John Ambulance tests.

Safety posters of the National Safety Council and of the Elliott Service Company were posted on bulletin-boards at various places over the property. Each employee has a book of safety rules which are issued by the company. In addition, these rules are posted on signboards in conspicuous places; records show that during the year "hard-boiled" hats have been instrumental in preventing many head-injuries, while a greater number of the men are wearing the safety-shoes made by the different shoe-manufacturers.

Safety meetings are held at two-week intervals for each level in the mines and for each of the surface departments. Underground safety meetings are held in the level lunch-room immediately after lunch. All men working on that level attend and each working-place on that level is discussed. Each man present is asked for suggestions to prevent personal injuries and to promote good working conditions. Every effort is made to eliminate any known hazard and to have every man understand the safest manner in which to perform his work.

The whole supervision and management of the housing, feeding, washing, and sanitation in the various camps is under the charge of Mr. Sinclair, who resides at the 2,200-foot tunnel camp and who very ably sees that his working staff carries out their duties in a satisfactory manner. For recreation there is a gymnasium, reading-room, library, tennis-courts, and swimming-pool. The company also maintains two hospitals—one at the Beach and one at the Tunnel camp: one doctor with nursing staff supervising both hospitals.

During my various visits of inspection I found the various camps to be in good order and the mines, generally speaking, were found to be in good condition. Ventilation and timbering were also found to be fairly good. The use of caps and powder were well handled and looked after and mining regulations relating to safe blasting were carefully attended to, although two or three accidents throughout the year can be attributed to this source.

The hoisting-ropes on skips and cages are kept in good condition and replaced as soon as 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. During the year the provisions of the "Metalliferous Mines Regulation Act" were well adhered to.

REPORT BY JAMES STRANG, INSPECTOR.

Clayburn Co., Ltd.—Head office, Vancouver; J. W. Ball, manager; Edward Wilkinson, mine manager. The company's factory and pits are situated at Kilgard, about 50 miles east of Vancouver. The factory is a modern plant just completed in 1931 and capable of handling a large output of firebrick, building-brick, and pipes, etc. At the present time for bricks there is one continuous kiln 420 feet long, with eighteen chambers, each capable of holding 35,000 bricks; besides this there are three kilns, not at present in use, each capable of holding 150,000 bricks and five circular kilns for pipes. The mines operating are Nos. 4 and 5 B North, No. 9, and Kilgard Fireclay.

There are six workable seams of fireclay, some suitable for building-bricks and pipes and some suitable for firebricks. At the top of the hill above the clay-deposits the company operates a shale-quarry, men being taken from the mine to work this when necessary. The mines are well timbered and worked on the regular pillar-and-stall system, all work being in the solid at present. Kilgard Fireclay mine is ventilated by a small electric fan; the others are ventilated by natural means. A good air-current is maintained at all working-faces.

A storage-battery locomotive hauls the material from the mine to the factory. The total tonnage for all clays mined underground for the year ended December, 1932, was 5,648 tons and from open-work 679 tons. This is only about 40 per cent. of last year's output. The number of men employed in the mines averaged sixteen, the same as last year.

NANAIMO MINING DIVISION.

REPORT BY JAMES STRANG, INSPECTOR.

Alexandria Mining Co.—This company's property is situated on Phillips arm. Early in the year an option was taken on this property by Eastern interests, with F. G. MacDonnell in charge at the mine. After some exploratory work on the 100- and 200-foot levels operations were discontinued. Twenty-two men were employed. Every effort was made to carry out the requirements of the "Metalliferous Mines Regulation Act."

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS AND THOMAS R. JACKSON, INSPECTORS.

REPORT BY JOHN G. BIGGS, INSPECTOR.

The low price of metals prevailing since the year 1930 has had an adverse effect on the metalliferous mining operations in this district, which resulted in the closing of the Granby Company's *Copper Mountain* mine during the above year, this being by far the largest operation in the district. Gold and gold-mining offers the chief ray of sunshine at the present time, and owing to the present abnormal world conditions causing an extreme stimulus for gold-mining the enthusiasm of the miners to capitalize this opportunity may lead to further mining developments in the Hedley and the Coquihalla districts.

Copper Mountain.—Owned by the Granby Consolidated Mining, Smelting, and Power Company. This mine did not operate during the year, only a crew of watchmen being employed; a number of families still reside at the camp.

Nickel Plate.—Owned by the Hedley Gold Mining Company. This mine remained idle during the year, except for a considerable amount of diamond-drilling and exploratory drifting, which was carried out by New York interests who had the property under option; this work will be resumed in 1933.

Silver King.—W. B. Dornberg, superintendent; A. K. Olson, mine foreman. This mine was opened in the spring of 1932 by the Murray Mining Company, Limited, and continued to operate in the No. 2 tunnel, where a fair amount of stoping was done. There were nine men employed underground, and I found the general conditions of the mine to be fairly good and the provisions of the "Metalliferous Mines Regulation Act" well adhered to.

Dawson.—A. Thomason, mine superintendent. This mine has been operated in a small way during the present year by the Consolidated Underwriters on the "Dyke" vein on the No. 2 adit.

During my last visit of inspection there were six men employed underground, and the general conditions of the mine were found to be in compliance with the provisions of the "Metalliferous Mines Regulation Act."

Placer-mining has been very active on the Similkameen and Tulameen rivers and the adjoining creeks during the year, and while there have been no large projects in operation, there has been a fairly large number of miners working on the gravel banks of the rivers. No "large strikes" have been heard of, but there is no doubt that this work has offered useful employment to many who otherwise would have had to look to the Government for relief, a circumstance that the average miner is anxious to avoid. There have been no accidents of any description at the metalliferous mines or placer operations reported to this office during the present year.

LILLOET MINING DIVISION.

REPORT BY THOMAS R. JACKSON, INSPECTOR.

Bridge River Exploration Co., Ltd.—Ernest R. Shepherd, general superintendent. This property is situated within 5 miles of the *Bralorne* mine and is reached by the main highway paralleling Cadwallader creek. The tunnel now being driven is No. 2 on the *California*, located on the top side of the highway, and is in 490 feet, with a total of 70 feet of crosscutting at 100-foot intervals. Another tunnel, 200 feet vertically below No. 2, has been started to cut the vein some 480 feet in from the tunnel portal. At the end of the year there were under construction a blacksmith-shop, compressor-house, and a board-house to accommodate a crew of about twenty men. During my last visit to this mine I found the timbering to be good, the roof and sides safe, and powder and caps well attended to. Twelve men were employed at the mine. Pending the completion of the camp accommodation, the men are attending to their own accommodation and cooking.

Pioneer.—David Sloan, general manager; Harry J. Cain, general superintendent; Robert Sloan, mine superintendent. A new 3-compartment shaft has been completed through to the surface and sunk below the 1,000-foot level an additional 650 feet, with levels cut at intervals of 125 feet in the latter distance. The shaft contains two hoisting compartments and a manway, each compartment being equipped with a 2-ton skip hung beneath the cage. There has been about 2,700 feet of development-work done between the seventh and fourteenth levels, together with a considerable amount of crosscutting. Loading-pockets have been installed below each level. Ventilating-raises have been put through from the west end of the eighth level to the seventh level and from the east end of the tenth level to the ninth level. This adds materially to the efficiency of the ventilating air-current.

Improvements in living-quarters consist of the completion of a new change-house for the miners, with housing large enough to accommodate 200 men; this is equipped with shower-baths, toilets, and basket hangers for the clothing, the whole being heated by a hot-water system from a 100-horse-power boiler placed near the sawmill and set in position so that the mill refuse can be used as fuel. A fully equipped dining-room 30 by 80 feet, with staff rooms in the upper story, was put into use during the year and commodious offices and machine-shops were also built. Several fire-hydrants have been put in and connected to the main water-supply. Fourteen 4- and 6-room houses, fully equipped, have been constructed for the accommodation of the married employees, and the services of a resident doctor were obtained during the year.

During my visits of inspection general conditions were found to be in a satisfactory condition, with careful attention being given to the use of explosives. The ventilation in the mine was fairly good and the timbering at all times was found to be satisfactory; over 100 men were employed underground at the end of the year. There were no fatal accidents during the year and only one accident of a serious nature was reported.

First-aid service is capably attended to, both on surface and underground, by an experienced first-aid man, who renders the necessary aid to the injured if the resident doctor happens to be somewhere else in the district. Generally speaking, the provisions of the "Metalliferous Mines Regulation Act" were well adhered to.

Bralorne.—Operated by the Bralorne Mines, Limited; R. Basustow, manager. In April, 1931, the Bralorne Mines, Limited, acquired the entire holdings of the Lorne Gold Mines, Limited, and in February, 1932, a 100-ton amalgamation-flotation mill was put into operation; since the latter date the property has produced 30,000 tons of gold ore. The mine is developed by a 3,000-foot tunnel which reaches a depth of 800 feet on the *King* vein; this tunnel is connected

to the surface by a series of raises which affords adequate natural ventilation. The vein below this tunnel is opened up by an inclined shaft sunk in the foot-wall of the vein to the extent of 200 or 300 feet. A compressed-air-driven hoist is situated at the top of the shaft. In the main tunnel an electric-battery locomotive is employed.

The camp is well provided with a dry-change house, bunk-house, and cook-house, as well as a number of dwellings for married men. A number of additions and improvements have been made during the year, especially in regard to more comfortable living conditions for the employees. On the same floor as the dining-room is the recreation-hall; by taking out the removable partition between the two halls the entire floor area can be utilized for a dance-hall. The building includes a general store where provisions may be purchased by employees at a reasonable price.

The whole of the property is illuminated by means of electricity produced by the generator located near the creek. Fire-fighting equipment and escape-ways are good. The sanitary arrangements for the men are quite efficient and all garbage is properly disposed of. At the beginning of the year Dr. D. M. King took over his medical duties for the whole of the gold-producing district and at present resides at the Bralorne camp.

During my last visit of inspection general conditions were found to be satisfactory, timbering good, first-aid equipment good, explosives and caps properly taken care of, and other matters to be in compliance with the "Metalliferous Mines Regulation Act." There were forty-four men employed underground, and about 125 tons of ore per day being produced. No accidents of any description have been reported to this office during the year.

CARIBOO MINING DIVISION.

REPORT BY THOMAS R. JACKSON, INSPECTOR.

Consolidated Gold Alluvials of B.C., Ltd.—N. C. de Ronne, mine manager. This property is situated on the road to Barkerville and is about 35 miles from Quesnel. During my last visit of inspection construction-work on the plant was being carried out, but underground operations had not been started; a large-capacity pump had been installed to cope with the water in the shafts and later to deal with the water encountered in working the underground deposit. The management anticipated proceeding with underground operations towards the end of the year; skilled miners only being employed for this class of work. Camp accommodation and sanitary arrangements were found to be good.

Lowhee Mining Co., Ltd.—Alfred F. Eastman, managing director; T. A. Harman, mine superintendent. This hydraulic placer operation is situated on Lowhee creek. During my last visit of inspection operations were being carefully worked. The top of the pit was well cleared and an inspection of the top and sides of the pit was made three times daily by the superintendent. A considerable quantity of blasting-powder is used in bulldozing the rocks and making them small enough to travel down the flume by the force of the water-supply. As there are several tons of explosives with a proportionate number of detonators used during the season's work, all for bulldozing purposes, the absence of accidents shows that all reasonable care has been exercised in the blasting operations. The camp accommodation was found to be good, with the cook-house clean and in good condition, and the sanitary arrangements were satisfactory. Twelve men were employed.

Cariboo Gold Quartz Mining Co., Ltd.—F. R. Wells, managing director; I. F. Fogle, mill superintendent; M. H. Atkinson, mine superintendent. The mill-construction started in July is now practically completed and operations will start about January 1st, 1933. The mill is designed for a present capacity of 50 tons per day, but can be stepped up to 100 tons per day by the addition of another fine-grinding unit. The mill is steam-heated by a wood-burning boiler plant.

The power-house has been enlarged during the year and additional power units installed. The present plant includes the original 94-horse-power Rushton-Hornsby Diesel engine driving a 409-cubic-foot Ingersoll-Rand compressor, and two new Rushton-Hornsby Diesel engines, one of 114 horse-power driving a 630-cubic-foot Sullivan compressor, and one of 224 horse-power driving an electric generator which will give power for mill operation and for camp lighting. A storage-tank for Diesel oil, of 52,000 gallons capacity, was erected during the year. Included in the power-house building is a completely equipped machine-shop. Mine-development has been pushed forward during the year and a number of new ore-showings opened up. A 340-foot raise

from the lowest level to the surface gives excellent ventilation throughout the mine and forms another exit.

A number of permanent buildings for camp accommodation have been erected and of sufficient capacity to provide good living-quarters for at least sixty men. The cook-house and dining-hall are in the one building and can nicely serve thirty-five to forty men at one sitting; food-storage arrangements are unusually well designed. A large warehouse for material-storage and a guest-house were included in the construction programme. The sanitary arrangements for the camp are good and all garbage is loaded into an iron car, taken away, and carefully disposed of. There is a dry-change house for the miners quite close to the mine, and it is expected to add improvements to this building which will serve a greater number of employees and at the same time increase their comfort.

First-aid service is well attended to by trained men in the employ of the company for the purpose of rendering assistance immediately. It might be possible, in the near future, to renovate the old Government Hospital at Barkerville, and use it for treatment of patients instead of having to take them to Quesnel Hospital, some 50 miles away, which is a very difficult feat of transportation in the midst of winter. There is a movement on foot at the present time to carry out this suggestion, coupled with the possibility of having a resident doctor. Contributions could come from workmen and others employed in the district to maintain a local medical man.

EAST KOOTENAY, WEST KOOTENAY, AND BOUNDARY INSPECTION DISTRICTS.

REPORT BY ROBT. STRACHAN, SENIOR INSPECTOR.

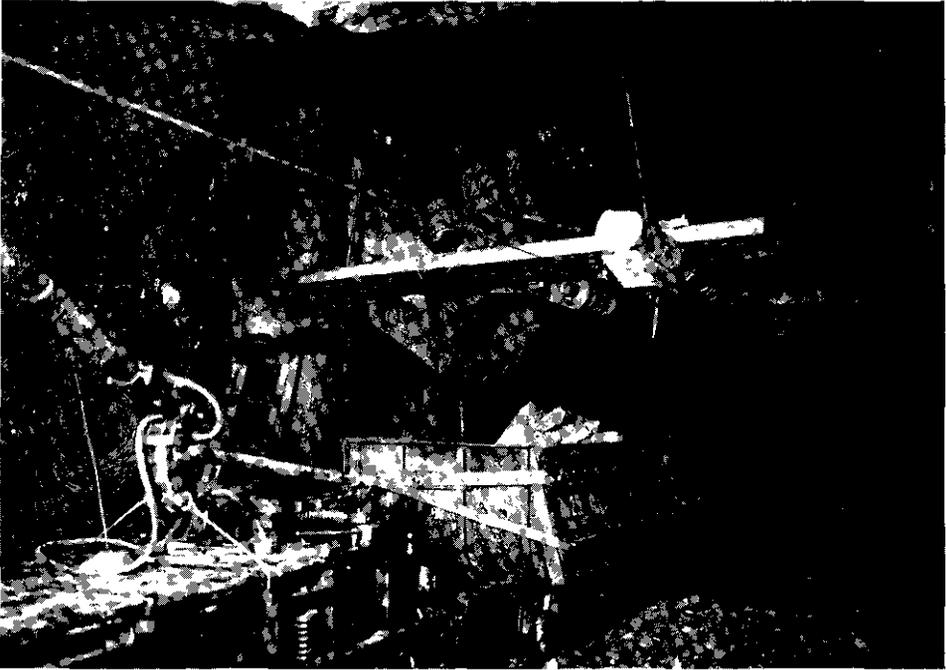
The Kootenay-Boundary district includes the Ainsworth, Arrow Lakes, Fort Steele, Golden, Grand Forks, Greenwood, Lardeau, Nelson, Revelstoke, Slocan, Slocan City, Trail, Trout Lake, and Windermere Mining Divisions. The inspection-work in the West Kootenay and Boundary districts, carried out for many years by H. H. Johnstone, was brought to a close on March 31st of the present year, when he was superannuated; since that time I have carried on the inspection of mines in these districts. The falling-off in activities mentioned in last year's report still continues, and prices for the base metals have not improved. This has struck the Slocan, Slocan City, and the Ainsworth districts very hard, with the result that practically all the mines have been closed down and there is little encouragement to search for more. There has been an increased demand for prospects with gold values and many old mines abandoned years ago have been reopened on a small scale.

TRAIL CREEK MINING DIVISION.

In this district many small properties were working, mostly by leasers, and included the *I.X.L.*, the *Midnight*, the *O.K.*, the *Gold Drop*, the *Rubinstein*, the *Christina*, the *Golden Butterfly*, the *Snowdrop*, and the *O.K. Fraction*, each property having from two to three men. Late in the year a company took over the *Velvet* mine, situated about 12 miles west of Rossland on the Rossland-Cascade highway, and had about fifteen men employed putting it in shape for production. The principal work was in overhauling the shaft and surface works, repairing cook-house and bunk-house, and installing a new mill. No underground mining had been done at the time of my last visit.

NELSON MINING DIVISION.

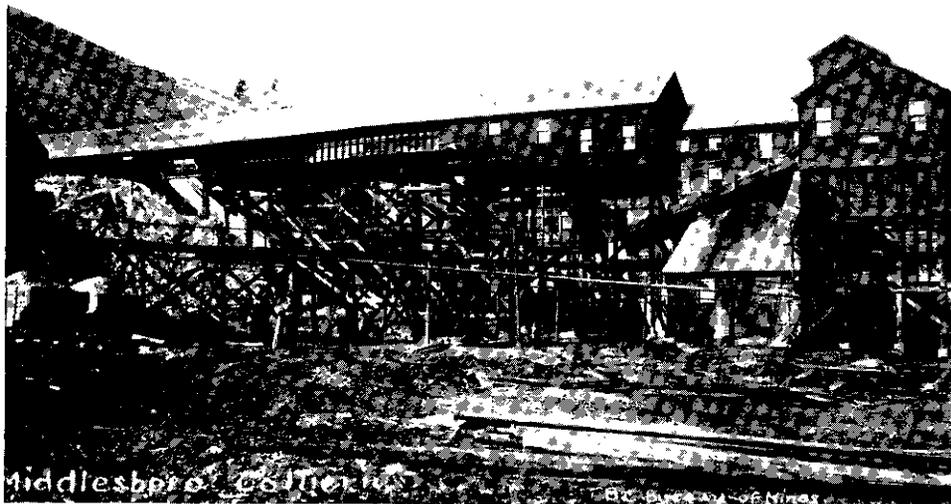
This district has been the scene of much activity in reopening many old mines noted for the gold values. The principal localities were around Salmo and Ymir and seventeen mines were in operation during some part of the year. The largest of these in the Salmo district is the *Reno*, which in the early part of the year worked with a force of about thirty men. Unfortunately, in February the mill burned down, and the most of the work later was simply on development and maintaining the mine in good shape. The Reno Company later acquired the *Mother Lode* and *Nugget* mines, including the mill, and it was decided not to rebuild the *Reno* mill, but to reorganize the *Mother Lode* mill to treat the *Reno* ore. This required the building of an aerial tramway to convey the ore from the *Reno* mine to the renovated mill, and took up the greater part of the summer. An hydro-electric plant was also installed on Sheep creek, below where Wolf creek enters it, to provide power for both the mill and the mine, and



Hidden Creek Mine, Anyox—Underground Loading Chute.



Britannia M. & S. Co.—Underground Loading Scraper.



Middlesboro Collieries, Ltd., Nicola Valley.



Blue Flame Collieries, Ltd., Princeton.

it was late in the year before all this work was completed. A force of men was kept on at the mine for development and maintenance and a temporary power plant furnished power; this allowed of working about twenty men and general conditions were very good. A force of twelve men was employed by the Gold Belt Syndicate, mostly engaged in surface-trenching on the property, which adjoins the *Mother Lode*.

