PART A

ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1938

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most *Excellent Majesty*.
1939.

BRITISH COLUMBIA DEPARTMENT OF MINES.

VICTORIA, B.C.

Hon. W. J. ASSELSTINE, *Minister.*

JOHN F. WALKER, *Deputy Minister.*

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D. E. WHITTAKER, *Chief Analyst and Assayer.*

P. B. FREELAND, *Chief Mining Engineer.*

R. J. STEENSON, *Chief Gold Commissioner.*

To His Honour ERIC WERGE HAMBER,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Mining Industry of the Province for the year 1938 is herewith respectfully submitted.

W. J. ASSELSTINE,
Minister of Mines.

Minister of Mines' Office,
June, 1939.

Mineral Display at the British Columbia Exhibit, World's Fair. San Francisco, 1939.

PART A.

THE MINING INDUSTRY.

BY

JOHN F. WALKER.

The value of mine production in 1938 was $64,485,551, a decrease of $1,990,351 from 1937. The decrease is due largely to the return to normal of base-metal prices. This is shown clearly in the case of lead and zinc, where the volume changes are slight but the decrease in value amounts to about 35 per cent. All phases of the industry, except clay products, showed decreases.

Lead production of 412,979,182 lb., though only slightly below the 1937 volume record, decreased in value from the all-time value record of $21,416,949 to $13,810,024.

Zinc production again established a record for volume with a production of 298,497,295 lb., but the value decreased from $14,274,245 to $9,172,825.

Coal, valued at $5,565,069, shows a decrease of 9.4 per cent. from the 1937 value.

Copper production increased in volume by 42.8 per cent. to 65,769,906 lb., but, due to lower prices, the value increased only 8.9 per cent. to $6,558,575. Production of this metal has made a very healthy recovery and is now about normal.

Silver production at 10,861,578 oz. is 4 per cent. below the record volume production of 1937, and the value of $4,722,288 is 6.8 per cent. less.

Non-metallic minerals and structural materials, taken in groups, show two losses to one gain, with individual items showing substantial gains or losses. There has been a steady improvement in these groups during the past few years, but 1938 shows the first set-back. Individual items indicate an increase in ordinary building activity and a decrease in heavier construction.

The total number of shipping-mines increased from 185 to 211, those shipping 100 tons decreased from 113 to 92.

The number of men employed decreased slightly from 16,129, last year's record, to 16,021; but wages and salaries increased from $21,349,690 to $22,791,685, the greatest amount ever paid out in any year.

Dividends decreased from the all-time record in 1937 of $15,085,293 to $11,992,316. These figures do not include dividends paid by the Howe Sound Mining Company, parent company of the Britannia Mining and Smelting Company, and the latter figure does not include dividends paid by Premier Gold Mining Company, Limited.

GENERAL SITUATION.

At the first of the year it appeared that volume and value production for 1938 would show some variation in individual items from that of 1937, but that the gross value would be about the same.

At the time of writing the situation does not appear to be quite so bright, as base-metal prices, particularly lead and zinc, have shown no tendency to improve and are averaging considerably below 1938 prices. Any appreciation that may take place before the end of the year can hardly be expected to raise prices for lead and zinc to the levels of last year.

It is anticipated lode gold may show a slight increase in volume. Increased production, particularly from Vancouver Island, is being offset to a large extent by decreased production from the Kootenays.

Placer gold should show a slight increase in value and it is anticipated that considerable testing and development of placer properties will be undertaken during the year.

Indications to date are that silver production will be substantially below that of last year, and while it is impossible to predict what may happen to the price for the metal, it is apparent that if the price holds the value production will be materially less.

Copper production should show a slight gain in volume but, unless the price of the metal recovers from its recent break, no increase in value is anticipated.

Lead production is expected to show a substantial decrease in volume and, unless the price of the metal improves to a greater extent than can be anticipated, there will be another appreciable decrease in the value production of this metal.

Zinc production is likely to show an appreciable decrease in volume and, like lead, a substantial decrease in value.

The value of coal production is expected to be about the same as in 1938.

Structural materials will likely have about the same value as last year.

In preparing the foregoing estimate, it is assumed that no major disaster will affect the mining industry or any of the larger producers. If the industry functions smoothly throughout the year, it is anticipated that while the value of mine production may be about $5,000,000 less than in 1938, the industry, in so far as employment and supplies are concerned, will have had a very good year.

GOLD PURCHASING.

Late in 1935 the Department of Finance, co-operating with the Department of Mines, undertook to purchase small lots of placer gold under 2 oz. in weight from the individual placer-miner. The Gold Commissioners throughout the Province have paid a cash price of $28 per ounce for clean gold, and have purchased dirty gold and amalgam on a deferred-payment basis. Purchases of gold have increased from 1,470 lots in 1936, valued at some $50,000, to 2,397 lots in 1938, valued at approximately $72,000. The total price paid has been almost exactly the same as that received from the Royal Canadian Mint, except for the Mint's handling charge of 1 per cent. This purchasing scheme has returned to the individual miners from $10,000 to $15,000 per annum more than if they had sold through the ordinary channels.

LECTURES TO PROSPECTORS.

A series of fourteen lectures prepared by the Deputy Minister of Mines in 1934 was again given during the winter of 1938–39 by the departmental Mining Engineers and others in different centres throughout the Province, as follows: Abbotsford, Kitchener, Nanaimo, Vancouver, Victoria, and Yahk.

The total estimated average attendance at the lectures was 264. This work was carried out in conjunction with the Department of Education. The brochure entitled "Elementary Geology applied to Prospecting" was used as a basis for these lectures and copies may be obtained from the Department of Mines at the nominal charge of 35 cents. A total of 822 of these books were distributed in 1938.

Prospectors' sets of about fifty rocks and minerals commonly found in British Columbia have been in great demand and 204 sets were distributed throughout the Province at a cost of 50 cents per set to the recipient. Requests for these sets have been received from many parts of Canada and the United States, but up to the present only those resident in British Columbia have been supplied.

DOMINION-PROVINCIAL MINE TRAINING CAMPS.

The Dominion and Provincial Departments of Labour carried on the plan created in former years, whereby young unemployed men between the ages of 20 and 25 years were given an opportunity to learn the general rudiments of mining and prospecting. Instruction was carried out under the direction of the Chief Mining Engineer.

This plan was a departure from the one followed in former years, which embraced placer-mining only, inasmuch that between fifty and sixty trainees, out of 125 instructed, who passed their examinations on subjects taught them at Emory Creek, were sent to Quesnel Forks in the Cariboo district for a further three months' training under practical instructors. The Quesnel Forks area had already been reported upon and mapped by the Geological Survey of Canada, so the trainees could familiarize themselves with the different types of rocks, etc., and learn how to explore a mineral deposit. In addition some placer-mining was done and recoveries made.

During the winter the metal-mine operators kindly co-operated with the Departments and gave jobs to about thirty trained young men. About fifteen more were able to obtain positions throughout the Province as a result of this training.

SAMPLING PLANT, PRINCE RUPERT.

In 1937 a sampling plant was built on the waterfront at Prince Rupert and put into operation on August 20th. The object in erecting a sampling plant at this point was chiefly for the purpose of stimulating prospecting and the development of properties along the Prince

Rupert branch of the Canadian National Railway. The sampling plant was erected on the Coast so that full advantage could be taken of special freight rates arranged especially for shipments of ore to the plant.

The sampling plant is, as its name implies, only a sampling plant and not a concentrator. Ores containing sufficient value to ship direct to the smelter are purchased and assembled at the plant until sufficient tonnage is accumulated to warrant shipment to the smelter. By mixing lots at the plant it is possible also to reduce smelter penalties on individual shipments and so give the prospector the benefit of a mixed lot.

The plant may also be used by those developing properties for the purpose of bulk-sampling.

For the calendar year 1938, 161 lots, comprising 24 tonnage lots for shipment, 90 lots for bulk test-sampling, and 47 lots for assay were received at the plant. These lots aggregated 104 tons and, including shipments to the plant late in 1937, 148 tons were shipped to the smelter, for which $7,536,75 was received as against $7,685.24 paid out by the plant.

This plant is serving its purpose and is stimulating prospecting and development of small properties to a greater extent than for many years. A full report on the sampling plant is contained in Part B.

GEOLOGICAL SURVEY OF CANADA.

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

For some years a branch office of the Geological Survey has been maintained in Vancouver, where copies of maps and reports on British Columbia can be obtained. The officer in charge of the British Columbia office is W. E. Cockfield, and the address is 305 Federal Building, Vancouver, B.C.

In 1936 a reorganization of several departments in the Federal Government was effected, and the Department of Mines and Resources created. One of the main branches of this Department is that of Mines and Geology, with sub-branches known as the Bureau of Geology and Topography and the Bureau of Mines. The Geological Survey of Canada and the Topographical Survey are now a part of the Bureau of Geology and Topography. During the season of 1937 the Bureau of Geology and Topography had the following officers employed on field-work in British Columbia:—

GEOLOGICAL PARTIES.

1. J. E. Armstrong and J. G. Gray commenced the study and mapping of the geology of Hazelton map-area, west half (latitude 55° to 56°, longitude 127° to 128°).

2. E. D. Kindle examined mineral properties tributary to the Canadian National Railways in the vicinity of Hazelton.

3. A. H. Lang commenced the study and mapping of the geology of Smithers map-area, east half (latitude 54° to 55°, longitude 126° to 127°).

4. C. H. Crickmay studied and mapped the geology of Quesnel Lake map-area, west half (latitude 52° 30′ to 52° 45′, longitude 121° 15′ to 121° 30′).

5. H. M. A. Rice completed the study and mapping of the geology of Nelson map-area, east half (latitude 49° to 50°, longitude 116° to 117°).

6. W. E. Snow continued the study and mapping of the geology of Hope map-area, west half (latitude 49° to 50°, longitude 121° to 122°).

7. M. F. Bancroft studied the geology and mineral deposits of Zeballos area, Vancouver Island.

8. F. H. McLearn completed stratigraphical and faunal studies in Peace River district.

TOPOGRAPHICAL PARTIES.

C. H. Smith and R. J. Parlee continued the mapping of the Tatlatui sheet (94 D) (latitudes 56° to 57°, longitudes 126° to 128°).

H. A. S. West mapped the east half of the Nelson sheet (82 F/6) (latitudes 49° 15′ to 49° 30′, longitudes 117° 00′ to 117° 15′).

METHOD OF COMPUTING PRODUCTION.

The total mine output of the Province consists of the outputs of metalliferous minerals, coal, structural materials, and miscellaneous metals, minerals, and materials, valued at standard recognized prices in Canadian funds.

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 the 1925 Annual Report have been followed in subsequent Annual Reports, with the addition of new tables.

The following notes explain the methods used:—

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

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

(2.) Gold-placer returns are received from operators giving production in crude ounces recovered; these are converted to fine-gold ounces by dividing the crude-ounce value by the old standard price of gold. The fine-gold content is then valued at the yearly average price of gold, which in 1936 was $35.03 per ounce. On this basis the average crude-gold value per ounce was $28.80 on Provincial placer-gold production.

(3.) The prices used in valuing the different metals are: For gold, the average price for the year; 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. As in 1936, copper in 1937 is valued at the average London metal-market price. Prior to 1932 copper was valued at the average New York price. The change was made because very little copper was being marketed in the United States on account of high tariff charges against importations from foreign countries. 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, St. Louis, and Montreal lead- and zinc-market prices differ materially from the London prices of these metals and are not properly applicable to the valuing of the British Columbia production.

By agreement with the Dominion Bureau of Statistics and the Provincial Statistical Bureaus, the following procedure of taking care of the exchange fluctuations has been agreed upon:—

(*a.*) Silver to be valued at the average New York price, adjusted to Canadian funds at the average exchange rate.

(*b.*) Lead, zinc, and copper to be valued at London prices, adjusted to Canadian funds at the average exchange rate.

(4.) In 1926 a change was made in computing coal and coke statistics. The practice in former years had 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 mine production. Coke-making is considered a manufacturing industry. As it is, however, of interest to the mining 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 mine 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, and from 1932 on the price used has been $4.25 per long ton. In making comparisons with former years the decline in dollar value is accentuated by this lowered price.

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TABLE I.—British Columbia Mine Production, 1937 and 1938.

	Quantity, 1937.	Quantity, 1938.	Value, 1937.	Value, 1938.	Per Cent. Increase (+) or Decrease (—).	
					Quantity.	Value.
Metallics.			$	$		
Bismuth						
Cadmium			715,747	410,090		— 42.7
Copper lb.	46,057,584	65,769,906	6,023,411	6,558,575	+ 42.8	+ 8.9
Gold, lode* oz.	460,781	557,522	16,122,727	19,613,624	+ 21.0	+ 21.7
Gold, placer* oz.	54,153	57,759	1,558,245	1,671,015	+ 6.7	+ 7.2
Lead lb.	419,118,371	412,979,182	21,416,949	13,810,024	— 1.5	— 35.5
Mercury lb.		760		760	+100.0	+100.0
Platinum oz.	22	16	1,066	515	— 27.3	— 51.7
Silver oz.	11,308,685	10,861,578	5,075,451	4,722,288	— 4.0	— 6.8
Zinc lb.	291,192,278	293,497,295	14,274,245	9,172,822	+ 2.5	— 35.7
Others			37,753		—100.0	—100.0
Totals			65,225,594	55,959,713		— 14.3
Fuel.						
Coal (2,240 lb.) tons	1,444,687	1,309,428	6,139,920	5,565,069	— 9.4	— 9.4
Non-metallics.						
Diatomaceous earth			1,346	363		— 73.0
Fluxes—limestone, quartz tons	22,089	21,089	18,032	16,676	— 4.5	— 7.5
Gypsum products, gypsite			151,175	171,372		+ 13.4
Iron oxides, mica			1,280	4,560		+256.4
Slate and rock granules, talc tons	186	274	2,790	3,295	+ 47.4	+ 18.1
Sodium carbonate, magnesium sulphate tons	1,013	722	17,030	11,668	— 28.7	— 31.5
Sulphur† tons	88,369	78,918	820,398	777,586	— 10.7	— 5.2
Totals			1,012,051	985,520		— 2.6
Clay Products and other Structural Materials.						
Clay Products.						
Brick—						
Common No.	5,291,044	7,221,378	75,334	102,767	+ 36.5	+ 36.4
Face, paving, sewer brick No.	995,600	525,715	35,147	21,045	— 47.2	— 40.1
Firebrick, blocks			126,115	105,933		— 16.0
Fireclay tons	694	467	9,986	6,489	— 32.7	— 35.0
Structural tile—hollow blocks			23,497	30,411		+ 29.4
Drain-tile, sewer-pipe No.	784,491	953,240	68,707	87,139	+ 21.5	+ 26.8
Pottery—glazed or unglazed			9,578	9,699		+ 1.3
Bentonite; other clay products			2,932	2,486		— 15.2
Totals			351,296	365,969		+ 4.2
Other Structural Materials.						
Cement			623,725	626,731		
Lime and limestone tons	71,293	42,373	143,124	102,444	— 40.6	— 28.4
Sand and gravel			552,634	609,464		+ 10.3
Stone—building, pulp-stones tons	6,079	12,207	132,524	90,970	+ 85.0	— 31.4
Rubble, riprap, crushed rock tons	343,587	230,538	295,034	179,671	— 33.0	— 39.0
Totals			1,747,041	1,609,280		— 7.9
Total value in Canadian funds			74,475,902	64,485,551		— 13.4

* Canadian funds.

† Sulphur content of pyrites shipped, estimated sulphur contained in sulphuric acid made from waste smelter-gases, and elemental sulphur.

TABLE II.—AVERAGE METAL PRICES USED IN COMPILING VALUE OF PROVINCIAL PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC.

Year.	Gold, Fine Ounce.	Silver, Fine Ounce.	Copper, Lb.	Lead, Lb.	Zinc, Lb.
	$	Cents.	Cents.	Cents.	Cents.
1901	20.67	56.002 N.Y.	16.11 N.Y.	2.577 N.Y.	.....
1902	.....	49.55 ,,	11.70 ,,	3.66 ,,	.....
1903	.....	50.78 ,,	13.24 ,,	3.81 ,,	.....
1904	.....	53.36 ,,	12.82 ,,	3.88 ,,	.....
1905	.....	51.33 ,,	15.59 ,,	4.24 ,,	.....
1906	.....	63.45 ,,	19.28 ,,	4.81 ,,	.....
1907	.....	62.06 ,,	20.00 ,,	4.80 ,,	.....
1908	.....	50.22 ,,	13.20 ,,	3.78 ,,	.....
1909	.....	48.93 ,,	12.98 ,,	3.85 ,,	.....
1910	.....	50.812 ,,	12.738 ,,	4.00 ,,	4.60 E. St. L.
1911	.....	50.64 ,,	12.38 ,,	3.98 ,,	4.90 ,,
1912	.....	57.79 ,,	16.341 ,,	4.024 ,,	5.90 ,,
1913	.....	56.80 ,,	15.27 ,,	3.93 ,,	4.80 ,,
1914	.....	52.10 ,,	13.60 ,,	3.50 ,,	4.40 ,,
1915	.....	47.20 ,,	17.28 ,,	4.17 ,,	11.25 ,,
1916	.....	62.38 ,,	27.202 ,,	6.172 ,,	10.88 ,,
1917	.....	77.35 ,,	27.18 ,,	7.91 ,,	7.566 ,,
1918	.....	91.93 ,,	24.33 ,,	6.67 ,,	6.94 ,,
1919	.....	105.57 ,,	18.70 ,,	5.19 ,,	6.24 ,,
1920	.....	95.80 ,,	17.45 ,,	7.16 ,,	6.52 ,,
1921	.....	59.52 ,,	12.50 ,,	4.09 ,,	3.95 ,,
1922	.....	64.14 ,,	13.38 ,,	5.16 ,,	4.86 ,,
1923	.....	61.63 ,,	14.42 ,,	6.54 ,,	5.62 ,,
1924	.....	63.442 ,,	13.02 ,,	7.287 ,,	5.39 ,,
1925	.....	69.065 ,,	14.042 ,,	7.848 Lond.	7.892 Lond.
1926	.....	62.107 ,,	13.795 ,,	6.751 ,,	7.409 ,,
1927	.....	56.37 ,,	12.92 ,,	5.256 ,,	6.194 ,,
1928	.....	58.176 ,,	14.570 ,,	4.575 ,,	5.493 ,,
1929	.....	52.993 ,,	18.107 ,,	5.050 ,,	5.385 ,,
1930	.....	38.154 ,,	12.982 ,,	3.927 ,,	3.599 ,,
1931	.....	28.700 ,,	8.116 ,,	2.710 ,,	2.554 ,,
1932	23.47	31.671 ,,	6.380 Lond.	2.113 ,,	2.405 ,,
1933	28.60	37.832 ,,	7.454 ,,	2.391 ,,	3.210 ,,
1934	34.50	47.461 ,,	7.419 ,,	2.436 ,,	3.044 ,,
1935	35.19	64.790 ,,	7.795 ,,	3.133 ,,	3.099 ,,
1936	35.03	45.127 ,,	9.477 ,,	3.913 ,,	3.315 ,,
1937	34.99	44.881 ,,	13.073 ,,	5.110 ,,	4.902 ,,
1938	**35.18**	**43.477** ,,	**9.972** ,,	**3.344** ,,	**3.073** ,,
Average 1934–38 (inclusive)	34.98	49.147 ,,	9.548 ,,	3.587 ,,	3.486 ,,

NOTE.—In making comparisons with average prices used prior to 1926, it should be remembered that deductions were made from the average prices as a means of adjustment between the "assay value content" of ores shipped instead of allowing percentage losses in smelting operations. The price of copper prior to 1926 was taken at "net"; silver, at 95 per cent.; lead, at 90 per cent.; and zinc, at 85 per cent. Subsequent to 1926 (inclusive) prices are true averages, and adjustments are made on the metal content of ores for loss in smelting and refining.

TABLE III.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1938.

Gold, placer	$85,931,959*
Gold, lode	227,550,196*
Silver	133,748,888
Copper	298,662,191
Lead	251,499,455
Zinc	151,296,960
Coal and coke	378,078,146
Structural materials	76,941,138
Miscellaneous minerals, etc.	14,597,258
Total	$1,618,306,191

* Canadian funds.

TABLE IV.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1938 (INCLUSIVE).

1852 to 1895 (inclusive)	$94,547,370	1918	$41,782,474
1896	7,507,956	1919	33,296,313
1897	10,455,268	1920	35,543,084
1898	10,906,861	1921	28,066,641
1899	12,393,131	1922	35,162,843
1900	16,344,751	1923	41,304,320
1901	20,086,780	1924	48,704,604
1902	17,486,550	1925	61,492,242
1903	17,495,954	1926	67,188,842
1904	18,977,359	1927	60,729,358
1905	22,461,325	1928	65,372,583
1906	24,980,546	1929	68,245,443
1907	25,882,560	1930	55,391,993
1908	23,851,277	1931	34,883,181
1909	24,443,025	1932	*28,798,406
1910	26,377,066	1933	*32,602,672
1911	23,499,072	1934	*42,305,297
1912	32,440,800	1935	*48,821,239
1913	30,296,398	1936	*54,081,967
1914	26,388,825	1937	*74,475,902
1915	29,447,508	1938	*64,485,551
1916	42,290,462		
1917	37,010,392	Total	$1,618,306,191

* Canadian funds.

TABLE V.—QUANTITIES AND VALUE OF MINE PRODUCTS FOR 1936, 1937, AND 1938.

Description.	1936.		1937.		1938.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer*.....oz.	43,389	$1,249,940	54,153	$1,553,245	57,759	$1,671,015
Gold, lode*.....oz.	404,472	14,168,654	460,781	16,122,727	557,522	19,513,624
Silver.....oz.	9,521,015	4,296,548	11,308,685	5,075,451	10,861,578	4,722,288
Copper.....lb.	20,806,672	1,971,848	46,057,584	6,023,411	65,769,906	6,568,575
Lead.....lb.	377,971,618	14,790,029	419,118,371	21,416,949	412,979,182	13,810,024
Zinc.....lb.	254,581,393	8,439,373	291,192,278	14,274,245	298,497,295	9,172,822
Coal.....tons, 2,240 lb.	1,346,471	5,722,502	1,444,687	6,139,920	1,309,428	5,565,069
Structural materials		1,796,677		2,093,337		1,975,249
Miscellaneous metals and minerals		1,646,396		1,766,617		1,396,885
Totals		$54,081,967		$74,475,902		$64,485,551

* Canadian funds.

TABLE VI.—PRODUCTION OF LODE GOLD, SILVER, COPPER, LEAD, AND ZINC.

Year.	Gold.		Silver.		Copper.		Lead.		Zinc.		Total Value.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		$		$		$		$		$	$
1887	.....	.....	17,690	17,331	.....	.....	204,800	9,216	.....	.....	26,547
1888	.....	.....	79,780	75,000	.....	.....	674,500	29,813	.....	.....	104,813
1889	.....	.....	53,192	47,873	.....	.....	165,100	6,498	.....	.....	54,371
1890	.....	.....	70,427	73,948	.....	.....	.....	.....	.....	.....	73,948
1891	.....	.....	4,500	4,000	.....	.....	.....	.....	.....	.....	4,000
1892	.....	.....	77,160	66,935	.....	.....	808,420	33,064	.....	.....	99,999
1893	1,170	23,404	227,000	195,000	.....	.....	2,135,023	78,996	.....	.....	297,400
1894	6,252	125,014	746,379	470,219	324,680	16,234	5,662,523	169,875	.....	.....	781,342
1895	39,270	785,400	1,496,522	977,229	952,840	47,642	16,475,464	532,255	.....	.....	2,342,526
1896	62,259	1,244,180	3,135,343	2,100,689	3,818,556	190,926	24,199,977	721,384	.....	.....	4,257,179
1897	106,141	2,122,820	5,472,971	3,272,836	5,325,180	266,258	38,841,135	1,390,517	.....	.....	7,052,431
1898	110,061	2,201,217	4,292,401	2,375,841	7,271,678	874,781	31,693,559	1,077,581	.....	.....	6,529,420
1899	138,315	2,857,573	2,939,413	1,663,708	7,722,591	1,351,453	21,862,436	878,870	.....	.....	6,751,604
1900	167,153	3,453,381	3,958,175	2,309,200	9,997,080	1,615,289	63,358,621	2,691,887	.....	.....	10,069,757
1901	210,384	4,348,603	5,151,333	2,884,745	27,603,746	4,446,963	51,582,906	2,002,733	.....	.....	13,683,044
1902	236,491	4,888,269	3,917,917	1,941,328	29,636,057	3,446,673	22,536,381	824,832	.....	.....	11,101,102
1903	232,831	4,812,616	2,996,204	1,521,472	34,359,921	4,547,535	18,089,283	689,744	.....	.....	11,571,367
1904	222,042	4,589,608	3,222,481	1,719,516	35,710,128	4,578,037	36,646,244	1,421,874	.....	.....	12,309,035
1905	238,660	4,933,102	3,439,417	1,971,818	37,692,251	5,876,222	56,580,703	2,399,022	.....	.....	15,180,164
1906	224,027	4,630,639	2,990,262	1,897,320	42,990,488	8,288,565	52,408,217	2,667,578	.....	.....	17,484,102
1907	196,179	4,055,020	2,745,448	1,703,825	40,832,720	8,166,544	47,738,703	2,291,458	.....	.....	16,216,847
1908	255,582	5,282,880	2,631,389	1,321,483	47,274,614	6,240,249	43,195,733	1,632,799	.....	.....	14,477,411
1909	238,224	4,924,090	2,532,742	1,239,270	45,597,245	5,918,522	44,396,346	1,709,259	8,500,000	400,000	14,191,141
1910	267,701	5,533,380	2,450,241	1,245,016	38,243,934	4,871,512	34,658,746	1,386,350	4,184,192	192,473	13,228,731
1911	228,617	4,725,513	1,892,364	958,293	36,927,656	4,571,644	26,872,397	1,069,521	2,634,544	129,092	11,454,063
1912	257,496	5,322,442	3,132,108	1,810,045	51,456,537	8,408,513	44,871,454	1,805,627	5,358,280	316,139	17,662,766
1913	272,254	5,627,490	3,465,856	1,968,606	46,460,305	7,094,489	55,364,677	2,175,832	6,758,768	324,421	17,190,838
1914	247,170	5,109,004	3,602,180	1,876,736	45,009,699	6,121,319	50,625,048	1,771,877	7,866,467	346,125	15,225,061
1915	250,021	5,167,934	3,366,506	1,588,991	56,918,405	9,835,500	46,503,590	1,939,200	12,982,440	1,460,524	19,992,149
1916	221,932	4,587,334	3,301,923	2,059,739	65,379,364	17,784,494	48,727,516	3,007,462	37,168,980	4,043,985	31,483,014
1917	114,523	2,367,190	2,929,216	2,265,749	59,007,565	16,038,256	37,307,465	2,951,020	41,848,513	3,166,259	26,788,474
1918	164,674	3,403,812	3,498,172	3,215,870	61,483,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040	27,590,278
1919	152,426	3,150,645	3,403,119	3,592,673	42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429	19,750,498
1920	120,048	2,481,392	3,377,849	3,235,980	44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,979	19,444,365
1921	135,663	2,804,154	2,673,389	1,591,201	39,036,993	4,879,624	41,402,288	1,693,354	49,419,372	1,952,065	12,920,398
1922	197,856	4,089,684	7,101,311	4,554,781	32,359,896	4,329,754	67,447,985	3,480,316	57,146,548	2,777,322	19,231,857
1923	179,245	3,704,994	6,032,986	3,718,129	57,720,290	8,323,266	96,663,152	6,321,770	58,343,462	3,278,903	25,347,062
1924	247,716	5,120,535	8,341,768	5,292,184	64,845,393	8,442,870	170,384,481	12,415,917	79,130,970	4,266,741	35,538,247
1925	209,719	4,335,269	7,654,844	5,286,818	72,306,432	10,153,269	237,899,199	18,670,329	98,257,099	7,754,450	46,200,135
1926	201,427	4,163,859	10,748,556	6,675,606	89,339,768	12,324,421	263,023,937	17,757,535	142,876,947	10,586,610	51,508,031
1927	178,001	3,679,601	10,470,185	5,902,043	89,202,871	11,525,011	282,996,423	14,874,292	145,225,443	8,996,135	44,977,082
1928	188,087	3,888,097	10,627,167	6,182,461	97,908,316	14,265,242	305,140,792	13,961,412	181,763,147	9,984,613	48,281,825
1929	145,339	3,004,419	9,918,800	5,256,270	101,483,857	18,375,682	302,346,268	15,269,696	172,096,841	9,268,792	51,174,859
1930	160,778	3,323,576	11,289,171	4,307,270	90,421,545	11,738,525	319,199,752	12,535,931	250,287,306	9,010,093	40,915,395
1931	146,039	3,018,894	7,524,320	2,247,514	63,194,299	5,289,363	248,783,508	6,742,282	205,071,247	5,237,520	22,535,573
1932	181,564	4,261,307*	7,130,838	2,258,453	49,841,009	3,179,956	254,488,952	5,378,878	192,120,091	4,621,641	19,700,235
1933	223,529	6,392,929*	7,006,406	2,650,720	42,608,002	3,176,341	271,606,071	6,495,731	195,963,751	6,291,416	25,007,137
1934	297,130	10,250,985*	8,572,916	4,068,792	48,084,658	3,567,401	347,366,967	8,461,859	247,926,844	7,546,893	33,895,930
1935	365,244	12,852,936*	9,251,544	5,994,075	38,791,127	3,023,768	344,268,444	10,785,930	256,239,446	7,940,860	40,597,569
1936	404,472	14,168,654*	9,521,015	4,296,548	20,806,672	1,971,848	377,971,618	14,790,029	254,581,393	8,439,373	43,666,452
1937	460,781	16,122,727*	11,308,685	5,075,451	46,057,584	6,023,411	419,118,371	21,416,949	291,192,278	14,274,245	62,912,783
1938	557,522	19,613,624*	10,861,578	4,722,288	65,769,906	6,558,575	412,979,182	13,810,024	298,497,295	9,172,822	53,877,333
Totals	9,462,015	227,550,196*	242,653,159	133,748,888	2,035,121,627	298,662,191	5,799,995,204	251,499,455	3,449,160,499	151,296,960	1,062,757,690

* Canadian funds.

TABLE VII.—VALUE OF GOLD PRODUCTION TO DATE.

Year.	Placer.	Lode.	Total.
1858–1862	$9,871,634		$9,871,634
1863–1867	16,283,592		16,283,592
1868–1872	9,895,318		9,895,318
1873–1877	9,019,201		9,019,201
1878–1882	5,579,911		5,579,911
1883–1887	3,841,515		3,841,515
1888–1892	2,525,426		2,525,426
1893	356,131	$23,404	379,535
1894	405,516	125,014	530,530
1895	481,683	785,400	1,267,083
1896	544,026	1,244,180	1,788,206
1897	513,520	2,122,820	2,636,340
1898	643,346	2,201,217	2,844,563
1899	1,344,900	2,857,573	4,202,473
1900	1,278,724	3,453,381	4,732,105
1901	970,100	4,348,603	5,318,703
1902	1,073,140	4,888,269	5,961,409
1903	1,060,420	4,812,616	5,873,036
1904	1,115,300	4,589,608	5,704,908
1905	969,300	4,933,102	5,902,402
1906	948,400	4,630,639	5,579,039
1907	828,000	4,055,020	4,883,020
1908	647,000	5,282,880	5,929,880
1909	477,000	4,924,090	5,401,090
1910	540,000	5,533,380	6,073,380
1911	426,000	4,725,513	5,151,513
1912	555,500	5,322,442	5,877,942
1913	510,000	5,627,490	6,137,490
1914	565,000	5,109,004	5,674,004
1915	770,000	5,167,934	5,937,934
1916	580,500	4,587,334	5,167,834
1917	496,000	2,367,190	2,863,190
1918	320,000	3,403,812	3,723,812
1919	286,500	3,150,645	3,437,145
1920	221,600	2,481,392	2,702,992
1921	233,200	2,804,154	3,037,354
1922	368,800	4,089,684	4,458,484
1923	420,000	3,704,994	4,124,994
1924	420,750	5,120,535	5,541,285
1925	280,092	4,335,269	4,615,361
1926	355,503	4,163,859	4,519,362
1927	156,247	3,679,601	3,835,848
1928	143,208	3,888,097	4,031,305
1929	118,711	3,004,419	3,123,130
1930	152,235	3,323,576	3,475,811
1931	291,992	3,018,894	3,310,886
1932	395,542	4,261,307	4,656,849*
1933	562,787	6,392,929	6,955,716*
1934	714,431	10,250,985	10,965,416*
1935	895,058	12,852,936	13,747,994*
1936	1,249,940	14,168,654	15,418,594*
1937	1,558,245	16,122,727	17,680,972*
1938	1,671,015	19,613,624	21,284,639*
Totals	$85,931,959	$227,550,196	$313,482,155*

* Canadian funds.

TABLE VIII.—Output of Mine Products by Districts and Divisions, 1934, 1935, 1936, 1937, and 1938.

Names.	Divisions.					Districts.				
	1934.	1935.	1936.	1937.	1938.	1934.	1935.	1936.	1937.	1938.
North-western District						$5,239,054	$4,543,389	$2,904,200	$3,273,581	$4,039,662
Atlin, Stikine, and Liard*	$307,313	$406,378	$549,047	$663,570	$1,261,309					
Nass River†	3,088,657	2,221,212	61,834							
Portland Canal	1,700,724	1,636,954	2,053,210	2,213,728	2,411,757					
Skeena, Queen Charlotte, and Bella Coola	142,360	278,845	240,109	396,283	366,596					
North-eastern District						780,122	1,717,546	1,998,344	2,418,194	3,004,755
Cariboo and Quesnel	690,386	1,618,191	1,867,539	2,275,097	2,852,392					
Omineca and Peace River	89,736	99,355	130,805	143,097	152,363					
South Central District						1,826,881	2,894,642	3,321,537	4,961,159	7,658,839
Nicola and Vernon	214,798	315,550	194,490	255,320	138,828					
Yale, Ashcroft, and Kamloops	404,238	248,891	437,550	364,789	429,168					
Clinton‡										
Grand Forks, Greenwood, and Osoyoos	694,414	1,799,685	2,118,630	2,643,559	3,027,462					
Similkameen	513,431	530,516	570,867	1,697,491	4,063,381					
South-eastern District						24,828,234	28,994,311	33,258,173	48,020,055	34,761,321
Fort Steele	20,042,528	23,067,831	27,089,325	39,507,405	27,279,192					
Windermere and Golden	1,360,312	530,863	12,513	16,770	15,443					
Ainsworth	48,246	215,104	55,962	268,820	34,789					
Slocan and Slocan City	84,719	406,133	194,696	667,696	127,706					
Nelson and Arrow Lake	1,496,843	1,991,723	3,051,401	4,267,950	4,721,998					
Trail Creek	1,786,961	2,582,959	2,742,916	3,224,300	2,523,800					
Revelstoke and Lardeau	8,625	199,698	111,460	67,114	58,393					
South-western District						*9,631,006*	*10,671,351*	*12,599,713*	*15,802,913*	*15,020,974*
Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria	2,965,047	3,262,171	3,881,722	4,463,293	4,499,167					
Vancouver, New Westminster, and Lillooet	6,466,377	7,172,367	8,303,079	11,069,818	10,315,933					
Yale, Ashcroft, and Clinton	199,582	236,813	414,912		205,874					
Totals§	$42,305,297	$48,821,239	$54,081,967	$74,475,902	$64,485,551	$42,305,297	$48,821,239	$54,081,967	$74,475,902	$64,485,551

* Liard Mining Division combined with Stikine Mining Division from and including 1937.

† Nass River Mining Division combined with Portland Canal Mining Division from and including 1937.

‡ Yale, Ashcroft, and Clinton Mining Divisions included in South-western District (Mainland section) from and including 1934. § Canadian funds.

TABLE IX.A.—Detail of Placer Gold, Lode Gold, and Silver in 1937 and 1938.

Districts and Divisions.	Year.	Tons.	Gold—Placer.		Gold—Lode.		Silver.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
North-western District:				$		$		$
Atlin	1937	.....	21,683	623,925	.....	.....	.....	.....
	1938	**58,759**	**24,871**	**719,538**	**12,765**	**449,073**	.....	.....
Bella Coola	1937	.....	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....	.....
Portland Canal	1937	268,012	8	230	48,883	1,710,416	1,006,049	451,525
	1938	**339,027**	**13**	**376**	**57,616**	**2,026,931**	**824,211**	**358,342**
Queen Charlotte	1937	.....	63	1,813	.....	.....	.....	.....
	1938	.....	**75**	**2,170**	.....	.....	.....	.....
Skeena*	1937	19,621	3	86	7,175	251,053	3,002	1,347
	1938	**21,052**	**26**	**752**	**8,872**	**312,117**	**7,817**	**3,399**
Stikine	1937	.....	714	20,545	.....	.....	.....	.....
	1938	.....	**2,181**	**63,098**	.....	.....	.....	.....
North-eastern District:								
Cariboo	1937	103,231	16,329	469,865	43,198	1,511,498	4,675	2,098
	1938	**149,893**	**13,616**	**393,922**	**62,105**	**2,184,854**	**6,304**	**2,741**
Omineca	1937	30	3,076	88,511	4	140	1,151	517
	1938	.....	**3,728**	**107,854**	.....	.....	.....	.....
Peace River	1937	.....	106	3,050	.....	.....	.....	.....
	1938	.....	**155**	**4,484**	.....	.....	.....	.....
Quesnel	1937	.....	8,800	253,219	.....	.....	.....	.....
	1938	.....	**8,283**	**239,634**	.....	.....	.....	.....
South Central District:								
Kamloops	1937	13,408	196	5,640	4,787	167,497	1,322	593
	1938	**19,445**	**172**	**4,976**	**6,208**	**218,397**	**989**	**421**
Nicola	1937	10,430	2	57	617	21,589	13,234	5,940
	1938	**16**	.....	.....	.....	.....	**5,520**	**2,400**
Vernon	1937	2,871	170	4,892	1,198	41,918	2,011	902
	1938	**1,277**	**148**	**4,282**	**378**	**13,298**	**1,274**	**554**
Grand Forks	1937	1,601	10	288	933	32,646	3,207	1,439
	1938	**1,980**	**27**	**781**	**673**	**23,676**	**3,861**	**1,679**
Greenwood	1937	41,000	152	4,374	3,286	114,977	665,953	298,886
	1938	**28,841**	**156**	**4,513**	**4,655**	**163,763**	**998,636**	**434,177**
Osoyoos	1937	188,259	.....	.....	55,214	1,931,938	57,761	25,924
	1938	**247,294**	**12**	**347**	**62,563**	**2,200,966**	**57,867**	**25,159**
Similkameen	1937	444,552	80	2,302	2,102	73,549	58,436	26,227
	1938	**1,223,214**	**324**	**9,374**	**8,749**	**307,790**	**214,705**	**93,347**
South-eastern District:								
Ainsworth	1937	59,623	1	29	64	2,239	83,234	37,356
	1938	**968**	**31**	**897**	**507**	**17,838**	**8,261**	**3,592**
Arrow Lake	1937	.....	.....	.....	.....	.....	.....	.....
	1938	**50**	**2**	**58**	**19**	**669**	**93**	**40**
Fort Steele	1937	2,219,755	836	24,056	65	2,274	8,267,901	3,710,717
	1938	**2,273,264**	**957**	**27,687**	**79**	**2,779**	**8,012,355**	**3,483,532**
Golden	1937	.....	9	259	.....	.....	.....	.....
	1938	.....	**16**	**463**	.....	.....	.....	.....
Lardeau	1937	3,182	1	29	285	9,972	32,937	14,782
	1938	**367**	.....	.....	**272**	**9,569**	**15,258**	**6,647**
Nelson	1937	275,241	282	8,114	111,710	3,908,733	198,609	89,138
	1938	**332,274**	**232**	**6,712**	**124,957**	**4,395,987**	**225,620**	**98,093**
Revelstoke	1937	114	97	2,791	.....	.....	4,469	2,006
	1938	.....	**144**	**4,166**	.....	.....	.....	.....
Slocan	1937	54,716	.....	.....	117	4,094	523,537	234,969
	1938	**4,867**	.....	.....	**89**	**3,131**	**123,799**	**53,824**
Slocan City	1937	4,933	1	29	23	805	18,998	8,526
	1938	**880**	**10**	**289**	**105**	**3,694**	**68,741**	**29,886**
Trail Creek	1937	25,000	.....	.....	9,390	328,556	149,821	67,241
	1938	**119,038**	**216**	**6,249**	**8,496**	**298,889**	**60,649**	**26,368**
Windermere	1937	1	17	489	.....	.....	13	6
	1938	.....	**2**	**58**	.....	.....	.....	.....
South-western District:								
Alberni	1937	.....	.....	.....	.....	.....	.....	.....
	1938	**75**	.....	.....	**23**	**809**	**28**	**12**
Ashcroft	1937	.....	451	12,978	.....	.....	.....	.....
	1938	.....	**504**	**14,581**	.....	.....	.....	.....
Clayoquot	1937	476	.....	.....	3,183	111,373	1,360	610
	1938	**26,483**	.....	.....	**17,979**	**632,501**	**11,750**	**5,108**
Clinton	1937	11,016	355	10,215	5,356	187,407	7,837	3,517
	1938	**6,765**	**969**	**28,034**	**3,289**	**115,707**	**3,926**	**1,707**
Lillooet	1937	335,146	554	15,941	148,876	5,209,171	52,955	23,767
	1938	**308,646**	**549**	**15,883**	**162,215**	**5,706,724**	**44,830**	**19,491**
Nanaimo	1937	525	1	29	39	1,365	37	17
	1938	**423**	**2**	**58**	**63**	**2,216**	**61**	**26**
New Westminster	1937	.....	88	2,532	.....	.....	.....	.....
	1938	.....	**211**	**6,104**	.....	.....	.....	.....
Quatsino	1937	.....	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....	.....
Vancouver	1937	2,122,131	.....	.....	14,215	497,383	150,162	67,395
	1938	**2,212,106**	.....	.....	**14,769**	**519,574**	**164,930**	**71,707**
Victoria	1937	.....	3	86	.....	.....	.....	.....
	1938	**3**	**4**	**116**	.....	.....	**14**	**6**
Yale	1937	370	65	1,871	61	2,134	14	6
	1938	**84**	**123**	**3,559**	**78**	**2,674**	**69**	**30**
Totals	1937	6,145,254	54,153	†1,558,245	460,781	16,122,727	11,308,685	5,075,451
	1938	**7,377,091**	**57,759**	**†1,671,015**	**557,522**	**19,613,624**	**10,861,578**	**4,722,288**

From and including 1937 the Liard Mining Division is combined with Stikine Mining Division.
From and including 1937 the Nass River Mining Division is combined with the Portland Canal Mining Division.
* Includes all shipments to Government sampling plant at Prince Rupert during 1938.
† Includes placer gold purchased by Gold Commissioners from "snipers" and others, and in many instances was not obtained in the mining division where sold, but disposed of at the most convenient place.

TABLE IX.B.—PRODUCTION IN DETAIL OF COPPER, LEAD, AND ZINC IN 1937 AND 1938.

DISTRICTS AND DIVISIONS.	YEAR.	COPPER.		LEAD.		ZINC.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
North-western District:			$		$		$
Atlin	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Bella Coola	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Portland Canal	1937	15,485	2,025	943,871	48,232	.....	.....
	1938	**303**	**30**	**779,834**	**26,078**	.....	.....
Queen Charlotte	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Skeena	1937	62,576	8,184	.....	.....	.....	.....
	1938	**133,851**	**13,348**	.....	.....	.....	.....
Stikine	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
North-eastern District:							
Cariboo	1937	.....	.....	144	7	41	2
	1938	.....	.....	.....	.....	.....	.....
Omineca	1937	.....	.....	5,215	267	11,547	566
	1938	.....	.....	.....	.....	.....	.....
Peace River	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Quesnel	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
South Central District:							
Kamloops	1937	27,925	3,652	6,835	349	738	36
	1938	**97,094**	**9,682**	.....	.....	.....	.....
Nicola	1937	183,410	23,986	183,410	9,372	4,823	237
	1938	.....	.....	**5,328**	**178**	**6,616**	**203**
Vernon	1937	.....	.....	384	20	.....	.....
	1938	.....	.....	**880**	**30**	**322**	**10**
Grand Forks	1937	4,801	628	1,470	75	1,637	80
	1938	**6,146**	**613**	**1,559**	**52**	**1,481**	**45**
Greenwood	1937	469,980	61,464	498,023	25,449	730,420	35,805
	1938	**240,048**	**23,938**	**636,464**	**21,283**	**807,344**	**24,810**
Osoyoos	1937	483,293	63,205	31,854	1,628	.....	.....
	1938	**372,596**	**37,155**	**34,869**	**1,166**	**287**	**9**
Similkameen	1937	7,692,756	1,006,059	.....	.....	.....	.....
	1938	**29,652,613**	**2,956,958**	.....	.....	.....	.....
South-eastern District:							
Ainsworth	1937	.....	.....	2,289,536	116,995	2,085,383	102,225
	1938	.....	.....	**72,168**	**2,413**	**24,760**	**761**
Arrow Lake	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Fort Steele	1937	.....	.....	405,373,908	20,714,607	266,176,726	13,047,988
	1938	.....	.....	**406,222,153**	**13,584,069**	**267,766,054**	**8,228,451**
Golden	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Lardeau	1937	.....	.....	170,375	8,706	112,600	5,520
	1938	.....	.....	**258,718**	**8,652**	**73,598**	**2,262**
Nelson	1937	.....	.....	2,824,882	144,351	1,490,845	73,081
	1938	.....	.....	**9,890,303**	**130,092**	**1,547,177**	**47,545**
Revelstoke	1937	.....	.....	86,640	4,427	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Slocan	1937	.....	.....	2,895,724	147,972	5,507,449	269,975
	1938	.....	.....	**500,658**	**16,742**	**637,388**	**19,587**
Slocan City	1937	.....	.....	15,728	804	10,647	522
	1938	.....	.....	**12,198**	**408**	**4,723**	**145**
Trail Creek*	1937	4,679,784	612,022	3,315,682	169,431	15,059,380	738,211
	1938	**1,700,694**	**169,593**	**287,362**	**9,609**	**27,627,545**	**848,994**
Windermere	1937	.....	.....	1,247	64	42	2
	1938	.....	.....	.....	.....	.....	.....
South-western District:							
Alberni	1937	.....	.....	.....	.....	.....	.....
	1938	**4,362**	**435**	.....	.....	.....	.....
Ashcroft	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Clayoquot	1937	165	22	4,169	213	.....	.....
	1938	**189,738**	**18,921**	**6,754**	**226**	.....	.....
Clinton	1937	16,969	2,219	.....	.....	.....	.....
	1938	**2,267**	**226**	.....	.....	.....	.....
Lillooet	1937	.....	.....	19,302	986	.....	.....
	1938	**109**	**11**	.....	.....	.....	.....
Nanaimo	1937	1,229	161	.....	.....	.....	.....
	1938	**301**	**30**	.....	.....	.....	.....
New Westminster	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Quatsino	1937	.....	.....	.....	.....	.....	.....
	1938	.....	.....	.....	.....	.....	.....
Vancouver	1937	32,419,185	4,239,781	449,972	22,994	.....	.....
	1938	**33,368,792**	**3,327,536**	**269,934**	**9,026**	.....	.....
Victoria	1937	.....	.....	.....	.....	.....	.....
	1938	**685**	**68**	.....	.....	.....	.....
Yale	1937	26	3	.....	.....	.....	.....
	1938	**307**	**31**	.....	.....	.....	.....
Totals	1937	46,057,584	6,023,411	419,118,371	21,416,949	291,192,278	14,274,245
	1938	**65,769,906**	**6,558,575**	**412,979,152**	**13,810,024**	**298,487,295**	**9,172,822**

* Includes zinc and lead recovered from slag and reclaimed slags which cannot be credited to individual mines.

TABLE IX.c.—Production Value of Placer Gold, Lode Gold, Silver, Copper, Lead, Zinc in 1937 and 1938.

Districts and Divisions.	Mining Division Total.		District Total.	
	1937.	1938.	1937.	1938.
	$	$	$	$
North-western District	.....	.....	3,119,381	3,975,252
Atlin	623,925	1,168,611	.....	.....
Bella Coola	.....	.....	.....	.....
Portland Canal	2,212,428	2,411,757	.....	.....
Queen Charlotte	1,813	2,170	.....	.....
Skeena	260,670	329,616	.....	.....
Stikine	20,545	63,098	.....	.....
North-eastern District	.....	.....	2,329,740	2,933,489
Cariboo	1,983,470	2,581,517	.....	.....
Omineca	90,001	107,854	.....	.....
Peace River	3,050	4,484	.....	.....
Quesnel	253,219	239,634	.....	.....
South Central District	.....	.....	3,993,623	6,586,032
Kamloops	177,767	233,476	.....	.....
Nicola	61,181	2,781	.....	.....
Vernon	47,732	18,174	.....	.....
Grand Forks	35,156	26,846	.....	.....
Greenwood	540,955	672,484	.....	.....
Osoyoos	2,022,695	2,264,802	.....	.....
Similkameen	1,108,137	3,367,469	.....	.....
South-eastern District	.....	.....	44,614,108	31,550,438
Ainsworth	258,844	25,499	.....	.....
Arrow Lake	.....	767	.....	.....
Fort Steele	37,499,637	25,326,518	.....	.....
Golden	259	463	.....	.....
Lardeau	39,009	27,130	.....	.....
Nelson	4,223,417	4,678,429	.....	.....
Revelstoke	9,224	4,166	.....	.....
Slocan	657,010	93,284	.....	.....
Slocan City	10,686	34,422	.....	.....
Trail Creek	1,915,461	1,359,702	.....	.....
Windermere	561	58	.....	.....
South-western District	.....	.....	10,414,176	10,503,137
Alberni	.....	1,258	.....	.....
Ashcroft	12,978	14,581	.....	.....
Clayoquot	112,218	656,756	.....	.....
Clinton	203,358	145,674	.....	.....
Lillooet	5,249,865	5,742,109	.....	.....
Nanaimo	1,572	2,330	.....	.....
New Westminster	2,532	6,104	.....	.....
Quatsino	.....	.....	.....	.....
Vancouver	4,827,553	3,927,843	.....	.....
Victoria	86	190	.....	.....
Yale	4,014	6,294	.....	.....
Totals	64,471,028	55,548,348	64,471,028	55,548,348

From and including 1937 the Liard Mining Division is combined with Stikine Mining Division.
From and including 1937 the Nass River Mining Division is combined with Portland Canal Mining Division.

TABLE IX.D.—PRODUCTION OF PLACER GOLD, LODE GOLD, AND SILVER, 1900–1938.

DISTRICTS AND DIVISIONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
	Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
North-western District:		$		$		$
Atlin*	527,797	11,666,495	30,556	819,092	52,453	32,290
Bella Coola	5	104	.....	.....	.....	.....
Liard	14,356	285,770	.....	.....	.....	.....
Nass River	175	3,500	124,395	2,765,216	8,175,679	5,604,918
Portland Canal	21	606	1,536,621	35,573,446	37,790,912	20,406,142
Queen Charlotte	1,485	33,444	1,953	41,174	29,413	16,916
Skeena	2,118	43,702	357,401	7,846,273	198,663	151,087
Stikine	10,877	252,092	.....	.....	.....	.....
District totals	556,834	12,285,713	2,050,926	47,045,201	46,247,120	26,211,353
North-eastern District:						
Cariboo†	1,874,103	37,836,744	197,435	6,873,662	22,387	10,858
Omineca	29,239	684,044	8,254	182,792	2,239,897	1,411,386
Peace River	3,549	77,556	.....	.....	.....	.....
Quesnel‡	596,743	12,155,173	.....	.....	.....	.....
District totals	2,503,634	50,753,517	205,689	7,056,454	2,262,284	1,422,244
South Central District:						
Kamloops	2,526	58,384	36,768	1,222,064	278,680	166,215
Nicola	228	4,592	7,932	212,100	238,675	115,335
Vernon	1,262	28,978	3,869	124,975	6,298	3,250
Grand Forks	651	13,652	164,480	3,549,556	1,940,984	855,183
Greenwood	2,933	67,957	900,484	19,067,605	15,676,811	8,428,325
Osoyoos	173	3,621	797,048	19,186,472	442,535	296,226
Similkameen	5,964	125,604	34,695	874,338	1,036,398	533,219
District totals	13,737	302,788	1,945,276	44,237,110	19,620,381	10,397,753
South-eastern District:						
Ainsworth	200	5,301	2,348	55,191	6,464,989	3,906,096
Arrow Lake	109	2,420	180	4,052	13,699	10,527
Fort Steele	15,232	337,902	2,392	51,770	95,110,630	48,071,235
Golden	203	4,594	6	124	388,762	197,445
Lardeau	863	19,784	18,672	512,001	152,350	84,373
Nelson	2,468	57,980	833,230	23,316,195	3,687,169	2,052,383
Revelstoke	3,667	75,927	12	335	50,097	31,309
Slocan	1	29	3,890	85,907	35,344,435	21,701,705
Slocan City	24	664	1,567	38,774	3,413,793	1,989,936
Trail Creek	593	16,589	2,573,708	54,413,939	3,212,053	1,802,846
Trout Lake	861	17,137	5,502	113,725	1,920,701	1,030,840
Windermere	217	5,160	64	1,323	705,682	503,498
District totals	24,438	543,487	3,441,571	78,593,336	150,464,360	81,382,193
South-western District:						
Alberni	266	5,503	409	13,592	1,581	923
Ashcroft	9,515	207,545	8,476	289,680	16,804	9,513
Clayoquot	1,308	26,436	22,956	791,496	38,636	23,583
Clinton	8,070	178,553	18,822	659,032	27,106	12,438
Lillooet§	88,740	1,799,153	992,237	31,995,548	270,288	128,241
Nanaimo	217	4,472	66,720	1,382,628	512,594	295,669
New Westminster	1,224	31,603	.....	.....	268	167
Quatsino	233	4,902	59	1,219	4,245	2,157
Vancouver	113	3,255	200,774	5,295,443	2,868,896	1,640,696
Victoria	423	9,269	35,348	730,644	734,287	399,098
Yale	7,423	152,529	3,455	78,182	6,532	3,270
District totals	117,532	2,423,220	1,349,256	41,237,464	4,481,237	2,515,755
Provincial totals	3,216,175	66,308,725	8,992,718	218,169,565	223,075,382	121,929,298

From and including 1937 the Liard Mining Division is combined with Stikine Mining Division.
From and including 1937 the Nass River Mining Division is combined with Portland Canal Mining Division.
From and including 1931 the Trout Lake Mining Division was combined with Lardeau Mining Division.
* Atlin totals include estimated placer gold production from and including 1898.
† Cariboo totals include estimated placer gold production from and including 1858.
‡ Quesnel totals include estimated placer gold production from and including 1858.
§ Lillooet totals include estimated placer gold production from and including 1874.

TABLE IX.E.—PRODUCTION OF COPPER, LEAD, AND ZINC, 1900–1938.

DISTRICTS AND DIVISIONS.	COPPER.		LEAD.		ZINC.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
North-western District:		$		$		$
Atlin	83,161	11,949	109,945	7,036	.....	.....
Bella Coola	.....	.....	.....	.....	.....	.....
Liard	.....	.....	.....	.....	.....	.....
Nass River	645,243,514	96,155,780	50,148	2,621	.....	.....
Portland Canal	3,896,838	579,919	20,495,792	909,962	1,867,664	110,254
Queen Charlotte	1,457,541	276,471	.....	.....	.....	.....
Skeena	5,653,225	883,032	.....	.....	.....	.....
Stikine	.....	.....	.....	.....	.....	.....
District totals	656,334,279	97,907,151	20,655,885	919,619	1,867,664	110,254
North-eastern District:						
Cariboo	.....	.....	656	30	492	16
Omineca	6,050,228	1,338,025	5,851,278	332,835	3,789,588	242,884
Peace River	.....	.....	.....	.....	.....	.....
Quesnel	.....	.....	.....	.....	.....	.....
District totals	6,050,228	1,338,025	5,851,934	332,865	3,790,080	242,900
South Central District:						
Kamloops	5,598,493	1,004,678	367,164	20,687	406,758	25,981
Nicola	536,304	103,443	2,098,415	84,604	233,677	7,561
Vernon	614	89	6,331	292	2,764	147
Grand Forks	47,136,356	7,326,841	415,144	13,363	551,537	14,001
Greenwood	393,506,886	63,113,042	6,854,488	268,938	4,974,142	168,281
Osoyoos	1,197,903	136,725	233,561	6,877	4,803	151
Similkameen	136,221,615	18,491,487	235,461	8,907	63,720	2,596
District totals	584,198,171	90,176,305	9,710,564	403,668	6,237,401	218,718
South-eastern District:						
Ainsworth	10,175	1,201	120,849,935	5,957,504	33,667,279	1,006,871
Arrow Lake	216,034	41,651	24,734	1,564	140	4
Fort Steele	28,592	6,193	5,062,425,758	219,046,571	3,046,990,639	130,537,887
Golden	10,822	1,949	54,189,305	1,717,514	53,392,821	1,750,033
Lardeau	155	12	984,137	45,170	227,984	10,747
Nelson	5,685,261	889,008	46,702,719	2,113,514	19,181,848	1,279,583
Revelstoke	683	124	939,741	55,885	8,093	469
Slocan	3,284	636	285,201,252	13,721,172	158,947,083	10,829,580
Slocan City	.....	.....	5,690,259	235,563	563,612	34,868
Trail Creek	111,629,145	16,804,631	14,919,062	621,844	105,648,613	3,673,809
Trout Lake	5,439	773	8,502,837	334,396	62,705	4,233
Windermere	46,556	8,641	13,798,509	829,410	592,765	33,011
District totals	117,636,146	17,754,819	5,614,227,748	244,680,107	3,419,283,582	149,161,095
South-western District:						
Alberni	313,646	51,329	263	8	.....	.....
Ashcroft	633,775	155,721	99	4	.....	.....
Clayoquot	1,289,566	219,225	11,087	445	.....	.....
Clinton	56,565	5,806	193	7	.....	.....
Lillooet	109	11	60,228	2,470	.....	.....
Nanaimo	20,041,451	3,173,273	.....	.....	.....	.....
New Westminster	21,712	5,897	.....	.....	.....	.....
Quatsino	174,642	27,693	.....	.....	.....	.....
Vancouver	570,950,614	82,088,203	7,020,358	245,536	17,981,772	563,988
Victoria	20,505,707	3,049,838	.....	.....	.....	.....
Yale	333	34	12,088	541	.....	.....
District totals	613,988,120	88,777,030	7,104,316	249,011	17,981,772	563,988
Provincial totals	1,978,206,944	295,953,330	5,657,550,447	246,585,270	3,449,160,499	150,296,955

From and including 1937 the Liard Mining Division is combined with Stikine Mining Division.
From and including 1937 the Nass River Mining Division is combined with Portland Canal Mining Division.
From and including 1931 the Trout Lake Mining Division was combined with Lardeau Mining Division.

TABLE IX.F.—PRODUCTION VALUE OF PLACER GOLD, LODE GOLD, SILVER, COPPER, LEAD, AND ZINC, BY MINING DIVISIONS AND DISTRICTS, 1900–1938.

DISTRICTS AND DIVISIONS.	Mining Division Total.	District Total.
	$	$
North-western District	.....	**184,479,291**
Atlin*	12,536,862	.....
Bella Coola	104	.....
Liard	285,770	.....
Nass River	104,532,035	.....
Portland Canal	57,580,329	.....
Queen Charlotte	368,005	.....
Skeena	8,924,094	.....
Stikine	252,092	.....
North-eastern District	.....	**61,146,005**
Cariboo†	44,721,310	.....
Omineca	4,191,966	.....
Peace River	77,556	.....
Quesnel‡	12,155,173	.....
South Central District	.....	**145,736,342**
Kamloops	2,498,009	.....
Nicola	527,635	.....
Vernon	157,731	.....
Grand Forks	11,772,596	.....
Greenwood	91,114,148	.....
Osoyoos	19,630,072	.....
Similkameen	20,036,151	.....
South-eastern District	.....	**572,115,037**
Ainsworth	10,932,164	.....
Arrow Lake	60,218	.....
Fort Steele	398,051,558	.....
Golden	3,671,659	.....
Lardeau	672,087	.....
Nelson	29,708,663	.....
Revelstoke	164,049	.....
Slocan	46,839,029	.....
Slocan City	2,299,805	.....
Trail Creek	77,333,658	.....
Trout Lake	1,501,104	.....
Windermere	1,381,043	.....
South-western District	.....	**135,766,468**
Alberni	71,355	.....
Ashcroft	662,463	.....
Clayoquot	1,061,185	.....
Clinton	855,836	.....
Lillooet§	33,925,423	.....
Nanaimo	4,856,042	.....
New Westminster	37,667	.....
Quatsino	35,971	.....
Vancouver	89,837,121	.....
Victoria	4,188,849	.....
Yale	234,556	.....
Provincial totals	1,099,243,143	**1,099,243,143**

From and including 1937 the Liard Mining Division is combined with Stikine Mining Division.
From and including 1937 the Nass River Mining Division is combined with Portland Canal Mining Division.
From and including 1931 the Trout Lake Mining Division was combined with Lardeau Mining Division.
* Atlin totals include estimated placer gold production from and including 1898.
† Cariboo totals include estimated placer gold production from and including 1858.
‡ Quesnel totals include estimated placer gold production from and including 1858.
§ Lillooet totals include estimated placer gold production from and including 1874.

TABLE X.—Production in Detail of Structural Materials, 1938.

Districts and Divisions.	Cement.	Lime and Limestone.	Building-stone.	Riprap and Crushed Rock.	Sand and Gravel.	Brick (Common).	Face, Paving, and Sewer Brick.	Firebrick, Blocks.	Fireclay.	Structural Tile, Hollow.	Drain-tile and Sewer-pipe.	Pottery, Glazed or Unglazed.	Other Clay Products.	Divisions.	Districts.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
North-western District															64,410
Atlin and Stikine				14,200	15,400									29,600	
Portland Canal															
Skeena and Queen Charlotte				5,217	12,631									17,848	
Bella Coola		8,444		3,104	5,414									16,962	
North-eastern District															53,643
Cariboo and Quesnel				299	30,277									30,576	
Omineca and Peace River				1,821	21,246									23,067	
South Central District															93,794
Nicola, Vernon, and Kamloops			3,000	926	23,601	3,002				1,158	538			32,225	
Grand Forks and Greenwood				1,000	3,450									4,450	
Osoyoos				3,193	40,730									43,923	
Similkameen				1,385	10,760								1,051	13,196	
South-eastern District															223,075
Fort Steele				32,499	75,386									107,885	
Windermere and Golden				614	14,308									14,922	
Ainsworth				500	8,790									9,290	
Slocan and Slocan City															
Nelson			6,570	4,540	29,973									41,083	
Trail Creek					22,798									22,798	
Revelstoke				8,126	18,971									27,097	
South-western District															1,540,327
Nanaimo and Alberni		83,160	30,000	5,100	23,464	22,208								163,932	
Victoria and Quatsino	626,731	10,840		2,542	69,520	34,903	355			5,801	8,343	3,549	528	763,112	
Lillooet				2,384	1,401									3,785	
Yale					17,000									17,000	
Clinton															
Ashcroft				7,300	199									7,499	
Vancouver			51,400	36,257	63,881									151,538	
New Westminster				48,664	100,264	42,654	20,690	105,933	6,489	23,452	78,258	6,150	907	433,461	
Totals	626,731	102,444	90,970	179,671	609,464	102,767	21,045	105,933	6,489	30,411	87,139	9,699	2,486	1,975,249	1,975,249

TABLE XI.—Production in Detail of Miscellaneous Metals, Minerals, and Materials, 1938.

Districts and Divisions.	Cadmium.	Diatomite.	Flux (Limestone and Quartz).	Gypsum Products.	Iron Oxides.	Mercury.	Platinum.	Slate and Rock Granules.	Soda and Magnesium Sulphate.	Sulphur (Elemental) and Sulphur Content of Pyrite and Sulphuric Acid Manufactured.	Division Totals.	District Totals.
	$	$	$	$	$	$	$	$	$	$	$	$
North-western District												
Atlin and Stikine												
Portland Canal												
Skeena and Queen Charlotte												
North-eastern District												395
Cariboo and Quesnel		363					32				395	
Omineca and Peace River												
South Central District												186,780
Nicola, Vernon, and Kamloops				171,372							171,372	
Grand Forks and Greenwood			14,957								14,957	
Osoyoos and Similkameen							451				451	
South-eastern District												1,143,019
Fort Steele												
Windermere and Golden												
Ainsworth												
Slocan and Slocan City												
Nelson and Arrow Lake			1,719								1,719	
Trail Creek and Revelstoke	410,090									731,210	1,141,300	
South-western District												66,691
Nanaimo and Alberni												
Victoria and Quatsino								2,900			2,900	
Lillooet and Clinton						760	32		2,268		3,060	
Yale and Ashcroft									9,400		9,400	
Vancouver and New Westminster					4,560			395		46,376	51,331	
Totals	410,090	363	16,676	171,372	4,560	760	515	3,295	11,668	777,586	1,396,885	*1,396,885

* Does not include mica sales valued at $1,562; data received too late.

TABLE XII.—British Columbia Mine Production, 1895–1938.