In addition to these two, the other mines working during some part of the year on Sheep creek were the *Kootenay Belle*, the *Vancouver Fraction*, the *Alexander*, and the *Queen*, with from two to seven men. At Ymir the *Yankee Girl* (old mine) worked steadily through the year with a force of about twenty men, and the *Goodenough* with five. The *Blackcock*, the *Ymir-Wilcox*, the *Shiloth*, the *Tamarac*, and the *Pathfinder* all worked during some part of the year with forces of from seven to two men. The *Perrier*, the *El Dorado*, the *Golden Age*, and the *Molly Gibson* at Kokanee creek worked with small forces during some part of the year.

GRAND FORKS MINING DIVISION.

The *Union* mine in this district worked steadily through the year with a force of about sixty men; the mine was kept in splendid condition, as was the cook-house, wash-house, and all the accommodation for the workmen. The values in this mine are principally gold, the ores being treated in a mill at the mine and the concentrates hauled by truck to the railway at Lynch Creek, and in some instances, where exceptionally rich ore has been found, it was shipped without treatment in the mill; the mine is situated about 45 miles from Grand Forks on the North fork of the Kettle river.

On the *Pathfinder*, situated south of Lynch Creek, a tunnel is being driven for the purpose of striking ore at depth, and worked all year with a force of five men.

R. Forshaw, of Greenwood, who owns the *Brooklyn* and *Stemwinder* mines at Phoenix, took a few cars of ore from an open-cut on the *Brooklyn* mine during the year.

GREENWOOD MINING DIVISION.

The principal operations in this district were confined to Wallace mountain at Beaverdell during the year. The *Bell*, the *Highland Lass*, and the *Wellington* mines worked steadily throughout the year despite the low prices prevailing for silver, the principal value in the ores mined. The *Beaver* operated during a portion of the year and the *Sally* carried out some prospecting-work with a small force of men. The number of workmen employed varied from twenty in the *Bell* to seven in the *Highland Lass*.

The *Carmi* mine was reopened at the latter part of the year, when a force of about twelve men was employed putting it in shape and prospecting for ore; this is a very old mine and carries gold values and is situated at Carmi, 5 miles west of Beaverdell, on the Kettle Valley Railway. This mine was formerly operated by a steam plant and had a mill attached, but the mill has been dismantled; the steam plant is still available for use. Many of the features of this mine and plant will have to be readjusted to comply with the "Metalliferous Mines Regulation Act," and this is being attended to.

In the early part of the year some work was done on the *North Star*, in the Jewel Lake district, but was discontinued in July.

FORT STEELE MINING DIVISION.

The only mine in active operation during the year was the *Sullivan*, and here the general depression curtailed activities to some extent. Besides reducing the number of days during which the mine operated, a number of workmen have been laid off and only 460 were employed in and around the mine during the year. This mine is covered in a detailed report by Inspector H. E. Miard.

ACCIDENTS.

Two accidents occurred during the year, both in the *Sullivan* mine, involving three men. Both these accidents came under subsection (b), section 19, "Metalliferous Mines Regulation Act." The first and more serious occurred on June 9th, 1932, in U-11 stope of the *Sullivan* mine, when John Dickson and George Brown, miners, were killed instantly when a large body of ore fell in their working-place; this probably occurred when they were barring down at the beginning of the shift. The other accident occurred while timber was being moved from an old cog; a workman being injured by a falling timber.

REPORT BY H. E. MIARD, INSPECTOR.

In the course of the year thirty-three certificates of competency as blaster were issued from this office under the provisions of the "Metalliferous Mines Regulation Act," twenty-eight being granted in the West Kootenay and Boundary districts, three in East Kootenay, and two being issued as substitutes. In addition, five certificates of the same class were issued under the provisions of the "Quarries Regulation Act," the applicants in all cases being engaged in road-work.

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; safety and efficiency engineer, Jos. R. Giegerich; assistant safety engineer, J. M. Wolverton. The continued abnormally low demand for metals made itself felt here possibly somewhat more acutely during 1932 than in the course of the previous year, with an appreciable reduction in the size of the working-force and some curtailment of output as a result. However, at the end of the year the total number of persons employed by the Consolidated Mining and Smelting Company at Kimberley was still 850, of whom 460 were on the mine crew, 268 underground, and 192 on the surface. The average output amounts to 5,500 tons and towards the end of the year the mine was operated five days per week.

Mining and Development Work.—The method of mining followed has been thoroughly described in previous reports and continues to give excellent results from all points of view. The operations are still extending, notwithstanding the unsatisfactory economic conditions prevailing generally, and the aggregate length of the new development-work done during 1932 amounted to 4,538.5 feet, which represents a by no means inconsiderable addition to the area already accessible. Work on the new slope, intended to open the ore-body below the 3,900-foot level, proceeded satisfactorily until the early part of June, when operations were temporarily suspended, being resumed again at the end of the year. The programme outlined in the report for 1931, regarding concreting, tracks, etc., was carried out in a manner reflecting considerable credit upon those responsible for its planning and execution.

A raise to the surface has been started from the north-end workings and will eventually be used both for ventilation and for the introduction of gravel for stowing purposes. The ore-body at this point lies at a depth of approximately 600 feet, but it is expected that the work will be completed in the course of the present year.

The construction of concrete pillars continued until late in the year, when an abnormally heavy fall of snow rendered the excavating of gravel too onerous, but this work will be resumed as soon as weather conditions become more favourable. All features of this method of supporting ground have been studied with the greatest care, and its application may now be considered as having advanced well out of the experimental stage and as forming a part of the operating routine at the *Sullivan*.

Additions to Plant and Equipment.—An electrically driven, 16- by 10- by 12-inch cross-compound compressor has been installed underground to supply power for pumps and drills in the slope, on the night shift, and on idle days. A safety measure well worthy of note is the installation of double brake-bands on the drums of the slope-hoist, this being done to guard against the possible failure of one of them should the clutch give way during a hoist. The slight difficulties presented by this addition, for which no provision had been made in the original design, were skilfully overcome.

An ambulance car for use underground has been built and was receiving its finishing touches at the time of the last inspection. It is entirely closed, an electric heater, sunk in the floor, maintains a comfortable temperature in it at all times, and necessary ambulance requisites are arranged so as to be immediately available in case of need. Stretchers are to be suspended on elastic supports in order to minimize the shocks resulting from rapid transit over the mine-tracks.

Means of signalling to the motormen in case of emergency, when the man-trip is being hauled in or out of the mine, have been provided in the form of large Klaxon horns operated by means of a rope running through the coaches. Safety-chains have also been added to the coupling device on the same vehicles.

Edison electric safety-lamps are used on the cages in the blind shaft while men are hoisted, as, according to the safety rules in force, "No smoking or open lights are allowed on moving

skips." The batteries are charged in the hoist-room, where the necessary appliances have been provided.

The 4,500- and 4,600-foot levels are connected by an incline plane, over which material of all descriptions, including explosives, has to be lowered or hoisted. The desirability of using some device to prevent the loaded tram from running away, should the rope break or the hoist suddenly refuse duty, was quite apparent, but as it is necessary to guard against this while both hoisting and lowering the tram, and, besides, the hoistman has to throw slack on the rope at some points, ordinary means of achieving this end were not applicable. However, the difficulty was ingeniously overcome by a simple device designed by the construction engineer and built in the mine shops.

All drill shanking, as well as sharpening, is now done underground. As the former operation requires oil tempering, the troughs in which this essential part of the work is carried out are enclosed in a concrete compartment provided with a steel door which can be closed instantaneously should the oil become ignited, thus smothering the fire in its incipient stage. Up to the present time the need for this has not arisen.

Explosives.—Underground, 30 and 60 per cent. Polar Forcite gelatine is used exclusively for blasting purposes. The increased use of the higher grade of explosive has been accompanied by several advantages, among which are less smoke and a very appreciable decrease in the amount of secondary blasting required. All explosives are distributed from well-appointed magazines established at carefully selected points on the various levels, made as nearly fire-proof as possible, provided with electric light, and kept scrupulously clean. A stringent set of rules concerning the storage and handling of explosives is rigidly enforced.

Ventilation.—The ventilation is generally good, but towards the end of the year a slight deficiency became evident in the case of a few stopes in the north end, where it became difficult to drive the smoke away. However, the nature of the problem is clearly understood by the officials and it has been energetically attacked. The new raise started from this part of the mine will eventually afford an effective remedy, but in the meantime all necessary measures are being taken to overcome the difficulty.

Plans and Model of Workings.—Reference has already been made in previous reports to the very thorough manner in which the progress of the operations is recorded by the engineering staff and reproduced on the model of the mine, a close examination of which will give a clearer idea of the exact configuration of the workings in a few minutes than would hours spent in the study of plans.

Accidents.—Two accidents, one of them entailing the loss of two lives, were reported to this office during the year. The non-fatal occurrence involved a fracture of the right leg, sustained by a workman engaged in removing old cribbing in the Upper mine.

The fatal accident occurred while two miners were barring down a bench in which a round of shots had been fired at the end of the previous afternoon shift. They were caught and carried into the chute by a mass of ore, amounting to several hundred tons, which slid away suddenly owing to the unsuspected presence of a fracture in the ore body about 20 feet ahead of the front of the bench. Some powder and capped fuse found later among the broken ore seemed to indicate that the men had recognized the dangerous nature of the bench and were preparing to blast the loosened material instead of barring it down. Following this occurrence all shiftbosses visited the place, and afterwards took their men into it in small groups to give them an exact idea of the nature of the accident and of the best manner in which similar mishaps could be guarded against. After investigation the accident-prevention committee came to the conclusion that the height of benches should be limited to 12 feet.

Safety and First-aid Work.—Very gratifying progress was made in the matter of accident-prevention during 1932. The comprehensive statistical records of accidents kept show that the ratio of shifts lost, owing to injuries sustained in or around the mine, to the total number of days worked has been reduced to 4 per 1,000 for the entire crew; separate tabulations showing the proportion to be 6.1 per 1,000 underground and 1.1 per 1,000 on the surface. The Upper mine was operated throughout the last five months of the year without a single "lost-time" accident, and only three man-shifts were lost for the entire mine during the month of December. In a paper on this subject presented to the accident-prevention committee, Robert Woodey, foreman of the Upper mine, attributed the enviable record of the section under his charge to the strict enforcement of the "safety rules" introduced last year, to clear and definite directions given

to miners and other employees, and to close co-operation between officials and workmen in all matters pertaining to safety.

Old crib-work built in the Upper mine during the early days of the operation and well-nigh useless as ground-support has been removed, as it was considered that the presence of these piles of decaying timber constituted a fire risk, although quite evidently a remote one. All shiftbosses carry a report-book while making their rounds and note the condition of the workings as they proceed with their inspection.

Each underground or surface employee receives a copy of the "Sullivan Mine Safety First Bulletin," edited by the safety engineer and published every six months. This publication contains a summary of the accident statistics compiled during the two preceding semi-annual periods, besides comments on their significance and appropriate recommendations. It is interesting to note that, notwithstanding the fact that the past year has seen a remarkable decrease in the number and gravity of the accidents recorded, as compared with 1931, the last issue of the "Safety Bulletin" called attention to the fact that 75 per cent. of the accidents having occurred in the course of the preceding twelve months belonged to the avoidable class, and asked all those concerned to join in a determined effort to reduce this ratio during 1933.

The satisfactory results obtained during the year in the matter of safety are evidently due to several factors, among which we must recognize the unflagging energy with which the official staff tried to eliminate possible causes of accidents, the painstaking search for possible improvements carried on by the committees organized in 1931, the hearty co-operation of the workmen, and the general use of such protective accessories as hard-boiled hats, hard-toed boots, goggles, and gloves.

Ambulance classes were held during the present winter with an attendance of 170, of whom 125 were taking the first-year course, the others receiving instruction in second-, third-, and fourth-year work.

Living Accommodation and Welfare-work.—This subject has been treated at length in some previous reports, and it may suffice to say that a visit to the living-quarters maintained by the company, the residential section of MacDougall's camp, the recreation-hall, or the hospital would convince even the most critically minded observer that a lively interest is taken by the management in the welfare of the employees and that nothing that could be reasonably expected in this line has been overlooked.

All men employed underground and in the rock-house are to be examined for incipient silicosis. As this entails the taking of radiographs of the lungs, it is a rather slow and somewhat expensive process, but good progress was being made with it at the beginning of the present year.

For the benefit of university graduates at present employed at the mine in various capacities, classes in structural geology and prospecting are held by Dr. Jure and Mr. Hings respectively. This opportunity to enlarge their knowledge of these two important subjects seems to be highly appreciated by those qualified to take advantage of it.

Conclusion.—From the foregoing it will be seen that the year 1932 has been marked by a long step forward in the progress towards safety at the *Sullivan* mine, and also that still better results may be confidently expected in the future. Various reasons to which the improvement observed during the past twelve months is to be attributed have already been outlined in this report, and only one remains to be mentioned, perhaps the most important of them, the spirit animating the entire organization, without which all the other factors detailed would have remained ineffective or would never have come into existence. Once again the writer finds it his pleasant duty to thank the officials for their progressive attitude and for the friendly manner in which all suggestions conveying the slightest hint of a possible improvement are always received. The workmen are to be congratulated over the intelligent understanding of matters pertaining to safety that they have displayed, undoubtedly one of the most important among the factors responsible for the lowering of the accident-rate during the past year.

PHOSPHATE-MINES.

No work of importance was done on the phosphate properties of the Consolidated Mining and Smelting Company during the year, but the study of the geological features of the phosphate-bearing section of the district and of the nature of the deposit at various points was continued, as long as weather conditions remained favourable, by two of the company's engineers, L. Telfer and C. White.

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.

The tables showing coal production and men employed in collieries are shown on pages 230 and 231.

VANCOUVER ISLAND INSPECTION DISTRICT.

GEO. O'BRIEN AND THOS. R. JACKSON, INSPECTORS.

The Canadian Collieries (Dunsmuir), Limited, operated Nos. 4 and 5 mines, Comox Colliery; Nos. 9 and 10, or New Prospect, Wellington Extension Colliery; and No. 5 and Alexandra mines, South Wellington.

The Western Fuel Corporation of Canada, Limited, operated its No. 1 mine, Nanaimo Colliery.

The Granby Consolidated Mining, Smelting, and Power Company, Limited, operated the Nos. 1 and 2 mines, Granby Colliery, Cassidy. This operation was abandoned in September.

Lantzville Colliery Company operated its No. 1 mine at Nanoose.

Fiddick mine was operated at South Wellington.

Richardson mine was operated at South Wellington.

Biggs' mine was operated at Wellington.

Jingle Pot mine was operated at Wellington.

Chilton's Prospect was operated at South Wellington.

Cowie's Prospect was operated at South Wellington.

NORTHERN INSPECTION DISTRICT.

CHARLES GRAHAM, INSPECTOR.

Bulkley Valley Colliery, Limited, operated the Bulkley Valley mine.

Lake Kathlyn Anthracite Coal Company operated at Smithers.

NICOLA-PRINCETON INSPECTION DISTRICT.

JOHN G. BIGGS, INSPECTOR (HEADQUARTERS, PRINCETON).

The Middlesboro Collieries, Limited, operated Nos. 2 and 3 North, No. 2 South, No. 2 East, and Prospect mines, Middlesboro Colliery, Merritt.

The Coalmont Collieries, Limited, operated Nos. 3, 4, and 5 mines, Coalmont Colliery, Blakeburn.

The Tulameen Valley Coal Mines, Limited, operated at Princeton.

The Blue Flame Collieries, Limited, operated its No. 1 mine (formerly Lynden Coal Company, Limited).

The Pleasant Valley Coal Mining Company operated its Nos. 1 and 2 mines, Princeton.

Bromley Vale Colliery (formerly King Colliery) operated No. 1 mine, Princeton.

North Thompson Coal Company, Limited, operated at Chu Chua.

Red Triangle Coal Company, Limited, operated at Princeton.

Sunshine Coal Company operated at Merritt.

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 and the Prospect, Coal Creek Collieries (Nos. 1 South, 2, 9, and Prospect mines were abandoned at the end of the year); No. 3, Nos. 1 and 3 East, and No. 8 mines, Michel Colliery.

The Corbin Coals, Limited, operated Nos. 3, 4, and 6 mines, Corbin Colliery.

VANCOUVER ISLAND INSPECTION DISTRICT.

REPORT BY GEO. O'BRIEN, INSPECTOR.

Western Fuel Corporation of Canada, Ltd.

Head Office—Nanaimo, B.C.

F. Perry, President, Montreal, Que.; Lieut.-Col. C. W. Villiers, Vice-President, Nanaimo, B.C.; P. S. Fagan, Secretary-Treasurer, Nanaimo, B.C.; John Hunt, General Manager, Nanaimo, B.C.

The only producing mine operated by this company during 1932 was the Nanaimo Colliery; the Reserve mine was kept dewatered throughout the year, but apparently market conditions did not warrant production.

NANAIMO COLLIERY.

Arthur Newbury, Mine Manager; A. W. Courtney, Overman, North Side;
John Sutherland, Overman, South Side.

A detailed description of the power-installation, washery plant, and equipment has been given in previous Annual Reports. No additions were made during the year.

No. 1 mine was in operation 205 days during 1932 and the average daily output was 1,630 tons. This output is produced from the North and South sides of the mine, with the proportion about evenly divided. The average number of men of all classes employed underground daily is approximately 700 for the twenty-four-hour period. The sizes of coal as prepared for the market are lump, nut, pea, and slack. The steam-coal size is plus 2 inches; domestic blended is plus 3 inches; domestic Douglas is plus 3 inches; No. 1 nut is plus 1½ to 2 inches; No. 2 nut is plus 1 to 1½ inches; pea is plus ¼ to 1 inch; slack coal washed is minus ¼ inch. There are occasions when customers desire a mixture of the various sizes for steam-coal and this is specially prepared for them.

Both the Douglas and Newcastle seams are operated. Practically the whole of the workings are submarine, having an average cover of about 450 feet.

In the Newcastle seam the entire operation on both sides of the mine are worked on the long-wall system, with faces averaging 300 feet long. Pan-conveyors operated by compressed air are used on these faces and are very efficient. All undercutting is done by coal-cutting machines, the average depth of cut being about 6 feet. There are twenty-five coal-cutting machines in use in the mine, all operated by compressed air except one, which is operated by electricity. Direct current of 250 volts is used on this machine.

The Douglas seam operations are chiefly extraction of pillars. There are a few small sections in the South side of the mine where some solid work is being done on the long-wall system. Pan-conveyors and machine-undercutting are standard practice in these sections. The haulage system underground is divided into two parts, animal and mechanical. In both the pumping and the mechanical haulage systems steam, compressed air, and electricity are used.

Ventilation of the underground workings is achieved by means of two fans, one situated at Protection shaft and the other at No. 2 shaft. There is a third fan at No. 2 shaft held ready for immediate use in case of emergency. There are three separate means of ingress and egress from the underground workings.

During 1932 a new travelling-road was constructed from the bottom of Protection shaft to the Puyallup Slope workings, which decreased the distance to be travelled underground by the workmen in this section of the mine by nearly 2 miles. Practically all the workmen are now transported by ferry across the bay to Protection island, where they descend Protection shaft.

There are thirty-nine underground certificated mine officials of all classes, or one mine official for every eighteen workmen and for every 40 tons of coal produced.

Every effort appears to be made to keep the accident-rate down to the minimum, but in spite of all efforts accidents are occasionally occurring. During 1932 one fatal accident and four serious non-fatal accidents were reported from this colliery. The fatal accident and one of the non-fatal accidents were caused by mine-cars and haulage; two of the non-fatal accidents were caused by falls of rock at the working-face. The other was caused by a wooden roller falling down No. 1 shaft and striking a workman that was employed at the shaft-bottom. Investigation of these accidents disclosed that some of them at least might have been avoided

had a little better judgment been used by the workmen themselves. A feature of several of the accidents was that they occurred directly after a period of idle time, indicating that greater alertness is necessary after the mine has been idle for some days. Several sections of the mine were permanently abandoned during 1932. This was chiefly because all the commercial coal had been recovered in these sections. This, however, did not cause any decrease in output, but rather an increase, as the workings are now more concentrated than formerly and additional sections are being developed to replace the abandoned sections.

Ventilation was found to be generally good at all times and very little explosive gas or gas-caps were found. Precautions against coal-dust were continued by the application of lime-rock dust to all suspected areas.

Regular inspections were made monthly by the workmen's "gas committee," and at no time during 1932 were any reports of danger, or apprehended danger, made by this committee.

Report-books as required by the "Coal-mines Regulation Act" are kept at the mine and were regularly examined by me. Sampling of mine-air and mine-dust was regularly carried out.

On the whole, general working conditions with regard to safety at this colliery were found to be fairly satisfactory throughout the year.

Canadian Collieries (Dunsmuir), Ltd.

WELLINGTON EXTENSION MINES.

This division of the Canadian Collieries (Dunsmuir), Limited, mining properties comprises No. 5 mine and the Alexandra mine, South Wellington, and No. 9 mine, Old Wellington.

WELLINGTON EXTENSION, No. 5 AND ALEXANDRA MINES, SOUTH WELLINGTON COLLIERY.

Wm. Wilson, Mine Manager; Joseph Wilson, Overman.

This colliery is situated in the Cranberry district, near South Wellington. Most of the output is shipped to the loading-wharves at Nanaimo. A small tonnage goes by rail to the Ladysmith wharves for the use of steam-tugs, and some is shipped by rail to the C.P.R. ferry-slip at Ladysmith and transported by barges to the mainland.

No. 5 mine and the Alexandra mine are connected. They are ventilated by the same fan and supervised by the same officials. These mines, in the Douglas seam, were completely closed down during May, June, and July. Pumping operations and repair-work were carried on, however, and the mines were in good condition when reopened on August 1st. Work has been continued steadily since that time.

The South Wellington Colliery was worked during 174 days in 1932 and the average daily output was 600 tons. The average number of men employed daily was 225. There are eleven certificated mine officials underground, or one mine official for every twenty men and for every 55 tons of coal produced.

During 1932 ventilation of both mines was kept up to a fairly high standard. Explosive gas and gas-caps were found occasionally, but not in large quantities. In most cases the accumulations were caused by some disarrangement of the ventilation, which was quickly remedied. Both mines are naturally damp and there are no accumulations of dangerous coal-dust. On December 28th spontaneous combustion was discovered in a caved roadway in No. 1 Incline Pillar section in No. 5 mine, where the Douglas seam is about 20 feet thick. Immediate steps were taken to load the heated coal out of the area affected and some 200 tons was removed. The combustion was successfully overcome and no damage done.

Only one serious non-fatal accident was reported from this colliery during 1932; this was caused by mine-cars and haulage.

No. 9 MINE, OLD WELLINGTON.

This mine was closed down indefinitely on February 16th, 1932, due to the coal-trade depression, and remained closed for the rest of the year.

Lantzville Collieries, Ltd.**No. 1 MINE, LANTZVILLE.**

Arthur Challoner, Overman.

This mine is situated on Nanoose bay, about 9 miles north of Nanaimo. The Upper Wellington seam is worked and is found to be of excellent quality. The seam averages about 22 inches in thickness and is worked on a semi-longwall system. Work was done on 248 days in 1932. Only a small daily tonnage, however, is produced, the output for the year being, approximately, 4,300 tons.

Ventilation generally was fairly good throughout the year, but I found explosive gas and gas-caps several times in the working-places in small quantities. Roadways and working-places were well timbered and maintained in a safe condition. The mine is very damp and there are no accumulations of dangerous coal-dust. The general and special rules are fairly well complied with and every effort appears to be made to keep the accident-rate down to the minimum. No accidents were reported from this colliery during 1932.

FIDDICK MINE, SOUTH WELLINGTON.

Richard Fiddick, Jr., Operator; Wm. Roper, Overman.

This mine is on the site formerly occupied by the Pacific Coast Coal Company near South Wellington. The present operation consists entirely of recovering pillars that were left in by the former operators. The seam is the Douglas seam and is of excellent quality. The daily output is small and most of it is sold locally, though a small percentage goes to the mainland.

Ventilation is by natural means and no explosive gas or gas-caps were found during 1932. Roadways and working-places were well timbered and maintained in a safe working condition. The mine is very damp and there are no accumulations of dangerous coal-dust.

A new prospect in the Douglas seam was opened on the opposite side of the valley during the year, which is expected to give good results in the coming year. No accidents were reported from this mine during 1932.

RIGGS' MINE, WELLINGTON.

James Biggs, Operator; J. W. Sanders, Fireboss.

This mine is situated about a mile from Wellington, on the site formerly occupied by the Dunsmuir interests many years ago. Present operations consist entirely of recovering the outcrop pillars that were left in by former operators. The seam is the Wellington seam and is of excellent quality. The output is small and is sold locally.

Ventilation, partly natural and partly mechanical, was good throughout the year and no explosive gas or gas-caps were found. Roadways and working-places were well timbered and maintained in a safe working condition. The mine is very wet during the rainy season and considerable trouble is caused from surface-water seepage flooding the roadways. The mine was closed down during part of the month of November and the whole of December as a result of the extremely heavy rainfall. No accidents were reported from this mine during 1932.

JINGLE POT MINE, EAST WELLINGTON.

Robert B. Sinclair, Operator; Alex. McLaughlin, Overman.

This mine is situated on the original Jingle Pot mining property at East Wellington, about 3 miles from Nanaimo. The present operations consist of recovering the outcrop pillars left in by the former operators. The seam is the Wellington seam and is of good quality but friable.

The old Jingle Pot slope was partly reopened and repaired and is now used as the main haulage-slope. The output is small and is sold partly locally and partly on the mainland. It is shipped by scow from Nanaimo.

Ventilation is by natural means and no explosive gas or gas-caps were found during 1932. Roadways and working-places were fairly well timbered and maintained in a safe working

condition. The mine is naturally damp and there are no dangerous accumulations of coal-dust. No accidents were reported from this mine during 1932.

RICHARDSON BROS.' MINE, SOUTH WELLINGTON.

Richardson Bros., Operators; Hugh M. Davidson, Overman.

This mine is situated on the site formerly occupied by the Pacific Coast Coal Company near South Wellington. Present operations consist entirely of recovering the pillars left in by the former operators. The seam is the Douglas seam and is of excellent quality, but fairly friable. The output is small and is sold partly locally and partly on the mainland. It is shipped in railway-cars by barge from Ladysmith.

Ventilation is by natural means and no explosive gas or gas-caps were found during the period of operation. Roadways and working-places are well timbered and maintained in a safe working condition. The mine is naturally damp and there are no dangerous accumulations of coal-dust. The mine was closed down for the first ten months of the year and was reopened on November 1st under new management. It appears to be doing very well for a small operation and work is carried on steadily. No accidents were reported from this mine during 1932.

CHILTON'S PROSPECT MINE, SOUTH WELLINGTON.

Chilton and Associates, Operators.

Prospecting for the Douglas and Wellington seams was carried on for several months during the year by George Chilton and associates in the area between Extension and South Wellington in the Cranberry district. A 10- by 6-foot slope was driven a distance of 220 feet on the full pitch of the coal-measures at an angle of about 10° from the horizontal. The measures driven through were chiefly fireclay shales with a conglomerate roof and sandy-shale floor. At the face of the slope a drill-hole was put down and Mr. Chilton informed me that he struck the coal in the Douglas seam at a distance of 17 feet vertically below the floor of the slope. Work ceased at the end of September, but the owners expect to resume operations in the spring of 1933.

COWIE'S PROSPECT MINE, SOUTH WELLINGTON.

Cowie and Associates, Operators.

Work is here carried on in the same field as at the Chilton prospect, but under a separate lease. Several short tunnels and slopes were driven, but the coal-seam has not yet been reached. The owners continue prospecting in hopes of coming upon the seam.

This covers in a general way the active operations in this district for 1932. I made regular inspections of all report-books kept at the various mines in my district during the year and found that the "Coal-mines Regulation Act" and special rules are very well complied with. Copies of the general and special rules are posted at all the larger mines and every effort appears to be made to see that they are carried out.

All workmen underground in this district are supplied with electric cap-lamps of the Edison and Wheat types. All mine officials are supplied with Wolf flame safety-lamps for gas-testing. All blasting operations are carried out under the supervision of certificated mine officials, electric shot-firing batteries and cables being used for this purpose. Permitted explosives only are used. Regular sampling of mine-air and mine-dust was carried out during the year. Analyses of the various samples proved that they were well within the requirements of the "Coal-mines Regulation Act."

All accidents reported to this office were investigated and in the case of fatal accidents the inquests were attended. I wish to express my appreciation and thanks to the Coroner for the courtesy extended in being permitted to question all witnesses at inquests. I also wish to thank the mine officials and workmen generally for their co-operation in the attempt to further the interests of safety in coal-mining, in which we were fairly successful during 1932.

REPORT BY THOMAS R. JACKSON, INSPECTOR.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

F. Perry, President, Montreal, Que.; Lieut.-Col. C. W. Villiers, Vice-President, Nanaimo, B.C.; H. S. Adlington, Secretary-Treasurer, Montreal, Que.; P. S. Fagan, Assistant Secretary, Nanaimo, B.C.; John Hunt, General Superintendent, Nanaimo, B.C.

This division of the Canadian Collieries (Dunsmuir), Limited, comprises the Comox Colliery, Nos. 4, 5, and 6 mines and Scott slope, situated in the vicinity of Cumberland.

COMOX COLLIERIES.

Nos. 4 and 5 mines and the Scott slope were worked during 1932. The Scott slope is an opening to work a new area of No. 4 mine and is about a mile from the portal of the older mine. The slope was worked for the greater part of the year, following which most of the men employed were transferred to No. 5 mine.

The hydro-electric plant of this company has been in constant operation. Sufficient electricity is generated 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.

John S. Williams, Manager.

For description of power plant, ventilating apparatus, haulage-engine, etc., see previous Annual Reports.

The extraction of pillars continues in No. 1 and No. 2 slopes and is confined chiefly to the lower end of the slopes, where the slope pillars are being removed. It is the intention to extract these pillars to a point sufficiently far up the slopes to permit the water in the old workings to reach the main pumping-station, situated on No. 2 slope just below No. 6 East level. A new pump-house has been constructed for the larger electrical pumping installation and is equipped with all the safety appliances required by law.

The number of men employed at this mine was considerably reduced in the last quarter; consequently the output fell from 1,000 tons to 300 tons per day. Most of the workmen were transferred to No. 5 Comox mine, which had not been worked, and by the end of December No. 5 mine was producing about 750 tons per day.

One fatal and five serious accidents occurred in these mines during 1932.

Electric head-lights of the Edison "H" storage-battery type are used by the workmen and flame safety-lamps of the Wolf type are used by the firebosses for gas-testing purposes.

First-aid equipment is kept underground at handy places. The main station is situated just outside the portal of No. 4 mine.

During the last inspection in December the mine was found to be free from gas that could be detected by means of the safety-lamp, and analyses of air samples showed less than 0.2 per cent. of methane passing in the main return airways. Ventilation measurements showed 31,000 cubic feet of air passing per minute in No. 1 slope and 54,000 cubic feet per minute in No. 2 slope. The slopes are worked three shifts per day, with thirty men on each shift.

Gas committee reports covering conditions in the Scott slope and Nos. 1 and 2 slopes of No. 4 Comox mines have been received at this office every month; these reports were generally of a satisfactory nature.

Analyses of dust samples taken throughout the year show that the roadways comply with the regulations *re* coal-dust.

No. 5 MINE.

Thomas W. Scott, Superintendent; Robert Laird, Manager; Samuel Jones, Overman.

This mine was not worked until September. A gang of men employed in the Scott slope was then transferred to the underground workings of No. 5 mine to clean up, timber, repair, and generally put the mine in condition for the production of coal. The Middle seam is being worked. The Upper seam is pretty well worked out and the Lower seam has not been extensively exploited.

The mine commenced producing coal in October and at the end of December was producing 750 tons per day. About 600 tons of this production is obtained from the long-wall section, which is now about 2,250 feet in length.

Three electrical coal-cutters are in use. Two of these are Anderson and Boyce machines and one Sullivan type; the former type is preferred. The voltage used is 440 and the current is carried from the armoured cables to the machines by "cab-tire" trailing cables. Machines and cables are of the approved type for mine use. Undercutting is chiefly done in the band of rock next the floor. From these cuttings there is produced a rock-dust that materially assists in nullifying the coal-dust danger.

Permitted explosives are used in blasting under the supervision of certificated firebosses and only certificated miners are employed on the face-line. Machinemen and machine-helpers are required to possess a miner's certificate also.

Height for roadways is generally taken out of the floor, though roof-brushing is done as well. The roof runs from fair to good on the face-line and is easily supported by means of post and cap-piece. Sets of timber are made use of where necessary on main and side roadways.

Electric head-lights of the Edison "H" storage-battery type are used by the workmen and flame safety-lamps of the Wolf type are used by the firebosses for gas-testing purposes. First-aid equipment is kept underground in suitable places.

On account of the length (4,000 feet) and grade of the slope, a man-trip with safety-car attached was arranged to enable the workmen to ride to the top of the slope at the completion of each shift.

The seam produces methane gas even when the mine is idle. Mine-air sample tests taken during the first nine months of the year show by analysis a methane content of from 0.5 to 1.25 per cent. in the return airways; these consist of West side split, East side split, and main return. The sampling was done at least 4,000 feet from the shaft-bottom.

At the present time the mine is well ventilated with two separate splits and a third is being formed, but this is not sufficient to dilute the methane given off under all conditions that occur. A slight fall in the atmospheric pressure is reflected by an immediate increase in the methane content of the air, while the undercutting of coal also produced an increased percentage of gas while cutting is being done. Present indications are that electrical coal-cutters will be prohibited at an early date unless the methane-outflow lessens. The electric-driven coal-cutters may be replaced by machines driven by compressed air. There are at present two Sullivan and one Gardner-Denver air-compressors in use underground, situated nearly a mile from the shaft.

Some seventy air samples were taken in this mine during the year, in addition to numerous tests by means of the Burrell methane-detector and the flame safety-lamp.

All the roadways in this mine have been liberally treated with lime-dust and comply with the regulations. Reports by the miners' inspection committee have been of a satisfactory nature.

On December 17th a sudden inflow of methane was produced in the vicinity of a fault in the Main slope section, but this emergency was dealt with without accident.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.

Head Office—Vancouver, B.C.

Chas. Bocking, President. Vancouver, B.C.; L. R. Thomas, Assistant Treasurer, Vancouver, B.C.; Robert Henderson, Superintendent. Cassidy, B.C.; Fritz John, Overman.

This mine was closed in September, 1932, having been worked on 152 days during the nine months it was in production.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

The following were the coal companies operating in this district during 1932: Coalmont Collieries, Limited; Middlesboro Collieries, Limited; Tulameen Coal Mines, Limited; Pleasant Valley Mining Company, Limited; Blue Flame Collieries, Limited; Sunshine Coal Company; Bromley Vale Collieries, Limited; Red Triangle Coal Company; North Thompson Coal Com-

pany; and Normandale Coal Company. Bromley Vale Coal Company, Limited, Red Triangle Company, North Thompson Coal Company, and Normandale Coal Company commenced operations during the present year. Coalmont Collieries, Limited, and Middlesboro Collieries, Limited, chiefly cater to the railway trade, while the mines in the Princeton field rely on the domestic trade.

Prospecting for coal in the Princeton field has been actively carried on during 1932 and may result in the development of further mines. Those at present producing, however, have a capacity much beyond the demand. All the mines in this district lost considerable working-time due to lack of orders.

ACCIDENTS.

Two fatal accidents and six others of a serious nature were reported during 1932. Five of these happened underground at the Coalmont Collieries, two underground at the Blue Flame Collieries, and one underground at the Tulameen Coal Mines, Limited.

LABOUR TROUBLES.

During November labour trouble developed at the mines in the immediate vicinity of Princeton, which resulted in a strike at the Tulameen Coal Mines, Limited, and the Pleasant Valley Coal Mines, Limited, on December 1st. The Tulameen mine was idle for about two weeks, when work was resumed, but the mines of the Pleasant Valley Mining Company were still idle at the end of the year. Work was resumed in No. 2 mine of this company in January, 1933.

DANGEROUS OCCURRENCES.

Three serious cases of spontaneous combustion occurred in the lower part of No. 4 mine, Coalmont Collieries, Limited, during 1932, and the last outbreak, in November, was sufficiently serious to require the sealing-off, and later flooding, of the entire lower part of this mine.

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-mining operation in the district, and three separate mines in the same seam are being worked. The mines are known as Nos. 3, 4, and 5 and are connected on the surface by an electric railway which transports the coal to an aerial-tram station. It is shipped on the tram to Coalmont, on the Kettle Valley Railway, some 3½ miles from and 1,600 feet below the tram-station.

No. 3 MINE.

The portal of this mine is on the same elevation as, and 1,000 feet north of, the upper terminal of the aerial tram and is the oldest work by the company. It was developed by a 8 by 12 well-timbered adit-level following the strike of the seam, a "barrier-pillar" being left between this mine and the old No. 2 mine, which operated in the same seam of coal.

All the work consists of extraction of "pillars" in close proximity to the main haulage-level.

The coal is from 8 to 12 feet in thickness and somewhat friable, so that a very small amount of explosive is used; the measures are weak and specially close timbering is required in all workings.

Ventilation is produced by a 5-foot "booster" fan, belt-driven by a 30-horse-power induction-motor situated near the entrance to the counter-level. During my last visit of inspection ventilation measurements showed 13,000 cubic feet of air per minute passing into this mine for the use of sixteen men. The air was fairly well conducted around the working-faces, the brattice and stoppings being in good order.

Working-places were well timbered and sufficient timber was provided for the use of the miners. Roads were well timbered, in fairly good condition, and well treated with inert dust. Analysis of material taken from these roads proved them to fill the requirements of the Coal-dust Regulations. During 1932 no trace of methane was reported in this mine.

No. 4 MINE.

Harry E. Hopkins, Overman.

This is the largest and most important working of the Coalmont Collieries, Limited. It is situated 5,400 feet north of the entrance to the No. 3 mine. The main entrance is a 7- by 10-foot rock tunnel cutting across the measures for about 1,600 feet, at which point it intersects the original Main slope driven from the outcrop.

The main seam of coal in the Coalmont area is one of a series in a thickness of approximately 120 feet, and practically all the production to date has been from this seam. A tunnel has been driven from No. 8 West level into one of the lower seams and considerable development carried out during the latter part of the year; this lower seam has a thickness of 9 feet of clean coal of good quality. At the end of the year most of the production was coming from this new seam.

Ventilation is maintained by an 84-inch double-inlet belt-driven Sirocco reversible fan operated by a 75-horse-power constant-speed motor situated near the entrance to the counter-slope. During my last visit ventilation measurements showed 23,000 cubic feet of air a minute passing into this mine for the use of fourteen men. The brattice and stoppings were found to be in good condition and the mine free from any trace of methane. The working-places were well timbered and sufficient timber was provided. The roads were well timbered, in good condition, and well treated with inert dust. Analyses of material taken from these roads proved that they conformed with the requirements of the Coal-dust Regulations.

No. 5 MINE.

Wilfred Valentine, Fireboss.

No. 5 mine is a new development by the Coalmont Collieries, Limited. It is situated 2,800 feet north and at an elevation of 1,000 feet above the entrance to No. 4 mine. A considerable amount of development-work has been carried on in opening this new area; the Main and Counter slopes are down 1,000 feet on a pitch of approximately 18°; very little lateral work has been done, as it is proposed to drive the slopes to a predetermined distance and to recover the coal when retreating.

The mine is operating in the same seam of coal as the Nos. 3 and 4 mines, the measures being generally of a friable nature and requiring heavy timbering. Ventilation at present is fairly good and is produced naturally. No trace of methane has been found in this mine during 1932. The mine is well timbered and the roads, being naturally wet, are free from dangerous coal-dust. Five men are employed per shift in this mine.