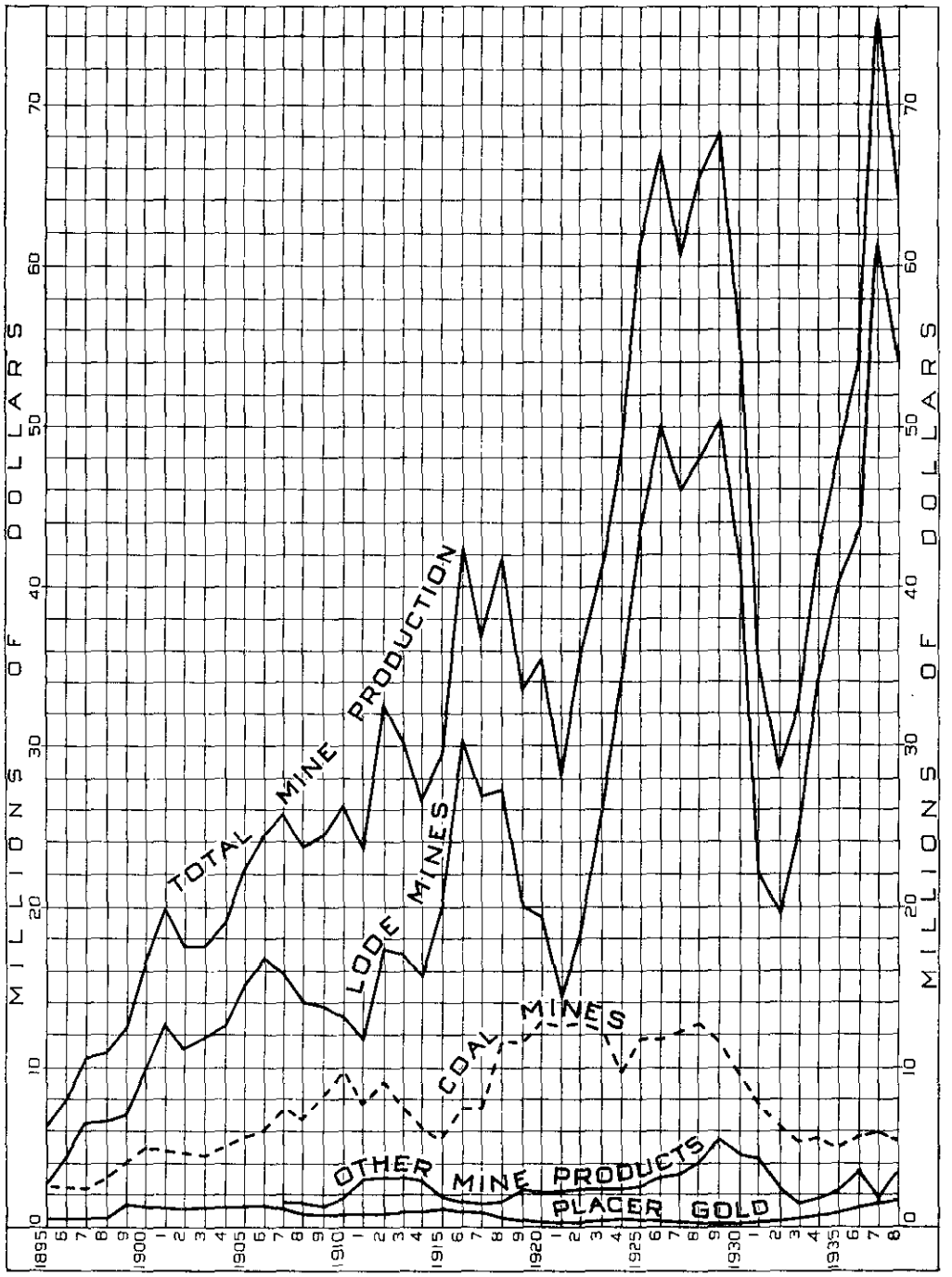


TABLE XIII.—Production of Lode Mines in British Columbia, 1913–1938.

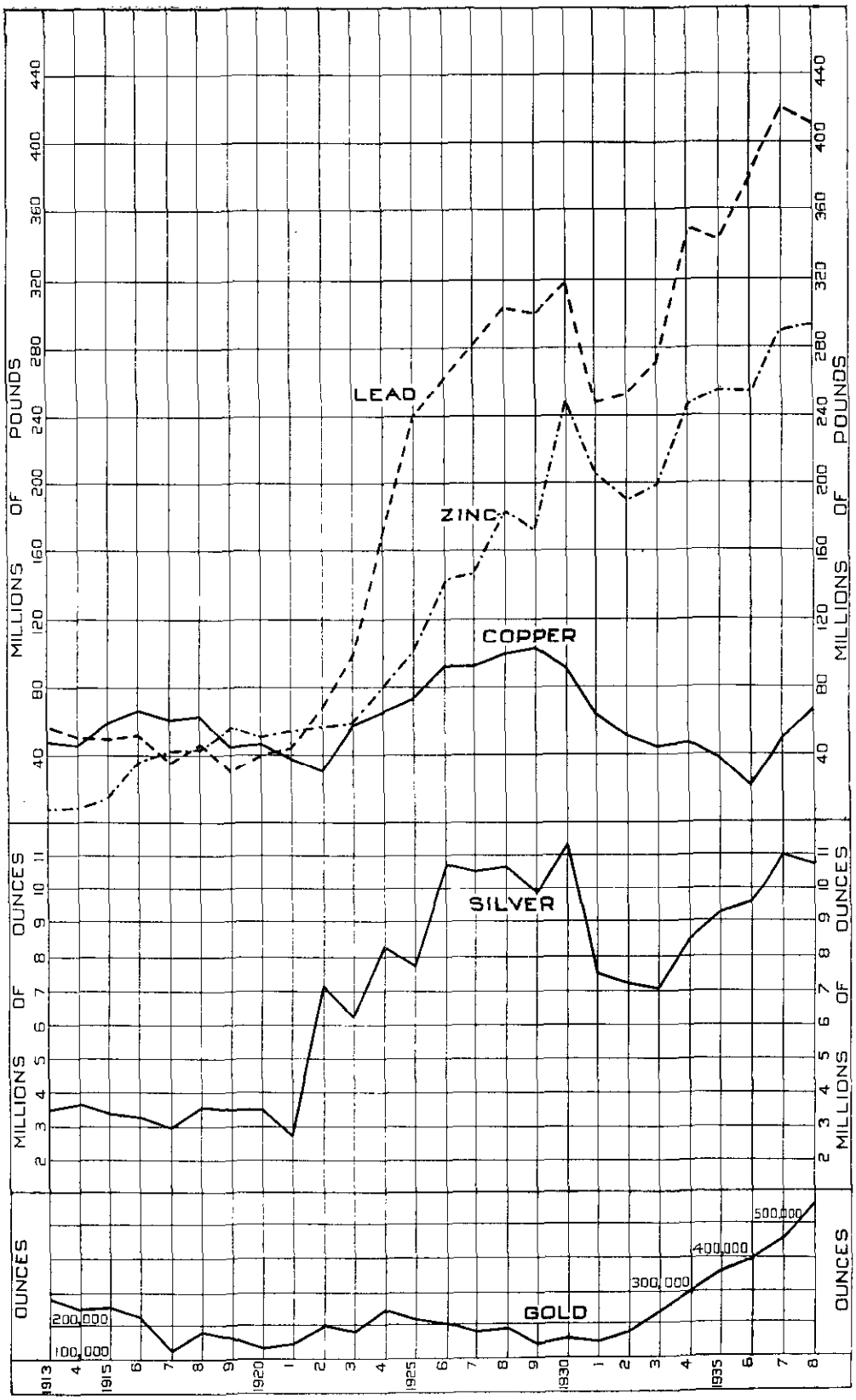


TABLE XIV.—Coal Production per Year to Date.*

	Tons. (2,240 lb.)	Value.		Tons. (2,240 lb.)	Value.
1836-1885	3,029,011	$9,468,557	1913	2,137,483	$7,481,190
1886	326,636	979,908	1913	2,137,483	7,481,190
1887	413,360	1,240,080	1914	1,810,967	6,338,385
1888	489,301	1,467,903	1915	1,611,129	5,638,952
1889	579,830	1,739,490	1916	2,084,093	7,294,325
1890	678,140	2,034,420	1917	2,149,975	7,524,913
1891	1,029,097	3,087,291	1918	2,302,245	11,511,225
1892	826,335	2,479,005	1919	2,267,541	11,337,705
1893	978,294	2,934,882	1920	2,595,125	12,975,625
1894	1,012,953	3,038,859	1921	2,483,995	12,419,975
1895	939,654	2,818,962	1922	2,511,843	12,559,215
1896	896,222	2,688,666	1923	2,453,223	12,266,115
1897	882,854	2,648,562	1924	1,939,526	9,697,630
1898	1,135,865	3,407,595	1925	2,328,522	11,642,610
1899	1,306,324	3,918,972	1926	2,330,036	11,650,180
1900	1,439,595	4,318,785	1927	2,453,827	12,269,135
1901	1,460,331	4,380,993	1928	2,526,702	12,633,510
1902	1,397,394	4,192,182	1929	2,251,252	11,256,260
1903	1,168,194	3,504,582	1930	1,887,130	9,435,650
1904	1,253,628	3,760,884	1931	1,707,590	7,684,155
1905	1,384,312	4,152,936	1932	1,534,975	6,523,644
1906	1,517,303	4,551,909	1933	1,264,746	5,375,171
1907	1,800,067	6,300,235	1934	1,347,090	5,725,133
1908	1,677,349	5,872,472	1935	1,187,968	5,048,864
1909	2,006,476	7,022,666	1936	1,346,471	5,722,502
1910	2,800,046	9,800,161	1937	1,444,687	6,139,920
1911	2,193,062	7,675,717	1938	1,309,428	5,565,069
1912	2,628,804	9,200,814			
			Totals	88,518,506	$352,404,546

* 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 XV.—Coke Production from Bee-hive Ovens in British Columbia from 1895 to 1925.

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

TABLE XVI.—Coke and By-products Production of British Columbia, 1937 and 1938.

Description.	1937.		1938.	
	Quantity.	Value.	Quantity.	Value.
Coal used in making coke, long tons	148,348	$570,250	157,951	$623,649
Coke made in bee-hive ovens, long tons	43,215	277,726	48,760	315,294
Coke made in by-product ovens, long tons				
Coke made in gas plants, long tons	52,813	330,821	53,004	345,790
Total coke made, long tons	96,028	$608,547	101,764	$661,084
Gas sold and used		1,746,047		1,770,839
Tar produced		46,698		44,324
Other by-products				
Total production value of coke industry		$2,401,292		$2,476,247

TABLE XVII.—Dividends paid by Mining Companies, 1897–1938.

Lode-gold Mines.

Company or Mine.	Locality.	Class.	Amount paid.
Arlington	Erie	Gold	$55,468
Athabasca	Nelson	Gold	25,000
Bralorne	Bridge River	Gold	3,606,050
Belmont-Surf Inlet	Princess Royal Island	Gold	1,437,500
Cariboo Gold Quartz	Wells	Gold	479,990
Cariboo-McKinney	Camp McKinney	Gold	565,588
Canadian Pacific Exploration	Nelson	Gold	37,500
Centre Star	Rossland	Gold	472,255
Fairview Amalgamated	Oliver	Gold	5,329
Fern	Nelson	Gold	15,000
Goodenough	Ymir	Gold	13,931
Hedley Mascot	Hedley	Gold	362,260
Island Mountain	Wells	Gold	262,680
I.X.L.	Rossland	Gold	132,533
Jewel-Denero	Greenwood	Gold	11,751
Kelowna Exploration	Hedley	Gold	90,000
Kootenay Belle	Sheep Creek	Gold	101,280
Le Roi Mining Co.	Rossland	Gold	1,475,000
Le Roi No. 2	Rossland	Gold	1,574,640
Lorne	Bridge River	Gold	20,450
Nickel Plate	Hedley	Gold	3,423,191
Pioneer	*Bridge River*	*Gold*	6,706,768
Poorman	Nelson	Gold	25,000
Premier	Premier	Gold	19,658,075
Queen	Sheep Creek	Gold	85,000
Relief	Erie	Gold	5,000
Reno	Sheep Creek	Gold	897,840
Sheep Creek Mines, Ltd.	Sheep Creek	Gold	581,250
Silbak Premier	Premier	Gold	200,000
Sunset No. 2	Rossland	Gold	115,007
War Eagle	Rossland	Gold	1,245,250
Motherlode	Sheep Creek	Gold	162,500
Ymir Gold	Ymir	Gold	300,000
Ymir Yankee Girl	Ymir	Gold	133,501
Miscellaneous mines		Gold	23,530
Total, lode-gold mines			$44,306,117

The gold-copper properties of Rossland are included in this table.

Silver-lead-zinc Mines.

Antoine	Rambler	Silver-lead-zinc	$10,000
Beaverdell-Wellington	Beaverdell	Silver-lead-zinc	97,200
Bell	Beaverdell	Silver-lead-zinc	476,297
Bosun (Rosebery-Surprise)	New Denver	Silver-lead-zinc	27,500
Capella	New Denver	Silver-lead-zinc	5,500
Consolidated Mining and Smelting Co. of Canada, Ltd.	Trail	Silver-lead-zinc	79,789,101
Couverapee	Field	Silver-lead-zinc	5,203
Duthie Mines, Ltd.	Smithers	Silver-lead-zinc	50,000
Florence Silver	Ainsworth	Silver-lead-zinc	35,393
Goodenough	Cody	Silver-lead-zinc	45,668
H.B. Mining Co.	Hall Creek	Silver-lead-zinc	8,904
Highland Lass, Ltd.	Beaverdell	Silver-lead-zinc	132,464
Highland Bell, Ltd.	Beaverdell	Silver-lead-zinc	159,547
Horn Silver	Similkameen	Silver-lead-zinc	6,000
Idaho-Alamo	Sandon	Silver-lead-zinc	400,000
Iron Mountain (Emerald)	Salmo	Silver-lead-zinc	20,000
Jackson	*Retallack*	*Silver-lead-zinc*	*20,000*
Last Chance	Three Forks	Silver-lead-zinc	213,109
Lone Batchelor	Sandon	Silver-lead-zinc	50,000
Carried forward			$81,551,886

TABLE XVII.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1938—*Continued.*

Silver-lead-zinc Mines—Continued.

Company or Mine.	Locality.	Class.	Amount paid.
Brought forward			$81,551,886
Lucky Jim	Three Forks	Silver-lead-zinc	80,000
Mercury	Sandon	Silver-lead-zinc	6,000
Meteor	Slocan City	Silver-lead-zinc	10,257
Monitor and Ajax	Three Forks	Silver-lead-zinc	27,500
Mountain Con	Cody	Silver-lead-zinc	71,387
McAllister	Three Forks	Silver-lead-zinc	40,894
Noble Five	Cody	Silver-lead-zinc	72,859
North Star	Kimberley	Silver-lead-zinc	496,901
No. One	Sandon	Silver-lead-zinc	6,754
Ottawa	Slocan City	Silver-lead-zinc	107,928
Payne	Sandon	Silver-lead-zinc	1,438,000
Providence	Greenwood	Silver-lead-zinc	33,810
Queen Bess	Alamo	Silver-lead-zinc	26,000
Rambler-Cariboo	Rambler	Silver-lead-zinc	575,000
Reco	Cody	Silver-lead-zinc	332,492
Ruth Mines, Ltd.	Sandon	Silver-lead-zinc	165,000
St. Eugene	Moyie	Silver-lead-zinc	566,000
Silversmith	Sandon	Silver-lead-zinc	725,000
Slocan Silver	Alamo	Silver-lead-zinc	11,600
Slocan Star	Sandon	Silver-lead-zinc	567,500
Spokane-Trinket	Ainsworth	Silver-lead-zinc	9,564
Standard Silver Lead	Silverton	Silver-lead-zinc	2,700,000
Sunset and Trade Dollar	Retallack	Silver-lead-zinc	88,000
Utica	Kaslo	Silver-lead-zinc	64,000
Wallace Mines, Ltd. (Sally)	Beaverdell	Silver-lead-zinc	135,000
Washington	Rambler Station	Silver-lead-zinc	38,000
Whitewater	Retallack	Silver-lead-zinc	592,515
Miscellaneous mines		Silver-lead-zinc	70,237
Total, silver-lead-zinc mines			$90,609,084

Copper Mines.

Britannia M. & S. Co.*	Britannia Beach	Copper	$6,552,578
Canada Copper Corporation	Greenwood	Copper	615,399
Cornell	Texada Island	Copper	8,500
Granby Cons. M.S. & P. Co.†	Anyox	Copper	8,025,471
Marble Bay	Texada Island	Copper	175,000
Hall Mines	Nelson	Copper	160,000
Miscellaneous mines		Copper	260,770
Total, copper mines			$15,797,718

* The Howe Sound Company is the holding company for the *Britannia* mine in British Columbia and other mines in Mexico and the State of Washington. Dividends paid by the Howe Sound Company are therefore derived from all operations, and in the foregoing table the dividends credited to the *Britannia* mine have been paid by the Britannia Mining and Smelting Company, Limited, none being credited subsequent to 1930. In making comparison with yearly totals the amounts credited to the Howe Sound Company have been deducted for the years shown, so the total in the annual report concerned will show the higher figure. Dividends paid by Premier Gold Mining Company, Limited, are derived from operations in British Columbia and other countries, and so cannot now be credited to British Columbia. Silbak Premier is a subsidiary of Premier Gold Mining Company, and dividends paid by that company are, of course, included in Provincial totals.

† The amount shown to the credit of the Granby Consolidated Mining, Smelting, and Power Company, Limited, does not include the sum of $6,749,996 paid by the company during 1935 and 1936 as a distribution or repayment of capital, subsequent to the closing-down of its operations at Anyox and the company going into voluntary liquidation. Operations ceased at Anyox in August, 1935. The company since that date has revived its business charter and is conducting operations at Allenby, B.C.

The term "Miscellaneous" noted in each class of dividend covers all payments of $5,000 and under, together with payments made by companies or individuals requesting that the item be not disclosed.

In compiling the foregoing table of dividends paid, the Department wishes to acknowledge the kind assistance given by companies, individuals, and trade journals in giving information on the subject.

TABLE XVII.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1938—*Continued.*

Coal.

Wellington Collieries, Ltd., Nanaimo	$16,000,000
Crow's Nest Pass Coal Co., Ltd., Fernie	12,122,602
Total	$28,122,602

Miscellaneous and Structural.

Various	$1,630,041

Aggregate of all Classes.

Lode-gold mining	$44,306,117
Silver-lead-zinc mining	90,609,084
Copper-mining	15,797,718
Coal-mining	28,122,602
Miscellaneous and structural	1,630,041
Total	$180,465,562

Dividends paid Yearly, 1919 to 1938, inclusive.

Year.	Amount paid.	Year.	Amount paid.
1919	$2,494,283	1930	$10,543,500
1920	1,870,296	1931	4,650,857
1921	736,629	1932	2,786,958
1922	3,174,756	1933	2,471,735
1923	2,983,570	1934	4,745,905
1924	2,977,276	1935	7,386,070
1925	5,853,419	1936	10,513,705
1926	8,011,137	1937	15,085,293
1927	8,816,681	1938	11,992,316
1928	9,572,536		
1929	11,263,118	Total	$127,930,040

Dividends paid during 1937 and 1938.

	1937.	1938.
Arlington		$11,510
Beaverdell-Wellington	$18,000	
Bralorne Mines, Ltd.	935,250	1,184,650
Cariboo Gold Quartz Mines, Ltd.	133,330	213,329
The Consolidated Mining and Smelting Co. of Canada, Ltd.	11,413,189	8,164,587
Crow's Nest Pass Coal Co., Ltd.	279,351	109,795
Fairview Amalgamated Gold Mines	2,668	2,661
Hedley Mascot Gold Mines, Ltd.		362,260
Highland Bell, Ltd.	52,634	92,110
Island Mountain Mines, Ltd.	52,536	105,072
I.X.L.		900
Kelowna Exploration		90,000
Kootenay Belle		101,280
Pioneer Gold Mines of B.C., Ltd.	875,875	700,700
Premier Gold Mining Co., Ltd.	800,000	
Reno Gold Mines, Ltd.	225,600	197,400
Sheep Creek Gold Mines, Ltd.	187,500	281,250
Silbak Premier		200,000
Ymir Yankee Girl Mine, Ltd.	22,251	
Others	87,109	174,812
Totals	$15,085,293	$11,992,316

TABLE XVIII.—CAPITAL EMPLOYED, SALARIES AND WAGES, FUEL AND ELECTRICITY, AND PROCESS SUPPLIES, 1938.

District and Class.	Capital employed.	Salaries and Wages.	Fuel and Electricity.	Process Supplies.
North-western District—	$	$	$	$
Lode-mining	5,723,246	1,383,040	108,800	492,901
Placer-mining	3,609,758	216,742	18,461	25,547
Coal-mining	----	----	----	----
Miscellaneous and structural	468,435	31,489	13,245	1,889
Totals	9,801,439	1,631,271	140,506	520,337
North-eastern District—				
Lode-mining	4,523,490	988,365	109,446	494,124
Placer-mining	4,065,390	608,063	20,307	34,166
Coal, miscellaneous, and structural	22,900	30,980	22,017	2,230
Totals	8,611,780	1,627,408	151,770	530,520
South Central District—				
Lode-mining	9,810,788	1,906,164	370,484	721,135
Placer-mining	136,412	25,685	2,716	295
Coal-mining	1,214,404	485,218	45,973	59,475
Miscellaneous and structural	26,549	81,237	13,574	45
Totals	11,188,153	2,498,304	432,747	780,950
South-eastern District—				
Lode-mining	57,787,991	8,919,434	1,841,651	1,911,365
Placer-mining	107,100	38,835	2,028	841
Coal-mining	6,314,295	892,423	66,921	230,000
Miscellaneous	514,391	79,458	943	----
Structural	51,780	13,784	915	1,154
Totals	64,775,557	9,943,934	1,912,458	2,143,360
South-western District—				
Lode-mining	19,994,298	3,834,672	282,296	1,854,957
Placer-mining	221,432	40,970	266	24
Coal-mining	17,958,965	2,146,708	178,689	668,778
Miscellaneous	14,892,098	398,818	38,722	----
Structural	5,569,126	643,626	258,652	45,574
Totals	58,635,919	7,064,794	758,625	2,569,333
Grand totals, 1938	153,012,848	22,765,711	3,396,106	6,544,500
Grand totals, 1937	145,520,641	21,349,690	3,066,311	6,845,330
Grand totals, 1936	142,663,065	17,887,619	2,724,144	4,434,501
Grand totals, 1935	143,239,953	16,753,367	2,619,639	4,552,730

NOTE.—The above figures, compiled from returns on the subject made by companies and individuals, illustrate the amount of capital employed in the mining industry in 1938, the amount of money distributed in salaries and wages, fuel and electricity, and process supplies (explosives, chemicals, drill-steel, lubricants, etc.).

Capital employed includes: Present cash value of the land (excluding minerals); present value of buildings, fixtures, machinery, tools, and other equipment; inventory value of materials on hand, ore in process, fuel and miscellaneous supplies on hand; inventory value of finished products on hand; operating capital (cash, bills and accounts receivable, prepaid expenses, etc.).

TABLE XIX.—TONNAGE, NUMBER OF MINES, NET AND GROSS VALUE OF LODE MINERALS, 1901–1938.

District.	Year.	Tonnage.	No. of Shipping-mines.	No. of Mines Shipping over 100 Tons.	Net Value to Shipper of Lode Minerals produced.	Gross Value of Lode Minerals produced.
	1901	920,416	119	78	.....	$14,100,282
	1902	998,999	124	75	.....	11,581,153
	1903	1,286,176	125	74	.....	12,103,237
	1904	1,461,609	142	76	.....	12,909,035
	1905	1,706,679	146	79	.....	15,980,164
	1906	1,963,872	154	77	.....	18,484,102
	1907	1,804,114	147	72	.....	17,316,847
	1908	2,083,606	108	59	.....	15,847,411
	1909	2,057,713	89	52	.....	15,451,141
	1910	2,216,428	83	50	.....	14,728,731
	1911	1,770,755	80	45	.....	11,454,063
	1912	2,688,532	86	51	.....	17,662,766
	1913	2,663,809	110	58	.....	17,190,838
	1914	2,175,971	98	56	.....	15,225,061
	1915	2,690,110	132	59	.....	19,992,149
	1916	3,188,865	169	81	.....	31,483,014
	1917	2,761,579	193	87	.....	26,788,474
	1918	2,892,849	175	80	.....	27,590,278
	1919	2,112,975	144	74	.....	19,750,498
	1920	2,178,187	121	60	.....	19,444,365
	1921	1,562,645	80	35	.....	12,920,398
	1922	1,573,186	98	33	.....	19,227,857
	1923	2,421,839	77	28	.....	25,347,092
	1924	3,397,105	86	37	.....	35,538,247
	1925	3,849,269	102	40	.....	46,200,135
	1926	4,775,073	138	55	$38,558,613	51,508,031
	1927	5,416,021	132	52	27,750,364	44,977,082
	1928	6,241,310	110	49	29,070,075	48,281,825
	1929	6,977,681	106	48	34,713,887	51,174,859
	1930	6,803,846	68	32	21,977,688	40,915,395
	1931	5,549,103	44	22	9,513,931	22,535,573
	1932	4,340,158	75	29	7,075,393	19,700,235
	1933	4,030,778	109	47	13,976,368	25,007,137
	1934	5,087,334	145	69	20,243,278	33,895,930
	1935	4,916,149	177	72	25,407,914	40,597,569
	1936	4,456,521	168	70	29,975,608	43,666,452
	1937	6,145,254	185	113	44,762,860	62,912,783
North-western	**1938**	**418,838**	**9**	**6**	**2,755,135**	**3,189,318**
North-eastern	**1938**	**149,893**	**10**	**3**	**3,013,420**	**2,187,595**
South Central	**1938**	**1,522,067**	**65**	**32**	**5,126,222**	**6,561,759**
South-eastern	**1938**	**2,731,708**	**101**	**39**	**15,739,441**	**31,503,859**
South-western	**1938**	**2,554,585**	**26**	**12**	**9,124,804**	**10,434,802**
Totals	**1938**	**7,377,091**	**211**	**92**	**$35,759,022**	**$53,877,333**

TABLE XX.—MEN EMPLOYED IN THE MINING INDUSTRY OF BRITISH COLUMBIA, 1901–1938.

District.	Year.	Placer-mining.	Lode-mining.			In Concentrators.	In Smelters.	Coal-mining.			Structural Materials.		Miscellaneous.	Total.
			Under.	Above.	Total.			Under.	Above.	Total.	Quarries and Pits.	Plants.		
	1901	.....	2,736	1,212	3,948	.....	.....	3,041	931	3,974	.....	.....	.....	7,922
	1902	.....	2,219	1,126	3,345	.....	.....	3,101	910	4,011	.....	.....	.....	7,356
	1903	.....	1,662	1,088	2,750	.....	.....	3,137	1,127	4,264	.....	.....	.....	7,014
	1904	.....	2,143	1,163	3,306	.....	.....	3,278	1,175	4,453	.....	.....	.....	7,759
	1905	.....	2,470	1,240	3,710	.....	.....	3,127	1,280	4,407	.....	.....	.....	8,117
	1906	.....	2,680	1,303	3,983	.....	.....	3,415	1,390	4,805	.....	.....	.....	8,788
	1907	.....	2,704	1,239	3,943	.....	.....	2,862	907	3,769	.....	.....	.....	7,712
	1908	.....	2,567	1,127	3,694	.....	.....	4,432	1,641	6,073	.....	.....	.....	9,767
	1909	.....	2,184	1,070	3,254	.....	.....	4,713	1,705	6,418	.....	.....	.....	9,672
	1910	.....	2,472	1,237	3,709	.....	.....	5,903	1,855	7,758	.....	.....	.....	11,467
	1911	.....	2,435	1,159	3,594	.....	.....	5,212	1,661	6,873	.....	.....	.....	10,467
	1912	.....	2,472	1,364	3,837	.....	.....	5,275	1,855	7,130	.....	.....	.....	10,967
	1913	.....	2,773	1,505	4,278	.....	.....	4,950	1,721	6,671	.....	.....	.....	10,949
	1914	.....	2,741	1,433	4,174	.....	.....	4,267	1,465	5,732	.....	.....	.....	9,906
	1915	.....	2,709	1,435	4,144	.....	.....	3,708	1,283	4,991	.....	.....	.....	9,135
	1916	.....	3,357	2,036	5,393	.....	.....	3,694	1,366	5,060	.....	.....	.....	10,453
	1917	.....	3,290	2,198	5,488	.....	.....	3,760	1,410	5,170	.....	.....	.....	10,658
	1918	.....	2,626	1,764	4,390	.....	.....	3,658	1,769	5,247	.....	.....	.....	9,637
	1919	.....	2,513	1,746	4,259	.....	.....	4,145	1,821	5,966	.....	.....	.....	10,225
	1920	.....	2,074	1,605	3,679	.....	.....	4,191	2,158	6,349	.....	.....	.....	10,028
	1921	.....	1,355	975	2,330	.....	.....	4,722	2,163	6,885	.....	.....	.....	9,215
	1922	.....	1,510	1,239	2,749	.....	.....	4,712	1,932	6,644	.....	.....	.....	9,393
	1923	.....	2,102	1,516	3,618	.....	.....	4,342	1,807	6,149	.....	.....	.....	9,767
	1924	.....	2,353	1,680	4,033	.....	.....	3,894	1,524	5,418	.....	.....	.....	9,451
	1925	.....	2,298	2,840	5,138	.....	.....	3,828	1,615	5,443	.....	.....	.....	10,581
	1926	299	2,606	1,735	4,341	808	2,461	3,757	1,565	5,322	493	324	124	14,172
	1927	415	2,671	1,916	4,587	854	2,842	3,646	1,579	5,225	647	138	122	14,830
	1928	355	2,707	2,469	5,176	911	2,748	3,814	1,520	5,334	412	368	120	15,424
	1929	341	2,926	2,052	4,978	966	2,948	3,675	1,353	5,028	492	544	268	15,565
	1930	425	2,316	1,260	3,576	832	3,197	3,389	1,256	4,645	843	344	170	14,032
	1931	688	1,463	834	2,297	581	3,157	2,957	1,125	4,082	460	526	380	12,171
	1932	874	1,355	900	2,255	542	2,036	2,628	980	3,608	536	329	344	10,524
	1933	1,134	1,786	1,335	3,121	531	2,436	2,241	853	3,094	376	269	408	11,369
	1934	1,122	2,796	1,729	4,525	631	2,890	2,050	843	2,893	377	187	360	12,985
	1935	1,291	2,740	1,497	4,237	907	2,771	2,145	826	2,971	586	270	754	13,737
	1936	1,124	2,959	1,840	4,799	720	2,678	2,015	799	2,814	931	288	825	14,179
	1937	1,371	3,603	1,818	5,421	1,168	3,027	2,286	867	3,153	724	327	938	16,129
North-western	1938	275	393	287	680	82	.....	.....	.....	.....	36	4	17	1,094
North-eastern	1938	671	347	203	550	28	.....	10	3	13	30	.....	10	1,300
South Central	1938	97	603	352	955	282	.....	271	142	413	111	29	.....	1,887
South-eastern	1938	96	1,189	595	1,784	362	3,158	467	226	693	136	56	110	6,395
South-western	1938	164	1,317	829	2,146	167	.....	1,340	503	1,843	587	208	232	5,345
Totals	1938	1,303	3,849	2,266	6,115	919	3,158	2,088	874	2,962	900	295	369	16,021

TABLE XXI.—METALLIFEROUS MINES SHIPPING IN 1938.