All the coal at the Coalmont Collieries is mined by hand. Edison electric head-lamps are used by the employees underground and flame safety-lamps of the Wolf type are used by the officials for inspection purposes. Blasting is done under the supervision of certificated officials appointed for this purpose and shots fired by means of electric detonators. A first-aid room is maintained with a qualified first-aid man in constant attendance and a medical officer is in residence at the mines. The mine-rescue station is equipped with five sets of Gibbs 2-hour oxygen apparatus, and all-service gas-masks: these with the necessary supplies are ready for any emergency.

Middlesboro Collieries, Ltd.

E. W. Hamber, President, Vancouver, B.C.; Thos. Sanderson, Secretary, Vancouver, B.C.; Robert Fairfoull, Superintendent, Merritt, B.C.; James Fairfoull and Alex. Allen, Overmen; Thomas Rowbottom, Garnet S. Corbett, and Richard Dunnigan, Firebosses.

This colliery is situated in the Nicola valley, 1 mile west of Merritt. It was worked during the whole year. The mine railway connects with the Kettle Valley Railway by a spur about 1 mile in length.

At present there are two mines operating, known as the No. 2 South and No. 3 North. These mines are situated 300 feet above and 2,000 to 3,000 feet south of the mine-tipple, to which the coal is delivered by a surface incline. No new developments took place at this colliery. No. 2 South mine was the most important, all underground work being toward development of

the area, while in No. 3 North mine underground work consisted of the extraction of pillars and retreating towards the portal. No. 3 North was abandoned early in the year.

The coal-seams generally are highly inclined and are undercut by machines of the post-puncher type, while the use of explosives is curtailed as much as possible. Permitted electric head-lamps are used by all employees underground, except that flame safety-lamps of the Wolf type are used by the officials for inspection purposes. Samples of dust have been taken at these mines each month during the present year and analyses have shown them to conform with the requirements of the Coal-dust Regulations. The employees underground have availed themselves of the provisions of General Rule 37 and have appointed a "mine committee" to make an inspection of these mines each month, and in all cases these reports have been favourable regarding the conditions of these mines. Copies of the "Coal-mines Regulation Act" and special rules are also well posted at these mines.

The ventilation in both mines is produced naturally owing to the difference in elevation between the portals and the higher outcrop openings, and during my inspection in December there was 12,000 cubic feet of air a minute passing through No. 2 South mine for the use of forty men and 1,000 cubic feet of air a minute passing through No. 3 North mine for the use of sixteen men. Air was well conducted around the working-faces and no gas was found during the year. The working-places were well timbered and roadways in fairly good condition.

No serious accidents were reported at this colliery during 1932.

Tulameen Coal Mines, Ltd.

R. Dixon, Managing Director, Vancouver, B.C.; A. B. Barclay, Secretary, Vancouver, B.C.;
John Bennett, Superintendent, Princeton, B.C.

No. 2 MINE.

William Westnedge, Underground Manager; William Strang, Overman; Robert Gourley, David Francis, James Simm, Frank Lester, and Thomas Dobie, Firebosses.

This mine lies 2 miles west of Princeton and is connected with the Kettle Valley Railway over a half-mile spur. Operations are being carried on in what is known as the No. 1 seam of the Princeton area, and, while the total thickness of the seam is about 24 feet, the lower section is intersected by bands of shale, fireclay, and bone, with the result that work is confined to the upper section of the seam, which is thick and of good quality.

The seam is reached by a 500-foot slope driven on a pitch of 20°, while the counter-slope rises at a steeper pitch. The strike of the seam was followed some 1,700 feet from the foot of the slope, and slopes were driven from this level to the dip for 1,000 feet, while the ground on the upper side of the level has also been developed for several hundred feet; pillar-extraction on the lower part of the mine had started at the end of the year. The coal is undercut by puncher machines and the use of explosive limited as much as possible.

During the last visit of inspection to this mine ventilation measured showed 12,550 cubic feet of air a minute passing through for the use of forty-two men. There was a slight gas-cap showing at one of the working-faces and the rest was clear of any trace of gas; the brattice and stoppings being in fairly good order.

Working-places were well timbered, sufficient suitable timber being provided for this use. The roads were well timbered, in fairly good condition, and, being naturally wet, were free from dangerous coal-dust. Approved Edison electric head-lamps are used by all the employees underground, except that safety-lamps of the Wolf type are used by the officials for inspection purposes.

Little, if any, change has been made in the power plant during 1932. The plant consists of three return-type tubular boilers. The larger section is used in the operation of air-compressors having a capacity of about 2,500 feet of free air a minute, all of which is used underground for the operation of the mine-pumps, mining-machines, and hoists. This mine is equipped with a modern screening and cleaning plant at the surface, located in close proximity to the entrance to the Main slope.

Labour trouble developed during December, with the result that some working-time was lost. Operations were, however, resumed at the end of 1932.

Pleasant Valley Mining Co., Ltd.

W. R. Wilson, President, Vancouver, B.C.; R. R. Wilson, Vice-President, Victoria, B.C.; Miss Margaret Duncan, Secretary-Treasurer, Vancouver, B.C.; Thomas Cunliffe, Superintendent, Princeton, B.C.

Nos. 1 AND 2 MINES.

John Gillham and William Harmison, Firebosses.

This colliery is situated 2 miles west of Princeton, on the south side of the Tulameen river and in close proximity to the Kettle Valley Railway, with which it is connected. The mine-tipple, power plant, and the general surface equipment are of the most modern type. Work has been of an intermittent nature during 1932. In December some labour trouble developed, causing the suspension of work, and the mines were idle at the end of the year. The coal is all undercut by puncher machines and a very small amount of explosive is used in the coal.

The entrance to the No. 1 mine is situated 900 feet east of the tipple. It was developed by a pair of adit-drifts cutting across the measures, where No. 1 seam was encountered 700 feet from the portal. Levels have been driven 2,000 feet from the strike of the seam and five sets of inclines driven from the level towards the outcrop. Two of the inclines have now reached the surface after being driven 900 feet on a pitch of 20°. Some pillars have been extracted from these incline-workings.

The coal is brought down the inclines by air-driven Meco conveyors, which discharge into the mine-cars on the Main level. Owing to the difference in elevation between the main haulage-level and the surface croppings, ventilation is at present produced naturally. During my last visit of inspection ventilation was found to be good, the mine free from any trace of gas, the brattice and stoppings in good order, the working-places well timbered, and sufficient timber provided for the use of the miners. The roads were also well timbered, in good condition, and, being naturally wet, were free from dangerous coal-dust.

No. 2 mine is situated 1,700 feet west of the mine-tipple and is driven in the same seam of coal as the Tulameen mine on the opposite side of the river. It is known as the No. 1 seam of the Princeton district and at present is being developed by the No. 1 West levels from the surface croppings, following the strike of the seam, heading into the mountain, and reaching a distance of some 1,200 feet from the portal. At the end of the year these levels had 6 feet of clean coal showing at the faces.

Ventilation is produced by a 4-foot belt-driven enclosed-type fan situated at the portal of the counter-slope and operated by a compressed-air engine. During my last visit of inspection ventilation was found to be fairly good, the mine free from any trace of gas, and the brattice and stoppings in good order. The working-places were well timbered and sufficient suitable timber provided for the purpose. Roads were also well timbered, in good condition, and an analysis of material taken from these showed them to conform with the requirements of the Coal-dust Regulations.

Blue Flame Collieries, Ltd.

Lester Ecker, Managing Director, 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.

This mine is situated 10 miles west of Princeton and is reached by following the Hope-Princeton highway a distance of about 9 miles. Here a private road follows the right bank of Lamont creek a further distance of 1 mile to the mine; the coal is hauled from the mine-bunkers to the Kettle Valley Railway near Princeton. A new slope was commenced at a point some 400 feet from the portal of the mine and has been continued a distance of 500 feet, while a fair amount of lateral work has been done on each side of the slope.

Ventilation is maintained by a 4-foot, direct-driven, high-speed fan of the enclosed type situated near the entrance to the counter-slope. During my last inspection ventilation measured

showed 8,000 cubic feet of air a minute passing into this mine for the use of sixteen men; the brattice and stoppings were in good condition, the air well conducted around the working-faces, and no trace of explosive gas found. Working-places and roads were well timbered, in good condition, and treated with inert dust. Sufficient suitable timber was provided for these purposes.

Edison 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. The power plant consists of a 66-inch return-tubular boiler situated near the entrance to the mine, which provides power for the Main slope hoist, fan-engine, and lighting and charging plant; while a single-stage steam-driven air-compressor, having a capacity of 500 feet of air a minute, provides power for the mining-machines and the underground pumps.

A bunk-house and dining-room is maintained where most of the employees are accommodated, and during the present year several of the employees have built their own homes. This has been followed by the erection of a one-room school for the education of the children of the employees. During my last visit of inspection twenty-six men were employed.

Bromley Vale Collieries, Ltd.

R. Haigh, President, Princeton, B.C.; P. W. Gregory, Secretary, Princeton, B.C.;

R. Haigh, Superintendent, Princeton, B.C.; Ernest Ward, Shiftboss.

This is a new mine opened during 1932. It is located on the north bank of Bromley creek, near the south boundary of Lot 385 and about 5 miles south of Princeton. An adit-tunnel follows the strike of the seam, which is pitching about 35°, and this had at the end of the year been driven 300 feet in a fairly good seam of coal, which has a thickness of 6 feet. Raises are being driven to the outcrop to provide a second exit and provide for further ventilation.

A tipple and screening plant has been built, and it is of interest to note that all this preliminary work was carried out by a small group of miners without the usual financial backing required for such development.

During my last inspection visit the mine was found to be well timbered and free from any trace of gas. Ventilation was fairly good and was produced by a force-fan situated near the entrance to the mine and operated by a gasoline-engine; the air being conducted to the working-faces by means of wood pipes. Edison electric lamps are used by the employees in the mine, all shots being fired with an electric battery by a certificated fireboss. All the work in the mine is above the adit-level and as a result no power is required at the present time; the mine, being damp, is free from dangerous coal-dust.

North Thompson Coal Co.

Sam Mottishaw, Superintendent.

This property is situated near Chu Chua, on the Canadian National Railway, 55 miles north of Kamloops, the mine being about three-quarters of a mile from the railway.

Work was carried on in a small way during the years 1920 to 1923 with little, if any, commercial success. Several small seams of coal outcrop on the property.

Mining operations are at present confined to the upper adit-level, driven 300 feet into the side-hill from the creek. Here is a long-wall face of coal about 100 feet in width. The coal is all mined by machines of the post-puncher type and hauled from a small screening plant situated near the entrance to the mine to the railway by motor-truck.

At the time of my last inspection visit four men were being employed underground. The general conditions of the mine were good and there was no trace of explosive gas. The working-face was well timbered and sufficient suitable timber was provided for the use of the miners. The mine, being naturally wet, was free from dangerous coal-dust. Edison electric head-lamps are used by the employees underground. A safety-lamp of the Wolf type is used by the officials for inspection purposes.

Red Triangle Coal Co.

M. H. Schweikert, President, Tonasket, Wash. ; J. T. Maage, Vice-President, Tonasket, Wash. ; J. L. Lewis, Secretary, Princeton, B.C. ; M. H. Schweikert, Treasurer, Tonasket, Wash. ; W. R. Foster, Superintendent, Princeton, B.C.

This company commenced work on the old United Empire property about 4 miles east of Princeton, which was worked intermittently for several years prior to 1920. The property has, I understand, been taken over under lease by the present operators from a Spokane interest.

The seams are steeply inclined and the old mine level followed the strike of the seam from the surface croppings a distance of some 1,500 feet, where a number of pillars were blocked out on the high side of this level. This seam is from 3 feet 6 inches to 4 feet in thickness, with a 4-inch rock band about 2 feet 6 inches from the floor.

As all the old roadways were found to be caved, a tunnel across the measures was begun in 1932 to reach this pillar area and to prospect the intervening ground. The old pillar area was reached at 825 feet from the portal and a 4-foot seam of inferior coal cut on the way. Work has been continued on this old pillar section over a short distance and preparations have been made for a raise on this coal-seam to the surface outcrop, situated on the side of the hill, some 250 feet in elevation.

Ventilation is produced by an enclosed-type force-fan situated near the entrance to the mine, belt-driven by a gasoline-engine, and the air is conducted to the face of the level by means of "vent-tubes." At my last visit of inspection the ventilation was found to be fair and the mine to be free from any trace of methane. There was, however, a little black-damp being given off from the old gob area. The roads were well timbered, in good condition, and, being naturally wet, were free from dangerous coal-dust. Four men were employed underground. Electric head-lights are used by the employees underground and flame safety-lamps of the Wolf type are used for the purpose of inspection. Permitted explosives are used for blasting, all shots being fired with an electric battery by a certificated person.

During November a small tippie and screening plant was constructed near the entrance to the mine, near the railway, consisting of a wire-mesh screening plant and a travelling picking-belt with small bunkers, where the coal is screened and prepared. The coal is hauled in motor-trucks to a railway loading-chute near Princeton.

NORTHERN INSPECTION DISTRICT.

REPORT BY CHARLES GRAHAM, INSPECTOR.

Bulkley Valley Colliery.

F. M. Dockrill, Operator, Telkwa, B.C. ; Asa Robinson, Fireboss, Telkwa, B.C.

During 1932 this mine has been worked almost continuously with a small crew varying from four to ten men. It is located on Goat creek, 7 miles from the railway, and coal is hauled by truck to the side-track at Telkwa. There is no power plant of any kind at the mine. The slope is down about 225 feet and a level driven to the right. All the operations are on this level, which parallels the outcrop. The mine is ventilated by natural means, frequent openings through to the surface keeping the ventilation fairly good. No explosive or inflammable gas has been detected and the mine is free from dust.

Lake Kathlyn Anthracite Coal Co., Ltd.

G. H. Heen, President, Vancouver, B.C. ; Thos. Campbell, Vice-President, Smithers, B.C. ; F. N. Ballard, Secretary-Treasurer, Smithers, B.C. ; Thos. Campbell, Superintendent, Smithers, B.C. ; Roy Wicks, Fireboss.

Work was begun early in October and considerable preparatory work has been done. Bunk-house accommodation for the employees is provided. A bunker of 160-ton capacity was erected and a chute 520 feet long built up the mountain to the tunnel-mouth at the Ballard seam. A Gardner-Denver air-compressor, capacity 165 cubic feet, driven by a 37-horse-power gasoline-

engine, was erected. The mine is about 3 miles from the railway at Lake Cathlyn, whence it is proposed to ship.

An old tunnel had been driven on the Ballard seam 65 feet, and this was continued by the present operators. A fault was struck about 100 feet in and the coal pinched out. This was gone through and coal again found. Another fault was met with at about 180 feet and the coal again pinched out. The tunnel is now in about 220 feet. Two men are now employed prospecting the fault.

EAST KOOTENAY INSPECTION DISTRICT.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

Three collieries, consisting of eleven separate mines, were operated during 1932—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. The depression has adversely affected the production of coal, this being 12 per cent. less than in 1931. The decrease is greatest in Coal Creek Colliery, where it is 40.8 per cent. Michel decrease is 12.2 per cent. Corbin, on the other hand, has increased its production almost 10 per cent. The production of coke from slack coal at both Coal Creek and Michel decreased 53.3 per cent. Coal Creek was worked only 77 days during the year, Michel 160 days, and Corbin 248 days. In September the coke-ovens attached to Coal Creek Colliery at Fernie were closed down and all coke will be produced in future from the ovens at Michel. These have a capacity greatly exceeding the present demand.

No labour trouble occurred during the year and relations between the employers and employees have been very good.

ACCIDENTS.

Twelve serious accidents, of which four were fatal, were reported and investigated during 1932. Two of the fatalities occurred in Coal Creek Colliery and two in Corbin Colliery.

Michel Colliery was entirely free from either fatal or non-fatal accidents, and this reflects great credit on the part of the workmen and the officials. By occupations the accidents occurred to: Miners, 4; drivers, 3; timbermen, 2; and firebosses, tracklayers, and contractor, one each. Falls of coal, rock, or timbers were responsible for six accidents, haulage five, and exploding detonator one.

DANGEROUS OCCURRENCES.

An outbreak of fire occurred in the outcrop coal and in a disused tunnel in No. 8 mine, Michel Colliery. This was promptly and efficiently dealt with. A case of spontaneous heating was reported from No. 4 mine, Corbin Colliery, on December 9th, and every effort is being made to isolate and control this heated area. The fire in No. 6 mine, Corbin Colliery, reported in 1930 and 1931, is still being kept very well under control.

This fire in No. 6 mine, Corbin, as mentioned in previous reports, is situated in an isolated portion of the mine, separated from the main mine by dykes or intrusive walls of shale. This area has been abandoned for a long time and is badly caved. The fire seems to have penetrated the carbonaceous-shale walls and is very difficult to reach. A very large amount of coal and shale seems to be under heat here over a large area of caved ground, and the task of dealing with it is very difficult. Every precaution is being taken to prevent it from spreading and in making the conditions safe for those engaged in the task of dealing with it.

VENTILATION.

General conditions with respect to ventilation have been very well maintained during 1932. These are dealt with in more detail in the report of Mr. MacDonald, Inspector of Mines.

The percentage of methane in the air-currents varied very much during the year, owing no doubt to the irregular working of the mines. Eighty samples of mine-air were sent to the Department of Mines at Ottawa for analysis, twenty-one being from Coal Creek Colliery, eight from Michel, and fifty-one from Corbin. A large number of the samples taken at Corbin Colliery were in the areas around the extensive fire in No. 6 mine and were taken more especially for the purpose of checking the amount of carbon monoxide given off than the methane content of

the air, as the methane did not at any time exceed 5 per cent. The carbon monoxide in the different samples varied from 0.04 to 0.43 per cent.

Despite the irregular working, the amount of explosive gas given off in No. 1 East mine, Coal Creek Colliery, continues, and, as usual, the No. 3 split shows the highest percentage—namely, 1.37 per cent. This is a slight decrease from 1931. No. 4 split shows 1 per cent. methane as in 1931, while the other two splits both show under 1 per cent.

Michel Colliery ventilation is very good and in no case is more than 1 per cent. methane indicated.

At Corbin Colliery, No. 6 mine very seldom shows over 1 per cent., but No. 4 mine shows an average of 1.2 per cent., a slight increase over 1931.

The unusual conditions existing at Corbin Colliery, such as great thick veins of coal, the method of mining by the caving system, and the existence of large areas of caved ground, impossible of inspection, make it imperative that the percentage of methane in the air-currents and accumulations of gas be kept down to the minimum.

While it is difficult to maintain roadways open in the mine owing to the friable nature of the coal, I consider that strong air-currents should be circulated. Slack air-currents and the decrepitation of the coal tend to encourage heating and eventually fires.

REGULATIONS FOR PRECAUTIONS AGAINST COAL-DUST.

Conditions with respect to this danger have been kept very well during 1932, and it is very important that this work should be kept up.

The principal method of dealing with the coal-dust hazard in this district is to distribute finely crushed lime rock, purchased from the Summit Lime Works, situated east of Crownsnest in Alberta. This dust is not only used to dilute the coal-dust, but has proved very valuable in fighting mine fires.

At Coal Creek Colliery 845 dust samples were taken, at Michel 249, and at Corbin 123; only 32 of these fell short of the requirements, 50 per cent. incombustible dust. The areas from which these latter samples were taken were immediately re-treated with rock-dust until analysis showed the requirements of the Act were complied with.

INSPECTION ON BEHALF OF THE WORKMEN.

This inspection has been made regularly at all the mines in the district every month, and is of great value in maintaining safer and healthier conditions in and around the mines.

We appreciate the interest taken by the workmen's committee in this inspection, and conditions during 1932 have been found to be very satisfactory, no complaints or unsatisfactory reports being sent to this office.

Searches for matches or other articles contrary to Rule 9, section 101, of the "Coal-mines Regulation Act" were made regularly during the year. In the two cases where men were found to have matches in their possession, one man was convicted and fined and the other dismissed.

Two prosecutions under General Rule 12 (*re* blasting) resulted in convictions and fines.

EXPLOSIVES.