Mine or Group.	Location of Mine or Mill.	Owner or Agent.	Rated Daily Capacity.		Operating at.	Date of First Operation.	Process.	Character of Ore.
			1937.	1938.				
			Tons.	Tons.	Tons.			
Polaris-Taku	Taku River (Tulsequah)	Polaris-Taku Mining Co., Ltd., Tulsequah	150	150	100	Nov., 1937	Flotation	Gold.
Big Missouri	Stewart (Salmon River)	Buena Vista Mining Co., Ltd., Trail	750	750	500	Mar., 1938	Flotation; cyanidation	Gold.
Dolly Varden	Alice Arm	T. W. Falconer, Alice Arm						Silver, gold, lead.
Granby Point	Anyox	Karl Eklund, leaser, Anyox						Silver, gold, lead.
Mountain Boy	American Creek	B. T. McDonald, Stewart						Silver, copper.
Silbak Premier	Stewart	Silbak Premier Mines, Ltd., Premier	500	500	500	July, 1922	Flotation	Gold, silver, lead.
Surf Inlet	Surf Inlet	Surf Inlet Cons. Gold Mines, Ltd., Vancouver	75	50	50	Aug., 1937	Table concentration; flotation	Gold, silver, copper.
Surf Point	Porcher Island	Reward Mining Co., Ltd., Vancouver	25	25	*50	July, 1933	Flotation	Gold, silver.
Sampling Plant	Prince Rupert	British Columbia Department of Mines, Prince Rupert				1937		Gold, silver, copper, lead, zinc.
Cariboo Gold	Wells	Cariboo Gold Quartz Mining Co., Ltd., Vancouver	275	300	300	Jan., 1938	Cyanidation	Gold, silver.
Cariboo Hudson	Wells	Cariboo Hudson Gold Mines, Ltd., Vancouver		100	100	Sept., 1938	Cyanidation	Gold, silver.
Island Mountain	Wells	Island Mountain Mines, Ltd., Wells	110	110	110	Nov., 1934	Cyanidation	Gold, silver.
Copper King	Kamloops	McKelvie Bros., Kamloops		30	*25	1938	Concentration	Gold, silver, copper.
Windpass	Dunn Lake	Windpass Gold Mining Co., Ltd., Vancouver	50	50	†50	Mar., 1934	Flotation	Gold, silver, copper.
Iron Cap	Kamloops	D. B. Sterrett, Savona						Gold, silver, copper.
Thelma	Nicola	Sheffield Gold and Silver Mines, Ltd., Vancouver						Silver, lead, zinc.
Kalamalka	Lavington	Kalamalka Gold Mines, Ltd., Vernon						Gold, silver.
Okanagan Mines Syndicate	Vernon	C. Penny and S. Heidler, Vernon						Gold, silver, lead, zinc.
Athelstan	Grand Forks	W. E. McArthur, Greenwood						Gold, silver.
Buckingham	Greenwood	A. F. Mason, Grand Forks						Gold, silver, lead, zinc.
City of Paris	Grand Forks	H. M. Brinkman, Grand Forks						Gold, silver, lead, zinc.
Gold Medal	Grand Forks	M. Kabatoff, Grand Forks						Gold, silver.
Inland Empire	Paulson	Inland Empire Mines Syndicate, Trail						Gold, silver.
B.C.	Denoro	A. Docksteader and E. Vant, Grand Forks						Silver, copper.
Molly Gibson	Paulson	Molly Gibson Mines, Ltd., Calgary, Alta.						Gold, silver.
Little Bertha	Grand Forks	D. C. Manly, Box 230, Grand Forks						Gold, silver.
F. Simpson	Grand Forks	F. Simpson, Grand Forks						Silver, copper.
Superior	Grand Forks	Donald McCullum, Grand Forks						Gold, silver.
Union	Granby River	Leasers from J. F. McCarthy, Wallace, Idaho						Gold, silver, lead, zinc.
Yankee Boy	Grand Forks	Riegel Mines, Ltd., Grand Forks						Gold, silver.

* Intermittent. † Idle at present.

TABLE XXI.—METALLIFEROUS MINES SHIPPING IN 1938—*Continued.*

Mine or Group.	Location of Mine or Mill.	Owner or Agent.	Rated Daily Capacity.		Operating at	Date of First Operation.	Process.	Character of Ore.
			1937.	1938.				
			Tons.	Tons.	Tons.			
Bank of England	Greenwood	Robert Forshaw, Greenwood						Gold, silver.
Barnato	Kettle River	J. H. Redden, Caulfeild; F. O. Peterson, Westbridge						Gold, silver.
Brooklyn	Greenwood	W. E. McArthur, Greenwood						Gold, silver, copper.
Granby	Phoenix	W. E. McArthur, Greenwood	50	50	*50	Sept., 1936	Flotation	Gold, silver, copper.
Number Seven	Boundary Falls	W. E. McArthur, Greenwood						Gold, silver, lead.
Beaver	Greenwood	Hilmer Nordman, leaser, Beaverdell						Silver, lead, zinc.
Carmi	Greenwood	J. Kerr, Carmi						Gold, silver.
Crescent	Greenwood	Leasers, Greenwood						Gold, silver, lead, zinc.
Dentonia	Greenwood	Robert Lee *et al.*, Greenwood	100			April, 1934	Flotation; cyanidation	Gold, silver, lead, zinc.
Dynamo	Greenwood	Jerome McDonell, Greenwood						Gold, silver, lead.
Gold Drop	Jewel Lake	L. Bossbart and leasers, Greenwood						Gold, silver.
Gold Nugget	Greenwood	C. G. Dodd, Greenwood						Gold, silver.
Highland Bell	Greenwood	Highland Bell, Ltd., Penticton						Gold, silver, lead, zinc.
Highland Chief	Greenwood	Highland Chief Mines, Ltd., Kelowna						Silver, lead.
Keno	Greenwood	S. Bombini, Greenwood						Gold, silver, lead.
Midnight Group	Beaverdell	Dr. W. T. Hoyes, Beaverdell						Gold, silver, lead.
O.K. Group	Triple Lakes	S. Peterson, Westbridge						Gold, silver.
Kettle Valley	Grand Forks	George Mehmal, Grand Forks						Gold, silver.
Lyon-Advance	Beaverdell	Lyon-Advance Syndicate, Penticton						Silver, lead, zinc.
Maybe	Crick (Trapper) Creek	S. Bergland, Westbridge						Gold, silver.
Mogul	Greenwood	C. Sherdahl and S. Bergland, Westbridge						Gold, silver.
North Star	Jewel Lake	Greenbridge Gold Mines, Ltd., Calgary, Alta.						Gold, silver.
Providence	Greenwood	Riegel Mines, Ltd., Grand Forks						Gold, silver, lead, zinc.
Rambler	Beaverdell	J. J. Kennedy, Beaverdell						Silver, lead, zinc.
Rico	Greenwood	Robert Cheyne, Kelowna						Silver, lead, zinc.
Rosemont	Beaverdell	W. R. Fowler, Beaverdell						Gold, silver.
Sally	Beaverdell	Sally Mines, Ltd., Penticton						Gold, silver, lead, zinc.
Tiger	Beaverdell	J. S. Nordman and Partner, Beaverdell						Silver, lead, zinc.
Wellington	Beaverdell	Beaverdell-Wellington Syndicate, Greenwood						Gold, silver, lead, zinc.
Winner	Greenwood	J. Price *et al.*, Greenwood						Gold, silver.
Winnipeg	*Greenwood*	*Donald McDonald, leaser, Greenwood*						*Gold, silver, copper.*
Brown Bear	Oliver	W. Dalrymple and L. Hozier, Oliver						Gold, silver.
Fairview Amalgamated	Osoyoos	Fairview Amalgamated Gold Mines, Ltd., Vancouver	150	150	150	Aug., 1935	Amalgamation; blanket-tables; flotation	Gold, silver, copper, lead.

* Intermittent.

Gold Standard	Oro Fino Mountain	Gold Standard (Fairview) Mining Co., Ltd., Penticton	...	...	...	...	...	Gold, silver.
Grandoro	Oliver	J. P. Wukelick, leaser, Penticton	40	40	*35	Jan., 1935	Amalgamation; cyanidation	Gold, silver.
Green Mountain	Penticton	Eric Bresser, Penticton	...	...	...	...	...	Gold, silver.
Osoyoos	Osoyoos	Osoyoos Mines of Canada, Ltd., Calgary, Alta.	50	75	75	Mar., 1936	Table concentration; flotation; cyanidation	Gold, silver, copper.
Mak Siccar	Osoyoos	Whitehead and Davidoff, Grand Forks	...	...	...	...	...	Gold, silver.
Hedley Mascot	Hedley	Hedley Mascot Mines, Ltd., Vancouver	170	175	175	May, 1936	Flotation	Gold, silver, copper.
Kelowna Exploration	Hedley	Kelowna Exploration Co., Ltd., Hedley	200	250	250	Sept., 1934	Cyanidation; flotation	Gold, silver, copper.
Twin Lakes	Osoyoos	Gold Standard (Fairview) Mining Co., Ltd., Penticton	...	...	...	...	...	Gold, silver.
Copper Mountain	Allenby	Granby Con. M.S. and Power Co., Vancouver	3,000	3,000	3,000	1920‡	Flotation	Copper, silver, gold.
Hamilton Bros.	Rabbit Mountain	Hamilton Bros., Tulameen	...	...	...	...	...	Gold, silver.
Silver Moon	Princeton	E. Michel *et al.*, Princeton	...	...	...	...	...	Gold, silver.
Caledonia	Blaylock	Geo. E. McCready, Retallack	...	...	...	...	...	Silver, lead.
Dardanelles	...	S. N. Ross, Nelson	...	...	...	...	...	Silver, lead, zinc.
Charleston	Retallack	A. J. Harris, Kaslo	...	...	...	...	...	Silver, lead, zinc.
Eureka	Kaslo (Lyle Creek)	Roy Wallace, Walla Walla, Washington	...	...	...	...	...	Gold, silver.
Highland Surprise	Retallack	Highland Surprise Gold Mines, Ltd., Vancouver	...	...	...	...	...	Gold, silver.
Kilo	Lemon Creek	H. V. Dewis, Silverton	...	...	...	...	...	Gold, silver, lead, zinc.
G. & S.	Woodberry Creek	C. E. Gordon, Kaslo	...	...	...	...	...	Gold, silver, lead, zinc.
Lucky Boy	Kaslo	Charles Lind, Jr., Kaslo	...	...	...	...	...	Silver, lead, zinc.
St. Patrick	Argenta	Mrs. J. Brochier, Kaslo	...	...	...	...	...	Silver, lead, zinc.
Silver Coin	Woodberry Creek	Stanley MacLennan *et al.*, Ainsworth	...	...	...	...	...	Silver, lead, zinc.
Silver Horn	Ainsworth	O. H. Giegerich, Kaslo	...	...	...	...	...	Silver, lead, zinc.
Revenue	Sturgis Creek	H. E. Singel, Kaslo	...	...	...	...	...	Silver, lead, zinc.
Paladoro	Edgewood	S. P. Pond, Nelson	...	...	...	...	...	Gold, silver.
Golden Egg	Sawmill Creek	J. J. Rollheiser, Kimberley	...	...	...	...	...	Gold, silver.
Midway	Moyie	T. M. Leask, Moyie	...	...	...	...	...	Gold, silver, lead, zinc.
Sullivan	Kimberley	Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	6,000	6,000	6,000	Aug., 1923	Flotation	Silver, lead, zinc.
New True Fissure	Ferguson	New True Fissure Mining and Milling Co., Ltd., Windsor, Ont.	50	50	*50	Oct., 1937	Flotation	Gold, silver, lead, zinc.
Winslow	Trout Lake	W. G. Wilkins and W. J. Scorgie, Penticton	...	...	...	...	...	Gold, silver.
Athabasca	Nelson	Noble Five Mines, Ltd., Nelson	...	...	...	...	...	Gold, silver, lead, zinc.
Arlington	Erie Creek	R. O. Oscarson, leaser, Erie	...	...	...	...	...	Gold, silver, lead, zinc.
Bayonne	Tye	Bayonne Consolidated Mines, Ltd., Vancouver	50	50	†50	Nov., 1936	Cyanidation	Gold, silver.
Bear	Hall Creek	R. E. Crerar, Nelson	...	...	...	...	...	Gold, silver.
Black Cock	Ymir	Rod McNeill *et al.*, Ymir	...	...	...	...	...	Gold, silver, lead, zinc.
Bunker Hill	16-Mile Creek	R. G. Hall, Aberdeen, Washington	...	...	...	...	...	Gold, silver.
California	Nelson	Alex. Poelzer *et al.*, Verner H. Garras, and R. H. Kline, Nelson	...	...	...	...	...	Gold, silver, lead, zinc.
Cartref	Nelson	R. Nelson *et al.*, Trail	...	...	...	...	...	Gold, silver, lead.

* Intermittent. † Idle at present. ‡ Resumed in July, 1937.

TABLE XXI.—METALLIFEROUS MINES SHIPPING IN 1938—*Continued.*

Mine or Group.	Location of Mine or Mill.	Owner or Agent.	Rated Daily Capacity.		Operating at.	Date of First Operation.	Process.	Character of Ore.
			1937.	1938.				
			Tons.	Tons.	Tons.			
Clubine Comstock	Boulder Creek	Clubine Comstock Gold Mines, Ltd., Nelson	——	——	——	——	——	Gold, silver.
Davne	Salmo	Currie and Hawes, Nelson	——	——	——	——	——	Gold, silver, lead, zinc.
Daylight	Nelson	Peter Rolick, Nelson	——	——	——	——	——	Gold, silver.
Howard	Nelson	Durango Mines, Ltd., Vancouver	100	100	†100	1937	Flotation	Gold, silver, lead, zinc.
Excelsior	Ymir	Philip Heay, Ymir	——	——	——	——	——	Gold, silver.
Good Hope	Bird Creek	L. P. Gormley, Nelson	——	——	——	——	——	Gold, silver.
Gold Belt	Sheep Creek	Gold Belt Mining Co., Ltd., Vancouver	——	100	100	1938	Cyanidation	Gold, silver.
Gold Crown	Nelson	R. Reese *et al.*, Nelson	——	——	——	——	——	Gold, silver.
Granite Poorman	Taghum	Livingstone Mining Co., Ltd., Blewett	30	30	30	Sept., 1934	Amalgamation; cyanidation	Gold, silver.
Harriet	Erie	S. A. Curwen and J. Turk, Ymir	——	——	——	——	——	Gold, silver.
Keystone	Erie	Dufferin Golds, Ltd., Vancouver	——	——	——	——	——	Gold, silver, lead, zinc.
Kootenay Belle	Sheep Creek	Kootenay Belle Gold Mines, Ltd., Vancouver	100	100	100	Oct., 1934	Cyanidation	Gold, silver.
Kootenay Ore Hill	Sheep Creek	H. D. Forman, Salmo; Joe Gallo, Nelson	15	15	*15	Dec., 1936	Concentration	Gold, silver, lead, zinc.
Lone Silver	Salmo	Lone Silver Gold Mines, Ltd., Vancouver	——	——	——	——	——	Gold, silver, lead, zinc.
Lucky Dick	Ymir	B. Price *et al.*, Ymir	——	——	——	——	——	Gold, silver.
Myrtle	Ymir	H. Brown, Ymir	——	——	——	——	——	Gold, silver.
Nugget-Motherlode	Salmo	A. Endersby, Sr. and Jr., Sheep Creek	——	——	——	——	——	Gold, silver.
Relief Arlington	Erie	Relief Arlington Mines, Ltd., Erie	75	75	75	1933	Amalgamation; flotation; cyanidation	Gold, silver.
Reno	Sheep Creek	Reno Gold Mines, Ltd., Vancouver	120	120	120	Dec., 1932	Cyanidation	Gold, silver.
Royal Canadian	Nelson	C. E. Crossley, Nelson	——	——	——	——	——	Gold, silver.
Sheep Creek	Sheep Creek	Sheep Creek Gold Mines, Ltd., Vancouver	150	150	150	May, 1935	Cyanidation	Gold, silver.
Spokane	Tye	R. M. and K. K. Laib, Bayonne	——	——	——	——	——	Gold, silver, lead, zinc.
Summit Group	Salmo	H. D. Forman, Salmo	——	——	——	——	——	Gold, silver, lead, zinc.
Twilight	Nelson	A. D. Papazian and T. L. Paris, Nelson	——	——	——	——	——	Gold, silver, lead.
C. Peterson		C. Peterson, Nelson	——	——	——	——	——	Gold.
Venus Juno	Nelson	R. Heddle, Nelson	——	——	——	——	——	Gold, silver.
Virginia	Bayonne	J. W. Mulholland, Nelson	——	——	——	——	——	Gold, silver.
Centre Star	Ymir	Wesko Mines, Ltd., Nelson	100	100	†100	Oct., 1936	Flotation; cyanidation	Gold, silver, lead, zinc.
Wilcox	Ymir	Wilcox Mines Syndicate, Ymir	20	20	*20	1933	Amalgamation	Gold, silver, lead, zinc.
Ymir (Old Mill Site)	Ymir	Ymir Mill Leasing Syndicate, Nelson	——	——	——	——	——	Gold, silver, lead, zinc.
Ymir Consolidated	Ymir	Ymir Consolidated Gold Mines, Ltd., Vancouver	100	100	100	July, 1935	Amalgamation; flotation	Gold, silver, lead, zinc.
Yankee Girl	Ymir	Ymir-Yankee Girl Gold Mines, Ltd., Vancouver	100	100	100	Dec., 1934	Cyanidation; flotation	Gold, silver, lead, zinc.
Alpha	Silverton	Leasers from Western Exploration Co., Silverton	——	——	——	——	——	Silver, lead, zinc.
Bosun	New Denver	Leasers, New Denver	——	——	——	——	——	Silver, lead, zinc.
Canadian	Sandon	A. H. Upton, Sandon	——	——	——	——	——	Gold, silver, lead, zinc.

Capella	New Denver	C. Stedile, New Denver						Gold, silver, lead, zinc.
Chicago	Sandon	S. Sibileau, Sandon						Gold, silver, lead, zinc.
Hewitt	Silverton	Galena Farm Consolidated Mines, Ltd., leasers						Silver, lead, zinc.
Lucky Jim	Zincton	Lucky Jim Lead and Zinc Co., Ltd., Vancouver	200	200	*200	1927	Concentration; flotation	Zinc.
Metallic	Silverton	Evart A. Erikson, Silverton						Silver, lead, zinc.
Molly Hughes	New Denver	Slocan Idaho Mines Corp., 509 Hutton Bldg., Spokane						Silver, lead, zinc.
Monitor	Three Forks	Slocan Monitor Mines, Ltd., Nelson						Gold, silver, lead, zinc.
McAllister	Three Forks	George Allen, New Denver						Gold, silver.
Noble Five	Cody	Noble Five Mines, Ltd., Nelson						Silver, lead, zinc.
Noonday	Silverton	Evart A. Erikson, Silverton						Silver, lead, zinc.
Number One	Sandon	J. M. Harris and F. T. Kelly, Sandon						Silver, lead, zinc.
Palmita	Alamo	C. Cunningham, Alamo						Silver, lead, zinc.
Payne	Sandon	J. P. Wilson estate, Sandon						Silver, lead, zinc.
Ruth-Hope	Sandon	Leasers from Ruth-Hope Mining Co., Ltd., Vancouver						Silver, lead, zinc.
Silver Ridge	Sandon	Silver Ridge Mining Co., Ltd., Sandon						Silver, lead, zinc.
Sovereign	Alamo	Leasers, E. J. Vandergrift, agent, New Denver						Silver, lead, zinc.
Victor	Sandon	E. Doney, lessee, Sandon						Gold, silver, lead, zinc.
Arlington	Slocan City	H. E. Scovil, Slocan City						Gold, silver, lead, zinc.
Bell	Slocan City	W. E. Graham and Pat Maguire, G. Larson *et al.*, Slocan City						Gold, silver.
Get There Eli	Slocan City	G. Larson *et al.*, Slocan City						Gold, silver.
Goldstream	Lemon Creek	Charles Ritchie, Slocan City						Gold, silver.
Howard Fraction	Slocan City	H. L. Harbour, Slocan City						Gold, silver.
Hummingbird	Slocan City	Charles Lundstrom and E. Hammerer, Slocan City						Gold, silver, lead, zinc.
L.T.	Springer Creek	D. B. O'Neail, Slocan City						Gold, silver.
Lakeview	Slocan City	Ross Basic *et al.*, Nelson; E. H. Kinder *et al.*, Slocan City						Gold, silver, lead, zinc.
Meteor	Slocan City	G. Larson *et al.*, Slocan City						Gold, silver.
Marmion & Maryland	Slocan City	W. J. Ternan *et al.*, Trail						Gold, silver.
Ottawa	Spring Creek	Leasers, Ottawa Silver Mining & Smelting Co., 401 Sherwood Bldg., Spokane, Washington	100	100	†100	1937	Concentration	Silver, lead, zinc.
Paris Fraction	Slocan City	G. Larson *et al.*, Slocan City						Gold, silver.
Vertical	Slocan City	A. G. Ewing, Slocan City						Gold, silver, lead, zinc.
Cariboo Group	Rossland	John Tomich, Rossland						Gold, silver.
Evening Star	Rossland	James Barnes and H. D. Griswold, Rossland						Gold, silver.
Gold Drip	Rossland	Charles Ritchie, Rossland						Gold, silver.
Golden Eagle	Rossland	Ole Osing, Rossland						Gold, silver.
I.X.L.	Rossland	I.X.L. Lessors, Ltd., Rossland						Gold, silver.
Jumbo	Rossland	J. C. Martin, Box 265, Cheney, Wash.						Gold, silver.

* Intermittent. † Idle at present.

TABLE XXI.—METALLIFEROUS MINES SHIPPING IN 1938—*Continued.*

Mine or Group.	Location of Mine or Mill.	Owner or Agent.	Rated Daily Capacity.		Operating at.	Date of First Operation.	Process.	Character of Ore.
			1937.	1938.				
			Tons.	Tons.	Tons.			
Midnight	Rossland	Midnight Mining Co., Rossland						Gold, silver.
O.K.	O.K. Mountain	O.K. Leasing Co., Box 522, Rossland						Gold, silver.
Rossland Properties	Rossland	Leasers from Cons. Mining & Smelting Co., Trail						Gold, silver, copper.
Thistle	Alberni	United Prospectors, Ltd., Victoria						Gold, copper.
Abco	Ahousat	Abco Mines, Ltd., Vancouver						Gold, silver.
Central Zeballos	Zeballos	Central Zeballos Gold Mines, Ltd., Vancouver						Gold, silver.
Danzig	Nootka	Danzig Mines, Ltd., Seattle, Wash.						Gold, silver.
Man-O-War	Zeballos	Man-O-War Mines, Ltd., Victoria						Gold, silver.
Privateer	Zeballos	Privateer Mine, Ltd., Victoria		75	75	Sept., 1938	Cyanidation; concentration	Gold, silver.
Rey Oro	Zeballos	Rey Oro Gold Mining Corp., Ltd., Vancouver		10	*10	1938	Cyanidation; concentration	Gold, silver.
Sidney Inlet	Sidney Inlet	Sidney Inlet Mining Co., Ltd., Vancouver		150	†150	1938	Flotation	Copper, silver, gold.
Spud Valley	Zeballos	Spud Valley Gold Mines, Ltd., Vancouver		50	50	1938	Cyanidation; concentration	Gold, silver.
White Star	Zeballos	White Star Mine, Ltd., Vancouver						Gold, silver.
Vidette	Savona	Vidette Gold Mines, Ltd., Vancouver	60	60	60	Dec., 1933	Flotation	Gold, silver, copper.
Bralorne	Bridge River	Bralorne Mines, Ltd., Vancouver	475	475	475	Feb., 1932	Amalgamation; flotation	Gold, silver.
B.R.X.	Bridge River	B.R.X. (1935) Mines, Ltd., Vancouver		125	110	May, 1938	Cyanidation	Gold, silver.
Jewel	Roxey Creek	Jewel Prospectors Synd., 829 Pender Street West, Vancouver						
Pioneer	Bridge River	Pioneer Gold Mines of B.C., Ltd., Vancouver	300	425	300	Feb., 1928	Cyanidation	Gold, silver.
Emancipation	Yale	Dawson Consolidated, Ltd., Vancouver						Gold, silver.
Aufeas	Hope	H. L. Wood, Hope						Gold, silver, copper.
Crown Gold	Nanaimo Lakes	Crown Gold Mining Syndicate, Victoria						Gold.
Dillon	Shoal Bay	Dillon Mining Trust, Shoal Bay						Gold, silver, copper.
Fagan	Shoal Bay	J. J. Fagan, Shoal Bay						Gold, silver, copper.
Seccondee	Vananda	Seccondee Gold Mining and Milling Syndicate, Vananda						Gold, silver, copper.
Sundt	Thurlow	Tom Sundt, Thurlow						Gold, silver, copper.
Ashloo	Squamish	Ashloo Gold Mines, Ltd., Vancouver	25	25	*25	Sept., 1936	Table concentration; flotation	Gold, silver, copper.
Britannia	Britannia Beach	Britannia Mining and Smelting Co., Ltd., Britannia Beach	6,000	6,000	6,000	Jan., 1923	Flotation	Copper, gold, silver.
Coles		W. C. Coles, Vancouver						Gold, silver, copper.
Ralph	Goldstream	W. J. Davey, Victoria						Silver, copper.

* Intermittent. † Idle at present.

TABLE XXII.—Mining Companies employing an Average of Ten or more Men during 1938.

Shipping Mines.

Name of Mine or Company.	Days Operating.		Tonnage.		Average Number of Men.	
	Mine.	Mill.	Mined.	Milled.	Mine.	Mill.
Polaris-Taku Mining Co., Ltd.	362	364	52,679	58,759	110	7
Buena Vista Mining Co., Ltd. (Big Missouri)	333	282	154,387	154,387	103	28
Silbak Premier Mines, Ltd.	312	348	184,606	184,606	300	30
Reward Mining Co., Ltd. (Surf Point)	166	166	11,520	3,511	13	5
Surf Inlet Consolidated Gold Mines, Ltd.	312	348	20,281	17,428	49	12
Cariboo Gold Quartz Mining Co., Ltd.	313	365	102,541	102,539	296	13
Cariboo Hudson Gold Mines, Ltd.	365	47	2,438	2,438	66	2
Island Mountain Mines, Ltd.	365	365	44,916	44,916	97	9
Windpass Gold Mining Co., Ltd.	365	365	19,049	19,059	60	6
Brooklyn (W. E. McArthur)	352	269	12,887	12,775	14	7
Highland-Bell, Ltd.	291	.....	5,100	.....	30	.....
Wellington (Beaverdell-Wellington Syndicate)	299	.....	647	.....	23	.....
Fairview Amalgamated Gold Mines, Ltd.	363	363	46,810	46,060	44	7
Hedley Mascot Gold Mines, Ltd.	334	356	63,868	63,868	60	18
Kelowna Exploration Co., Ltd. (Nickel Plate)	330	365	88,697	88,636	118	59
Osoyoos Mines of Canada, Ltd.	365	365	20,639	20,639	36	11
Granby Cons. Mining, Smelting & Power Co., Ltd.	328	362	1,223,492	1,223,212	356	176
Cons. M. & S. Co. of Canada, Ltd. (Sullivan)	300	350	2,286,740	2,272,890	701	241
New True Fissure Mining & Milling Co., Ltd.	90	90	3,079	293	10	4
Bayonne Cons. Mines, Ltd. (Bayonne)	365	365	19,298	19,298	58	9
Clubine Comstock Gold Mines, Ltd.	365	.....	851	.....	11	.....
Gold Belt Mining Co., Ltd.	350	66	9,844	9,844	51	2
Kootenay Belle Gold Mines, Ltd.	316	365	48,238	48,238	106	10
Livingstone Mining Co., Ltd. (Granite-Poorman)	170	170	1,351	1,351	11	1
Relief Arlington Mines, Ltd.	365	365	45,918	29,367	82	22
Reno Gold Mines, Ltd.	365	365	48,885	49,158	98	20
Sheep Creek Gold Mines, Ltd.	339	361	53,728	53,728	88	9
Wesko Mines, Ltd.	240	202	15,096	15,096	24	8
Ymir Consolidated Gold Mines, Ltd.	354	354	16,394	13,978	30	4
Ymir-Yankee Girl Gold Mines, Ltd.	365	365	42,565	42,718	77	14
Durango Gold Mines, Ltd.	.....	.....	42,500*	42,500	35	5
Rossland Properties (C. M. & S.)	.....	.....	9,633	.....	100	.....
Central Zeballos Gold Mines, Ltd.	365	.....	31	.....	28	.....
Man-O-War Mines, Ltd.	365	.....	19	.....	12	.....
Privateer Mine, Ltd.	365	98	45,389	7,234	91	6
Sidney Inlet Mining Co., Ltd.	180	150	17,000	15,500	37	2
Spud Valley Gold Mines, Ltd.	365	37	1,917	1,917	49	1
Vidette Gold Mines, Ltd.	365	308	6,683	6,732	62	3
Bralorne Mines, Ltd.	365	365	180,526	180,526	357	18
B.R.X. (1935) Consolidated Mines, Ltd.	287	86	4,787	4,787	33	2
Pioneer Gold Mines of B.C., Ltd.	309	365	142,775	143,175	257	27
Ashloo Gold Mines, Ltd.	236	223	5,012	5,012	14	5
Britannia Mining & Smelting Co., Ltd.	365	353	2,206,992	2,206,992	1,067	101

Non-shipping Mines.

Cons. Mining & Smelting Co. (Anyox)	360	.....	.....	.....	86	.....
Cons. Mining & Smelting Co. (Croydon and Vega)	309	.....	.....	.....	11	.....
Snowshoe Gold Mines, Ltd.	240	.....	.....	.....	14	.....
Quesnel Quartz Mining Co., Ltd.	360	.....	.....	.....	17	2
Cons. Nicola Goldfields, Ltd.	360	.....	.....	.....	23	.....
Canty Gold Mines (Hedley), Ltd.	360	.....	.....	.....	35	.....
Red Buck Mines, Ltd.	.....	.....	.....	.....	20	.....
Western Exploration Co., Ltd.	360	.....	.....	.....	17	.....
Base Metals Mining Corporation, Ltd.	307	.....	.....	.....	25	.....

* Estimated.

SYNOPSIS OF MINING LAWS OF BRITISH COLUMBIA.

Mineral Act and Placer-mining Act.

The mining laws of British Columbia are very liberal in their nature and compare favourably with those of any other part of the world. The terms under which both lode and placer claims and placer leaseholds are held are such that a prospector is greatly encouraged in his work, and the titles, especially for mineral claims and placer-mining leaseholds, are perfect. The fees required to be paid are as small as possible, consistent with a proper administration of the mining industry, and are generally lower than those commonly imposed elsewhere. Provision is also made for the formation of mining partnerships practically without expense, and a party of miners is enabled to take advantage of these sections of the Acts so that such miners may work their claims jointly.

Placer-mining leases are granted for a period of twenty years and are approximately 80 acres in size. On a lode claim of 51 acres the expenditure of $500 in work, which may be spread over five years, is required to obtain a Crown grant, and surface rights are obtainable at a small figure, in no case exceeding $5 per acre.

The following synopsis of the mining laws will be found sufficient to enable the miner or intending investor to obtain a general knowledge of their scope and requirements; for particulars, however, the reader is referred to the Acts relating to mining, which may be obtained from any Mining Recorder, or from the Department of Mines or the King's Printer, Victoria, B.C.

Free Miners' Certificates.

Any person over the age of 18, and any joint-stock company, may obtain a free miner's certificate on payment of the required fee.

The fee to an individual for a free miner's certificate is $5 for one year. To a joint-stock company having a capital of $100,000, or less, the fee for a year is $50; if capitalized beyond this, the fee is $100.

The free miners' certificates run from date of issue and expire on the 31st day of May next after its date, or some subsequent 31st day of May (that is to say, a certificate may be taken out a year or more in advance if desired). Certificates may be obtained for any part of a year, terminating on May 31st, for a proportionately less fee.

The possession of this certificate entitles the holder to enter upon all lands of the Crown, and upon any other lands on which the right to so enter is not specially reserved, for the purpose of prospecting for minerals, locating claims, and mining.

A free miner can hold, by location, during any period of twelve months, eight mineral claims within a radius of 10 miles, and may acquire others by purchase. Under the "Placer-mining Act," a free miner may locate, in any period of twelve consecutive months, one placer claim or leasehold in his own name and one placer claim or leasehold for each of three free miners for whom he acts as agent, on any separate creek, river-bed, bar or dry diggings. Other placer claims or leaseholds may be acquired by purchase.

In the event of a free miner allowing his certificate to lapse, his mining property (if not Crown-granted) reverts to the Crown (subject to the conditions set out in the next succeeding paragraph), but where other free miners are interested as partners or co-owners the interest of the defaulter becomes vested in the continuing co-owners or partners *pro rata*, according to their interests.

Six months' extension of time within which to revive title in mining property which has been forfeited through the lapse of a free miner's certificate is allowed. This privilege is given only if the holder of the property obtains a special free miner's certificate within six months after the 31st of May on which his ordinary certificate lapsed. The fee for this special certificate in the case of a person is $15 and in that of a company $300.

It is not necessary for a shareholder, as such, in an incorporated mining company to be the holder of a free miner's certificate.

Mineral Claims.

Mineral claims are located and held under the provisions of the "Mineral Act."

A mineral claim is a piece of land not exceeding in area fifty-one and sixty-five one-hundredths acres. The angles must be right angles unless the boundaries, or one of them, are the same as those of a previously recorded claim.

No special privileges are allowed for the discovery of new mineral claims or districts.

A mineral claim is located by erecting two "legal posts," which are stakes having a height of not less than 4 feet above ground and squared 4 inches at least on each face for not less than a foot from the top. A tree-stump so cut and squared also constitutes a legal post. A cairn of stones not less than 4 feet in height and not less than 1 foot in diameter 4 feet above the ground may also be used as a legal post. Upon each of these posts must be written the name of the claim, the name of the locator, and the date of location. On No. 1 post, in addition, the following must be written: "Initial post. Direction of Post No. 2 [*giving approximate compass bearing*] ——— feet of this claim lie on the right and ——— feet on the left of the line from No. 1 to No. 2 posts."

The location-line between Nos. 1 and 2 posts must be distinctly marked—in a timbered locality by blazing trees and cutting underbrush, and in bare country by monuments of earth or rock not less than 2 feet in diameter at the base, and at least 2 feet high—so that the line can be distinctly seen.

Mineral claims must be recorded in the Mining Recorder's office for the mining division in which they are situate within fifteen days from the date of location, one day extra being allowed for each 10 miles of distance from the recording office after the first 10 miles. If a claim is not recorded in time it is deemed abandoned and open for relocation, but if the original locator wishes to relocate he can only do so by permission of the Gold Commissioner of the district and upon the payment of a fee of $10. This applies also to a claim abandoned for any reason whatever.

Mineral claims are, until the Crown grant is issued, held practically on a yearly lease, a condition of which is that during such year assessment-work be performed on the same to the value of at least $100, or a payment of such sum be made to the Mining Recorder. Such assessments must be recorded before the expiration of the year, or the claim is deemed abandoned. If, however, the required assessment-work has been performed within the year, but not recorded within that time, a free miner may, within thirty days thereafter, record such assessment-work upon payment of an additional fee of $10. The actual cost of the survey of a mineral claim, to an amount not exceeding $100, may also be recorded as assessment-work. If, during any year, work is done to a greater extent than the required $100, any further sum of $100—but not less—may be recorded and counted as further assessments; such excess work must be recorded during the year in which it is performed. All work done on a mineral claim between the time of its location and recording may be counted as work done during the first period of one year from the recording. As soon as assessment-work to the extent of $500 is recorded and a survey made of the claim, the owner of a mineral claim is entitled to a Crown grant on payment of a fee of $25, and giving the necessary notices required by the Act. Liberal provisions are also made in the Act for obtaining mill-sites and other facilities in the way of workings and drains for the better working of claims.

Placer Claims.

Placer-mining is governed by the "Placer-mining Act," and by the interpretation clause its scope is defined as "the mining of any natural stratum or bed of earth, gravel, or cement mined for gold or other precious minerals or stones." Placer claims are of four classes, as follows:—

"'Creek diggings': any mine in the bed of any stream or ravine:

"'Bar digging': any mine between high- and low-water marks on a river, lake, or other large body of water:

"'Dry diggings': any mine over which water never extends:

"'Precious-stone diggings': any deposit of precious stones, whether in veins, beds, or gravel deposits."

The following provisions as to extent of the various classes of claims are made by the Act:—

"In 'creek diggings' a claim shall be two hundred and fifty feet long, measured in the direction of the general course of the stream, and shall extend in width one thousand feet, measured from the general course of the stream five hundred feet on either side of the centre thereof:

"In 'bar diggings' a claim shall be:—

"(*a.*) A piece of land not exceeding two hundred and fifty feet square on any bar which is covered at high water; or

"(*b.*) A strip of land two hundred and fifty feet long at high-water mark, and in width extending from high-water mark to extreme low-water mark:

"In 'dry diggings' a claim shall be two hundred and fifty feet square."

The following provision is made for new discoveries of placer-mining ground:—

"If any free miner, or party of free miners, discovers a new locality for the prosecution of placer-mining and such discovery be established to the satisfaction of the Gold Commissioner, placer claims of the following sizes shall be allowed to such discoverers, namely:—

"To one discoverer, one claim..... 600 feet in length;

"To a party of two discoverers, two claims amounting together to.....1,000 feet in length;

"And to each member of a party beyond two in number, a claim of the ordinary size only.

"The width of such claims shall be the same as ordinary placer claims of the same class: Provided that where a discovery claim has been established in any locality no further discovery shall be allowed within five miles therefrom, measured along the watercourses."

Every placer claim shall be as nearly as possible rectangular in form, and marked by four legal posts at the corners thereof, firmly fixed in the ground. On each of such posts shall be written the name of the locator, the number and date of issue of his free miner's certificate, the date of the location, and the name given to the claim. In timbered localities boundary-lines of a placer claim shall be blazed so that the posts can be distinctly seen, underbrush cut, and the locator shall also erect legal posts not more than 125 feet apart on all boundary-lines. In localities where there is no timber or underbrush, monuments of earth and rock, not less than 2 feet high and 2 feet in diameter at base, may be erected in lieu of the last-mentioned legal posts, but not in the case of the four legal posts marking the corners of the claim.

A placer claim must be recorded in the office of the Mining Recorder for the mining division within which the same is situate, within fifteen days after the location thereof, if located within 10 miles of the office of the Mining Recorder by the most direct means of travel. One additional day shall be allowed for every 10 miles additional or fraction thereof. The number of days shall be counted inclusive of the days upon which such location was made, but exclusive of the day of application for record. The application for such record shall be under oath and in the form set out in the Schedule to the Act. A claim which shall not have been recorded within the prescribed period shall be deemed to have been abandoned.

To hold a placer claim for more than one year it must be rerecorded before the expiration of the record or rerecord.

A placer claim must be worked by the owner, or some one on his behalf, continuously, as far as practicable, during working-hours. If work is discontinued for a period of seven days, except during the close season, lay-over, leave of absence, sickness, or for some other reason to the satisfaction of the Gold Commissioner, the claim is deemed abandoned.

Lay-overs are declared by the Gold Commissioner upon proof being given to him that the supply of water is insufficient to work the claim. Under similar circumstances he has also the power to declare a close season, by notice in writing and published in the Gazette, for all or any claims in his district. Tunnel and drain licences are also granted by him on the person applying giving security for any damage that may arise. Grants of right-of-way for the construction of tunnels or drains across other claims are also granted on payment of a fee of $25, the owner of the claims crossed having the right for tolls, etc., on the tunnel or drain which may be constructed. These tolls, however, are, so far as the amount goes, under the discretion of the Gold Commissioner.

Co-owners and Partnerships.

In both the "Mineral" and "Placer-mining" Acts provision is made for the formation of mining partnerships, both of a general and limited liability character. These are extensively taken advantage of and have proved very satisfactory in their working. Should a co-owner fail or refuse to contribute his proportion of the expenditure required as assessment-work on a claim he may be "advertised out," and his interest in the claim shall become vested in his co-owners who have made the required expenditure, *pro rata* according to their former interests.

It should not be forgotten that if any co-owner permits his free miner's certificate to lapse, the title of his associates is not prejudiced, but his interest reverts to the remaining co-owners; provided that said co-owner has not taken advantage of the six months' period of grace allowed for the taking-out of a special free miner's certificate, thus reviving the title to his interest.

Placer-mining Leases.

Leases of unoccupied Crown lands approximately 80 acres in extent may be granted by the Gold Commissioner of the district after location has been made by staking along a "location-line" not more than one-half a mile (2,640 feet) in length. In this line one bend, or change of direction, is permitted. Where a straight line is followed two posts only are necessary—namely, an "initial post" and a "final post." Where there is a change of direction a legal post must be placed to mark the point of the said change. The leasehold is allowed a width not in excess of one-quarter mile (1,320 feet), and the locator, both on his "initial post" and in his notice of intention to apply, which is posted at the office of the Mining Recorder, is required to state how many feet are included in the location to the right and how many feet to the left of the location-line.

That section of the Act dealing with the staking of placer-mining leases follows:—

"105. (1.) For the purpose of locating a placer leasehold, a line to be known as the 'location-line' shall be marked on the ground by placing a legal post at each end, one post to be known as the 'Initial Post' and the other as the 'Final Post.' The direction of the location-line may change at not more than one point throughout its length, and an intermediate legal post shall be placed at the point at which the direction changes. The total length of the location-line, following its change of direction (if any), shall not exceed two thousand six hundred and forty feet.

"(2.) Upon the initial post and the final post shall be written the words 'Initial Post' and 'Final Post' respectively, together with the name of the locator and the date of the location. On the initial post shall also be written the approximate compass-bearing of the final post, and a statement of the number of feet of the leasehold lying on the right and on the left of the location-line, as viewed from the initial post, not exceeding in the aggregate a width of thirteen hundred and twenty feet, thus: 'Direction of Final Post, . feet of this claim lie on the right and feet on the left of the location-line.' In addition to the foregoing, where there is a change of direction in the location-line as marked on the ground, the number '1' shall be written on the initial post; the number '2' shall be written on the intermediate post; and the number '3' shall be written on the final post. There also shall be affixed to the initial post a notice to the following effect, namely: 'Application will be made under the "Placer-mining Act" for a lease of the ground within this location.'

"(3.) The location-line shall at the time of location be marked between the legal posts throughout its length so that it can be distinctly seen; in a timbered locality, by blazing trees and cutting underbrush, and in a locality where there is neither timber nor underbrush, by placing legal posts or monuments of earth or stones not less than two feet high and not less than two feet in diameter at the base, so that the location-line can be distinctly seen.

"(4.) Where, from the nature or shape of the surface of the ground, it is impracticable to mark the location-line of a leasehold as provided by this section, the leasehold may be located by placing legal posts as witness-posts, as near as possible to the location-line, and writing on each witness-post the distance and compass-bearing of some designated point on the location-line from the witness-post; and the distances and compass-bearing so written on the witness-posts shall be set out in the application for the lease and in any lease granted thereon.

"(5.) The locator shall, within thirty days after the date of the location, post a notice in Form I in the office of the Mining Recorder, which notice shall set out:—

"(*a.*) The name of the intending applicant or each applicant if more than one, and the numbers of their free miners' certificates:

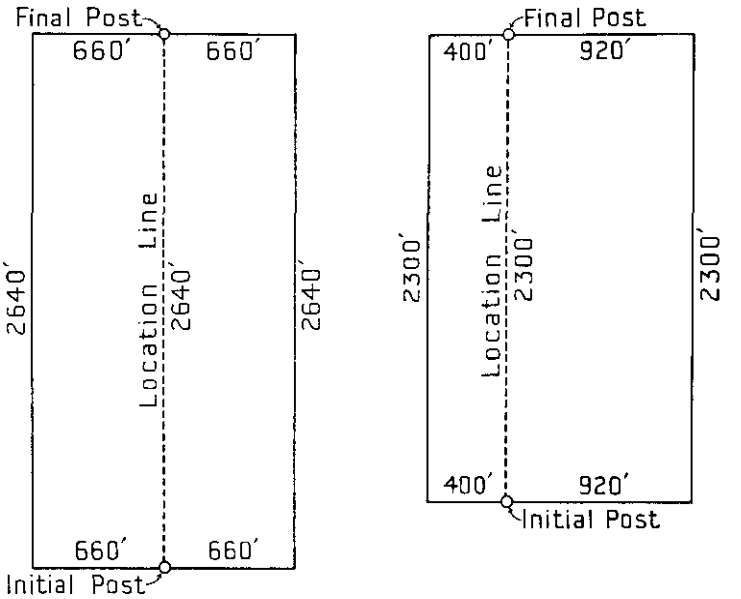
"(*b.*) The date of the location:

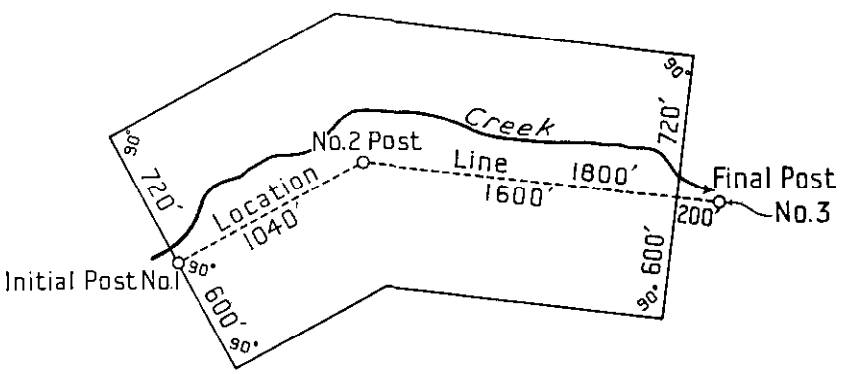
"(*c.*) The number of feet lying to the right and left of the location-line, and the approximate area or size of the ground.

The words written on the initial post and final post shall be set out in full in the notice; and as accurate a description as possible of the ground to be acquired shall be given, having special reference to any prior locations it may join, and the general locality of the ground to be acquired."

EXAMPLES OF VARIOUS METHODS OF LAYING OUT PLACER LEASEHOLDS.

Showing Areas secured with Location-lines of Various Lengths.





Another provision is that there must be affixed to the "initial post" and to the "final post" a numbered metal identification tag furnished by the Mining Recorder with each free miner's certificate issued. These tags may be attached to the posts, or placed in a container within a cairn, either at the time of location or some time during the succeeding year, but

must be so placed before the Mining Recorder will grant the first certificate of work in respect of the leasehold.

The annual rental on a placer-mining lease is $30, and the amount to be expended annually on development-work is $250.

Authority also has been given for the granting of special placer-mining leases in locations other than has been defined.

For more detailed information the reader is referred to the complete "Placer-mining Act," which may be obtained from the King's Printer, Victoria, B.C.

Table of Fees, Mineral Act and Placer-mining Act.

Individual free miner's certificate, annual fee	$5.00
Company free miner's certificate (capital $100,000 or less), annual fee	50.00
Company free miner's certificate (capital over $100,000), annual fee	100.00
Recording mineral or placer claim	2.50
Recording certificate of work, mineral claim	2.50
Rerecord of placer claim	2.50
Recording lay-over	2.50
Recording abandonment, mineral claim	10.00
Recording abandonment, placer claim	2.50
Recording any affidavit	2.50
Records in "Records of Conveyances"	2.50
Filing documents, "Mineral Act"	.25
Filing documents, "Placer-mining Act"	1.00
Recording certificate of work, placer-mining lease	2.50
For Crown grant of mineral rights under "Mineral Act"	25.00
For Crown grant of surface rights of mineral claim under "Mineral Act"	10.00
For every lease under "Placer-mining Act"	5.00

Provisional Free Miners' Certificates (Placer) Act.

This Act provides for the issuance of "provisional free miners' certificates" for the locating, recording, representing, and working of placer claims of a size, and according to the terms, and in the manner set out in Parts II. and III. of the "Placer-mining Act." Any person over 18 years of age who has resided in the Province continuously for a period of not less than six months prior to date of his application may, on application accompanied by a statutory declaration or other satisfactory evidence as to his age and period of residence in the Province, obtain from any Gold Commissioner or Mining Recorder a provisional free miner's certificate. No fees are payable in respect of such certificate, and it abolishes the fees payable in respect of the recording or rerecording of placer claims, but no record or rerecord of a claim shall be granted for a longer period than one year without the payment of fees. It should be pointed out that the provisional free miner's certificate does not carry the privileges of an ordinary free miner's certificate as to the staking and working of placer-mining leases or mineral claims.

The Act also gives the Lieutenant-Governor in Council, as a means of unemployment relief, power to make provision for the establishment, equipment, maintenance, and operation of one or more placer training camps at suitable locations, at which unemployed persons who hold provisional free miners' certificates and are British subjects may acquire knowledge and training in the art of placer-mining and may be afforded gainful work in the recovery of minerals by placer-mining. Reserves for the location of such camps shall not exceed one mile in length by one-half mile in width, and the right is given to enter into agreements with private holders under the Act for the development of their ground by means of unemployment relief camps.

Department of Mines Act, 1937.

The "Department of Mines Act" empowers the Minister of Mines to organize the Department or to reorganize it from time to time to meet changing conditions in the mining industry. It provides for examination and certification of assayers; for the conducting of short courses of lectures in practical geology and mineralogy; and for the purchase of ore from the Provincial sampling plants. The said Act also provides for the expenditure of public moneys

for the construction, reconstruction, or repair of trails, roads, and bridges to facilitate the exploration of the mineral resources of any mining district, or in the operation and development of any mining property.

Iron and Steel Bounties Act, 1929.

The Lieutenant-Governor in Council may enter into an agreement with any person whereby the Crown will pay to that person, out of the Consolidated Revenue Fund, bounties on pig-iron and steel shapes when manufactured within the Province, as follows:—

(*a.*) In respect of pig-iron manufactured from ore, on the proportion produced from ore mined in the Province, a bounty not to exceed three dollars per ton of two thousand pounds:

(*b.*) In respect of pig-iron manufactured from ore, on the proportion produced from ore mined outside the Province, a bounty not to exceed one dollar and fifty cents per ton of two thousand pounds:

(*c.*) In respect of steel shapes of commercial utility manufactured in the Province, a bounty not to exceed one dollar per ton of two thousand pounds.

Bounty, as on pig-iron under this Act, may be paid upon the molten iron from ore which in the electric furnace, Bessemer or other furnace, enters into the manufacture of steel by the process employed in such furnace; the weight of such iron to be ascertained from the weight of the steel so manufactured.

Bounty on steel shapes under this Act shall be paid only upon such steel shapes as are manufactured in a rolling-mill having a rated productive capacity per annum of at least twenty thousand tons of two thousand pounds per ton.

Metalliferous Mines Regulation Act.

At the 1935 session of the Provincial Legislature " An Act to amend and consolidate the Enactments regulating the Working of Metalliferous Mines, Quarries, and Metallurgical Works " was passed. This Act is known as the " Metalliferous Mines Regulation Act," and, in its general tone, its clear purpose is to maintain the highest standard in respect of safety and of healthy conditions, both on the surface and underground in mining operations. The idea is to not only assure, as far as practicable, the protection of workmen against injury, but to establish those conditions best calculated to safeguard the health of the men employed. The Act also provides for the drafting of regulations, if such are found necessary, for the protection of men who are working under conditions which may lead to pulmonary disability.

This Act may be divided into six parts, as follows:—

(1.) Administration:

(2.) Duties of owners, managers, and others:

(3.) Special Rules for protection of miners:

(4.) General Rules, having reference to: (*a*) Employees; (*b*) Ventilation; (*c*) Explosives and blasting; (*d*) Fire-protection; (*e*) Connection between mines; (*f*) Mine signals; (*g*) Aid to injured; (*h*) Prevention of dust; (*i*) Handling of water; (*j*) Sanitation; (*k*) Protection of working-places, shafts, winzes, raises, etc.; (*l*) Ladder-ways; (*m*) Shaft equipment and operation; (*n*) Testing of brakes; (*o*) Haulage; (*p*) Protection from machinery; (*q*) Electrical installations:

(5.) General Rules for quarries:

(6.) Supplemental.

SUMMARY OF ACTS SPECIALLY RELATING TO MINING.

(The complete Acts may be obtained from the King's Printer, Victoria, B.C.)

Mining Licences under the Coal and Petroleum Act.

Any person desiring to prospect for coal, petroleum, or natural gas upon any unsurveyed unreserved lands in which these resources are held by the Crown may acquire a licence to do so over a rectangular block of land not exceeding 640 acres, of which the boundaries shall run due north and south and east and west, and no side shall exceed 80 chains (1 mile) in length. Before entering into possession of the said lands he shall place at the corner of such block a legal stake, or initial post, and shall inscribe thereon his name and the angle represented by such post, thus: "A. B.'s N.E. corner," or as the case may be, and shall post in a conspicuous place upon the said land, and also in the Government office of the land recording district, notice of his intention to apply, as well as publishing the same in the B.C. Gazette and local newspaper once each week for four consecutive weeks. If the area applied for is surveyed no staking is required, but the same procedure with regard to advertising notice of intention to apply is necessary.

The application for said licence shall be in writing, in duplicate, and shall contain the best written description possible, with a diagram of the land sought to be acquired, and shall be accompanied with a fee of $100. The application shall be made to the Commissioner of Lands for the district, within sixty days from date of first publication in B.C. Gazette, and by him forwarded to the Minister of Lands, who will grant such licence—provided no reasons arise to the contrary—for a period not to exceed one year, and at the expiration of the first year an extension of such licence may be granted for a second or third year at a fee of $100.

Where coal is discovered during the existence of licence or within thirty days after expiration, the land held under licence, having been surveyed and licence conditions fulfilled, may be leased for five years at rental of 15 cents an acre, subject to renewals for five successive periods of three years each, renewal fee being $100 for each lease, in addition to annual rental.

Lessees, on showing continuous work has been done and reasonable expenditure made for development, may, after carrying out the provisions of the lease, purchase at $20 per acre where surface is available, or $15 per acre for under-surface rights where surface is not available. Lands under the sea may be purchased at $15 per acre. Provided also that, in addition to the rental or purchase price, there shall be paid to the Government as a royalty 2½ cents a barrel (35 imperial gallons) of crude petroleum raised or gotten from such land. (*See* chapter 175, R.S.B.C. 1936.)

Taxation Act.

A preliminary note is essential to the understanding of this Act. As the law has stood, a Crown-granted mineral claim on which taxes were in arrears for a number of years was offered for sale by the Government at a *tax* sale, with arrears of taxes plus interest and charges and Crown-grant fees as an upset price. If no sale was made the property remained in the hands of the Assessor until desired by some one, when it could only be purchased by tender. It was not open to location under the "Mineral Act" and a prospector had no protection, and to relieve the situation an amending Act was passed.

Under the amended Act such reverted Crown-granted mineral claim may be obtained by any person under a lease for one year upon payment of $25, and a renewal of such lease may be granted upon payment of further $25 for a further period of one year, but no longer. During the period of such lease the lessee has the right to enter, prospect, and mine on such mineral claim, save for coal, petroleum, and natural gas, and during such time the lessee has the option to purchase such Crown-granted mineral claim upon payment of all taxes, costs, and interest which remained due and unpaid on such claim on the date of its forfeiture to the Crown, together with an amount equal to all taxes and interest which, except for its forfeiture to the Crown, would have been payable in respect thereof from the date of the lease to the date of application for a Crown grant. If, however, the lessee establishes to the satisfaction of the Gold Commissioner that he has expended upon the claim in mining-development work a sum of not less than $200 a year during the continuance of the lease, then the payment of the sum in respect of taxes and penalties from the date of the lease to

the date of application for a Crown grant shall not be required. Provision also is made for the grouping of adjoining claims, not exceeding eight in number, and the performing on one of such claims mining-development work for all of the claims.

A person may obtain a lease, or interest in a lease, of eight such claims in the same mining division.

Such leases are not transferable and are subject to the rights any person may already hold to any portion of the surface of such Crown-granted mineral claim.

Taxation of Mines.

Crown-granted mineral claims are subject to a tax of 25 cents per acre. The tax becomes due on April 1st in each year, and if unpaid on the following June 30th is deemed to be delinquent.

All mines, other than coal, are subject to an output tax (payable quarterly) of 2 per cent. on gross value of mineral, less cost of transportation from mine to reduction-works and the cost of treating same at reduction-works or on the mining premises.

Any such mine, not realizing on ore shipments a market value of $5,000 in any one year, is entitled to a refund of the output tax paid.

All mines are subject to a tax upon income, subject to the exemptions and allowances given in the "Income Tax Act"; provided, in the case of those mines paying an output tax, that an income tax is only collected if such tax prove greater than the output tax, and the output tax is then regarded as part payment of the income tax.

In addition to the ordinary working expenses, mines are allowed to deduct from their income a charge for:—

(1.) Development—being such proportion of this capital expenditure as is ascertained to be chargeable to the year's operation:
(2.) Depreciation of buildings and plant:
(3.) Depletion—being such proportion of the capital cost of the mine as, being a wasting asset, is ascertained to be chargeable to the year's operation.

The above-mentioned charges are allowable at the discretion of the Minister of Finance, subject, however, to an appeal to the Lieutenant-Governor in Council.

The rate of income tax varies from 1 per cent. up to a maximum of 10 per cent. on incomes of $19,000 and over.

Coal is subject to a tax of 10 cents per ton of 2,240 lb., except coal shipped to coke-ovens within the Province. Tax payable monthly.

Coke is subject to a tax of 10 cents per ton of 2,240 lb., except in respect of coke produced from coal upon which this tax has already been paid. Tax payable monthly.

Coal land from which coal is being mined (Class A) is taxed at 1 per cent. upon the assessed value, in addition to any other tax.

Unworked coal land, known as "Coal Land, Class B," is subject to a tax of 2 per cent. upon the assessed value.

For further particulars *see* the "Taxation Act," also the "Public Schools Act," which are obtainable from the King's Printer, Victoria, B.C.

ASSAY OFFICE.

BY

D. E. WHITTAKER.

During the year 1938 there were made by the staff in the Assay Office, 7,100 assays or quantitative determinations and 1,574 analyses; of these the majority were for the Department 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	$82.00
Fees for assaying	147.00
Fees for assayers' examinations	480.00
Total cash receipts	$709.00

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

Attorney-General's Department	$545.00
Agricultural Department	1,630.00
Board of Health	1,085.00
Treasury	2,397.00
Forest Branch	385.00
Other departments	135.00
	$6,177.00
Value of work done outside of Mines Department work	$6,886.00

Two thousand three hundred and ninety-seven lots of gold were received from the Gold Commissioners, who are purchasing amounts up to 2 oz. to aid the prospector in disposing of his gold.

FREE DETERMINATIONS.

In addition to the above quantitative work, 419 qualitative determinations, or tests, were made in connection with the identification and classification of rocks or minerals sent to the Assay Office for a report; for these no fees were charged, as it is the established custom of the Department 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 Department asks that the locality from which the sample was obtained be given by the sender.

EXAMINATIONS FOR ASSAYERS.

The writer has the honour, as Secretary, to submit the Annual Report for the year 1938 of the Board of Examiners for Certificates of Competency and Licence to practise Assaying in British Columbia, as established under the "Department of Mines Act, 1937."

A meeting of the Board of Examiners was held on May 16th, June 21st, and December 22nd. Five candidates applied for examination on April 25th and four passed the examination. Six candidates applied for examination on May 9th and all passed the examination. Three candidates applied for examination on June 6th and all passed. Five candidates applied for examination on November 28th and all passed the examination. Three candidates applied for exemption under the Act and were granted certificates.

GOLD COMMISSIONERS AND MINING RECORDERS.

The following list shows the Gold Commissioners and Mining Recorders of the Province:—

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-recorder.
Atlin	Atlin	H. F. Glassey	H. F. Glassey	G. H. Hallett.
Sub-office	Telegraph Creek			T. S. Dalby.
Sub-office	Haines (U.S.)		(Com. for taking Affidavits)	B. A. Barnett.
Sub-office	Tulsequah			W. J. Nelson.
Sub-office	Juneau (U.S.)		(Com. for taking Affidavits)	Harold E. Brown.
Stikine	Telegraph Creek	T. S. Dalby	T. S. Dalby	
Sub-office	Boundary via Telegraph Creek			F. W. Grimble.
Sub-office	Burns Lake			F. E. Trousdell.
Sub-office	McDame Creek			Gerald Davis.
Sub-office	Fort St. John			F. W. Beatton.
Sub-office	Dease Lake Townsite			R. J. Campbell.
Skeena	Prince Rupert	N. A. Watt	N. A. Watt	A. J. Lancaster.
Sub-office	Kitimat			Chas. E. Moore.
Sub-office	Copper River			L. G. Skinner.
Sub-office	Terrace			P. Kelsberg.
Sub-office	Stewart (Portland Canal)			H. W. Dodd.
Sub-office	Rosswood			Mrs. Alberta Smith.
Sub-office	Kimsquit			Percy Gadsden.
Portland Canal	Stewart	N. A. Watt (at Prince Rupert)	H. W. Dodd	
Sub-office	Anyox			W. Eve.
Sub-office	Alice Arm			Mrs. L. Cummings.
Bella Coola	Prince Rupert	N. A. Watt	N. A. Watt	A. J. Lancaster.
Sub-office	Bella Coola			C. A. Brynildsen.
Sub-office	Ocean Falls			Geo. H. Hill.
Sub-office	Kimsquit			Percy Gadsden.
Queen Charlotte	Queen Charlotte	N. A. Watt	D. T. R. McColl, M.D.	
Sub-office	Lockeport			
Omineca	Smithers	H. B. Campbell	H. B. Campbell	
Sub-office	Fort Grahame			J. Copeland.
Sub-office	Bella Coola			C. A. Brynildsen.
Sub-office	Finlay Forks			A. MacKinnon.
Sub-office	Fort St. James			Mrs. A. Kynoch.
Sub-office	Manson Creek			W. B. Steele.
Sub-office	Telkwa			T. J. Thorp.
Sub-office	Prince George			Geo. Milburn.
Sub-office	Hudson Hope			F. F. Monteith.
Sub-office	Kimsquit			Percy Gadsden.
Sub-office	Fort St. John			F. W. Beatton.
Sub-office	Whitewater (Finlay River) via Fort Grahame			James Ware.
Sub-office	Cedarvale			John Thompson.
Sub-office	Terrace			P. Kelsberg.
Sub-office	Fort Fraser			J. D. Moore.
Sub-office	Vanderhoof			Geo. Ogsdon.
Sub-office	Pacific			J. C. McCubbin.
Sub-office	Hazelton			Andrew Grant.
Sub-office	Burns Lake			F. E. Trousdell.
Sub-office	Usk			Jas. L. Bethurem.
Sub-office	Takla Landing			Mrs. Wilhemina Aiken.
Sub-office	Copper River			L. G. Skinner.
Peace River	Fort St. John	H. B. Campbell (at Smithers)	F. W. Beatton	
Sub-office	Fort Nelson			H. J. Engleson.
Sub-office	Prince George			G. Milburn.
Sub-office	Finlay Forks			A. MacKinnon.
Sub-office	Hudson Hope			Melvin Kyllo.
Sub-office	Pouce Coupe			A. E. Roddis.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-recorder.
Cariboo	Barkerville	H. A. Bryant	H. A. Bryant	
Sub-office	Quesnel			A. Sydney.
Sub-office	Prince George			Geo. Milburn.
Sub-office	McBride			M. B. McBrayne.
Sub-office	Fort McLeod			J. E. McIntyre.
Quesnel	Williams Lake	L. C. Maclure	L. C. Maclure	
Sub-office	Quesnel			A. Sydney.
Sub-office	Likely			A. Morrison.
Sub-office	Barkerville			H. A. Bryant.
Sub-office	Horsefly			A. B. Campbell.
Sub-office	Keithley Creek			Wm. Lowden.
Sub-office	Hanceville			E. R. Hance.
Clinton	Clinton	R. J. A. Dorrell	R. J. A. Dorrell	
Sub-office	Williams Lake			L. C. Maclure.
Sub-office	Haylmore via Gold Bridge			W. Haylmore.
Sub-office	Hanceville			E. R. Hance.
Kamloops	Kamloops	P. H. McCurrach	P. H. McCurrach	D. G. Dalgleish.
Sub-office	Chu Chua			George M. Fennell.
Sub-office	Vavenby			H. Finley.
Sub-office	Salmon Arm			A. P. Suckling.
Ashcroft	Ashcroft	P. H. McCurrach (at Kamloops)	W. F. Knowlton	
Sub-office	Lytton			H. Elgie.
Nicola	Merritt	P. H. McCurrach (at Kamloops)	A. G. Freeze	
Similkameen	Princeton	Chas. Nichols	Chas. Nichols	
Sub-office	Hedley			John Love.
Vernon	Vernon	R. M. McGusty	R. M. McGusty	F. H. C. Wilson.
Sub-office	Kelowna			C. W. Dickson.
Greenwood	Greenwood	L. A. Dodd	L. A. Dodd	
Sub-office	Kettle Valley			G. B. Gane.
Sub-office	Beaverdell			T. W. Clarke.
Sub-office	Oliver			W. H. Laird.
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			John Love.
Sub-office	Oliver			W. H. Laird.
Golden	Golden	A. W. Anderson	A. W. Anderson	C. J. Dainard.
Windermere	Windermere	A. W. Anderson (at Golden)	A. M. Chisholm	
Fort Steele	Cranbrook	J. E. Kennedy	J. E. Kennedy	A. A. Robertson.
Sub-office	Fernie			J. R. Nolan.
Ainsworth	Kaslo	Claude MacDonald	W. M. H. Dunn	
Sub-office	Trout Lake			
Sub-office	Poplar Creek			A. Robb.
Slocan	New Denver	Claude MacDonald (at Kaslo)	Frank Broughton	
Sub-office	Sandon			H. Bradbury.
Slocan City	Slocan	Claude MacDonald	T. McNeish	W. E. Graham.
Nelson	Nelson	J. Cartmel	J. Cartmel	J. A. Stewart.
Sub-office	Creston			R. H. Hassard.
Sub-office	Ymir			S. Curwen.
Sub-office	Salmo			M. C. Donaldson.
Arrow Lake	Nakusp	J. Cartmel (at Nelson)	N. A. Herridge	
Revelstoke	Revelstoke	Wynfield Maxwell	W. Maxwell	
Lardeau	Beaton	Wynfield Maxwell (at Revelstoke)	Stephen Rowe	
Sub-office	Trout Lake			
Trail Creek	Rossland	A. C. Sutton	A. C. Sutton	
Nanaimo	Nanaimo	C. L. Monroe	C. L. Monroe	W. H. Cochrane.
Sub-office	Ladysmith			J. A. Knight.
Sub-office	Alert Bay			Jos. Howe.
Sub-office	Vananda			Henry Carter.
Sub-office	Shoal Bay, Thurlow P.O.			C. C. Thompson.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-recorder.
Nanaimo—*Continued.*				
Sub-office	Granite Bay			H. J. Bull.
Sub-office	Cumberland			S. B. Hamilton.
Sub-office	Zeballos			Geo. Nicholson.
Sub-office	Alberni			W. H. Boothroyd.
Alberni	Alberni	W. H. Boothroyd	W. H. Boothroyd	G. C. Rolf.
Clayoquot	Tofino	W. H. Boothroyd (at Alberni)	C. W. Sharp	
Sub-office	Zeballos			Geo. Nicholson.
Sub-office	Alberni			W. H. Boothroyd.
Sub-office	Nanaimo			C. L. Monroe.
Quatsino	Quatsino	W. H. Boothroyd (at Alberni)	Ed. Evenson	
Victoria	Victoria	R. J. Steenson	P. J. Mulcahy	
New Westminster	New Westminster	A. P. Grant	A. B. Gray	
Sub-office	Chilliwack			C. J. Whittaker.
Sub-office	Lytton			H. Elgie.
Sub-office	Hope			
Vancouver	Vancouver	A. S. Tyrer	R. A. Burgoyne	
Sub-office	Alert Bay			Jos. Howe.
Sub-office	Powell River			J. P. Scarlett.
Sub-office	Shoal Bay, Thurlow P.O.			C. C. Thompson.
Lillooet	Lillooet	L. J. Price	L. J. Price	T. B. Williams.
Sub-office	Haylmore via Gold Bridge			W. Haylmore.
Sub-office	Taseko River			Leslie MacAdams.