At Michel and Corbin explosives are used to bring down the undermined coal; no explosives are used for this purpose at Coal Creek Colliery. At all the collieries explosives are used for blasting rocks 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 rules have been fairly well complied with, except in two cases when prosecutions resulted.

COAL-CUTTING MACHINERY.

Three coal-cutting machines were used in the district; these were of the Hardy post type, and all in Michel Colliery. Five hundred and forty-nine tons were produced by this means, while compressed-air-driven picks were used to a considerable extent in both Coal Creek and Michel mines.

MINE-RESCUE AND FIRST AID.

Classes in this work were held in each colliery during 1932 for the training of new students and to enable older students to refresh their memories and to take advanced work. The amount

of mine-rescue apparatus, all of-the self-contained breathing type, at the collieries is similar to last year, and consists of six machines at Coal Creek and Michel and five at Corbin.

First-aid rooms are maintained at all the collieries and are equipped with adequate supplies of first-aid material and pulmotors, all of which are kept in good condition.

The equipment at the Mine-rescue Station at Fernie is also similar to last year and has been maintained in good condition. Copies of all notices required under the "Coal-mines Regulation Act" and mine-plans have been kept posted at all the collieries and maintained in good condition during the year.

The seismograph which was received here early in July was set up on a prominent bed of conglomerate above the No. 2 seam at Coal Creek, and was in steady operation until almost the end of December, when it was dismantled.

The intention is to set it up in No. 1 East mine on the No. 18 East slope at the place selected earlier in the year. Mr. Miard has had supervision of the seismograph and his report will cover its operation in detail.

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. MacNeill, Vice-President, Vancouver, B.C.; J. S. Irvine, Secretary, Fernie, B.C.; A. Klauer, Treasurer, Fernie, B.C.; Robt. Bonar, Superintendent, Michel, B.C.; Bernard Caufield, Superintendent, Coal Creek, B.C.; H. P. Wilson, General Manager, Fernie, B.C.

The above company operated, during 1932, 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 connections from the colliery are 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, 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 operated during 1932 were No. 1 East, No. 1 South and Prospect, 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 was steadily engaged in repairing the main roads and airways. In the month of July it was decided to stop all operations in this mine and recover all material; this was completed and the mine permanently sealed on August 1st.

Owing to the continued depression in the coal trade, the company reached the decision that a further curtailment of operations was necessary at this colliery and orders were issued to stop Nos. 2, 1 South and Prospect. Active production of coal was suspended in these mines on September 9th and recovery of material begun. The Prospect mine was sealed at the end of October, while all material was recovered from No. 2 mine and final arrangements made for sealing on November 12th, this being delayed to permit Nos. 2 and 1 South mines being sealed together. At the moment of writing, the final touches are being put on the stoppings at the main portals of No. 1 South mine.

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. In the latter part of 1932 it was found necessary to build a new cribbing and effect considerable repairs at the approach to the tippie at No. 3 mine; owing to the great height of this cribbing, this proved to be a task of some magnitude, but I am pleased to report that it was carried through successfully.

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 close to the mines, while a fairly 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 on the conditions prevailing in the various mines throughout the year:—

No. 1 EAST MINE.

J. Caufield, Overman; E. Morrison, T. Reid, J. Maltman, E. Rutledge, and
J. Whyte, 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 175,150 cubic feet of air a minute, under a water-gauge of 3.4 inches. Ventilation is divided into four splits; the quantities passing in each at the last inspection measured as follows:—

No. 1 Split.—25,000 cubic feet of air a minute for the use of forty-two men and nine horses. Burrell gas-detector, 0.8 per cent. methane.

No. 2 Split.—24,000 cubic feet of air a minute for the use of forty-five men and six horses. Burrell gas-detector, 0.8 per cent. methane.

No. 3 Split.—24,500 cubic feet of air a minute for the use of twenty men and four horses. Burrell gas-detector, 1 per cent. methane.

No. 4 Split.—23,100 cubic feet of air a minute for the use of fifteen men and three horses. Burrell gas-detector, 0.9 per cent. methane.

North Return.—112,500 cubic feet of air a minute for the use of eighty men and thirteen horses. Safety-lamp indicated 0.8 per cent. methane.

West side of fan-shaft, 110,500 cubic feet of air a minute; east side of fan-shaft, 60,000 cubic feet of air a minute; total return air, 170,500 cubic feet of air a minute.

Although explosive gas has been found on several occasions during the course of inspection, conditions in general have been good all over the mine, considering the circumstances regarding the reduction in the number of days worked during the year. 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 regularly with crushed limestone-dust and by sprinkling systems. Three hundred and ninety-three samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but six of these being above the standard set by the above regulation.

No. 1 SOUTH MINE.

F. Landers, Overman.

No. 1 South is in 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 127,900 cubic feet of air a minute, under a water-gauge of 4.5 inches. (NOTE.—This fan ventilated Nos. 2 and 1 South mines and was operated as a single-inlet unit.)

This mine was all on one split; the quantity passing at the last inspection prior to dismantling the fan measured 19,800 cubic feet of air a minute for the use of fourteen men and five horses.

No. 2 Mine, Main Return.—110,000 cubic feet of air a minute for the use of sixty-five men and eleven horses. Safety-lamp indicated a trace of methane.

Fan-drift, Nos. 2 and 1 South Mines.—120,900 cubic feet of air a minute for the use of seventy-nine men and sixteen horses.

No explosive gas was found during any of our inspections, while the methane content in the return air-current was always under 0.5 per cent. Until September 9th this mine was operated steadily with a crew of fourteen engaged in repairing main roads and making permanent return airways for No. 2 mine, as these roadways were driven originally through the No. 1 South workings. Roadways and timbering were kept in good condition, a good supply

of timber being provided. All roadways and working-places, where required, were treated regularly with crushed limestone-dust.

Nine 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.

On the date mentioned above all regular operations were suspended and recovery of material was begun. This was completed and preparations made to erect permanent seals on the main haulage-road and High Line intake airway at the end of December. It is anticipated that these will be finished and finally sealed off in the early part of January, 1933.

No. 1 SOUTH PROSPECT.

F. Landers, Overman.

Prospecting operations were carried on steadily in this mine with a crew of nine men until September 9th, when orders were issued to stop all operations and recover the material. This was accomplished and both openings were permanently sealed in October. No explosive gas was found during the course of inspection and general conditions were good throughout the year.

No. 2 MINE.

C. McNay, Overman; J. Bushell, W. Green, and J. Halle, Firebosses.

This mine is situated on the tippie-level and operated the upper and western portion of No. 2 seam. It was ventilated by an electrically driven 11- by 7½-foot Sirocco fan, particulars of which may be found in the report dealing with No. 1 South mine. The ventilation was divided into two splits; the quantities passing in each at the last inspection prior to shutting down the fan measured as follows:—

No. 1 Split.—38,000 cubic feet of air a minute for the use of twenty-three men and four horses. Safety-lamp indicated a slight trace of methane.

No. 2 Split.—65,000 cubic feet of air a minute for the use of forty-two men and six horses. Safety-lamp indicated a slight trace of methane.

While explosive gas was found several times in the course of inspection, ventilating conditions in general were good all over the mine and the methane content in the return air-currents was always under 0.5 per cent. Roadways and timbering were kept in a good state of repair and a good supply of timber provided. The requirements of the various systematic timbering orders were fairly well attended to at the working-faces. All roadways and working-places, where required, were treated regularly with crushed limestone-dust. One hundred and fifty-five samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but eleven of these being in keeping with the standard set by the above regulation.

Active production of coal was stopped in this mine on September 9th and recovery of material begun. This was completed in the early part of November and arrangements made for the erection of a permanent stopping in the rock-tunnel portion of the main haulage roadway. All that is necessary to finish this seal is the closing of a steel door, which will be done as soon as the No. 1 South stoppings are finished.

No. 3 MINE.

J. Worthington, Overman; R. Phillips, W. Brown, and E. Caulfield, Firebosses.

No. 3 mine is in 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 168 r.p.m., produced an average quantity of 62,000 cubic feet of air a minute, under a water-gauge of 4.8 inches. Ventilation is divided into two splits; the quantities passing in each at the last inspection measured as follows:—

No. 1 Split.—9,600 cubic feet of air a minute for the use of fourteen men and two horses. Burrell gas-detector, 0.5 per cent. methane.

No. 2 Split.—29,600 cubic feet of air a minute for the use of forty-two men and nine horses. Burrell gas-detector, 1.2 per cent. methane.

Main Return.—60,000 cubic feet of air a minute for the use of fifty-six men and eleven horses. Safety-lamp indicated 1 per cent. methane.

While explosive gas has been found a few times in the course of our inspections, ventilating conditions in general have been good all over the mine throughout 1932; Burrell readings taken

regularly in the return air-currents have varied from 0.6 per cent. in No. 1 split to 1.5 per cent. methane in No. 2 split. Roadways and timbering have been kept in good shape and a good supply of timber provided. The requirements of the various systematic timbering orders have been well attended to at the working-faces. All roadways and working-faces, where required, are treated regularly with crushed limestone-dust and sprinkling systems. Two hundred and eighty-eight 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.

No. 9 MINE.

R. Fowler, Fireboss.

No. 9 mine was worked fairly steadily during the first six months of 1932 by a crew of seven men engaged in repairing the main roads and driving a new main return airway. In July the company decided to suspend operations and recover all material, permanent seals being finished in No. 9 main haulage and also on No. 1 North main road, as this formed the main return airway for No. 9. These seals were finally completed on August 1st. The ventilation was all on one split; the quantity passing at the last inspection measured as follows:—

Main Intake.—11,000 cubic feet of air a minute for the use of seven men and two horses.

No explosive gas was found during the course of inspection and the methane content in the return air-current was always well under 0.5 per cent. Roadways and timbering were kept in good condition and a good supply of timber provided. All roadways and working-places, where required, were treated regularly with crushed limestone-dust.

MICHEL COLLIERY.

Robt. Bonar, Manager; J. Henney, Safety Inspector.

Michel Colliery is situated on Michel creek, 24 miles north-east of Fernie, on 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.

Extensive alterations have been made to the tippie to facilitate grading and loading the large variety of sizes and grades of coal demanded by the present-day trade. A large double-deck shaking screen of modern design has been installed; this shaker is so arranged that its product can be diverted to either of the two picking-tables and boom-loaders, or to a conveyor connected to an up-to-date coal-cleaning plant, from which clean coal can be returned to the tippie or slack-bins for coking purposes or loaded direct into railway-cars. The coal going to the slack-bins can be rescreened by double-vibrating screen situated on top of the slack-bins, producing a very high grade of blacksmith-coal. This product is delivered into a division of the bins and thus loaded by gravity for shipment. The fine coal goes into the main bin to be used later for making coke.

Belt-conveyors were installed to facilitate the distribution of coal, all of which are equipped with anti-friction troughing and return rollers, motor-driven through silent-chain and machine-cut gears. Most of the new equipment has alternating current motor drives. A modern cleaning plant of concrete and brick construction was erected in the latter part of the year and equipped with steel sash throughout; this type of building is as near fire-proof as it is possible to make it. While provision has been made for two cleaning units in the building, one only has been installed so far. This consists of one 8- by 17.5-foot air coal-cleaning table, from which the clean coal can be returned to the tippie or slack-bins for coking purposes or loaded direct into the cars, and which takes care of the sizes from 1½ inches to ¾ inch. It is the intention of the management to install another unit to take care of the finer sizes. An electrically driven fan having a capacity of 65,000 cubic feet of air a minute supplies the air necessary for the unit being operated at present. The installation of the above cleaning plant entailed a number of changes in the tippie arrangements, the principal of which was the moving of the slack-elevator which delivers the slack coal to the bins. Most of the equipment for the above plant was supplied by the Manitoba Bridge & Iron Works, of Winnipeg.

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 on the conditions prevailing in the various mines throughout the year:—

No. 3 MINE.

Robt. McFegan, Overman; J. Strachan, T. Owen, O. Winstanley, and H. Beard, Firebosses;
J. McAlpine and W. Weaver, Shotfirers.

This mine operates the upper No. 3 seam 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 122,100 cubic feet of air a minute, under a water-gauge of 2.9 inches. Ventilation is divided into three splits; the quantities passing in each at the last inspection measured as follows:—

No. 2 Split.—21,000 cubic feet of air a minute for the use of fifty-five men and seven horses. Safety-lamp indicated a trace of methane.

No. 3 Split.—7,200 cubic feet of air a minute for the use of twenty men and two horses. Safety-lamp indicated a trace of methane.

No. 4 Split.—9,000 cubic feet of air a minute for the use of eighteen men and three horses. Safety-lamp, 0.3 to 0.4 per cent. methane.

Main Return.—105,000 cubic feet of air a minute for the use of ninety-three men and twelve horses. Safety-lamp, 0.4 per cent. methane.

Explosive gas was found on two occasions in the course of inspection, while Burrell readings taken in the return air-currents have always been under 0.5 per cent. methane. Roadways and timbering have been kept in a good state of repair, 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-six samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but one being above the standard set.

No. 1 MINE.

Robt. McFegan and D. James, Overmen; W. Cartwright, A. Ball, W. McKay, and S. Lazaruk, Firebosses.

This mine is reached by a crosscut tunnel from the upper No. 3 seam of No. 3 mine, which intersects Nos. 2, 1, "A," and "B" seams; Nos. 1 and "B" only being operated at present. It is ventilated by No. 3 East fan, particulars of which may be found in the report dealing with the latter mine. Ventilation is divided into two splits; the quantities passing in each at the last inspection measured as follows:—

No. 1 Seam, Intake.—28,000 cubic feet of air a minute for the use of fifty-two men and ten horses.

"B" Seam, Return.—18,000 cubic feet of air a minute for the use of forty-five men and three horses. Burrell gas-detector, 0.3 per cent. methane.

No. 1 Mine, Main Return.—60,000 cubic feet of air a minute for the use of ninety-seven men and thirteen horses. Safety-lamp, 0.4 per cent. methane.

Explosive gas was found on one occasion during the course of inspection, while the methane content in the return air-currents has always been under 0.5 per cent. Roadways and timbering have been kept in good condition, a good supply of timber being provided for the purpose, and the requirements of the 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. One hundred and thirty-three samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but six of which were in keeping with the standard set.

No. 8 MINE.

Robt. Taylor, Overman; W. McKay, J. Scales, and W. Gregory, Firebosses.

This mine operates the upper portion of No. 8 seam and is ventilated by an electrically driven 8- by 3½-foot Jeffrey fan, which, running at a speed of 240 r.p.m., produced an average quantity of 55,300 cubic feet of air a minute, under a water-gauge of 2.7 inches. The ventilation

is divided into two splits; the quantities passing in each at the last inspection measured as follows:—

No. 1 Split.—11,000 cubic feet of air a minute.

No. 2 Split.—10,000 cubic feet of air a minute.

Main Return.—56,000 cubic feet of air a minute for the use of four men and one horse.

No explosive gas was found in No. 8 mine during the course of our inspections, while the methane content in the return air-currents has always been kept under 0.5 per cent. Roadways and timbering have been kept in a fairly good state of repair and a good supply of timber provided. The requirements of the various systematic timbering orders were 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. Forty samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all of which were above the standard set.

In November signs of fire were reported in the vicinity of the old fan-shaft; this apparently is an aftermath of a fire that passed over this ground in the summer of 1930, burning down the old fan-house in its course and igniting the seam along the outcrop, as fire was first discovered at this location on September 15th, 1930. At that time the old entries were repaired in beyond the fire and the heated ground cooled off. A considerable amount of timbering and cogging was done in dealing with the original fire, and it would appear as though the latest outbreak is centred chiefly in the region surrounding this timber. Water-lines are connected with the mine pumping systems for the purpose of cooling this area; as soon as this is effected all heated material will be removed. The area mentioned above is isolated from the mine-workings.

Due to the depression in the coal business, active production of coal was suspended in this mine on September 9th; since this date a small crew of men has been steadily engaged in repairing the main roads and airways.

NO. 3 EAST MINE.

D. James, Overman; W. Cartwright and A. Ball, Firebosses.

This mine is supervised by the "B" seam officials of No. 1 mine 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 94,900 cubic feet of air a minute, under a water-gauge of 2.1 inches. This fan provides the ventilation for Nos. 1 and 3 East Mines; the quantities passing at the last inspection measured as follows:—

No. 1 Mine, Main Return.—60,000 cubic feet of air a minute for the use of ninety-seven men and thirteen horses. Safety-lamp, 0.4 per cent. methane.

No. 3 East, Main Return.—91,200 cubic feet of air a minute for the use of one hundred men and thirteen horses. Safety-lamp indicated a slight trace of methane.

As in recent years, all operations have been chiefly confined to necessary repairs on main roads and airways and pumping water into the heated ground in old lower No. 3 seam. While a little heating is still evident at the top-west stopping, conditions in general may be said to be fairly good all over this district, while a careful watch is always maintained in the suspected area.

Corbin Collieries, Ltd.

Austin Corbin, President, Spokane, Wash.; J. M. Fitzpatrick and E. J. Robert, Vice-Presidents, Spokane, Wash.; A. M. Allen, Secretary-Treasurer, Spokane, Wash.; R. G. Crocker, General Manager, Spokane, Wash.; E. L. Warburton, Superintendent, Corbin, B.C.

CORBIN COLLIERY.

E. L. Warburton, Manager; J. Taylor, Assistant Manager.

Corbin 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. The colliery consists of four mines—Nos. 3, 4, 5, and 6. Of these, Nos. 4 and 6 produced practically the total output, with the exception of some commercial coal which was mined at No. 3 mine or "Big Showing" between October 12th and December 23rd; no work of any kind was done in No. 5 mine during 1932.

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. During 1932 a contract was arranged with G. Watkin Evans, of Seattle, to carry out a certain amount of experimental and test work at No. 3 mine. On September 17th Mr. Evans and Mr. R. Selman, excavating engineer, arrived at Corbin with the necessary equipment for this project. This comprised a caterpillar-type, gasoline-driven shovel and six "White" trucks capable of hauling 6 tons of coal; to facilitate haulage from this mine, a loading-chute and siding were constructed at a point approximately 200 yards west of old No. 4 incline, while the trail up the mountain was graded and increased in width to make it suitable for truck-haulage. This preliminary work was completed on October 10th, and after some necessary cleaning-up had been done work was begun on the lower bench on October 12th, the coal being hauled by truck from the mine to the loading-chute mentioned above, where it was loaded into railway-cars for transportation to the cleaning plant.

During the two and a half months this mine was in operation a considerable amount of trenching was done, and the information thus gained should prove of value when planning future operations in this section of the property.

Edison electric cap safety-lamps are 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 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 on the conditions generally prevailing in the various mines throughout the year:—

No. 3 MINE ("BIG SHOWING").

R. Pettigrew, Overman.

After a lapse of six years this mine was again opened on October 12th and continued to operate until December 23rd, on which date the contractors decided to suspend all work until the spring of 1933, as it was found practically impossible to keep the truck roadway open, due to the heavy snowfall and wintry conditions in general. This is an open-cut mine, the method of working being to remove the overburden from the seam, which is then mined in a series of benches, the coal being loaded direct into trucks by gasoline-shovel; where blasting was necessary, all shots were prepared and fired under the direct supervision of a certificated official.

At the last inspection in December all operations were confined to the lower bench, or what was formerly known as "Water-tank Spur." General conditions were good, the bench kept well trimmed, and the haulage-roadway down the mountain was in good shape.

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 fan of the Guibal type, which, running at a speed of 150 r.p.m., produced an average quantity of 20,430 cubic feet of air a minute, under a water-gauge of 1.5 inches. The ventilation is all on one split; the quantity passing at the last inspection measured as follows:—

A Level Return.—21,600 cubic feet of air a minute for the use of twenty-three men and three horses. Burrell gas-detector, 1.1 per cent. methane.

Explosive gas was found on two occasions during the course of inspection, while Burrell readings taken regularly in the return air-current have varied from 0.6 to 1.5 per cent. methane. Roadways and timbering have been kept in good shape and a good supply of timber provided. The requirements of the systematic timbering orders were well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. Forty-two samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but four of these being in keeping with the standard set.