GOLD COMMISSIONERS' AND MINING RECORDERS' OFFICE STATISTICS, 1938.

Districts and Divisions.	Free Miners' Certificates.			Lode-mining.					Placer-mining.				Revenue.		Total.	
	Individual.	Company.	Special.	Mineral Claims recorded.	Certificates of Work.	Bills of Sale, etc.	Certificates of Improvements.	Leases of Re-verted Crown-granted Mineral Claims.	Placer Claims recorded.	Placer Leases recorded (Bench, Creek, and Dredging).	Certificates of Work, Placer Leases.	Bills of Sale, etc.	Free Miners' Certificates.	General.	Mining Divisions.	Districts.
North-western District																**$24,704.85**
Atlin	393	6	2	39	44		5		47	37	141	58	$2,201.75	$8,898.85	$11,100.60	
Bella Coola	16			4	3								68.25	17.50	85.75	
Portland Canal	187	3	1	177	577	29	1			1	2		1,097.25	3,010.85	4,108.10	
Queen Charlotte	22			8	17	4			3				102.25	100.25	202.50	
Skeena	96		3	55	130	10		24	2	1			459.00	1,180.60	1,639.60	
Stikine	171			36	136	8				25	44	53	819.50	3,748.80	4,568.30	
North-eastern District																**63,338.85**
Cariboo	461	16		599	1,733	102	56		23	126	389	151	3,545.00	30,658.75	34,203.75	
Omineca	540	12	3	244	752	109		1	18	38	337	72	3,267.25	12,663.21	15,930.46	
Peace River										1				35.00	35.00	
Quesnel	496	4	3	402	229	96	14		45	81	168	36	1,887.50	11,281.94	13,169.44	
South Central District																**25,192.05**
Kamloops	359	1	1	213	227	51			29		16	10	1,696.50	1,970.35	3,666.85	
Nicola	46	2		64	245	19							396.75	1,559.50	1,956.25	
Vernon	244	3	6	99	103	11			17	17	4	6	1,257.25	2,525.80	3,783.05	
Grand Forks	84	1		54	54	17		9	5	6	3	2	470.25	829.75	1,300.00	
Greenwood	170	3	1	199	209	23	3	42	8	3	52	3	950.75	3,258.75	4,209.50	
Osoyoos	175	3	4	217	329	36	30	3	1				1,180.75	1,896.20	3,076.95	
Similkameen	404	8	1	268	302	23			15	24	49	20	2,260.75	4,938.70	7,199.45	
South-eastern District																**26,972.19**
Ainsworth	103	6		91	102	29	5	16	4				1,067.25	1,409.70	2,476.95	
Arrow Lake	12			13	4								52.75	42.75	95.50	
Fort Steele	255	3		98	192	9			12	13	59	17	1,357.75	4,483.25	5,841.00	
Golden	45	2	2	2	39	1				2	5		387.50	326.09	713.59	
Lardeau	45			88	117	19							211.50	506.25	717.75	
Nelson	404	27	6	292	759	94	21	17	39	22	12	19	3,992.25	5,335.20	9,327.45	
Revelstoke	107	3	2	50	126	71	10	5	2	4	43	49	677.25	3,574.80	4,252.05	
Slocan	39	1		29	41	1	4						262.75	309.50	572.25	
Slocan City	42			43	74	2	1		3				199.00	302.00	501.00	
Trail Creek	156	5		47	22	5	1	9					1,143.00	409.50	1,552.50	
Windermere	57	2	1	23	88	3							388.00	534.15	922.15	
South-western District																**74,335.38**
Alberni	257	1		211	75	17	6	8	2	1	9		899.25	2,431.25	3,330.50	
Ashcroft	129	1	2	113	131	20			14	10	13	18	998.25	1,814.90	2,813.15	
Clayoquot	900	7	5	3,441	1,179	513	33	20	13		3	5	4,010.00	14,868.88	18,878.88	
Clinton	117	3	1	119	276	55			23	13	21	14	697.25	2,815.30	3,512.55	
Lillooet	321	15		450	815	87	39	3	3	10	16		2,652.25	5,746.30	8,398.55	
Nanaimo	180		1	401	75	35		1	3				682.00	1,261.45	1,943.45	
New Westminster	185		6	181	170	28		2	14	1	3		824.50	1,212.00	2,036.50	
Quatsino	175			201	29	53							633.00	636.50	1,269.50	
Vancouver	2,130	137	38	397	235	59		5					19,686.75	2,292.65	21,979.40	
Victoria	493	17	5	96	34	11		11	7	9	17	4	2,833.25	2,963.90	5,797.15	
Yale	175	8		163	349	33			12	3	34	5	1,463.00	2,912.75	4,375.75	
Totals	10,191	300	94	9,177	10,022	1,653	229	176	364	448	1,440	542	$66,779.25	$14,476.87	$211,543.12	**$211,543.12**

VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

3,125-539-9858

PART B

ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1938

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

BRITISH COLUMBIA DEPARTMENT OF MINES.

VICTORIA, B.C.

Hon. W. J. ASSELSTINE, *Minister.*

JOHN F. WALKER, *Deputy Minister.*

JAMES DICKSON, *Chief Inspector of Mines.*

D. E. WHITTAKER, *Chief Analyst and Assayer.*

P. B. FREELAND, *Chief Mining Engineer.*

R. J. STEENSON, *Chief Gold Commissioner.*

PART B.

NORTH-WESTERN DISTRICT.

BY

JOSEPH T. MANDY.

SUMMARY.

During 1938, field-work was confined to the Stewart and Alice Arm sections of the Portland Canal Mining Division and to the area tributary to the Canadian National Railway between Prince Rupert and Vanderhoof. In the latter area the field-work was generally relative to the Department of Mines' sampling plant at Prince Rupert with a view to stimulating and increasing prospecting, development, and production through the service of this plant.

In the Atlin Mining Division placer-gold operations have expanded and output has been sustained. Lode production from the *Polaris-Taku* mine, Taku River section, which was initiated at a milling rate of 150 tons a day in November, 1937, was increased to a rate of 200 tons a day during the latter part of 1938.

In the Stikine Mining Division placer operations and output materially increased on Boulder Creek, in the Turnagain (Little Muddy) River section. Several leases were optioned in this area by the Barrington interests and preparations made for extended mechanized operations during the season of 1939.

In the Unuk River area of the Portland Canal Mining Division lode prospecting declined, but the Unuk River Placer Gold Company continued exploratory work on Sulphurets Creek with a small crew.

In the Stewart section production from the Silbak-Premier Mines, Limited, has proceeded normally. In this section, a feature of the year was the completion in March of the *Big Missouri* underground mill of 750 tons daily capacity and the inception of production from this property.

Exploratory and development work in the Stewart area showed a marked decline in comparison with former years and appreciable work of this type was confined to only a few properties. Underground exploration of the *Salmon Gold* property, Salmon River area, by Consolidated Mining and Smelting Company of Canada, Limited, was continued. The Napco Company and the Excelsior Syndicate also employed small crews on superficial exploration of their holdings in the American Creek area. Towards the year-end exploration and development of the *Gold Drop* and *Gold Knife* groups in the Marmot River area, by the Chartered Mining Explorers Syndicate, was commenced and planned to continue throughout the winter months.

The decline in general prospecting activity, cited in the 1937 Annual Report of the Minister of Mines, showed a marked continuance in the Stewart area during the 1938 season.

New discoveries of interest were made on the *Napco* property in the American Creek area. Towards the close of the season low gold values were reported from a new discovery on Porter Creek, in the upper section of the Nass River drainage-basin.

Exploration and development of the *Hidden Creek* copper deposits at Anyox was continued by the Consolidated Mining and Smelting Company of Canada, Limited. In the Sylvester Bay section, adjacent to Anyox, a discovery of remarkably rich native gold mineralization in a narrow quartz vein adjacent to the beach was made on the *Gold Leaf* group by James Flynn. A small tonnage was mined and shipped to the sampling plant at Prince Rupert.

The Alice Arm area remained generally inactive during the year and prospecting in this section has continued to decline. Mining and shipping of high-grade silver ore from the *Dolly Varden* property was continued by T. W. Falconer and on the *Homestake* group energetic further exploration was carried out by British Lion Mines, Limited. Towards the close of the season the discovery of promising values in widespread pyritic mineralization was reported from the Kinskuch Lake area by G. Fiva, of Alice Arm.

In the Coast area the Surf Inlet Consolidated on Princess Royal Island was continuously operated, with production at a daily milling rate of about 70 tons. In the Prince Rupert section the mill at the *Surf Point* property of the Reward Mining Company was destroyed by fire in June.

Construction of a new mill of about 50 tons capacity was commenced towards the year-end. Production from this property and the *Edye Pass* group should resume early in 1939. Exploration of the pyritic deposits of the Ecstall River near Port Essington, Skeena River, was continued by Northern Pyrites, Limited.

In the area tributary to the Canadian National Railway between Prince Rupert and Vanderhoof, general interest in all branches of the industry was markedly revived and stimulated through the service of the Department of Mines' sampling plant at Prince Rupert. Advantage of this service was taken by many prospectors for ascertaining values in their workings through bulk-sampling as guidance to exploratory work and general prospecting. The guidance of bulk test-sampling of ore being prepared for shipment was also continuously sought by intending shippers. Many prospectors produced and received payment for shipments of ore ranging from a few hundred pounds to several tons. In the Usk, Smithers, and Topley areas, several prospectors extracting ore for shipment have continued work through the winter months. As a result of this stimulation, prospecting along the Canadian National Railway section has shown a most encouraging revival and some interesting new discoveries have been made.

In the Usk area several promising new veins have been discovered on the *Grotto* group, and gold and silver telluride mineralization (petzite and hessite) was discovered in the ore from the original veins shipped to the sampling plant from this group. In the Driftwood Creek area of the Babine Mountains a wide and continuous quartz vein carrying encouraging gold and silver values was discovered on the *Valhalla* group by Jens Baker and Ben Nelson, of Smithers, and plans were completed for the exploration of this discovery during the winter. In the Topley section new discoveries have also been made in the Finlay Creek area.

LODE-GOLD DEPOSITS.

Observatory Inlet Area.

Gold Leaf and Honeymoon.

These claims are owned by James Flynn, Anyox, B.C. They are located in the central section of Granby Peninsula, about 2 miles south of Anyox. The property is reached by regular coastal steamship service to Anyox and thence by rowboat or launch to the cabin and showings on the east shore or Sylvester Bay side of the peninsula. In rough weather a landing can be made on the more protected west shore (Granby Bay) of the peninsula, from where, at the narrowest section of the peninsula, a trail extends for about 300 feet to the cabin on the Sylvester Bay shore.

The claims were located on April 12th, 1938, as the result of spectacular native gold mineralization discovered in float a short time previously. This was traced to its source in a narrow quartz vein outcropping on a narrow rock bench along the shore of Sylvester Bay at about high-tide mark.

Granby Peninsula is a narrow strip of land 1½ miles wide at its southerly end and about three-eighths of a mile wide at its northerly end at Granby Point. It extends between Granby Bay on the west and Sylvester Bay on the east and in its central section at the northerly boundary of the *Honeymoon* claim is only about 300 feet wide.

In the region of the showings, the peninsula is about 900 feet wide with rock bluffs rising abruptly for 50 feet above the shore and reaching an elevation of about 260 feet above sea-level in the central area of the peninsula. The peninsula is covered with soil of comparatively shallow depth and fallen burnt timber. There is practically a complete absence of underbrush. Outcrops in longitudinal rock ridges and small rock domes frequently occur.

The area embraced by the claims is underlain by bedded, folded, and metamorphosed argillites of McConnell's Goose Bay formation, a component of the middle section of the Hazelton series. In the locality of the showings the argillites strike northward and are folded to steep but varying degrees of inclination.

This formation forms a large inclusion surrounded by granodiorite of the Coast Range batholith. In the region of the claims the inclusion is about 10 miles wide and the southerly

granodiorite contact strikes east about 3 miles south of the main showings. The argillites are intruded by numerous light and dark coloured dykes striking in varying directions and ranging from a few inches to over 20 feet in width. In places the quartz veins are adjacent to these dykes, but evidence indicates the latter as being postmineral in age.

The mineral deposit consists of quartz veins ranging from a few inches to several feet in width and generally conforming to the attitude of the formation. In places numerous quartz stringers and veinlets branch from the main veins and in the main showing form an intricate network on the foot-wall side of the vein. The veins are generally sparsely mineralized with small patches of galena, sphalerite, chalcopyrite, and pyrrhotite. In the main showing a defined ribboning is evident in places in the quartz on both the hanging- and foot-wall sides of the vein and in these sections small blebs of native gold from $\frac{1}{32}$ to $\frac{1}{16}$ of an inch in diameter are abundantly and intimately intermixed with galena, sphalerite, and pyrite mineralization.

The main showing consists of a quartz vein outcropping in a flat rock bench at high-tide level. The bench is about 30 feet wide and abuts the bluff which borders the shore-line. Along the central section of the vein the bluff face conforms approximately to the foot-wall of the vein. The vein strikes north 34 degrees east, obliquely across the rock bench and dips from 53 to 60 degrees south-eastward. A kersantite dyke, 2.5 feet in width, occurs adjacent to the vein on its hanging-wall side. From the high-tide line the vein can be traced by natural outcrop in a south-westerly direction for 160 feet, at which point it cuts into the bluff and further continuity in this direction is obscured by overburden.

In a north-easterly direction the vein can be seen continuing for several feet beneath the sea. Along its exposure the walls of the vein are comparatively tight and it ranges from 2 inches to 2 feet wide and averages about 8 inches in width. A network of quartz stringers and veinlets branch from it and extend into the foot-wall.

At high-tide mark an open-cut 52 feet long and at least 9 feet in depth has followed the vein below tide-mark as far as practicable. Work in this cut is carried out as the sequence of tides permits. In the face of this cut, 9 feet high, the vein ranges from 1.3 feet to 0.9 foot wide and shows ribboning on both the hanging- and foot-wall sides. It is meagerly mineralized mainly with sphalerite and pyrite with some native gold, especially in the ribboned sections. A sample of the vein in the face of this cut for a height of 9 feet and an average width of 10.8 inches, assayed: Gold, 0.46 oz. per ton; silver, 0.1 oz. per ton; copper, *nil;* lead, *nil;* zinc, 0.1 per cent.

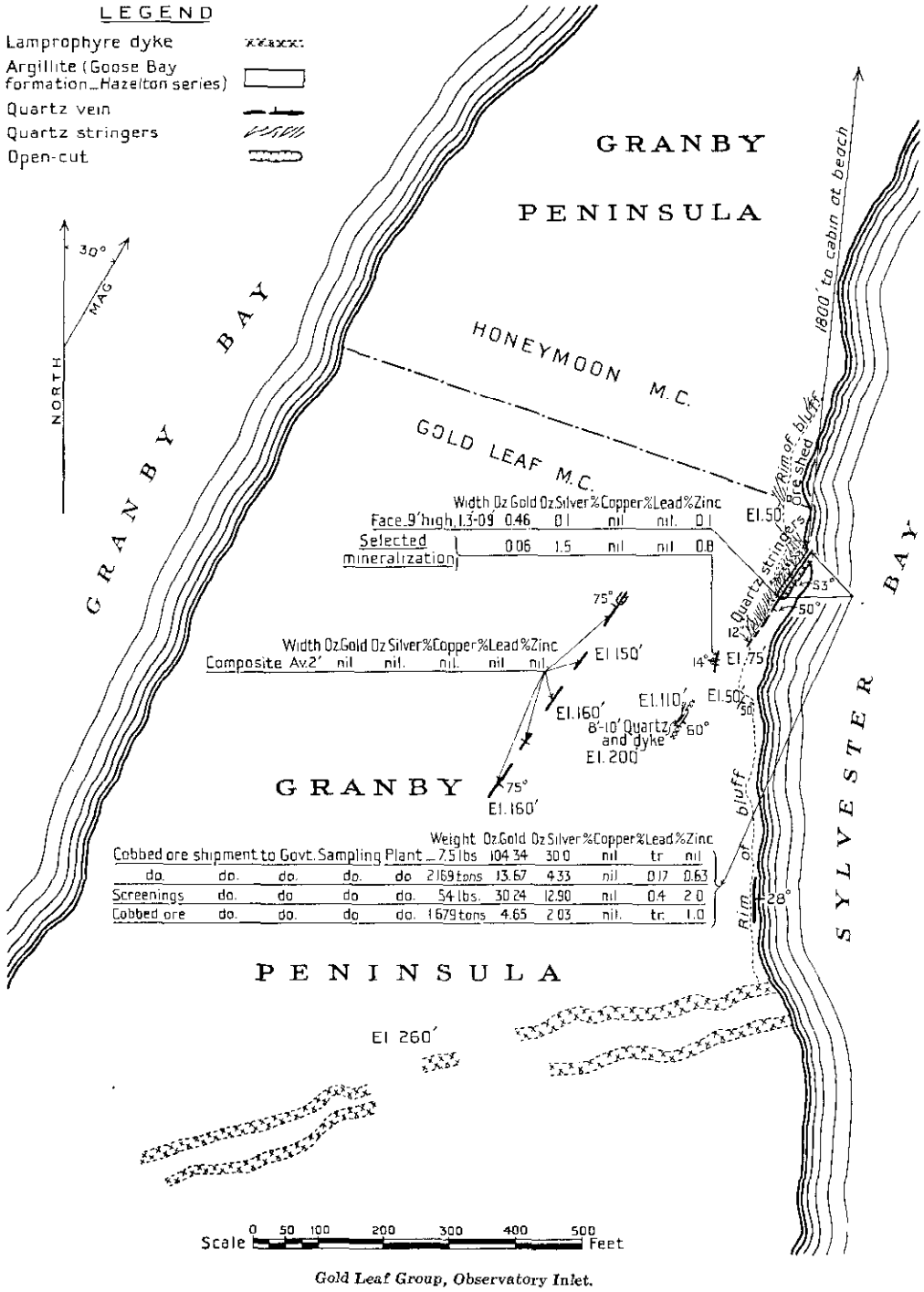
Beyond this face the cut continues at about high-water level for a length of 24 feet and from 4 to 5 feet in depth. In this section of the working the vein averages 5.4 inches in width and is sparsely mineralized.

From this open-cut shipments of carefully selected and cobbed ore have been made to the sampling plant at Prince Rupert. The results from these shipments are as follows:—

Character of Shipment.	Weight of Shipment.	Gold.	Silver.	Copper.	Lead.	Zinc.
		Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Cobbed ore	7.5 lb.	104.34	30.00	.....	Trace	*Nil*
Cobbed ore	2.169 tons	13.67	4.33	*Nil*	0.17	0.63
Screenings	54 lb.	30.24	12.90	*Nil*	0.40	2.00
Cobbed ore	1.679 tons	4.65	2.03	*Nil*	Trace	1.00

At elevation 75 feet and 60 feet south-westward from the last south-westerly exposure of the main showing a quartz vein 12 inches in width is exposed in a small open-cut. The vein strikes north 10 degrees east and dips 14 degrees westward. At this locality the argillite is folded to a small anticline and the attitude of the vein appears to conform to that of the formation. The vein is sparsely mineralized with pyrite and some sphalerite. For the purpose of determining possible values, a selected sample of the best mineralization was taken. This assayed: Gold, 0.06 oz. per ton; silver, 1.5 oz. per ton; copper, *nil;* lead, *nil;* zinc, 0.8 per cent.

At 110 feet elevation and about 100 feet south-westward from this showing and in approximate alignment with the main or "gold" vein, quartz and intermixed dyke, 8 to 10 feet in width, is naturally exposed on a small rock dome protruding through the overburden.



Gold Leaf Group, Observatory Inlet.

The attitude of this quartz mass is not clear, but it appears to dip 60 degrees eastward. No mineralization is apparent in it other than a few sparsely scattered specks of pyrite. No work has been done on this exposure.

On the beach, at about high-tide mark and about 400 feet south of the main showing, a quartz vein 6 to 8 inches in width outcrops for 70 feet along the edge of the bluff paralleling the shore. This vein strikes north and dips 28 degrees east, conformable to the formation. The argillite on both the hanging- and foot-walls is finely impregnated with pyrite and pyrrhotite and presents a pronouncedly rusty surface. The quartz vein is also heavily stained with iron oxide, but no sulphide mineralization was observed in it. No work has been done on this showing.

At 150 feet elevation and about 300 feet south-westward from the main showing a quartz vein 2.5 feet in width is exposed in a small open-cut. This vein shows a slightly ribboned structure, but is only sparsely mineralized with pyrite and pyrrhotite and an occasional speck of sphalerite. From this cut it can be traced in a southerly direction by five natural exposures along the crest of a small ridge for a distance of 350 feet to 160 feet elevation. In these exposures the vein ranges from 1.5 to 2.5 feet in width and exhibits the same characteristics as in the cut at the northerly end. It strikes north 34 degrees east and ranges in dip from 75 degrees north-westward at its northerly exposure to vertical in the central section and 75 degrees south-eastward at its southerly exposure, conforming in attitude to the formation. To determine possible values in this vein a composite sample across an average width of 2 feet was taken of the five exposures. This assayed: Gold, *nil;* silver, *nil;* copper, *nil;* lead, *nil;* zinc, *nil.* No work other than the one small cut at the northerly end has been done on this vein.

Alice Arm Area.

British Lion Mines, Ltd.

This is a private company incorporated in British Columbia in February, 1937, with registered office at 553 Granville Street, Vancouver. The authorized capitalization is 10,000 preferred and 20,000 common shares, both of $10 par value. A. F. Smith, Alice Arm, is the president of the company, and Thos. Slattery, Vancouver, is the secretary-treasurer.

The company owns a 25-per-cent. interest, with an option on the remainder, in the *Homestake* group, comprising the *Homestake, Homestake No. 1, Homestake No. 2, Homestake No. 3* Crown-granted mineral claims and the *Homestake* and *Homestake No. 1* fractional mineral claims, owned by A. F. Smith, A. Davidson, and Miles Donald, of Alice Arm.

The claims are amongst the earliest stakings in the Alice Arm area, and in 1918 were bonded to the Mineral Claims Development Company which did practically no work on them. In 1921 this company was reorganized into the Consolidated Homestake Mining and Development Company, with registered office at Vancouver. This company, with English and Canadian finances, carried out a small amount of surface and underground work under the supervision of Captain Gerhardi between the years 1921 and 1925.

In 1926 the property, with three other groups, was bonded to the C. Spencer interests of Vancouver, but no work was done by them on the *Homestake* group and the option was abandoned in 1927. In 1934 the property was optioned by a Vancouver syndicate, which later formed the present company. The claims are referred to in the Annual Reports of the Minister of Mines for the years 1916, 1918, 1919, 1920, 1921, 1923, 1925, 1926, 1927, 1930, 1933, and 1934; also in the Geological Survey, Canada, Summary Report, 1921, and Memoir 175.

The claims are between 2,800 and 3,700 feet elevation on the west side of the upper Kitsault Valley, bordering the Kitsault glacier, about 25 miles northward from the town of Alice Arm. They are adjoined on the west by the *Gold Reef* group and on the south by the *Vanguard* group.

The topography of the area generally is extremely rugged; but of the claims, is only moderately so. In the lower elevations comparatively steep slopes and rock bluffs border the Kitsault glacier, but are transitional into moderately-steep grass-covered slopes with some interspersed rock ridges in the higher elevations.

The area embraced by the claims is generally above timber-line, but in the lower elevations patches of good timber are available and the southerly valley-bottom near the claims is thickly timbered with spruce, hemlock, and cedar.

The property is reached by the Union Steamship Company weekly coastal service to Alice Arm, or by launch service to Alice Arm twice a week from Anyox. From Alice Arm the Dolly Varden narrow-gauge railway with gasoline-speeder transportation, conditioned for speeder and speeder-trailer loads up to about 2½ tons, extends to "Camp 8," a distance of 18 miles. From "Camp 8" a good pack-trail and "go-devil" trail extends for about 7 miles to the *Homestake* cabin-camp at 2,980 feet elevation.

The rock exposed on the claims consists of altered andesitic volcanics of the lower Hazelton group (Dolly Varden formation). On the claims the volcanics are intruded by irregular areas of quartz diorite and feldspar porphyry relative to the Coast Range batholith, the main easterly contact of which extends north and south about 5 miles westward from the claims.

The mineral deposit consists of a siliceous replacement-zone, locally brecciated and mineralized mainly with pyrite, chalcopyrite, galena, and sphalerite, and is in andesitic volcanics contiguous to intruded feldspar porphyry.

The zone strikes north-westward and dips from 70 to 80 degrees north-eastward. It has been explored by stripping and open-cuts and three adits from the brink of the glacier at 3,365 feet elevation along a length of 725 feet in a south-easterly direction to about 3,500 feet elevation. At that point the zone appears to be intersected by a cross-vein and offset 150 feet down the hill from where it can be traced a farther 160 feet in a south-easterly direction. Farther continuity towards the south-east is obscured by overburden.

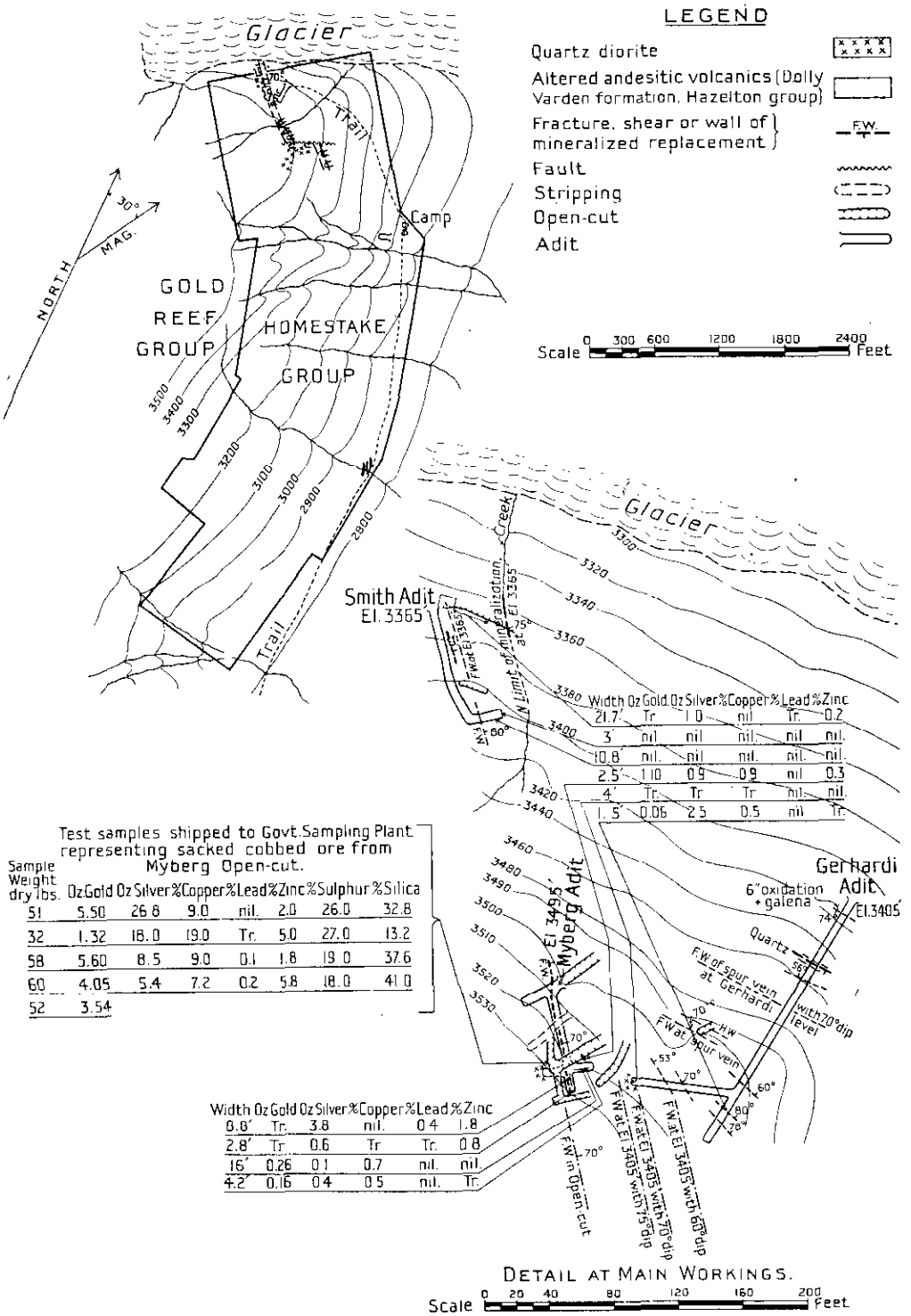
The zone ranges from about 15 to over 30 feet in width. Generally the walls are not well defined and mineralization is characteristically gradational into the formation. Interzonal slips which can be mistaken for walls occur frequently, but sulphide mineralization extends beyond these. In the north-westerly section of the zone, however, a comparatively well-defined fracture, with gouge, striking north 42 degrees west and dipping 70 to 80 degrees north-east appears to form the foot-wall for a distance of about 300 feet between the "Smith" adit and the "Myberg" adit and open-cut. In some sections unmineralized horses of rock also occur in the zone. The mineralization consists mainly of pyrite and chalcopyrite in patches, streaks and disseminations, with some sphalerite and galena and is irregularly distributed.

At 3,500 feet elevation and 80 feet eastward from the "Myberg" adit a spur or branch-vein striking north 85 degrees west and appearing to dip 70 degrees north is exposed in an open-cut. This can be traced by natural exposure and one open-cut for about 300 feet in an easterly direction; continuity at both extremities is obscured by overburden. Projection of the spur-vein strike towards the west indicates its possible junction with the main zone about 20 feet northward of the "Myberg" adit. In the surface exposures the spur-vein shows a width of from 10 to 13 feet of silicification with some calcite and is mineralized mainly with pyrite and some chalcopyrite. The foot-wall is fairly well defined but the mineralization appears to be gradational into the formation on the hanging-wall side.

The earlier work on this property consisted of surface-trenching and open-cutting by the owners and the driving of the "Gerhardi" crosscut-adit at 3,405 feet elevation for a distance of 174 feet and a short crosscut-adit at 3,000 feet elevation by the Consolidated Homestake Mining and Development Company. These workings are described in the previously mentioned reports. In the Annual Report of the Minister of Mines for 1934 the open-cuts with relative assays of samples are described.

Subsequent exploration by the Vancouver syndicate and during 1937 and 1938 by British Lion Mines, Limited, has consisted of the driving of the "Smith" adit at 3,365 feet elevation, the "Myberg" adit at 3,495 feet elevation, crosscutting to the west from the "Gerhardi" adit, and stripping and open-cutting in the locality of the "Myberg" adit. During 1938 this work was proceeding with a crew of six men, one man being continuously employed in back-packing supplies and ore samples between the camp and the terminus of the Dolly Varden railway at "Camp 8." The camp at 2,980 feet elevation consists of a log cabin with cooking and eating equipment and sleeping accommodation for three men, a smaller cabin with sleeping accommodation for two men, and a tent. There is no machinery installed at the property, all work being done by hand.

The "Smith" adit at 3,365 feet elevation, about 70 feet above and 80 feet south of the edge of the glacier, extends for 75 feet along a bearing ranging from south 55 to 68 degrees



Test samples shipped to Govt. Sampling Plant representing sacked cobbed ore from Myberg Open-cut.

Sample Weight dry lbs.	Oz Gold	Oz Silver	% Copper	% Lead	% Zinc	% Sulphur	% Silica
51	5.50	26.8	9.0	nil.	2.0	26.0	32.8
32	1.32	18.0	19.0	Tr.	5.0	27.0	13.2
58	5.60	8.5	9.0	0.1	1.8	19.0	37.6
60	4.05	5.4	7.2	0.2	5.8	18.0	41.0
52	3.54						

Width	Oz Gold	Oz Silver	% Copper	% Lead	% Zinc
21.7'	Tr.	1.0	nil.	Tr.	0.2
3'	nil.	nil.	nil.	nil.	nil.
10.8'	nil.	nil.	nil.	nil.	nil.
2.5'	1.10	0.9	0.9	nil.	0.3
4'	Tr.	Tr.	Tr.	nil.	nil.
1.5'	0.06	2.5	0.5	nil.	Tr.

Width	Oz Gold	Oz Silver	% Copper	% Lead	% Zinc
6.8'	Tr.	3.8	nil.	0.4	1.8
2.8'	Tr.	0.6	Tr.	Tr.	0.8
16'	0.26	0.1	0.7	nil.	nil.
4.2'	0.16	0.4	0.5	nil.	Tr.

British Lion Mines, Ltd. (Homestake Group), Alice Arm.

east. Along this stretch it appears to be in the foot-wall of the zone and from 6 to 8 feet westward from the indicated foot-wall fracture. An open-cut along the trail, eastward from and contiguous to the " Smith " adit-portal and adjacent blacksmith-shop, exposes irregularly-silicified andesite with sparse and irregular mineralization of pyrite, with some sphalerite and galena.

A sample across 21.7 feet of this exposure assayed: Gold, trace; silver, 1 oz. per ton; copper, *nil;* lead, trace; zinc, 0.2 per cent. The exposed andesitic volcanic rocks in the adjacent adit are locally mineralized with disseminated pyrite and are intersected by some calcite and quartz stringers and a few cross-fractures. At 75 feet from the portal there is a crosscut for 21 feet bearing north 54 degrees east. At 4 feet it intersects a well-defined gouge-filled fracture striking north 43 degrees west and dipping steeply towards the north-east, which may be correlated with the indicated foot-wall of the zone. Beyond this to the face of the crosscut the rock shows a small amount of irregular silicification with irregularly disseminated pyrite. A sample along 10.8 feet of the south wall of the crosscut to the face and also one across 3 feet of the face showed no values.

At 3,508 feet elevation, about 40 feet southward from the " Myberg " adit, the open-cut across the zone has been extended and deepened. Additional stripping has also been done along the foot-wall of the zone in this locality. A chip-templet sample of the walls and floor of the open-cut across 27 feet, taken in 1934, assayed: Gold, 0.3 oz. per ton; silver, 1.2 oz. per ton; copper, 3.9 per cent.

A channel sample along the floor of the cut across 27 feet, also taken in 1934, assayed: Gold, 0.8 oz. per ton; silver, 2.6 oz. per ton; copper, 3 per cent. The recent work has deepened the cut to about 12 feet at the face, with side-slashing for 16 feet along the foot-wall at the face where high-grade ore was encountered. In the cut the zone is heavily oxidized in places and shows sections of pronounced brecciation and irregular silicification, with appreciable but irregular mineralization of pyrite and chalcopyrite, in places in massive patches, with some sphalerite and galena. Interzonal fractures parallel to the strike of the zone also occur locally and the best mineralization appears to be associated with them. A sample of a well-defined interzonal streak mainly of massive pyrite with chalcopyrite, occurring on the south side of the cut, across 2.5 feet, assayed: Gold, 1.10 oz. per ton; silver, 0.9 oz. per ton; copper, 0.9 per cent.; lead, *nil;* zinc, 0.3 per cent. At the time of examination (September 13th to 15th), the face of the cut contiguous to the foot-wall of the zone showed comparatively slight and irregular silicification and mineralization and several cross-joints along which evidence of movement is apparent. Cobbing and sacking of selected ore from the face-area of this cut was proceeding at the time of examination.

About 10 tons of sacked ore was piled ready for shipment and awaited completion of the planking of the Dolly Varden Railway to permit the access of pack-horses to the area. Several bulk test samples of this material were back-packed to the railway and shipped to the sampling plant at Prince Rupert. The results from these samples are as follows:—

Sample Weight (Dry Lb.).	Gold.	Silver.	Copper.	Lead.	Zinc.	Sulphur.	Silica.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
51	5.50	26.8	9.0	*Nil*	2.0	26.0	32.8
32	1.32	18.0	19.0	Trace	5.0	27.0	13.2
58	5.60	8.5	9.0	0.1	1.8	19.0	37.6
60	4.05	5.4	7.2	0.2	5.8	18.0	41.0
52	3.54						

The " Myberg " adit at 3,495 feet elevation is driven under these workings, with a back of about 8 feet to the surface at the intersection of the foot-wall of the zone at 10 feet from the portal and a back of about 24 feet between the face of the south drift and the floor of the southerly open-cut. Extending to the portal of the adit is an open-cut across the strike of the zone for 28 feet in overburden and oxidized material. The adit continues as a cross-cut for 29 feet and at 8 feet from the portal passes through what appears to be the foot-wall of the zone, which is heavily oxidized at this point. A drift continues south along the foot-wall for 62 feet to its face. At a distance of 46 feet along the drift a crosscut is driven north-east into the zone for 16 feet and another south-west into the foot-wall formation for 14 feet.

In the drift south the foot-wall of the zone is sheared and contains gouge. For a distance of 46 feet along the drift to the crosscuts the zone is irregularly silicified and locally brecciated. Along this stretch it is irregularly and sparsely mineralized, mainly with pyrite and some chalcopyrite. Beyond this point to the face of the drift the zone is more intensely silicified and mineralized with streaks and patches of pyrite and chalcopyrite with a little sphalerite and galena. This mineralization is also exposed in the north-east crosscut for 16 feet at this point, especially on the south side of the crosscut. At the face of this crosscut the zone contains a highly silicified and brecciated band 4.2 feet in width. A chip-templet sample of the south wall of the north-east crosscut for 16 feet across the zone, assayed: Gold, 0.26 oz. per ton; silver 1.1 oz. per ton; copper, 0.7 per cent.; lead, *nil;* zinc, *nil.* A chip-templet sample of mineralized brecciated quartz 4.2 feet in width, on the south side of this crosscut, at the face, assayed: Gold, 0.16 oz. per ton; silver, 0.4 oz. per ton; copper, 0.5 per cent.; lead, *nil;* zinc, trace. A chip-templet sample of the east wall of the "Myberg" adit drift, along the strike of the zone for a length of 8.8 feet south of the north-east crosscut, assayed: Gold, trace; silver, 3.8 oz. per ton; copper, *nil;* lead, 0.4 per cent.; zinc, 1.8 per cent. A chip sample of the best mineralization showing at the face of the drift, across 2.8 feet on its east side, assayed: Gold, trace; silver, 0.6 oz. per ton; copper, trace; lead, trace; zinc, 0.8 per cent.

The south-west crosscut for 14 feet off the "Myberg" drift at a point 46 feet from its commencement penetrates the foot-wall of the zone and extends into the foot-wall formation. This shows slight silicification, some disseminated pyrite, and some quartz stringers. Towards the face of this crosscut the volcanics show evidence of assimilation and hybridization by an intrusive rock, and at the face intrusive feldspar porphyry can be identified.

The "Gerhardi" adit is at 3,405 feet elevation, 185 feet north-eastward from the portal of the "Myberg" adit, and was driven by hand by the old Consolidated Homestake Mining and Development Company in the years 1921 to 1925. It is a crosscut driven obliquely to the strike of the zone and extends for 174 feet on a bearing of south 6 degrees west.

At 12 feet from the portal a well-defined, oxidized cross-fracture, dipping 74 degrees south, 6 inches in width and carrying some massive galena, is intersected. At 44 feet from the portal a band of barren quartz, 3 feet in width striking north 87 degrees west and dipping steeply south, cuts across the adit. At a distance of 56 feet from the portal a well-defined slip striking east and dipping 56 degrees north is intersected. The formation exposed in the adit to this point is slightly silicified, shows a few quartz and calcite stringers and is slightly mineralized with disseminated pyrite. The fractures and quartz intersected up to this point may possibly be relative to the spur-vein exposed on surface, but this relationship cannot be definitely correlated.

The adit continues in altered and slightly pyritized volcanics carrying a few quartzose cross-fractures and an occasional grain of chalcopyrite. At 132 feet from the portal a well-defined fracture striking north 73 degrees west and dipping 60 degrees north-eastward is intersected. From this point to the face the formation is more intensely silicified and mineralized with disseminated pyrite, with a little chalcopyrite and several quartz stringers and cross-fractures cut obliquely across the adit.

A sample across a width of 1.5 feet of the best mineralization of pyrite and chalcopyrite observed in this portion of the adit, taken on the west side of the adit 21 feet from the face and adjacent to a well-defined fracture striking north 70 degrees west and dipping 80 degrees north-eastward, assayed: Gold, 0.06 oz. per ton; silver, 2.5 oz. per ton; copper, 0.5 per cent.; lead, *nil;* zinc, trace. The mineralization exposed in the adit for 20 feet to the face may possibly be relative to the hanging-wall section of the zone, but computation indicates that the main adit would have to be extended about 50 feet to intersect the projection of the foot-wall of the zone at this level.

Recent work done by the British Lion Mines, Limited, in the "Gerhardi" adit, consists in driving a crosscut off the main adit from a point 140 feet in from the portal. At the time of examination this extended 64 feet along a bearing of south 72 degrees west. For a length of 40 feet along this working the formation is appreciably altered and mineralized with disseminated pyrite, shows irregular but moderate silicification and contains some quartz and calcite stringers, and is similar in character to that exposed in the last 30 feet of the main adit. At a point 30 feet from its commencement the working intersects a defined slip

striking north 55 degrees west and dipping 70 degrees north-eastward. At a point 12 feet beyond this, another well-defined slip, with gouge, striking north 56 degrees west and dipping 53 degrees north-eastward, is intersected. From this point to the face, a distance of 22 feet, mineralization with disseminated pyrite diminishes appreciably and some local, small patches and streaks of pyrite and chalcopyrite are encountered. At the face the formation shows evidence of digestion by an intrusive rock, similar to the face of the west crosscut off the "Myberg" adit, and patches of feldspar porphyry occur. A chip-templet sample of the face, across 4 feet, assayed: Gold, trace; silver, trace; copper, trace; lead, *nil;* zinc, *nil.*

The foot-wall of the zone indicated in the "Myberg" adit at 3,495 feet elevation, if projected with a dip of 60 degrees eastward to the "Gerhardi" adit level at 3,405 feet elevation, should be intersected at a point 38 feet in from the commencement of the "British Lion Mines" crosscut off the "Gerhardi" adit. With a dip of 70 degrees eastward it would be intersected at about the face and a dip of 75 degrees eastward would place it about 9 feet beyond the face. In order to be certain of intersecting the possible continuance of the indicated foot-wall of the zone to the "Gerhardi" adit-level, and in view of a possible irregularity in dip, the crosscut should be continued west for about 20 feet.

In accordance with the attitude of the indicated foot-wall of the zone in the upper workings, the mineralization intersected in the "British Lion Mines" crosscut west off the "Gerhardi" adit may possibly be correlated with the zone. In this case, one of the slips intersected in this working may be the downward extension of the foot-wall. Taking into consideration a possible north or south rake of the values indicated in the "Myberg" adit and open-cut, further constructive underground exploration of this possibility could be conveniently carried out by drifting north and south off the "British Lion Mines" crosscut along the west slip and also by continuing south in the "Smith" adit along the foot-wall indicated in that locality.

In view of the fact that it is indicated by the topography that any possible permanent development of this property could be most conveniently carried out from the easterly side of the hill-slope, the zone should be traced and explored in that direction. This would supply information relative to the location of possible permanent working sites. The topography of the locality and the attitude of the zone also lend themselves to convenient exploration of the zone by diamond-drilling. This, however, should be preceded by further detailed stripping, open-cutting, and detailed sampling of all workings.

Terrace-Usk-Pitman Area.

Zymoetz Group.

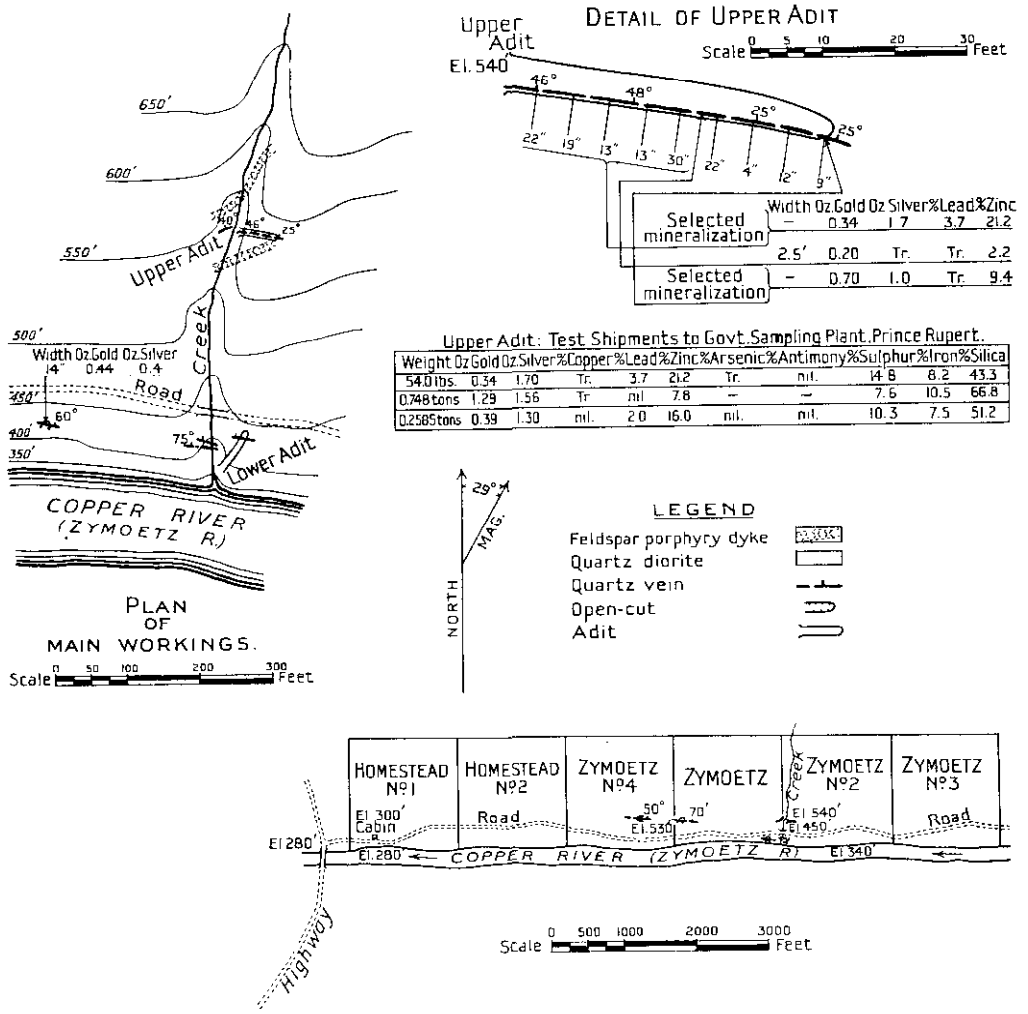
This is a group of eight mineral claims, comprising the *Homestead No. 1* and *No. 2* and the *Zymoetz, Zymoetz No. 2, No. 3,* and *No. 4,* and is held by T. Turner, of Terrace, by location. The claims are referred to in the Annual Report of the Minister of Mines for 1934 and also in Department of Mines and Resources, Ottawa, Memoir 205, 1937.

The property is situated at the base of the southerly slope of Kleanza (O.K.) Mountain, between elevations of about 250 and 600 feet. The claims lie along and adjacent to the north side of the Zymoetz (Copper) River, about 2 miles east of its confluence with the Skeena River. The locality is about 8 miles eastward by road from Terrace station and 9 miles southward by road from Usk station on the Canadian National Railway. It is reached by a branch motor-road, suitable for light motor-cars, which leaves the Terrace–Usk Highway at the north end of the Zymoetz River bridge at about 280 feet elevation. From this point the road extends east along the north bank of the Zymoetz River for about 700 feet to T. Turner's cabin, at 300 feet elevation, from where it continues east to 450 feet elevation at the main workings about 1¼ miles from the highway. From this point, short branch-trails lead up and down the hill to the main workings which are contiguous to the branch-road.

The topography is moderately rugged with hill-slopes varying from 15 to 30 degrees and intervening rock ridges and bluffs. In the valley-bottom by the workings the Zymoetz River is deeply incised in a canyon with rock-bluff walls or steep, timbered slopes. West of this, towards the confluence of this stream with the Skeena River, the valley-bottom flattens appreciably. The area is thickly timbered and generally covered with several feet of soil and glacial debris, but the underbrush is comparatively light.

The claims lie eastward from the end of a spur of granodioritic rock, which trends north-eastward for about 15 miles across Kleanza Mountain, Kleanza (Gold) Creek, and Bornite

Mountain Range to the vicinity of Chimdemash Creek. This intrusive is an offshoot of the Coast Range batholith. At its commencement, in the region of the claims, it is about 8 miles wide and tapers to a width of about 1¼ miles at its north-easterly end on the northerly slope of the Bornite Mountain Range. Along its trend it is intrusive mainly into andesitic volcanic rocks of the Hazelton formation of Jurassic age.



Upper Adit: Test Shipments to Govt. Sampling Plant, Prince Rupert.

Weight	Oz Gold	Oz Silver	%Copper	%Lead	%Zinc	%Arsenic	%Antimony	%Sulphur	%Iron	%Silica
54.0 lbs.	0.34	1.70	Tr.	3.7	21.2	Tr.	nil.	14.8	8.2	43.3
0.748 tons	1.29	1.56	Tr	nil	7.8	—	—	7.6	10.5	66.8
0.2585 tons	0.39	1.30	nil.	2.0	16.0	nil.	nil.	10.3	7.5	51.2

Zymoetz Group, Terrace-Usk Area.

The rock formation of the workings consists of medium- to fine-grained quartz diorite. Locally, this rock shows evidence of hybridization through assimilation of roof-rocks. In some sections the degree of this hybridization is sufficient to mask almost completely the characteristics of the intrusive. The quartz diorite is cut by feldspar porphyry dykes 10 to 15 feet in width trending north-eastward. Locally, these are transitional into the quartz diorite and take the form of gradationally-segregated streaks and patches.

The mineral deposits consist of quartz veins ranging from about 4 to 30 inches in width. The veins have generally loose walls with a local development of gouge, but in places branch into stringers with intervening silicified rock. Generally they strike east and dip north at flat to moderate but generally steep angles. The greatest widths occur in the sections of steepest dip. Mineralization in the quartz veins consists of pyrite, chalcopyrite, sphalerite, galena, and some magnetite. These minerals occur in irregular streaks and patches in the quartz. The owner reports the presence also of native gold.

The lower showing is at 450 feet elevation on the *Zymoetz No. 2* claim, about 60 feet above Zymoetz River. At this point two converging quartz veins, 2 to 10 inches in width and 4 feet apart in hybrid quartz diorite, cut across the deeply-incised bed of a small creek. The lower vein strikes north 83 degrees west and dips 75 degrees northward; the upper vein strikes north 70 degrees west and dips northward at about the same angle. The two veins should join about 20 feet east of the outcrop in the creek. The veins can be traced to the west for about 30 feet and to the east for about 15 feet in the rock bluff confining the creek, but further continuity in both directions is obscured by overburden. Where exposed the quartz is well-mineralized with sphalerite, pyrite, and some galena. About 25 feet below the outcrop and adjacent to the creek on its east side a crosscut adit is driven for 66 feet along a bearing of north 36 degrees east into the steep bluff-face. At a point 56 feet in from the portal of this working, an irregular quartz vein, 1 foot to 2.5 feet in width, is intersected. This is sparsely mineralized with pyrite, sphalerite, and a little galena, and may be correlated with the vein-outcrop in the creek-bed.

A channel sample across 28 inches of the vein exposed on the west wall of the adit, taken by E. D. Kindle, of the Geological Survey, Canada, and quoted in Memoir 205, 1937, assayed: Gold, 0.08 oz. per ton; silver, 0.15 oz. per ton; lead, trace; zinc, 0.32 per cent.

At 420 feet elevation and 250 feet north 76 degrees west from the lower adit, an open-cut into the steep hill-slope exposes a quartz vein 14 inches in width. This strikes north 80 degrees west and dips 60 degrees northward; it has loose walls and is well mineralized with pyrite. A chip sample representative of the exposure in the cut, across an average width of 14 inches, assayed: Gold, 0.44 oz. per ton; silver, 0.4 oz. per ton. Until further intervening tracing is done, this vein cannot be definitely correlated with that exposed in the creek and lower adit. It also could be conveniently explored by drifting from the locality of the open-cut, by crosscutting and drifting from a location slightly above the Zymoetz River, or by drifting west along the strike of the vein intersected in the lower adit and crosscutting and raising off this drift.

The main working is on the *Zymoetz No. 2* claim at 540 feet elevation in the narrow rock-confined and steep draw of the same creek in which the lower vein occurs.

At this point a well-defined and sheared quartz vein outcrops in quartz diorite along the rock bluffs of both sides of the creek. On the west side it can be traced for about 50 feet and further continuity in that direction is obscured by overburden. On the east side the vein-fissure can be seen in the vertical bluff-face along a height of about 20 feet, beyond which the vein cuts over the shoulder of the bluff and further continuity eastward is obscured by overburden. Where exposed, the vein strikes generally north 77 degrees west and dips northward at angles ranging from 25 to 48 degrees. It varies from about 4 to 30 inches in width and is locally well-mineralized with pyrite, sphalerite, and some chalcopyrite, magnetite, and galena. The owner reports the presence also of native gold in the mineralization exposed in the drift-adit on this vein. Locally, the vein is shattered and sheared and pinches and swells in conformity to short changes in the direction of the strike and the steepness in dip of the fissure. On the east side of and adjacent to the creek at this point, a drift-adit is driven in the face of the bluff on a general bearing of south 79 degrees east for a distance of 45.7 feet. At the time of examination (July 11th) the face of the adit had veered to a bearing of south 75 degrees east along a section of flat dip, with the result that a steepening of the vein had thrown it into the roof.

By reverting to the original bearing the condition can be rectified. The vein in the adit ranges from 4 to 30 inches in width and pinches and swells in accordance with slight changes in strike and dip, the best widths occurring in the sections of steepest dip. The walls are generally loose and in places the vein is crushed and sheared. It is generally well but irregularly mineralized with pyrite, sphalerite, some chalcopyrite, magnetite, and galena. A sample of selected mineralization exposed in an average width of 19.4 inches for a length of 26 feet from the portal assayed: Gold, 0.70 oz. per ton; silver, 1 oz. per ton; lead, trace; zinc, 9.4 per cent. A sample across a width of 2.5 feet, at 28 feet from the portal, assayed: Gold, 0.20 oz. per ton; silver, trace; lead, trace; zinc, 2.2 per cent. In the face the dip flattens and the vein pinches to 9 inches in width with pronounced shearing and gouge and contains streaks and nodules of massive sphalerite with some galena. A selected sample of this

mineralization in the face assayed: Gold, 0.34 oz. per ton; silver, 1.7 oz. per ton; lead, 3.7 per cent; zinc, 21.2 per cent.

In order to ascertain values, bulk test samples of the vein in the upper adit were shipped by the owner to the sampling plant at Prince Rupert. The assay results from these are as follows:—

Weight.	Gold.	Silver.	Copper.	Lead.	Zinc.	Arsenic.	Silica.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
54 lb.	0.34	1.70	Trace	3.7	21.2	Trace	43.3
0.748 ton	1.29	1.56	Trace	*Nil*	7.8	.. ..	66.8
0.2585 ton	0.39	1.30	*Nil*	2.0	16.0	*Nil*	51.2

At 530 feet elevation on the *Zymoetz* claim and about 1,400 feet west of the upper adit an open-cut exposes quartz stringers in schistose volcanics. The stringers strike south 84 degrees east and dip 70 degrees northward and are generally barren. Continuity of the stringers in both directions beyond the open-cut is obscured by overburden. About 550 feet westward from this point and at 520 feet elevation on the *Zymoetz No. 4* claim, an open-cut exposes a quartz vein 12 inches in width in quartz diorite. This vein strikes south 85 degrees east and dips 50 degrees northward and is mineralized with some pyrite. Continuity of this vein in both directions beyond the open-cut is obscured by overburden.

These two showings may possibly be outcrops of the same vein, but further stripping and intervening tracing is required to definitely establish this possibility and also the possibility of correlation with the vein exposed in the upper adit.

Further detailed prospecting on this group by stripping and trenching, especially in the vicinity of feldspar porphyry dykes and along the projected strike of these dykes, may lead to the discovery of other veins.

Dome Mountain Area.

Babine Gold Mines, Ltd. (Free Gold Group).

This is a private company with an authorized capital of 50,000 shares of $1 par value, all of which are issued. The address of the head office is c/o W. R. Wilson and Sons, 744 Hastings Street, Vancouver, B.C. This company holds an option on sixteen claims, including the *Free Gold* group, owned by Alex Chisholm, of Smithers, and situated on Dome Mountain, Omineca Mining Division, about 26 miles eastward by motor-road and winter road from the town of Telkwa, on the Canadian National Railway.

The property is reached from Telkwa (1,677 feet elevation) by motor-road, a distance of about 9 miles to 2,600 feet elevation. From this point a winter sleigh-road extends for about 6 miles to the well-equipped Halfway cabin at Guess Lake (Paradise Lake) at 3,600 feet elevation. From there the winter road continues for about 11 miles to the Babine Gold Mines camp at 4,160 feet elevation, a total distance of about 26 miles from Telkwa. Of this route, the last 6½ miles of winter road follows a new location with a grade of 2 to 10 per cent., cut out for a width of 30 feet in heavy timber; long stretches, however, cross swampy ground and deep muskeg. The old location of this latter section of the route, although about 2¾ miles shorter and on more solid ground, traversed excessively steep grades. Pack- and saddle-horses may be procured at Latchford's ranch on the motor-road about 7 miles from Telkwa. The camp at the property is about 900 feet southward from the main surface workings. It consists of 5 well-equipped cabins with sleeping accommodation for about three men in each, a completely equipped cook-house and dining-room, a barn for horses, hay-shed, two stilt-caches, and a root-house.

Dome Mountain is a prominent outlying dome of 5,700 feet elevation, situated on the east flank of the southerly end of the Babine Range at about latitude 54° 44′ 21″ N., longitude 126° 38′ 17″ W. Its easterly slopes are drained by Federal Creek and its many tributaries into Fulton River, Fulton Lake, and Babine Lake (elevation 2,220 feet), which lies 27 miles east. The property is at about 4,200 feet elevation on the eastern slope of the mountain. The area is not rugged and on the property slopes of from 10 to 20 degrees prevail. These are well timbered, generally covered with varying depths of glacial overburden and have few bed-rock outcrops.

About the year 1914 numerous gold-bearing quartz veins were discovered in an area about 2½ miles long by 1½ miles wide on the north-eastern slope of Dome Mountain. The main period of activity on these early discoveries began in 1918, and during the subsequent four or five years considerable work was done, mainly on one vein, on claims owned by the Dome Mountain Gold Mining Company, a subsidiary of the Federal Mining and Smelting Company. Since that time the Federal property has remained idle, but the claims are still held by the company. References to these early activities are contained in the Annual Reports of the Minister of Mines for the years 1918, 1922, and 1924.

In recent years, however, prospecting of the area has continued and new discoveries have been made, on some of which appreciable exploratory work has been done with encouraging results. Among these is the *Free Gold* group, described in this report. This property was optioned by W. R. Wilson and sons in 1932, and the Babine Gold Mines, Limited, was incorporated to develop it. Appreciable exploratory work consisting of stripping, trenching, shaft-sinking, and crosscutting with some drifting was done on the property up to about 1935, since when no work has been done. Reference to this property is also contained in the Annual Reports of the Minister of Mines for the years 1933 and 1934, and in Bulletin No. 3, 1932; also in Department of Mines and Resources, Ottawa, Paper 36–20, 1936.

The showings and workings on this property are on the *Free Gold* and *Iron Mask* claims. This locality is underlain by altered andesitic volcanic rocks, probably of early Mesozoic age. These are intruded in the vicinity of the showings by an irregular mass of quartz porphyry which lies to the north-west and from which tongues and dykes extend into the volcanics.

The mineral deposit consists of a series of several quartz veins and quartzose shear-zones, ranging in width from a few inches to about 2.3 feet. These are exposed by many pits and trenches in a section about 650 feet long and 450 feet wide, lying southward and eastward from the quartz porphyry mass. The veins strike generally north-westward and dip steeply north-eastward, with the exception of some in the north-easterly section of the locality which have gentle dips. The veins are generally well defined with loose walls and locally appreciable movement along, and shattering or shearing of the vein-fractures has occurred. They are irregular both in strike and dip, and pinch or swell in conformity to the effect of movement on these irregularities and are locally split into stringers, veinlets, and quartzose shear-zones. Locally converging strikes indicate possible junctions of some veins at acute angles with each other along the strike with an attendant difficulty in definite correlation of some exposures, both on surface and underground, with the projection of any specific and closely-parallel vein. Instances of converging dips also indicate the possibility of vein junctions down the dip. This latter possibility is especially indicated in the relation in this respect between the main steeply-dipping veins and the gently-dipping veins in the north-easterly section.

This possibility of vein junction and intersection may have an important favourable bearing on the occurrence of ore-shoots at such junctions. In places the veins are contiguous to quartz porphyry dykes, which carry some pyrite, and the veins sometimes traverse this rock which in these sections is also crushed and sheared.

The veins are mineralized mainly with pyrite, with which is associated some sphalerite, galena, tetrahedrite, and chalcopyrite. Native gold was not observed by the writer, but is reported by the owner to occur and has also been identified under the microscope by the Department of Mines and Resources, Ottawa.

A bulk test sample weighing 219 lb., representative of ore from the workings, shipped by R. W. Wilson to the sampling plant at Prince Rupert, assayed: Gold, 2.12 oz. per ton; silver, 2.6 oz. per ton; copper, trace; lead, 1.6 per cent.; zinc, 4.6 per cent.

The following is from " Canada Department of Mines and Resources, Ore Dressing and Metallurgical Laboratories, Report, Ottawa, September 7th, 1938 ":—

" *Gold Ore from the Dome Mountain Mine, Smithers, British Columbia.*

"*Shipment.*—Six bags of ore, total weight 680 lb., were received on November 10th, 1937, from R. W. Wilson, 506 Pacific Building, Vancouver, British Columbia.

"*Sampling and Analysis.*—After cutting, crushing, and grinding by standard methods, a sample of the ore was obtained which assayed as follows:—

Gold	1.78 oz. per ton
Silver	2.18 oz. per ton
Lead	1.54 per cent.
Zinc	5.87 per cent.
Copper	0.15 per cent.
Arsenic	0.02 per cent.
Sulphur	10.38 per cent.

"*Characteristics of the Ore.*—Six polished sections were prepared and examined microscopically for the purpose of determining the character of the ore.

"Gangue: The gangue, which in the polished sections of selected pieces is minor in quantity to the sulphides, is white vein quartz.

"Metallic Minerals: The metallic minerals present in the sample are, in their order of decreasing abundance, pyrite, sphalerite, galena, tetrahedrite, chalcopyrite, and native gold.

"Pyrite is abundant as fine-textured masses which have been intricately shattered. Sphalerite occurs as small masses and as veinlets in pyrite. Small quantities of galena and lesser tetrahedrite are present as irregular masses and veinlets in pyrite; the two minerals occur together and also with sphalerite. Chalcopyrite is comparatively rare, occurring mostly as veinlets in pyrite.

"The succession of deposition of the sulphides is (1) pyrite, (2) sphalerite, (3) tetrahedrite, (4) chalcopyrite, and (5) galena. A period of shattering must have occurred between (1) and (2).

"A considerable number of irregular grains of native gold are visible in the sections. The metal occurs (1) as grains in galena which veins pyrite and (2) as grains in chalcopyrite which veins pyrite. The grain size of the visible gold is shown in the following table:—

"*Grain Size of the Native Gold.*

Mesh.		Gold in Galena which veins Pyrite.	Gold in Chalcopyrite which veins Pyrite.	Totals.
Minus	Plus	Per Cent.	Per Cent.	Per Cent.
	200	21.4	15.2	36.6
200	400	24.9		24.9
400	800	16.5	5.5	22.0
800		8.2	8.3	16.5
	Totals	71.0	29.0	100.0

"*Investigative Work.*—Treatment by concentration and cyanidation constituted the research procedure on this ore. Over 82 per cent. of the gold was recovered in a flotation concentrate and some 15 to 16 per cent. was extracted by cyanidation from the flotation tailing."