On the afternoon of December 9th, while the fireboss on shift was making his usual inspection, signs of heating were noticed at the foot of an old raise at the parting on the main haulage-road; this is located at a distance of approximately 1,000 feet from the mine portal. The raise mentioned above was driven many years ago right through to the old 400 Level work-

ings of this mine; as soon as signs of this heating were detected, preparations were made to drive a new raise inby this area and repair an old raise outby same, from which a new level, parallel to old 100 level, is being driven to connect with the new raise inby the suspected area. If this heating is local or confined to the lower portion of these old raises, the measures now instituted should prove effective. Water-lines are connected with the boiler-house pumps in case of emergency, while all roadways and working-places in this district are kept thoroughly dusted with crushed limestone-dust.

No. 6 MINE.

W. Almond, Overman; H. Osborne, D. Waddington, A. E. Rear, B. Cheetham, F. Coates,
and M. Gibson, Firebosses.

This mine operates the No. 6 seam and is ventilated by an electrically driven fan, which, running at a speed of 280 r.p.m., produced an average quantity of 50,820 cubic feet of air a minute, under a water-gauge of 0.5 inch. With the exception of the heated areas in A and No. 1 levels, the ventilation is all on one split; the quantity passing at the last inspection measured as follows:—

Main Intake.—56,000 cubic feet of air a minute for the use of fifty men and three horses.

Explosive gas has been found on two occasions during the course of inspection, while the methane content in the return air-current has always been kept well under 0.5 per cent. Roadways and timbering have been kept in good condition and a good supply of timber provided. The requirements of the systematic timbering rules are well attended to at the working-faces. All roadways and working-places, where required, are treated regularly with crushed limestone-dust. Eighty-one samples of dust were taken in accordance with Regulation No. 4 of the Coal-dust Regulations, all but four of these being in keeping with the standard set by the above regulation.

Conditions have been fairly good throughout the year in the heated areas in Nos. A and 1 levels, a careful watch being maintained on all suspicious places, while liberal quantities of crushed limestone-dust are constantly distributed around these places; water-lines are installed in all suspected places in the old workings, while Burrell all-service masks and canaries are always available in case of emergency.

REPORTS OF INSPECTORS OF QUARRIES.

REPORT BY JAMES STRANG, INSPECTOR.

VANCOUVER MINING DIVISION.

Coast Quarries Co., Ltd.—The Coast Quarries Company, Limited, property is situated at Granite Falls, Burrard inlet, about 18 miles from Vancouver. Granite is crushed and screened to various sizes for use in general construction-work. Auto-trucks convey the material from the quarry-face to the bunkers and two power-shovels handle the material at the face of the quarry. Conditions at this plant are generally good and the regulations well carried out. On my last inspection visit in November only ten men were employed, but they expected to resume full operations early in 1933.

Kilgard Red-shale Quarry.—This quarry is the property of the Clayburn Company, Limited, and is worked in conjunction with their clay-mines. The men are drawn from the mine to work in the quarry as required.

NEW WESTMINSTER MINING DIVISION.

Gilley Bros.' Quarry.—This property is situated at Silver Valley on the Pitt river. Further improvements have been made this year in their screening and loading equipment and in their transportation of material from the quarry to the plant. At both the plant and quarry every effort is made to conduct operations in a safe and satisfactory manner. In the earlier part of the year forty-one men were employed, but towards the end of the year this number was reduced to thirteen.

Maryhill Sand and Gravel Pit.—This plant is situated on the Fraser river below the junction of the Pitt and Fraser rivers. The plant is an up-to-date electrical equipment for screening and loading and from twelve to sixteen men are regularly employed. Every care is taken to comply with the safety regulations.

VICTORIA MINING 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. Power-shovels load the material into cars at the quarry-face and the cars are transported by gasoline-locomotives to the bunkers. Great interest is taken in safety methods for the protection of workmen, and in addition to the Government regulations in relation to blasting, this company has drawn up a set of special rules which the workmen must observe. Thirteen men are employed at the quarry and the whole plant is under the supervision of H. Anderson, manager.

Rosebank Lime Co.—A small quarry is operated by this company at Colwood, a few miles from Victoria. Conditions here were found to be satisfactory.

Pioneer Sand & Gravel Co.—This company operates a sand and gravel pit at Songhees Reserve, a few miles from Victoria; the sand and gravel being washed from the bank by the hydraulic method and carried by flume to the screening plant. Eight men are employed here when the plant is operating.

Producers Sand & Gravel Co.—Royal bay, Victoria. This operation is carried on in a similar manner to that of the above, eight to ten men being employed when conditions warrant it.

NANAIMO MINING DIVISION.

Pacific Lime Co.—A large limestone-quarry is owned and operated by this company at Blubber bay. About 150 men were employed at the quarry, lime-kilns, and sawmill early in the year, but this number has been greatly reduced, due to lack of orders. Conditions at the quarry and plant were found to be satisfactory.

B.C. Cement Co.—A quarry is operated by this company on the opposite shore of Blubber bay from the Pacific Lime Company. The rock is crushed here and shipped by scow to the Bamberton plant. Seven men are employed here. I regret to report a serious blasting accident to William Addison on January 5th, which occurred while he was in the act of spitting a bulldozing shot. The shot went off, causing serious injury to his right hand and face.

Marble Bay Quarry, Vananda.—This quarry, formerly operated by the Powell River Paper Company, was taken over by F. J. Beale. Four men are employed and conditions were found to be satisfactory.

Vancouver Granite Co.—Quarry bay, Nelson island. A dimension-stone quarry is operated here, employing nine men. Every effort is made to comply with the "Quarries Regulation Act" and conditions were found to be satisfactory.

VANCOUVER MINING DIVISION.

REPORT BY THOMAS R. JACKSON, INSPECTOR.

Decks Sand and Gravel Pit.—North Vancouver; Thos. O. Burgess, superintendent. This quarry is about 3 miles above Second Narrows bridge. This is a hydraulic operation, with the monitors working at 100 lb. pressure; all other power being electrical. Plant capacity about 100 tons per hour. About fifteen men were employed and worked 275 days during the year. The output of plant No. 3 was 41,706 cubic yards, while No. 4 produced 4,265 cubic yards. The general condition of the quarry and machinery was good and safe working conditions were maintained. No accidents were reported.

Cascade Sand and Gravel Quarry.—North Vancouver; William Hill, superintendent. This quarry recovers sand and gravel from the bed of Seymour creek by means of a large-capacity power-shovel. Electrical power is used generally and the machinery, equipment, and fencing were in good condition. The plant employed an average of eleven men and worked 240 days, producing 34,897 cubic yards of sand and gravel. No accidents were reported.

Builders' Supply Sand and Gravel Quarry.—North Vancouver; C. F. Robinson, superintendent. This plant has worked only at intervals during 1932. The general condition of the plant was good and no accidents were reported.

Hillside Sand and Gravel Quarry.—West Howe sound; Thomas Campbell, superintendent. On my visits of inspection to this quarry I found conditions good at the face and sides. Machinery, equipment, and fencing of plant was also in good condition. The camp accommodation, consisting of living-quarters, cook-house, and dining-room, was in good condition. Seven men were employed.

B.C. Sand and Gravel Quarry.—North Vancouver; William Monks, foreman. This company produced very little sand and gravel during 1932. The general conditions of the plant were in fairly good condition.

Britannia Sand and Gravel Quarry.—Britannia Beach; J. Rissett, superintendent. Production from this property totalled several scow-loads of sand and gravel during 1932 and the plant generally was in good condition.

NANAIMO AND ALBERNI MINING DIVISIONS.

REPORT BY GEO. O'BRIEN, INSPECTOR.

McDonald Cut-stone Operators.—This property is situated on Newcastle island, in the strait of Georgia. The work carried on is the getting-out of cylindrically cut stone for pulp-grinding mills, etc. Very little work was carried on during 1932. The quarry was closed down early in the year and is still closed.

Gabriola Shale Products, Ltd.—The property owned by this company is situated near the south end of Gabriola island, in the strait of Georgia. The product is a good-grade shale and is mined on the open-quarry system. The shale is used in the brick-making plant on the property. The quarry and plant were idle the whole year.

KAMLOOPS MINING DIVISION.

REPORT BY JOHN G. BIGGS, INSPECTOR.

Falkland Quarries.—This is the most important quarry in the district and is worked by the Canadian Gypsum and Alabastine Company, Limited, at Falkland. There is a large deposit of gypsite and three quarries have been opened. The largest is the upper and is known as No. 3

quarry. The face-wall in No. 3 quarry has a height of some 250 feet, but owing to the friable nature of the material and the height, the broken rock at the face is kept just a little steeper than the angle of rest, so that all the output is loaded from the quarry-floor, some considerable distance from the actual face. A self-acting incline conveys the material down the side of the mountain to an aerial tram, by which it is carried down to bunkers on the Canadian National Railway. It is then shipped to the company's plant at New Westminster. A considerable tonnage is shipped to the B.C. Cement Company, Victoria. On my last visit of inspection twelve men were employed at this quarry. The general conditions were found to be satisfactory and the provisions of the "Quarries Regulation Act" properly carried out. All the drilling, blasting, and barring operations were carried out by certificated shotfirers. No accidents were reported to this office during 1932.

GRAND FORKS MINING DIVISION.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

The large works referred to in 1931 in connection with the new power plant at Corra Linn, on the Kootenay river, were all completed by the end of 1931 and the new plant put in operation.

The only quarry in the Division—namely, that at Fife—was worked during a short period of the year, the work being done successfully and safely. Many small rock-work operations were carried out at various parts of the district. These were all visited and it was generally found that the workmen were capable and the work well managed.

The powder-magazines in connection with these small operations are temporary and we always found them in a safe place and well kept. On these small operations the men who did the blasting and those using and handling explosives were holders of permanent blasters' certificates under the blasting regulations made pursuant to the "Quarries Regulation Act."

Late in the year a commencement was made on the excavation of rock at Canyon, near Creston, for use in building a dam for a small power plant at this point. The plant is being built by the West Kootenay Power Company and the work is done under the superintendence of Fred Chapman. The work done under the Act has been very well supervised and no accidents were reported during 1932.

BELLA COOLA MINING DIVISION.

REPORT BY CHAS. GRAHAM, INSPECTOR.

Cunningham Island Quarry.—This limestone-quarry, owned by F. J. Beale, is the only one operating in the Northern district; 7,750 tons was produced, all of which was shipped to the Ocean Falls paper-mill. Five men were employed and general conditions were found to be satisfactory on my different visits of inspection.

GOVERNMENT MINE-RESCUE STATIONS.

MINE-RESCUE STATION, NANAIMO.

REPORT BY J. D. STEWART, INSTRUCTOR.

Twelve certificated men of the Western Fuel Corporation of Canada maintained a regular training schedule during 1932 and in the middle of the year a number of others carried out training practice with the rescue-machines.

Twenty-two emergency calls were made by medical practitioners for oxygen supplies and inhalators for the use of patients in extremities. Three calls from Ladysmith Hospital, six calls from Qualicum Beach, and thirteen calls from Nanaimo Hospital were answered; also the needs of the medical practitioners resident in Nanaimo.

Equipment at this station consists of six sets of McCaa machines; six sets of Gibbs machines; twelve sets of Burrell all-service gas-masks; and eighty M.S.A. self-rescuers; with adequate reserve supplies of materials and parts to maintain these in service for some considerable time.

MINE-RESCUE STATION, CUMBERLAND.

REPORT BY JOHN THOMSON, INSTRUCTOR.

During 1932 five men underwent full training course at this station and received certificates of competency in mine-rescue training. No emergency calls were sent in during the year, and thirty employees of the Comox Colliery maintained constant practice at this station.

Two teams from the district competed at the mine-rescue competition held in Nanaimo on June 18th, 1932.

Equipment consists of eleven sets of Paul oxygen apparatus; eleven sets of McCaa two-hour oxygen apparatus; twelve sets of the Burrell all-service gas-masks; and twenty-three self-rescuers. In addition, four sets of the Paul apparatus, owned by Canadian Collieries (Dunsmuir), Limited, are maintained at this station. Adequate stocks of supplies for these machines are maintained at all times.

MINE-RESCUE STATION, PRINCETON.

REPORT BY ALFRED GOULD, INSTRUCTOR.

During 1932 fourteen men took a full course of training and were granted certificates of competency in mine-rescue work. Eight members of the Princeton Volunteer Fire Brigade who had taken a full course of instruction during the later months of 1931 were granted certificates of competency. All of the above-mentioned candidates received instruction in the use of the H.H. inhalator and artificial respiration.

Five two-hour McCaa machines were sent to Blakeburn on October 25th for use in dealing with a mine fire. The machines are being maintained there for the present, as the Instructor from this station is visiting Blakeburn from time to time for the purpose of training a number of underground employees in mine-rescue work.

There were three calls for the H.H. inhalator during the year—one from Blakeburn and two from the Princeton General Hospital.

Equipment at this station consists of eleven sets of McCaa two-hour oxygen apparatus; eleven sets of Burrell all-service gas-masks; seventeen M.S.A. self-rescuers; one M.S.A. high-pressure pump for recharging oxygen cylinders; and one H.H. inhalator. An adequate supply of all necessary materials for the maintenance of the machines is kept on hand.

MINE-RESCUE STATION, FERNIE.

REPORT BY JOHN T. PUCKEY, INSTRUCTOR.

Two trained teams from Coal Creek Colliery maintained a regular training schedule during the first half of 1932 and sixteen men took the full training course and obtained certificates of competency in mine-rescue work. The members of the Fernie Fire Brigade underwent training in the use of the Burrell gas-mask.

The first-aid classes held in this station were maintained during the year, and 134 St. John Ambulance certificates were gained by examination as a result of these classes.

Equipment at this station consists of six McCaa machines; eleven Gibbs machines; twelve Burrell all-service gas-masks; and forty-eight self-rescuers. Adequate supplies to maintain these in service were in store.

Some of the equipment from this station has been maintained at Corbin Colliery during the latter part of the year as a precaution in dealing with a gob heating requiring attention.

PROSECUTIONS.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Colliery.	Occupation of Defendant.	Offence charged.	Judgment.
Tulameen Coal Mines, Ltd.— No. 1 mine.....	Fireboss.....	Being in a place of trust and absenting himself without permission from his superior officers (Special Rule No. 5)	\$5 and costs.
Crow's Nest Pass Coal Co.— Michel Colliery.....	Overman.....	Using igniter other than one approved by the Minister of Mines (General Rule No. 12)	\$20 and costs.
		Also firing more than one shot at one time in one place (General Rule No. 12)	\$10 and costs.
Michel Colliery.....	Miner.....	Having matches in his possession (General Rule No. 9)	\$7.50.
Corbin Collieries, Ltd.....	Miner.....	Ditto.....	Case dismissed.

PROSECUTIONS UNDER "METALLIFEROUS MINES REGULATION ACT."

Granby Cons. M.S. & P. Co., Ltd.— Hidden Creek mine.....	Miner.....	Unlawfully riding on surface skip (General Rule No. 11)	\$5 and costs.
Hidden Creek mine.....	Miner.....	Ditto.....	\$5 and costs.
Hidden Creek mine.....	Miner.....	"	\$5 and costs.

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.

The Board of Examiners, which was formed on July 10th, 1919, now consists of James Dickson, Chief Inspector of Mines, Chairman; Henry E. 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. 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 1932. The first was held on May 18th, 19th, and 20th, and the second on November 16th, 17th, and 18th.

The total number of candidates at the examinations were as follows: For First-class Certificates, 8 and 1 supplemental (4 passed and 5 failed); for Second-class Certificates, 5 (1 passed and 4 failed); for Third-class Certificates, 12 (6 passed and 6 failed); for Mine Surveyors, 3 (1 passed and 2 failed).

The following is a list of the candidates who successfully passed in the various classes:—

First-class Candidates.—Frederick W. Reger, Robert B. Bonar, Emrys Rolfe, and Wm. Frew.

Second-class Candidates.—James W. Dunn.

Third-class Candidates.—William E. Waller, James E. Heycock, Harry Vaton, Matthew Brown, Francis McVeigh, and Levi Elmes.

Mine Surveyor.—John S. Williams.

It was very gratifying to notice a decided improvement in the work of the Third-class candidates this year. There was distinct evidence of better preparation for the examinations by the candidates. 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 Education Department at Victoria.

EXAMINATIONS FOR CERTIFICATES OF COMPETENCY AS COAL-MINERS.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act further provides that every coal-miner shall be the holder of a certificate of competency as such. By "miner" is meant any person employed underground in any coal-mine to cut, shear, break, or loosen coal from the solid, whether by hand or machinery.

The work of the Board of Examiners in examining candidates has been carried out in all the mining districts and at intervals of not less than sixty days as required by the amendment to the Act.

No certificate has been granted to 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 1932 examinations have been held for candidates of certificates of competency as coal-miners in the various coal-mining districts of the Province. One hundred and forty-one candidates presented themselves for examination, 102 passed and 39 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 the "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.

INDEX.

A.

PAGE.		PAGE.	
Accidents, coal-mines	233	Antoine creek (Quesnel)	118
Metal-mines	257	Anyox smelter	52
Adams plateau	146	<i>April</i> (Omineca)	83
Ahbau creek	95	Argentine Syndicate	58
Ahbau lake	95	<i>Arlington</i> (Nelson)	195
Plan of area	97	Arrow (Lower) lake	196
Aiken lake	86	ARROW LAKE MINING DIVISION:	
AINSWORTH MINING DIVISION:		Report by Resident Mining Engineer	180
Report by Resident Mining Engineer	179	ASHCROFT MINING DIVISION:	
Akamina creek	173	Report by Resident Mining Engineer	147
Alaska Juneau Gold Mining Co.	65	Gold, placer	147
ALBERNI MINING DIVISION:		Ashlu creek	209
Report by Resident Mining Engineer	203	Ashnola trail	142
<i>Albion</i> (Trail Creek)	197	Assay Office, report on	27
Alexandria, Fraser river	105	<i>Astra</i> (Vancouver)	210
Alexandria Mining Co.	253	<i>Athabasca</i> (Nelson)	184
<i>Alice</i> (Nass River)	56	<i>Athelstan</i> (Grand Forks)	122
<i>Alice Lake</i> (Quatsino)	206	Atlin lake	65
<i>Allies</i> (Kamloops)	145	ATLIN MINING DIVISION:	
<i>Alpha</i> (Lilloet)	217	Report by Resident Mining Engineer	64
(Slocan)	178	Placer	64
<i>Amelia</i> (Greenwood)	130	Report by Inspector	249
American creek	59	Atlin Rufner Lead-Silver Mines, Ltd.	65
<i>Ample</i> (Lilloet)	211	<i>Aurum</i> (Yale)	156
<i>Annex</i> (Kamloops)	146	Aviation	37, 61
Antler creek (Cariboo)	102		

B.

Babine Gold Mines, Ltd.	85	<i>Blue Fan</i>	149
Baker inlet, mica	50	Blue Flame Collieries, Ltd.	271
Baldhead creek (Cariboo)	98	Blue Jack Mines, Ltd.	210
<i>B. and V.</i> (Fort Steele)	162	Blue Jacket creek (Queen Charlotte)	39
Barrington river, gold, placer	61	<i>Blue Mule</i> (Queen Charlotte)	44
<i>Bear</i> (Skeena)	51	<i>Bockner of the North.</i> See <i>Buccaneer of the</i>	
<i>Bear</i> river (Portland Canal)	57	<i>North.</i>	
Beaver creek (Quesnel)	113	<i>Bonanza, Anyox</i>	52
Beaver pass (Cariboo)	98	(Nelson)	194
Beaver Silver Mines, Ltd.	180	Boss creek	156
Bed Rock Gold Mining Co.	141	<i>Bosun</i>	178
BELLA COOLA MINING DIVISION	37	Boulder creek (Atlin), Consolidated Mining	
<i>Belleville</i> (Fort Steele)	162	and Smelting at	70
Bell Mines, Ltd. (Greenwood)	125	(Kamloops)	146
<i>Belmont-Surf Inlet</i>	49	Boundary creek, gold, placer	131
B.E. Mining Co.	136	Bralorne Mines, Ltd.	221, 254
Ben Bolt Mining Co., Ltd.	59	Brick	21, 253
Bentonite	22	Bridge river	212
<i>Big Boy</i> (Omineca)	84	Bridge River Consolidated Mines, Ltd.	219
<i>Big Eddy, Fraser river</i>	105	Bridge River Exploration Co.	219, 220, 254
Biggs' mine	264	Britannia Mining and Smelting Co.	209, 251
Big Lake creek	118	Britannia Sand and Gravel Quarry	285
<i>Big Missouri</i>	61	B.C. Cement Co., Ltd.	284
Big Slide Mining and Development Co., Ltd.		British Columbia Drilling and Dredging Co.	141
(N.P.L.), report by A. M. Richmond	149	B.C. Gold Mines, Ltd.	208
Birch creek (Atlin)	70	B.C. Sand and Gravel Quarry	285
<i>Bird</i>	104	Bromley creek	142
Bismuth	22	Bromley Vale Collieries, Ltd.	272
Bitter Creek Mines, Ltd.	59	<i>Brooklyn</i> (Greenwood)	129
<i>Black Bear, Cumshewa inlet</i>	48	<i>Buccaneer</i> (Liard)	64
<i>Black Bear creek</i> (Quesnel)	109	<i>Buccaneer of the North</i> (Omineca)	90
<i>Blackcock</i> (Nelson)	187	Builders' Supply Sand and Gravel Quarry	285
<i>Black creek</i> (Quesnel)	117	Building-stone	21
Black sands, Graham island	38	Bulkley Valley coal-mine	90, 273

	PAGE.		PAGE.
Bull creek (Atlin)	66	Burns Mountain Gold Quartz Mines, Ltd.	91
Bulldog creek	57	<i>Buster</i> (Grand Forks)	122
<i>Bullion</i> (Quesnel)	107	<i>Butcher Boy</i> (Greenwood)	126
Burns creek (Cariboo)	101	<i>Butte</i> (Lillooet)	226

C.

Cadmium	22	Coal production, Chu Chua	146
Cadwallader Gold Mines, Ltd.	216, 226	Kamloops	146
Cadwallader Syndicate Placers, Ltd.	219	Lake Kathlyn Anthracite Coal Co., Ltd.	90
<i>Calcine</i> (Omineca)	86	North Thompson	146
Calcium carbonate (Omineca)	90	Shorts creek	144
Canada Smelters, Ltd.	195	(Similkameen)	142
Canadian-American Mines, Ltd.	126	Telkwa	81
Canadian Collieries (Dunsmuir), Ltd.	266	(Vernon)	144
Report by Inspector	263	Collieries and production	228
C. & S. Mining Co., Ltd.	109	Collieries, men employed	231
<i>Canyon</i>	106	Coal-dust	239
<i>Cariboo-Amelia</i>	130	Inspectors' reports	261
Cariboo Consolidated Gold Mines, Ltd.	91	Coal Creek	276
Cariboo creek (Cariboo)	102	Coal-mine officials' examinations	289
<i>Cariboo Eagle</i> (Cariboo)	101	Coalmont Collieries, Ltd.	268
Cariboo Gold Quartz Mining Co., Ltd.	91, 255	Coal Sales Act	243
CARIBOO MINING DIVISION:		Coast Quarries, Ltd.	284
Report by Resident Mining Engineer	91	<i>C.O.D.</i> (Greenwood)	129
Gold, placer	92	Columario Gold Mines, Ltd.	83
Report by Inspector	255	<i>Columbia</i> (Nelson)	193
<i>Carmi</i> (Greenwood)	126	Comox Colliery	266
Plan	127	Compagnie Française des Mines D'or du	
Carvel creek	66	Canada	71
Cascade Sand and Gravel Quarry	285	Consolation creek	73
Cassiar Hydraulic Mining Co.	86	Consolidated Gold Alluvials of B.C., Ltd.	100, 255
Castle Rock, Fraser river	105	Consolidated Mining and Smelting Co. of	
<i>Catherine</i>	185	Canada, Ltd. (Atlin), Spruce creek	70
<i>Cayenne</i> (Quesnel)	103	<i>Alpha</i> (Lillooet)	217
Cayoosh creek	211	(Omineca)	86
Cedar creek (Quesnel)	111	Phosphate-mine	260
Cedar Creek Placer Gold, Ltd.	113	Rosland mines	196
Cement	21	Skagit River placers	158
<i>Centreville Hydraulic</i>	64	Slate creek (Omineca)	87
Champion Creek Placers, Ltd.	140	Trail smelter	198
<i>Chapleau</i>	179	Consolidated Underwriters, Ltd.	156
Cherry creek (Kamloops), soda	147	<i>Contact</i> (Ainsworth)	180
<i>Chieftain</i>	180	Contact Consolidated Gold Mines, Ltd.	123
Chilton's coal-mine	265	<i>Copper Coin</i> (Skene)	49
<i>Chin-Chin</i> (Nelson)	196	<i>Copper Mountain</i> (Similkameen)	140, 253
<i>Cholla</i>	181	<i>Copper No. 2</i> (Grand Forks)	122
Churn creek	155	Coquihalla river	156
Chutine river	61	Corbin Collieries, Ltd.	281
<i>Cimbria</i> (Omineca)	85	<i>Cottonwood</i> (Quesnel)	103
Clayburn Co., Ltd.	253	Cottonwood river	96, 99
CLAYOQUOT MINING DIVISION:		Cowie's coal-mine	265
Report by Resident Mining Engineer	203	Cracker creek (Atlin)	72
<i>Clift</i> (Osoyoos)	139	<i>Cracker Jack</i> (Osoyoos)	138
CLINTON MINING DIVISION:		Cranberry river	52
Report by Resident Mining Engineer	149	Crandell mountain, plan	169
Gold, placer	154	Crazy creek	225
Clothier, G. A., report as Resident Mining		Crowfoot mountain	145
Engineer	199	<i>Crown</i> (Similkameen)	140
Cloyah bay	50	Crow's Nest Pass Coal Co., Ltd.	276
Clubine Comstock Gold Mines	188	<i>Cumshewa</i> (Queen Charlotte)	46
<i>Cluckhoo</i> (Omineca)	89	Cunningham creek (Cariboo)	91, 103
Coal production	20	Cunningham Island quarry	286
Bulkeley valley	90		

D.

<i>D.A.</i> (Greenwood)	129	Davis bay	208
<i>Dan Tucker</i> (Lillooet)	225	<i>Dawson</i> (Yale)	156, 253
<i>Dardanelle</i> (Omineca)	83	Deadman creek	148

	PAGE.
Dease creek	63
Deeks Sand and Gravel	285
Dentonia Mines, Ltd.	130
See also <i>Jewel</i> .	
Devils Elbow mountain	61
Devils Lake creek (Cariboo)	101
Diatomite	22
(Quesnel)	91
<i>Dividend</i> (Osoyoos)	134
Placer	135
<i>Doffoy</i>	210

	PAGE.
Dog creek (Omineca)	87
Dominion creek	69
Donovan creek (Cariboo)	100
<i>Doratha Morton</i>	207
Dorreen	84
Douglas creek (Skeena), placer	51
Dragon creek	101
Driftwood creek (Omineca)	85
Dry gulch (Cariboo)	101
<i>Dry Hill</i> , placer	87
Dunwell Mines, Ltd.	58

E.

Ealue lake	61
<i>Eagle</i> (Skeena)	50
<i>Eagle Bank</i> (Slocan City)	179
Eagle creek (Similkameen)	140
<i>Early Bird</i> (Queen Charlotte)	41
Plan of	42
EASTERN MINERAL SURVEY DISTRICT (No. 5):	
Report by Resident Mining Engineer	159
<i>Eddy Pass</i> (Skeena)	49
<i>Edith</i> (Portland Canal)	60
Edmonton and B.C. Mining Syndicate	94
<i>Ehatset</i>	205
<i>El Capitan</i> (Victoria)	202
Eldorado creek (Atlin)	66
Eldow Placers	140
Electric power	233, 238

Electrical prospecting, <i>Evelyn</i> (Kamloops) ..	145
<i>Elk</i> (Slocan City)	178
Elise mountain	187
<i>Elizabeth</i> (Ainsworth)	180
<i>Engineer</i> (Atlin)	65
(Portland Canal)	57
Enterprise creek	179
Eric creek	195
Esperanza Mines, Ltd.	56
Esquimalt & Nanaimo Railway Belt	199
<i>Eureka</i> , McKinney	130
<i>Eva</i>	181
<i>Evelyn</i> (Kamloops)	145
<i>Evening Star</i>	197
Excelsior Prospecting Syndicate	59

F.

Fairview camp (Osoyoos)	134
<i>Falcon</i> (Vernon)	143
Falkland. gypsum	285
Fenton creek	155
<i>Ferguson</i> (Alberni)	203
Fiddick mine	264
Fife quarry	286
Fish Lake creek	162
Flathead valley, report by G. S. Hume	164
Flux	22
<i>Foggy Day</i>	182
FORT STEELE MINING DIVISION:	
Report by Resident Mining Engineer	161
Oil	161

FORT STEELE MINING DIVISION—Continued.	
<i>Sullivan</i> , report by Inspector	257
<i>Forty Thieves</i>	219
Foster Gold Mining and Smelting Co.	149
Four-mile lake (Cariboo)	98
Franklin camp	121
<i>Free Gold</i> (Omineca)	85
<i>Free Lance</i> (Cariboo)	92
Freeland, P. B., report as Resident Mining Engineer	119
French creek (Cariboo)	102
French Creek Hydraulic Placers, Ltd. (Cariboo)	102

G.

Gabriola Shale Products	285
Galloway, J. D., report as Provincial Miner- alogist	5
Gagen creek	92, 99
Gas in lode mine	146
<i>Geiler</i>	208
Georgia river (Portland Canal)	57
Georgia River Gold Mines, Ltd.	57
Germansen Placers, Ltd.	87
Gilley Bros.' quarry	284
Gladys lake	72
Goat creek. Telkwa	85
<i>Go East</i> , Cumsheewa inlet	46
Gold, placer (Atlin)	65
(Ashcroft)	147
Abhau	95
Barrington river	61

Gold, placer, beach sands	51
Boundary creek	131
Cranberry river	52
(Cariboo)	81
Coquihalla Mines, Ltd.	158
(Clinton)	154
Crows bar	155
Dog creek	87
(Grand Forks)	125
Hope	158
High bar	155
Hefley lake	146
Hixon creek	94
(Kamloops)	146
Kleanza creek	86
Kitsumgallum river	51
(Liard)	63

	PAGE.		PAGE.
Gold, placer, Log creek	158	<i>Golden</i> (Lillooet)	217
Lorne creek	86	<i>Golden Butterfly</i> (Trail Creek)	197
Lytton	147	<i>Golden Cache</i> (Lillooet)	211
Manson creek	87	Skeena river	83
Nass river	52	<i>Golden Coin</i> (formerly <i>Golden King</i>).....	209
North Thompson river	147	<i>Golden Eagle</i> , Topley	85
North-western Dredging	158	GOLDEN MINING DIVISION:	
(Osoyoos)	139	Report by Resident Mining Engineer	160
(Quesnel)	81	<i>Golden Zone</i> (Osoyoos)	139
Skagit river	158	<i>Goodenough</i> (Nelson)	187
Skaret creek	92	Gun Lake Gold Mines, Ltd.	218
Skeena river	51, 86	Guyet Placers, Ltd.	102
Spilus creek	156	Gypsum	22
Sulphurets creek	61	Falkland	285
Tabor creek	92, 93	Graham island, black sands	38
Terry creek	95	Granby bay	52
Tranquille creek	147	Granby Consolidated Mining, Smelting, and	
(Vernon)	144	Power Co., at Anyox	52, 246
Watson Bar creek	155	Cassidy	267
(Yale)	158	Copper mountain	253
Gold Beach Mines, Ltd.	39	GRAND FORKS MINING DIVISION:	
Gold Belt Mining Co.	190	Report by Resident Mining Engineer	121
Gold Commissioners	28	Report by Inspector	257
<i>Gold Cup</i> . See <i>Ohio</i> (Nelson).		Grandoro Mining and Milling Co.	138
<i>Gold Drip</i> (Trail Creek)	197	Granite bay (Nanaimo)	208
<i>Goldfield</i> (Kamloops)	145	<i>Granite-Poorman</i>	184
<i>Gold-Galena</i> (Slocan City)	179	Grant White leases	215
<i>Gold Hill</i> , McKinney	130	Greenwood	129
<i>Gold King</i> (Nelson)	185	GREENWOOD MINING DIVISION:	
(Tenquille creek)	211	Report by Resident Mining Engineer	125
Gold-mining review, J. D. Galloway	7	Gold, placer	181
Gold Pan creek	64	Report by Inspector	257
Gold Star Mines, Ltd.	39	Grouse creek (Cariboo)	102
<i>Goldstream</i> (Slocan City)	179		

H.

Hall creek (Ainsworth)	180	Hireen Placers, Ltd.	107
<i>Hard Pan</i> (Revelstoke)	181	Hixon creek	92, 103
Harkley gulch	59	Hixon creek, Little	94
Harpur camp	145	Holland claims	222
Hart lake (Vernon)	144	Hollywood Placers Syndicate	147
Harvey creek	114	Home Gold Mining Co., Ltd.	156
<i>Hawk</i> (Skeena)	51	<i>Homestake</i> , Anyox	52
Hay lake	95	Cumshewa inlet	46
<i>Hayden Bay</i>	207	(Grand Forks)	122
<i>H.B.</i> (Nelson)	186	<i>Hope</i> (Omineca)	85
<i>Heather</i> (Nelson). See <i>Mountaineer</i> .		Horsefly section	115
Hedley Gold Mining Co.	138, 253	<i>Horseshoe</i> (Omineca). See <i>Rex</i> .	
<i>Helen</i> (Omineca)	84	Houseman creek	101
Henry creek	138	Houston	85
Herbert arm	204	<i>H.P.H.</i>	207
<i>Hercules</i> (Lardeau)	182	<i>Hudson</i> (Cariboo)	91
<i>Hidden Creek</i> , Anyox, report by J. Dickson..	246	Hudson Bay mountain, coal on	90
Inspection of	249	<i>Humming Bird</i>	185
Reference	52	<i>Hunter</i> (Skeena)	48
<i>Highland Girl</i> (Lillooet)	226	<i>Hurdy</i> (Cariboo)	102
<i>Highland Lass</i> (Greenwood)	125	Hurley creek	219
Hillside Sand and Gravel Co.....	285		

I.

Imperial Development Syndicate	181	Inspection of metalliferous mines	249
<i>Independence</i> (Osoyoos)	138	Iron, bog	22
<i>Indian Maid</i>	140	Island mountain	91
Inspection of mines, report by Chief Inspec-		<i>I.X.L.</i> (Lillooet)	226
tor of Mines	227	(Trail Creek)	196

J.

	PAGE.		PAGE.
<i>Jackson</i> (Stikine)	61	Jingle Pot mine	264
<i>Jessie</i> (Nelson)	182	Johnston creek (Yale)	158
Jessie Gold Mines, Ltd.	85	Jolly creek	131
<i>Jewel</i>	130	Jumbo Gold, Ltd. (Nelson)	195
<i>See also</i> Dentonia Mines, Ltd.		<i>Juno</i> (Nelson)	184
Jewel lake	129		

K.

KAMLOOPS MINING DIVISION :		Khutze river	48
Report by Resident Mining Engineer	145	<i>Kilo</i> (Slocan City)	179
Coal	146	<i>King Solomon</i> (Greenwood)	128
Gold, placer	146	<i>King Tut</i> (Kamloops)	146
Non-metallics	147	Kishinena creek	174
<i>Kanaka bar</i>	147	Kitimat river	48
Keen creek	180	Kitsault river	52, 55
Keithley creek	113	Kitsault-Eagle Silver Mines	39
Kelowna, oil	144	Kitsumgallum lake, placer	50, 51
Kenny creek (Omineca)	87	<i>Klapan</i> (Stikine)	61
Kersley	99	Kleanza creek	84, 86
<i>Ketch</i> (Cariboo)	101	<i>Kootenay</i> (Queen Charlotte)	44
Kettle river	133	<i>Kootenay Belle</i>	193
<i>Keystone</i> (Nelson)	195	Kootenay harbour	44
Khee Khan creek (Cariboo)	98		

L.

Ladner creek	156	LILLOOET MINING DIVISION :	
<i>Lady Jane</i> (Stikine)	61	Report by Resident Mining Engineer	210
Lake creek (Cariboo)	98	Report by Inspector	254
Lake Kathlyn Anthracite Coal Co., Ltd. 90,	273	Lime	21
Lakelse lake	51	Lincoln creek	72
<i>Lakeview</i> (Nelson)	195	<i>Liquidator</i> (Similkameen)	139
Lantzville Collieries, Ltd., report by Inspector	264	<i>Little Bertha</i> (Grand Forks)	124
LARDEAU MINING DIVISION :		<i>Little Daisy</i> (Slocan City)	179
Report by Resident Mining Engineer	181	<i>Little Joe</i> (Quesnel)	112
Lasco Development Co.	208	Little McLeod river (Omineca)	88, 89
Lasqueti island	208	Little Muddy river	64
Lasqueti Mining Co.	208	Little Snowshoe creek	113
<i>Last Chance</i> (Grand Forks)	122	<i>Little Wonder</i> (Portland Canal)	59
(Nass River)	56	<i>L.L. and H.</i>	59
Last Chance creek	100	Lodi lake	95
Lawless (Bear) creek	140	Lorne creek	86
Lay, Douglas, report as Resident Mining		Lorne Gold Mines, Ltd.	221
Engineer	80, 83	Lost creek (Nelson)	195
<i>Lazy Boy</i>	225	Lower Bridge River Placers, Ltd.	213
<i>Lead</i> , Finlay creek	163	<i>Lowhee</i>	255
Leech river	202	Lowhee creek	102
<i>Leora</i> (Clayoquot)	204	Lowhee Mining Co., Ltd.	102
LIARD MINING DIVISION :		<i>Lucky Date</i> (Portland Canal)	59
Report by Resident Mining Engineer	63	<i>Lucky Day</i> (Nelson)	187
Placer-mining	63	<i>Lucky Jack</i> (Lardeau)	181
Lightning creek	100	<i>Lucky Strike</i> (Nass River)	56
Lightning peak	125	(Stikine)	61
Likely	106	Lytton, gold, placer	147
Lillooet and Cariboo Gold Fields Syndicate ..	211		

M.

Mackin creek	105	Marmot river	57
<i>Magna Dome</i>	225	Maroon mountain	51
<i>Mammoth</i> (Slocan)	178	Marshall creek (Lillooet)	214
Mandy, Joseph T., report as Resident Mining		Martel creek (Queen Charlotte)	39
Engineer	32	<i>Martle</i> (Nansimo)	207
Manson creek	86	Maryhill Sand and Gravel	284
<i>Maple Leaf</i> (Grand Forks)	121	<i>Mary Mac</i> (Lillooet)	216, 226
Marble Bay quarry	285	<i>Mascot</i> . <i>See Wellington.</i>	
Marks Gold and Copper Mines, Ltd.	205	<i>Master Ace</i> (Yale)	157
Marmot Engineer Syndicate	57	Men employed	24

	PAGE.		PAGE.
Mercer Exploration Co.	138	<i>Monday</i> (Portland Canal)	57
Meridian Mining Co., Ltd.	181	Monro creek (Atlin). <i>See Gladys.</i>	
Mesilinka river	86	<i>Montrase</i> (Portland Canal)	57
Metal prices	9	<i>Moonlight</i> (Portland Canal)	60
Metallurgical features	9	Moorehead Mines, Ltd.	107
<i>Meteor</i> (Slocan City)	178	<i>Moose</i> (Nass River)	56
Mica, Okanagan lake	144	Moose Syndicate	109
Armstrong	144	Moresby island, non-metallies	41, 48
Cherryville	144	<i>Morning Star</i> (Osoyoos)	134
(Skeena)	50	<i>Morrison</i> (Omineca)	85
<i>Mica Moid</i> (Skeena)	50	Mosquito creek (Cariboo)	100
Michel Colliery	279	Mosquito Creek Hydraulic	63
Middlesboro Collieries, Ltd.	269	<i>Mother Lode</i> , Burnt Basin	123
<i>Midnight</i> (Trail Creek)	196	<i>Motherlode</i> (Nelson)	190
Midway	131	(Skeena)	51
<i>Millie Mac</i>	180	<i>Mountaineer</i> (formerly <i>Heather</i>) (Nelson) ..	194
<i>Mineral Hill</i> , Kitimat	48	Murray creek (Cariboo)	96
Mineral production tables	13	<i>Mystery</i>	185
Mine-rescue stations	287	McAulay-Dwyer leases	108
Mines, Department of	27	McConnell creek	87
Mines shipping in 1932	24	McDarae creek	63, 64
Mitchell gulch	111	McGillivray creek	211
Moffatt creek (Vernon)	144	McKee creek	66
Mogul Mining Co., Ltd.	128	McKinley creek (Quesnel)	117
<i>Molly Gibson</i> (Grand Forks)	122	McKinney camp	130
(Nelson)	195	McKinney creek	133
Monashee creek, placer	144	McLeod river (Omineca)	88
Monashee mountain	133		

N.

Nabatlatch river	158	<i>Nickel Plate</i> (Osoyoos)	138, 253
Nahwitti lake	207	NICOLA MINING DIVISION:	
NANAIMO MINING DIVISION:		Report by Resident Mining Engineer	156
Report by Resident Mining Engineer	206	Nigger creek (Quesnel)	114
Report by Inspector	253	Nimkish lake	207
Nani, Mr. A.	94	Nitinat	202
<i>Nani No. 1</i> (Cariboo)	92	NORTH-EASTERN MINERAL SURVEY DISTRICT	
Nass river, placers	52	(No. 2):	
NASS RIVER MINING DIVISION:		Report by Douglas Lay, Resident Mining	
Report by Resident Mining Engineer	52	Engineer	80
Report by Inspector	249	<i>North Star</i> (Greenwood)	130
N. A. Timmins Corporation	49, 64	(Nelson)	183
National Gold Mines, Ltd.	211	North Thompson Coal Co.	272
NELSON MINING DIVISION:		North-western Aerial Prospectors, Ltd.	60
Report by Resident Mining Engineer	182	NORTH-WESTERN MINERAL SURVEY DISTRICT	
Report by Inspector	256	(No. 1):	
Newcastle Island stone	285	Report by Jos. T. Mandy, Resident Mining	
New Waverley Hydraulic Mining Co., Ltd. ..	102	Engineer	32
NEW WESTMINSTER MINING DIVISION:		Norwegian creek	131
Report by Resident Mining Engineer	210	<i>Nugget-Motherlode</i> (Nelson)	190

O.

Observatory inlet	52	OMINECA MINING DIVISION—Continued.	
O'Donnel river	65	Report by Inspector	251
O'Grady, B. T., report as Resident Mining		Coal, Bulkley valley	90
Engineer	159	Lake Kathryn Anthracite Coal Co.	90
<i>Ohio</i> (formerly <i>Gold Cup</i>) (Nelson)	186	Gold, placer	86
Oil, Flathead	174	Non-metallies	90
Kelowna	144	<i>Ophir-Lade</i>	182
Mission creek	144	<i>Ore Mountain</i> (Portland Canal)	59
(Quesnel)	81	<i>Ormond</i>	204
(Vernon)	144	<i>Oro Fino</i> (Osoyoos)	138
O.K. (Trail Creek)	196	Oro Fino mountain	136
Okanagan Oil and Gas Co.	144	Osoyoos lake	134
Olalla	138	OSOYOOS MINING DIVISION:	
<i>Old Timer</i> (Skeena)	51	Report by Resident Mining Engineer	134
<i>Oliver, Victoria</i> (Osoyoos)	134	Gold, placer	139
OMINECA MINING DIVISION:		Otter creek (Atlin)	71
Report by Resident Mining Engineer	83	<i>Oyster-Criterion</i>	181

P.

	PAGE.		PAGE.
Pacific Gold Mines, Ltd.	208	Pleasant Valley Mining Co., Ltd.	142, 271
Pacific Lime Co.	284	<i>Polaris</i> (Omineca)	86
<i>Paine</i> (Omineca)	84	<i>Pollock</i> (Osoyoos)	138
Parvenu Mines, Ltd.	136	Poquette creek	106, 111
Plan of workings	137	Porcher island	49
Pathfinder Consolidated Co.	124	<i>Porter-Idaho</i>	57
<i>Patsy</i> (Osoyoos)	138	PORTLAND CANAL MINING DIVISION :	
Paulson	122	Report by Resident Mining Engineer	56
<i>Paymaster</i> (Lillooet)	225	Report by Inspector	251
PEACE RIVER MINING DIVISION :		Pottery	21
Report by Resident Mining Engineer	91	Pre-Cambrian Gold Mines	143
<i>Peach</i> (Stikine)	61	Premier Gold Mining Co., Ltd.	60
Peers creek	157	<i>President</i> (Lillooet)	224
<i>Perkins</i> (Cariboo)	91	Prince George	91
<i>Perrier</i> (Nelson)	185	Prince George Gold Mines, Ltd.	93
Peterson flats	141	<i>Princess Edith</i> (Liard)	64
Phoenix	129	Princeton Properties, Ltd.	142
Phosphate-mines	260	Producers Sand and Gravel Co.	284
<i>Picadore</i> (Nelson)	187	Profits of mining companies	12
<i>Pilot</i> (Kamloops)	146	Prosecutions	288
Pine creek (Atlin)	69	Proserpine mountain	91
<i>Pioneer</i>	254	Prospecting, No. 1 District	33
Pioneer Extension Gold Mines, Ltd.	224	No. 2 District	81
Pioneer Gold Mines, Ltd.	222	Nos. 3 and 4 Districts	119
Pioneer Sand and Gravel Co.	284	No. 6 District	200
<i>Pipestem</i> (Yale)	156	In Liard	63
Pitt island	49	Classes	37
Placer Engineers, Ltd.	113, 114	<i>Prosperity</i> (Portland Canal)	57
Platinum, reference	22	<i>Purvis</i> group	86
(Osoyoos)	139	Pyrite, sulphur	22

Q.

Quadra island	208	QUEEN CHARLOTTE MINING DIVISION— <i>Cont'd.</i>	
Quarries, inspection of	245, 284	Clay	40
Quartz creek (Liard)	64	Quesnel Gold Mining Co.	110
QUATSINO MINING DIVISION :		QUESNEL MINING DIVISION :	
Report by Resident Mining Engineer	205	Report by Resident Mining Engineer	103
<i>Queen</i> (Nelson)	193	Oil	81
QUEEN CHARLOTTE MINING DIVISION :		Non-metallics	81
Report by Resident Mining Engineer	37	Quesnel Quartz Mining Co., Ltd.	103
General Development Co., Ltd.	46	Quesnel river, North fork	107
Report by Inspector	251	Quesnel section	104
Non-metallics	40	<i>Quinn</i> (Omineca)	85

R.

Radium	208	Richmond, A. M., report on <i>Big Slide</i>	149
Radium Explorers, Inc.	208	<i>Rio</i>	178
<i>Rainbow</i> (Omineca)	85	Rock, crushed	21
Red Hawk Gold Mines, Ltd.	225	Rock creek, placers	131
Red Triangle Coal Co.	273	Rock Creek Consolidated Placers, plan of	
<i>Red Wing</i> (Nass River)	53	workings	132
Plan of	54	<i>Rock Rabbit</i> (Grand Forks)	124
Relief Arlington Mines, Ltd.	195	Rosebank Lime Co.	284
Reno Gold Mines, Ltd.	190	Rossland	196
Rescue-stations	241	Rountree Mines, Ltd.	117
REVELSTOKE MINING DIVISION :		<i>Rover</i> (Nelson)	184
Report by Resident Mining Engineer	180	Rowe property	49
Gold, placer	181	<i>Royal</i> group (Lillooet)	226
Reward Mining Co., Ltd.	91	<i>Royal</i> (Slocan City)	179
<i>Rex</i> (formerly <i>Horseshoe</i>)	85	Ruby creek (Atlin)	70
Richardson's coal-mine	265	Ruby Gold Mines, Ltd.	108

S.

	PAGE.		PAGE.
<i>Sadie</i> (Skeena)	50	Snowdrop Leasing Syndicate	197
Sage creek	174	<i>Snowshoe</i> (Cariboo). See <i>Scotia</i> .	
Sailor creek	108	Soda	22
Sally Mines, Ltd. (Greenwood)	126	Sodium carbonate, Cherry creek	147
<i>Salmon Gold</i>	60	Sodium sulphate, Cherry creek	147
Salmon river (Portland Canal)	60	<i>Something Good</i> (Osoyoos)	138
Sanca Mines, Ltd.	195	Sotheran leases	140
Sand and gravel	21	SOUTHERN AND CENTRAL MINERAL SURVEY	
Sand creek (Omineca)	84	DISTRICTS (NOS. 3 AND 4):	
Sandstone, Moresby island	48	Report by Resident Mining Engineer	119
<i>Scotia</i> (formerly <i>Snowshoe</i>) (Cariboo)	92	Placer-mining	120
Scranton Consolidated Mining Co.	180	Coal	120
<i>Second Relief</i> (Nelson)	195	Non-metallics	120
Seismograph	240	Spanish creek	111
Shale	22	Spanish Mountain Mining Syndicate	111
Sheep creek	188	<i>Speedwell</i> (Kamloops)	146
Shoal bay (Nanaimo)	207	Spius creek	156
Shorts creek, coal	144	<i>Spokane</i> (Similkameen)	140
<i>Silverado</i> (Portland Canal)	57	Springer creek	178
<i>Silver Bear</i> (Ainsworth)	180	Spruce creek (Atlin)	67
<i>Silver Hill</i> (Nelson)	194	<i>Spyglass</i> (Lardeau)	182
<i>Silver King</i> (Similkameen)	253	Squaw creek (Atlin), report by J. T. Mandy	77
Silver King Mining Co.	139	Map of area	75
<i>Silver Lake</i> (Omineca)	85	<i>Standard</i> (Slocan)	178
Silver Leaf Mines, Ltd.	184	<i>Starlight</i> (Nelson)	183
<i>Silversmith</i>	178	Statistical review, by J. D. Galloway	5
Silver Tip Mining Co.	155	Steele gulch (Omineca)	87
SIMILKAMEEN MINING DIVISION:		<i>Stemwinder</i> (Greenwood)	129
Report by Resident Mining Engineer	139	<i>Sterling</i> (Revelstoke)	180
Gold, placer	140	Sterling creek (Osoyoos)	138
Coal	142	Sterling Gold Mines Co.	138
Similkameen river	141	<i>Stibnite No. 1</i>	217
Skaret creek	91, 92	STIKINE MINING DIVISION:	
SKEENA MINING DIVISION:		Report by Resident Mining Engineer	61
Report by Resident Mining Engineer	48	<i>Stillwater</i> (Nelson)	184
Gold, placer	51	<i>St. Anthony</i>	185
Report by Inspector	249	<i>St. Paul</i> (Vernon)	144
Skeena river	83	<i>Sullivan</i> , report by Inspector Miard	258
Gold, placer	86	Reference	162
<i>Skidegate-Sunrise</i>	39	Sulphurets creek, placer on	61
<i>Skookum</i> (Vernon)	143	<i>Summit</i> (Nass River)	56
Slade-Cariboo Gold Placers, Ltd.	100	(Osoyoos)	136
Slate creek (Omineca)	86, 87	Summit camp (Similkameen)	139
Slate Creek Consolidated Placers	140	Summit creek (Cariboo)	102
SLOCAN CITY MINING DIVISION:		<i>Sunnyside</i> (Kamloops)	146
Report by Resident Mining Engineer	178	<i>Surf Point</i> (Skeena)	49
SLOCAN MINING DIVISION:		Surprise lake	72
Report by Resident Mining Engineer	178	<i>Susie</i> (Osoyoos)	136
Slough creek (Cariboo)	101	Swift river (Cariboo)	99
Smithers	85		

T.

Tabor creek (Cariboo)	92, 93	Tom creek (Omineca)	87
<i>Tagore</i>	205	Topley area	85
Taku river	64	Topley Richfield Mining Co., Ltd.	85
Talc	22	TRAIL CREEK MINING DIVISION:	
<i>Tamarac</i> (Nelson)	187	Report by Resident Mining Engineer	196
Tatshenshini river, report by J. T. Mandy	74	Report by Inspector	256
<i>Taylor</i> group	221	Tranquille creek	145, 147
Telkwa	85	Treasure mountain	139
Coal	81	<i>Trehouse</i> (Cariboo)	103
Terry creek	95, 103	Truax creek	216, 226
Texada island	208	Tulameen Coal Mines, Ltd.	270
Texas Yankee Girl, Ltd.	186	Tulameen river	139
Thibert creek	64	<i>Two Fools</i> (Nelson)	196
Thornhill mountain	51	<i>225th</i> (Nelson)	184
Thutade lake	86	Tyaughton Creek Gold Placers, Ltd.	215
Tom creek, tributary of Terry creek	95	<i>Tyee</i> (Nass River)	56

U.

	PAGE.		PAGE.
<i>U and I</i>	182	Unuk river	61
<i>Unicorn</i>	60	Map of	62
<i>Union</i> (Grand Forks)	121	Usk	83
United States Smelting, Refining, and Mining Co., Ltd.	113		

V.

Vance lake (Atlin)	72	VERNON MINING DIVISION— <i>Continued.</i>	
<i>Vancouver</i> (Nelson)	193	Oil	144
<i>Vancouver Granite Co.</i>	285	Mica	144
VANCOUVER MINING DIVISION :		Gold, placer	144
Report by Resident Mining Engineer	209	Coal	144
Report by Inspector	251	Vidette Mines, Ltd.	148
<i>Vanguard</i> (Nass River)	56	<i>Viking</i> (Liard)	64
<i>Velvet</i> (Trail Creek)	197	<i>Virginia K.</i>	59
Velvet Gold Mining Co.	197	Vital creek, Chinese on	87
<i>Venus</i> (Nanaimo)	208	<i>Victor</i>	178
(Nelson)	184	<i>Victoria</i> (Nelson)	182
<i>Veritas</i>	218	VICTORIA MINING DIVISION :	
VERNON MINING DIVISION :		Report by Resident Mining Engineer	201
Report by Resident Mining Engineer	143	Volcanic creek (Atlin)	73

W.

Wallace mountain	125	Whittaker, D. E., report as Assayer	27
<i>Waterloo</i> , McKinney	130	<i>Why Not</i>	219
Waterloo Gold Mines, Ltd.	125	<i>Wilcox</i> (Nelson)	187
Watson Bar creek	155	<i>Wildcat</i> (Nass River)	56
Wayside Consolidated Gold Mines, Inc.	217	Williams creek, Lakelse lake	51
Weaver creek (Quesnel)	113	(Cariboo)	102
<i>Wellington</i> (Ainsworth)	180	Williams lake, placer at	115
<i>Wellington</i> (formerly <i>Mascot</i>) (Fort Steele)	162	WINDERMERE MINING DIVISION :	
<i>Wellington</i> (Greenwood)	126	Report by Resident Mining Engineer	161
<i>Western Copper Venture</i> (Skeena)	48	Wingdam	100
Western Exploration Co.	178	<i>Winner</i> (Greenwood)	129
Western Fuel Corporation of Canada, Ltd., report by Inspector	262	<i>Winnifred</i> (Clinton)	154
WESTERN MINERAL SURVEY DISTRICT (No. 6) :		Witwatersrand Syndicate, Ltd.	160
Report by Resident Mining Engineer	199	<i>Wolf</i> (Skeena)	51
<i>Whirlwind-Peggy</i>	138	<i>Wolf Lake</i> (Nelson)	194
<i>White Elephant</i> (Vernon)	143	Woodbury creek	180
<i>Whitewater</i> (Ainsworth)	180	<i>Wren</i> (Skeena)	50
(Nelson)	184	Wright creek (Atlin)	71
Taku river	64	W.W.W. (Alberni)	203

X.

<i>X-Ray</i> (Nelson)	187
-----------------------------	-----

Y.

YALE MINING DIVISION :		<i>Ymir</i> (Nelson)	186, 187
Report by Resident Mining Engineer	156	Yorkie creek	140
Gold, placer	158	<i>You</i>	204
<i>Yankee Girl</i> (Nelson)	186	<i>Ypres</i> (Lillooet)	218

Z.

Zeballos river	204
----------------------	-----

LIST OF ILLUSTRATIONS.

PLANS.

	PAGE.
Ahbau Lake Area—Map	97
Big Slide Mine—Plan	(Insert) 152
Carmi Mine	127
Dividend Mine	135
Early Bird Mine	42
Flathead Valley—Map	165
Parvenu Mines, Ltd.	137
Red Wing Mine	54
Reno Mine	191
Rock Creek Consolidated Placers	132
Sage Creek Dome	175
Squaw Creek Area—Map	75
Unuk River Area—Map	62
Witwatersrand Syndicate	161

PHOTOGRAPHS.

	OPPOSITE PAGE.
Pioneer Gold Mines of B.C., Ltd.	Frontispiece
Blue Flame Collieries, Ltd., Princeton	256
Boulder Creek, Atlin—Hydraulic Mining	64
Bralorne Mines, Ltd.	216
Britannia M. & S. Co.—Underground Loading Scraper	256
Cariboo Gold Quartz Mining Co., Ltd.—Camp	96
Diatomite Deposits, West Bank of Fraser River	80
Fraser River—Long-tom Placer Machine	96
Gold Belt Mining Co., Ltd., Nelson	192
Graham Island—Beach Placer Deposits	64
Guest Placers, Tulameen River	144
Hidden Creek Mine, Anyox—Underground Loading Chute	256
Lowhee Gulch, Cariboo—Hydraulic Mining	96
Mammoth Mine—Mill on Slocan Lake	144
Marshall Creek, Bridge River—Boomer Gate	216
Middlesboro Collieries, Ltd.	256
Moorehead Mines, Ltd.—Hydraulic Workings	96
Newcastle Island—Pulp-stone Quarry	216
Pacific Lime Co., Ltd., Texada Island	216
Quesnel, B.C.—View of Town	80
Reno Gold Mines, Ltd.	192
Spruce Creek, Atlin—Sluicing	80
Spruce Creek, Atlin—Washing with Rocker	80
Squaw Creek, Atlin—Deputy Mining Recorder's Office	64
Squaw Creek, Atlin—Canyon on Lower Part	64
Sullivan Mine—Crusher Plant at the Portal	192
Vidette Gold Mines, Ltd.	144
Weaver Creek, Fort Steele—Boomer Gate on	144
Wild Horse Creek, Fort Steele—Keystone Drill on	192

VICTORIA, B.C.:

Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1933.

LIBRARY CATALOGUE SLIPS.

[Take this leaf out and paste the separated title upon three of your catalogue cards.
The first and second titles need no addition; over the third write that subject
under which you would place the book in your library.]

British Columbia. *Bureau of Mines.*

Series.

Annual Report of the Minister of Mines for the year ended 31st December, 1932, being an account of mining operations in the Province. John D. Galloway, Provincial Mineralogist. 301 pp., plates, maps, 1932.

Victoria, Government Printing Bureau, 1933.

Galloway, John D. (*Provincial Mineralogist.*)

Author.

Annual Report of the Minister of Mines of British Columbia for the year ended 31st December, 1932, being an account of mining operations in the Province. (British Columbia, Bureau of Mines.) 301 pp., plates, maps, 1932.

Victoria, Government Printing Bureau, 1933.

Subject.

Annual Report of the Minister of Mines of British Columbia for the year ended 31st December, 1932, being an account of mining operations in the Province. John D. Galloway, Provincial Mineralogist. (British Columbia, Bureau of Mines.) 301 pp., plates, maps, 1932.

Victoria, Government Printing Bureau, 1933.