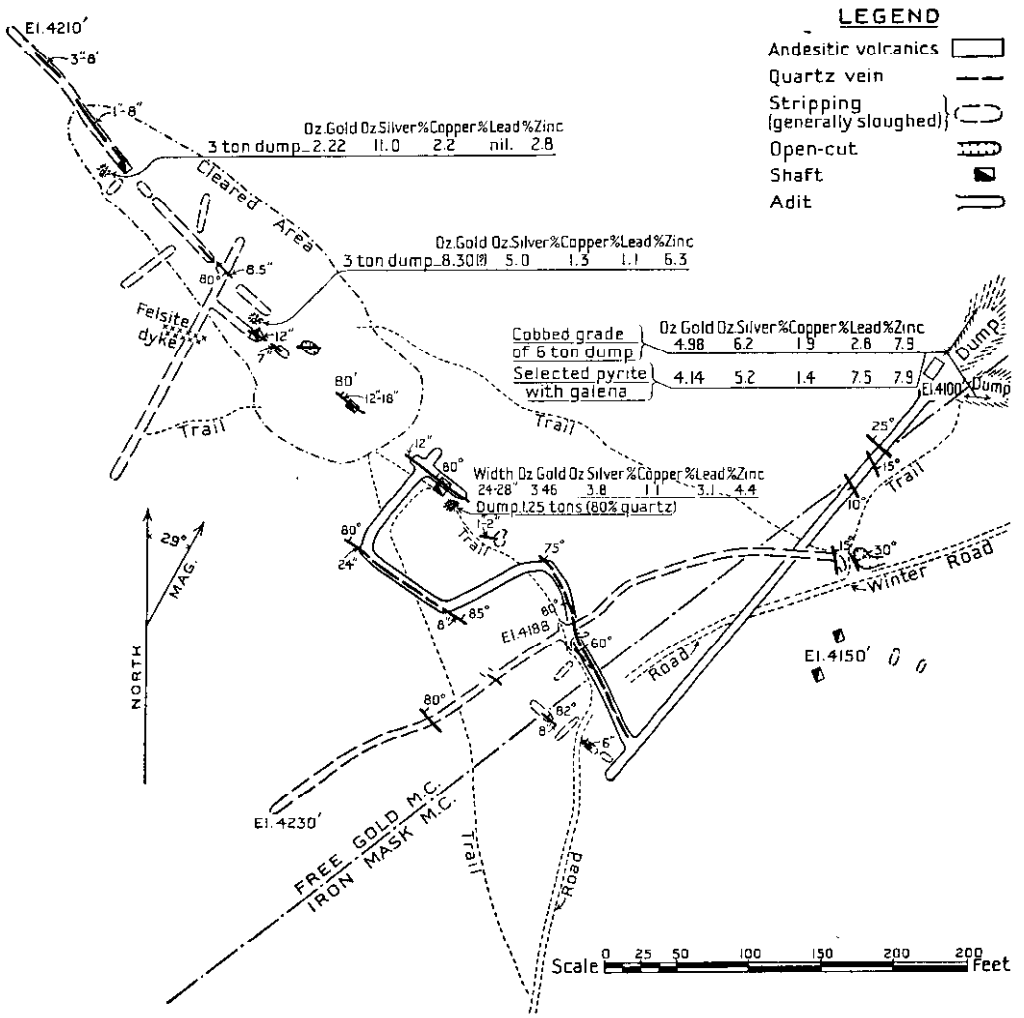
This report continues with details of the following tests: "Test No. 1 (A, B, C, and D)—Cyanidation and Flotation; Test No. 2—Bulk Flotation; Test No. 3—Flotation and Cyanidation; Test No. 4—Flotation and Cyanidation; Test No. 5—Hydraulic Classification and Amalgamation." It concludes with the following:—

"*Summary and Conclusions.*—The investigative work on this shipment shows that a bulk concentrate can be made assaying 5.9 oz. gold per ton, with recoveries of 97 per cent. of the gold and silver and 98 per cent. of the lead. Owing to the large amount of sulphides in the ore the ratio of concentration is low, 3.4: 1. These results were obtained from a soda-ash circuit. In a lime circuit over 82 per cent. of the gold and silver and 84 per cent. of the lead was recovered, the resulting concentrate assaying 17 oz. gold per ton, with a ratio of concentration of 10.9: 1; 86.1 per cent. of the gold in the flotation tailing was recovered by cyanidation, thus yielding an over-all recovery of 97.6 per cent.

"Straight cyanidation of the ore gave an extraction of 96.4 per cent. of the gold. High cyanide consumption and fouling of solutions occurred.

"Fifteen per cent. of the gold was recovered by amalgamation of a concentrate made by hydraulic concentration.

"The flow-sheet indicated by this investigation is to float, ship the concentrate, and cyanide the flotation tailing. A unit cell with a gold-trap or a mineral jig should be installed at the ball-mill discharge and the jig tailing should be sent to a classifier in closed circuit with the grinding mill."



Babine Gold Mines, Ltd., Dome Mountain.

Copies of this report with details of the tests can be procured on application to the Department of Mines and Resources, Ottawa.

The main workings are between 4,100 and 4,230 feet elevation on the *Free Gold* and *Iron Mask* claims, but no work has been done on the property since about 1935. The surface work comprises a main line of stripping in overburden from about 2 to 5 feet deep for a length of about 650 feet along the strike of the veins, with two main cross-trenches, respectively about 200 and 450 feet long and about 350 feet apart. Several pits and shallow shafts have also been sunk on the veins exposed.

Much of the stripping is sloughed, with a consequent covering of rock or veins which may formerly have been exposed, and the pits are either caved or filled with water sufficiently to prevent examination of the veins in their bottom sections. This surface work is distributed

between 4,150 and 4,230 feet elevation in a comparatively flat or gently-sloping terrain. About 335 feet north-eastward from the southerly end of the main trench-line a crosscut adit, 345 feet in length, has been driven from elevation 4,100 feet, giving a vertical back of about 90 feet at the southerly end of the main trench-line and about 100 feet at the westerly end of the workings off the crosscut. This work is shown in the accompanying map.

In this work four main veins (Nos. 1, 2, 3, and 4) or branches of one vein system, together with several minor veins, quartzose fractures, and shears, are exposed. Typical of these are local curves along the strike, and in some sections converging strikes and dips indicate possible junctions of the veins with each other. Characteristic also are branching stringers and minor parallel veins. The structure indicates a zone or belt of shattering with subsequent mineralization of the fractures, followed by shearing and repeated shattering along the planes of original fracturing. The quartz-filling in the main fractures ranges from about 1 inch to 18 inches in width with quartzose replacement and mineralization of the wall-rock in varying degree for widths of 1 foot to 2 feet on both sides of the veins.

In the northerly section of trenching at about 4,210 feet elevation, No. 2 vein is exposed at intervals for a length of 225 feet with short lenticular bands of quartz 1 inch to 8.5 inches in width, locally bordered by 1 foot of quartzose and mineralized wall-rock. This section of No. 2 vein has a general strike of north 40 degrees west and at the southerly end of the exposure it dips 80 degrees south-westward. In about the centre of this stripping a pit about 8 feet deep is filled with water, but the vein, 8 inches in width with several stringers, can be seen at the collar. An average sample from a dump of vein material adjacent to this pit estimated to contain 3 tons and composed of 50 per cent. quartz and 50 per cent. pyrite, by volume, assayed: Gold, 2.22 oz. per ton; silver, 11 oz. per ton; copper, 2.2 per cent; lead, *nil;* zinc, 2.8 per cent.

Vein No. 3 is offset about 25 feet to the south-west from the southerly end of No. 2 vein and is exposed for a length of 100 feet by stripping and two shafts, respectively 12 feet and 20 feet deep, at the northerly and southerly ends of the exposure. This vein strikes north 55 degrees west, converges towards the southerly projection of No. 2 vein, and dips 80 degrees north-eastward. It is from 7 to 18 inches in width and well mineralized with pyrite, some chalcopyrite, galena, and sphalerite. Adjacent to the shaft 12 feet deep, at the northerly end, is a dump of vein material estimated to contain about 3 tons. An average sample of this dump assayed: Gold, 8.30 oz. per ton; silver, 5 oz. per ton; copper, 1.3 per cent.; lead, 1.1 per cent.; zinc, 6.3 per cent. (The gold value in this assay is probably unreliable owing to the probable occurrence of native gold in the sample.)

Vein No. 4 is exposed for a length of 200 feet at 4,190 feet elevation at the extreme southerly end of the main line of trenching. It is offset about 100 feet from the southerly projection of No. 3 vein and strikes north 54 degrees west, practically parallel to No. 3, and dips 82 degrees north-eastward. It is from 6 to 8 inches in width and bordered by about 1 foot of small veinlets and siliceous replacement. It shows a slightly ribboned structure and is moderately mineralized with pyrite in a quartz gangue.

Vein No. 1 is exposed in an open-cut and cross-trench at 4,150 feet elevation, 225 feet north-eastward from vein No. 4. It comprises irregular outcrops of quartz veins and probably lenticular quartz masses 8 to 12 inches in width and sparsely mineralized with pyrite, striking north-westward and dipping from 15 to 30 degrees north-eastward.

At 4,150 feet elevation and respectively 50 and 75 feet southward from this are two old and caved shafts reported to be each about 15 feet deep. These were not examined, but typical vein material mineralized with pyrite, chalcopyrite, sphalerite, and galena is seen on the dump of the southerly shaft. A short distance east of these are two caved trenches.

Several minor quartz veins and sheared fractures are exposed in the trenches and others may occur in the sections that have sloughed.

At 4,100 feet elevation and 335 feet north-eastward from the southerly exposure of No. 4 vein, a crosscut-adit is driven 345 feet on a bearing of south 40 degrees west. At about 50 feet from the portal it intersects a network of irregular stringers, bunches, and lenticular masses of sparsely mineralized quartz, striking and dipping in different directions. These are probably the depth-continuation of the surface exposure designated as Vein No. 1 and beyond their south-westerly margin, of the vein in the caved shaft at 4,150 feet elevation.

The crosscut continues for a total distance of 345 feet, at which point it is about 90 feet vertically below the surface. At a point 320 feet from the portal it intersects what is

probably in part the depth-continuation of No. 4 vein and possibly in part the conjunction of No. 4, No. 3, and No. 2 veins. This is followed for 135 feet in a general north-westerly direction by a drift which shows from 3 to 10 inches of quartz moderately mineralized, mainly with pyrite. At 65 feet from the commencement of the drift a strongly-sheared quartzose fracture dipping 60 degrees north-eastward branches into the west wall of the drift.

Beyond this for 50 feet the vein in the drift dips 80 degrees south-westward and at the face of the drift dips 75 degrees north-eastward.

From the drift-face the working swings abruptly to the south-west and continues as a crosscut in that direction for 75 feet. At which point it intersects a well-defined quartz vein striking north 56 degrees west and dipping from 80 to 85 degrees north-eastward. This is followed by a drift for 75 feet in which the vein ranges from 8 inches in width at its south-easterly end to 24 inches in width at its north-westerly end in the face of the drift. It is well-mineralized mainly with pyrite and may possibly be correlated with the north-westerly projection of No. 4 vein.

The working then swings abruptly to the north-east and continues as a crosscut in that direction for 90 feet. At a distance of about 72 feet from the commencement of this crosscut it intersects a well-defined vein that may possibly be correlated with the conjunction of No. 2 and No. 3 veins. This vein is adjacent to and locally intermingled with a quartz porphyry dyke and strikes north 54 degrees west and dips 80 degrees north-eastward. It is followed for 10 feet in a north-westerly direction and for 35 feet in a south-easterly direction and ranges from 12 to 28 inches in width. It is well mineralized with pyrite, chalcopyrite, some sphalerite, and galena. At 15 feet from the south-easterly face a raise extends to the surface but was not examined. A chip-templet sample of the south-east face of the drift across the vein, 24 to 28 inches in width, assayed: Gold, 3.46 oz. per ton; silver, 3.8 oz. per ton; copper, 1.1 per cent.; lead, 3.1 per cent.; zinc, 4.4 per cent.

A sample representing the possible cobbed grade of a dump at the adit-portal, estimated to contain 6 tons of vein material from the adit-workings, assayed: Gold, 4.98 oz. per ton; silver, 6.2 oz. per ton; copper, 1.9 per cent.; lead, 2.8 per cent.; zinc, 7.9 per cent. A selected sample from this dump of pyrite with associated galena assayed: Gold, 4.14 oz. per ton; silver, 5.2 oz. per ton; copper, 1.4 per cent.; lead, 7.5 per cent.; zinc, 7.9 per cent.

There is no machinery on the property and all the work has been done by hand. No work has been done on this property for some time, but it is understood that exploration and development is planned to continue during 1939.

SILVER-LEAD-ZINC DEPOSITS.

Stewart Area.

Blue Ribbon Claim.

This claim is owned by Nels Edlund, of Stewart. It is situated between 4,900 and 5,000 feet elevation at the headwaters of Albany Creek, a south branch of Glacier Creek, and about 12 miles north-eastward by motor-road and pack-trail from seaboard at the village of Stewart. The ore-deposit on this claim was discovered in the autumn of 1937. The property is adjoined on the west by the *May No. 3* claim of the *Black Hill* group on which similar ore-deposits were partly explored a few years ago.

The property is reached by the Bear River motor-road from Stewart to the *Dunwell* mill at 250 feet elevation, a distance of 5½ miles. From this point a puncheoned pack-trail extends along the south side of Glacier Creek for a distance of 2 miles to a point near the fork of the stream at 1,000 feet elevation. Glacier Creek is then crossed to its north bank and about a quarter of a mile farther it is recrossed to its south bank and to the east side of Albany Creek. The trail then ascends the east bank of Albany Creek at a very steep grade along which it continues for 1¾ miles to 2,000 feet elevation. From this point the trail branches eastward up the mountain and continues at a generally very steep grade for 2½ miles to the tent-camp at 4,915 feet elevation, a total distance of 6½ miles from the Bear River motor-road and 12 miles from seaboard. The journey can be completed by motor-car and pack-horse in 3¾ hours from Stewart.

Rates quoted by the Stewart Cartage Company for packing and hauling ore from the showings to seaboard are as follows: Summer—2½ cents per lb., dependent on the reconditioning of the trail. Winter—$30 per ton, comprising rawhiding from the showings to the lower bridge, thence "go-devil" to the Bear River motor-road and trucking to seaboard.

The general topography of the area is rugged, the valleys bordered by steep and thickly-timbered slopes. Many bluffs rise to mountain peaks of 5,500 and 6,000 feet elevation which are surrounded by an extensive ice-field. Glaciers extend from the ice-field to the heads of the valleys and are the source of the main streams. Timber-line is at about 3,000 feet elevation. The immediate locality of the property comprises a comparatively gently-sloping terrain with moraine-covered flats and rocky or grass-carpeted knolls and ridges from which the ice has recently receded. On the south the region of the claim is bordered by a projecting glacier. The topography of the claim is illustrated on the map accompanying this report.

The claim is close to a boss of augite porphyry about 2 miles long by 1½ miles wide which is intrusive into argillite of the Lower Hazelton (Bitter Creek) series. The showings are near the east margin of the augite porphyry which, in view of the close proximity of several small roof-pendants of argillite, is exposed in this locality at about the level of its roof. The ore-deposit outcrops in the augite porphyry but has not been traced or located in an area of exposed argillite lying 200 feet north-east along the projected strike of the vein.

The ore-deposit consists of a well-defined quartz vein with some calcite, siderite, and ankerite, from 4 to 12 inches in width, with loose walls, and well mineralized with sphalerite, boulangerite, pyrite, galena, arsenopyrite, and some pyrrhotite and chalcopyrite. Microscopic examination in Department of Mines' laboratory, Victoria, of two polished sections composed mainly of a crystalline, bluish lead-grey mineral which occurs abundantly in massive aggregates or finely disseminated in the mineralization, presents the following data:—

"Metallic minerals identified in relative order of abundance: Boulangerite, arsenopyrite, sphalerite, pyrrhotite, and pyrite.

"The mineral identified as boulangerite is soft, grey, strongly anisotropic, yields good microchemical tests for lead and antimony and characteristic etch tests. It occurs finely disseminated through a quartz-carbonate gangue, in places intimately associated with finely divided subhedral to euhedral arsenopyrite crystals. In addition to occurring in boulangerite, arsenopyrite forms crystal aggregates in places. Sphalerite occurs typically as small irregular masses, in places intimately associated with boulangerite. Pyrrhotite forms irregular masses, for the most part dissociated from other minerals."

The vein strikes generally north 56 degrees east and dips from 50 to 60 degrees north-westward, but slight variations of the strike and dip occur for short distances. The foot-wall is locally sheared and the greatest vein widths generally occur at the points of steepest dip.

The vein outcrops in augite porphyry at 4,910 feet elevation, about 10 feet above the base of the frontal slope of 37 degrees of a ridge which at about 400 feet to the north-east rises to about 5,100 feet elevation. It has been explored and traced north-eastward for a horizontal distance of 68 feet by an adit 26 feet in length near the base of the slope and two long, benched open-cuts into the face of the slope extending to 4,962 feet elevation. Beyond this, spaced along a distance of 50 feet, three small trenches in shallow overburden and an open-cut have not located the vein, but may not be in alignment with its strike in the rising terrain. The details of this work and the vein exposures are illustrated in the accompanying map.

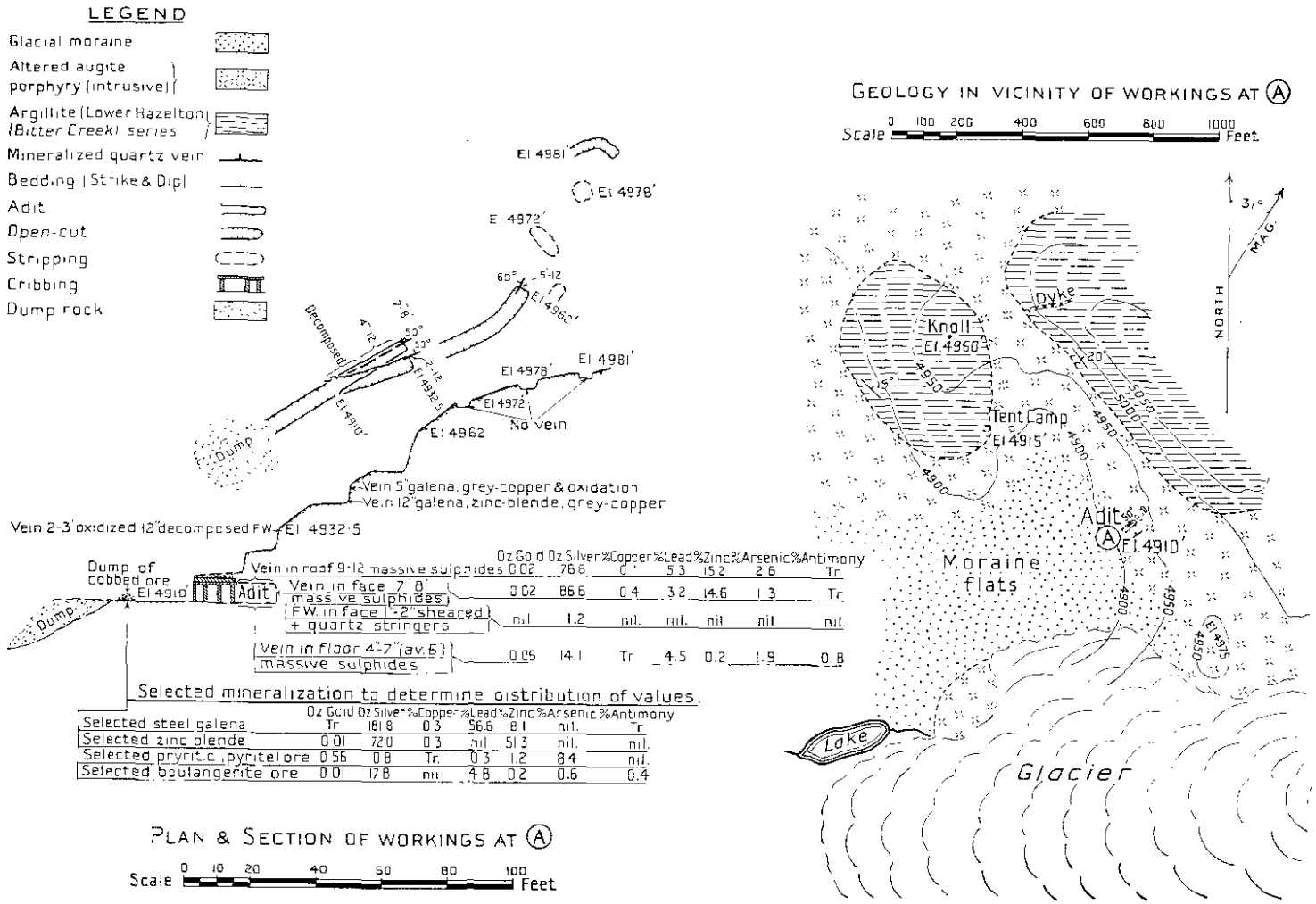
The following are the assays of samples taken from the adit:—

(1.) Vein, 9 to 12 inches in width with massive sulphides, exposed for a length of 12 feet in the roof of the adit, from the end of the cribbing to the face: Gold, 0.02 oz. per ton; silver, 78.8 oz. per ton; copper, 0.1 per cent.; lead, 5.3 per cent.; zinc, 15.2 per cent.; arsenic, 2.6 per cent.; antimony, trace.

(2.) Vein, 4 to 7 inches (average 6 inches) in width with massive sulphides, exposed for a length of 12 feet in the floor of the adit, from the end of the cribbing to the face: Gold, 0.06 oz. per ton; silver, 14.1 oz. per ton; copper, trace; lead, 4.5 per cent.; zinc, 0.2 per cent.; arsenic, 1.9 per cent.; antimony, 0.8 per cent.

(3.) Vein in the face of the adit, 7 to 8 inches in width with massive sulphides: Gold, 0.02 oz. per ton; silver, 86.6 oz. per ton; copper, 0.4 per cent.; lead, 3.2 per cent.; zinc, 14.6 per cent.; arsenic, 1.3 per cent.; antimony, trace.

(4.) Shearing, 1 to 2 feet in width with quartz stringers, on the foot-wall side of the vein in the face of the adit: Gold, *nil;* silver, 1.2 oz. per ton; copper, *nil;* lead, *nil;* zinc, *nil;* arsenic, *nil;* antimony, *nil.*



Blue Ribbon Mineral Claim, Glacier Creek, Portland Canal.

The following are assays of samples taken for the purpose of determining a possible localization of values in the mineralization to guide the selection and cobbing of a possible shipping-grade ore:—

Type of Ore.	Gold.	Silver.	Copper.	Lead.	Zinc.	Arsenic.	Antimony.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Steel galena	Trace	181.8	0.3	56.6	8.1	*Nil*	Trace
Sphalerite	0.01	72.0	0.3	*Nil*	51.3	*Nil*	*Nil*
Boulangerite	0.01	17.8	*Nil*	4.8	0.2	0.6	0.4
Pyrite	0.56	10.8	Trace	0.3	1.2	8.4	*Nil*

This indicates a high-grade silver content in the steel galena. It is also interesting to note the increased gold content in the selected pyrite, the arsenic content of which also indicates the presence of arsenopyrite.

To determine the possibility for profitable smelter shipments, a bulk test-sample of cobbed ore weighing 84 lb. from this property was shipped on September 6th, 1938, to the sampling plant at Prince Rupert. This assayed as follows:—

Gold, 0.02 oz. per ton; silver, 87 oz. per ton; Copper, 0.4 per cent.; lead, 6.8 per cent.; zinc, 19.5 per cent; arsenic, 1 per cent.; antimony, 0.1 per cent.; iron, 19.2 per cent.; sulphur, 15.3 per cent.; silica, 5.3 per cent.

Calculated in accordance with the Tacoma smelter schedule, to which, on account of the low lead content and relative differences in freight and treatment charges, the type of ore represented by the sample is best adapted, with prevailing metal prices (gold, $35.15 (Canadian) per ounce; silver, 42.75 cents per ounce; copper, 10.15 cents per pound) but exclusive of the lead and zinc content which are not paid for under this schedule, this shows a gross smelter value of $35.35 per dry ton and a net value of $18.45 per dry ton after deduction of smelter treatment, freight charges, etc. From this net value would have to be deducted a minimum additional cost of $30 per wet ton for transportation from the property to seaboard, plus the additional cost of mining, sorting, cobbing, and sacking of, roughly, $20 per wet ton, or a total further cost deduction of over $50 per dry ton. This indicates that when considered from the aspect of shipping, this grade and type of ore at this locality would incur a deficit or loss to the shipper of over $31.55 per dry ton. It also demonstrates that mining and shipment of this type (Tacoma type) of ore from this locality would require a gross smelter value of at least $66.90 per dry ton to cover all charges and costs before the shipper could make any profit beyond wages.

On the other hand, a profit is indicated in the selective mining, sorting, and cobbing of the steel galena and also of the sphalerite types of mineralization, should these types be found to occur in sufficient quantities and sufficiently massive distribution to permit efficient selection for shipment to the Trail smelter for disposal under the terms respectively of that smelter's Schedule " J " for lead ores and Schedule " C " for zinc ores.

The occurrence of high-grade silver-lead-zinc ores on this property exemplifies the requirements for profitable selective mining and shipping to smelters of different types of ores from outlying properties confronted with high transportation costs.

SPECIAL REPORTS.

In the 1937 Annual Report of the Minister of Mines a full description was given of the property of Napco Gold Mines, Limited (N.P.L.), in Part B, and a full description of the *Grotto* group in Part C. Reports bringing the work on these properties up to date are available on application to the Department of Mines, Victoria, at a cost of 50 cents each.

PROGRESS NOTES.

BY

CHARLES GRAHAM.

LODE-GOLD DEPOSITS.

ATLIN MINING DIVISION.

Atlin District.

There was no lode mining in the district during the year.

Tulsequah District.

Polaris-Taku Mining Co., Ltd.—B. C. Neiding, manager. The mine worked 362 days during the year and produced 59,260 tons of ore. Active development is being continued and 5,544 feet of drifting, 1,482 feet of raising, and 4,828 feet of diamond-drilling was done.

The mill only worked two shifts per day during the winter months on account of shortage of power. An additional Diesel-driven generator was installed. The plant is now able to operate at full capacity on either hydro-electric or Diesel power as required.

The only means of transportation to the mine during winter months is by airplane from Juneau, Alaska. All supplies for the winter have to be taken in during the summer months when the Taku River is open for navigation. Concentrates made during the winter months are stored at the mine and shipped out during the period of open water. Only perishable goods, passengers, mail, and emergency supplies are handled by plane in the winter months.

Additional bunk-house accommodation was provided and 145 men are employed.

LIARD MINING DIVISION.

McDame Creek District.

Very little was done in this district during the year. The Consolidated Mining and Smelting Company of Canada, Limited, who did considerable work on the *Vollaug* and *Crawford* groups of claims last year, dropped their option on the claims and removed their equipment. Some prospecting by the original owners is still being carried on.

PORTLAND CANAL MINING DIVISION.

Salmon River District.

Silbak Premier Mines, Ltd.—B. F. Smith, general manager; J. G. Pearcey, mine superintendent.

Active development, drifting, raising, and diamond-drilling totalling 17,632 feet has been carried on. The mine operated 312 days and produced 184,606 tons of ore.

Big Missouri Mine.—Owned by Buena Vista Mining Company, Limited; operated by Consolidated Mining and Smelting Company of Canada, Limited. D. S. Campbell, general superintendent; E. James, mine superintendent.

The underground mill was completed and the property went into active production in March. Since that time operations have been continuous and 154,387 tons of ore has been produced. The underground mill is operating successfully. Some adjustments have been made with a view to increasing mill capacity. Additional storage capacity for the hydro-electric plant was provided by a dam at Divide Lake.

Hercules Group.—Consolidated Mining and Smelting Company of Canada, Limited, operators. D. S. Campbell, general superintendent.

Considerable surface diamond-drilling had been done during 1936 and 1937 on this group of claims which adjoins the *Big Missouri*. The 306 drift on the 2,800-foot level of the *Big Missouri* mine was extended toward these claims during the year.

Salmon Gold Mining Co.—Consolidated Mining and Smelting Company of Canada, Limited, operators. D. S. Campbell, general superintendent.

Operations were carried on during the summer months and drifting was done on the ore-zone, with favourable results reported.

Troy Group.—Lake and McDonald, owners. Additional prospecting was done on this group during the year.

Several other groups of prospectors did assessment-work on their claims.

Marmot River District.

Gold Drop and Gold Boulder Groups.—C.M.X. Syndicate; E. Gordon McKenzie, manager. Eight men were employed by this syndicate on these claims. The property is on the Marmot River about 2 miles from the beach. There is a fair road to the property. Camp accommodation has been provided and development-work is being carried on during the winter.

BEAR RIVER DISTRICT.

Welldun Mining, Milling and Power Co., Ltd.—L. S. Davison, manager. Operations were suspended at the *Dunwell* mine and other associated properties late in 1937 and were not resumed during the year.

Oral M.—This property was operated and some tunnelling done by the Premier Gold Mining Company in 1937. They have dropped their option on the property and it is now being operated by John Haathi, of Stewart. Some additional drifting was done and some ore was mined and shipped to the sampling plant at Prince Rupert.

The Stewart Canal Gold Mines.—John Haathi, manager. The property adjoins the *Oral M.* Some additional drifting was done and a small quantity of ore shipped.

Red Reef.—This property also adjoins the *Oral M.* Some additional drifting was done by contract during the summer.

Bitter Creek Area.

Several groups of prospectors did assessment-work on their claims.

American Creek Area.

*Napco Gold Mines, Ltd. (N.P.L.).**—This company, with registered office at 800 Hall Building, Vancouver, was incorporated in February, 1938. The holdings comprise the following mineral claims: *Northern Nos. 1* to *8*, *Pass Nos. 1* to *4*, *Moonlight*, *Moonlight No. 1*, *Northern No. 10*, *Camp A*, *Protector*, *Precious*, and *Precious Nos. 1* to *8*. They lie between 3,300 and 5,400 feet elevation at the head of and on the west side of American Creek, about 27½ miles from the Stewart dock.

During 1938 a new camp with accommodation for four men was installed. About 50 feet of underground work was done; compressed air was supplied by a portable compressor driven by a Model A Ford engine.

The claims are underlain by calcareous and sandy argillite, quartzite, tuff, breccia, and greenstone of the Bitter Creek and Bear River series of the Lower Hazelton group. A sill-like mass of quartz diorite intrudes the rocks at the base of the Bear River series. Light and dark coloured dykes intrude the sediments and volcanics.

In the 1937 Annual Report of the Minister of Mines previous work is described in detail. During 1938 further work was done on the "gold stringer"; more open-cutting was done up the hill and 42 feet of crosscut and short drift was driven from a point 15.5 feet below the open-cut.

During 1938 open-cuts were made on new showings in the northern part of the claims. The showings are quartz stringers mineralized with chalcopyrite, pyrite, some galena, and sphalerite. There has been some wall-rock silicification.

At 4,030 feet elevation and about 4,500 feet northward from the "gold stringer" a number of stringers, striking northward and dipping 50 degrees eastward, outcrop in an area 130 feet long and 50 feet wide. Sulphide mineralized is exposed in an open-cut 21 feet long and 2 to 3 feet wide. A sample of unoxidized mineralized material assayed: Gold, 1.80 oz. per ton; silver, 23 oz. per ton; copper, 2 per cent.; lead, 0.9 per cent.; zinc, 6.3 per cent.

At 4,030 feet elevation and about 400 feet north of the last point two open-cuts, 50 feet apart, expose stringers striking north-westward. A selected sample of unoxidized material from the stringers which extend across a width of 3 feet assayed: Gold, 1.10 oz. per ton; silver, 16 oz. per ton; copper, 9.8 per cent.; lead, 0.7 per cent.; zinc, 3.6 per cent.

At 4,200 feet elevation and about 525 feet southward from the last point two 1- to 2-inch quartz stringers striking north-westward can be traced for 20 feet in a bluff-face, close to

* By J. T. Mandy.

a felsite dyke. A selected sample from the stringers assayed: Gold, 0.10 oz. per ton; silver, 2.2 oz. per ton; copper, 6.7 per cent.; lead, 1.2 per cent.; zinc, 3.4 per cent.

About 950 feet northward from the last point several quartz stringers striking north-westward and dipping south-westward outcrop close to a shear striking east and dipping south. The stringers are mineralized with irregular patches of chalcopyrite and some sphalerite and galena, from which a selected sample assayed: Gold, 0.26 oz. per ton; silver, 2.2 oz. per ton; copper, 6.7 per cent.; lead, 1.2 per cent.; zinc, 5.4 per cent.

At 3,975 feet elevation and about 660 feet north-eastward from the last showing, a fault striking northward occurs along the contact of volcanics on the west and calcareous argillite on the east. An 8-foot brecciated quartz vein outcrops in argillite close to and on the east side of the fault. It contains no visible sulphide minerals.

Excelsior Group.—Some open-cutting and a few feet of tunnelling was done. Some prospecting was done on the *Mountain Boy* and other groups on American Creek.

Georgia River Area.

Gold Leasers, Ltd.—Operations were suspended in 1937 and have not been resumed. Two groups of prospectors did assessment-work on their claims.

Alice Arm Area.

Wolf Group.—J. Fiva, owner, did some cleaning up in the old adit and mined a few tons which were sent to the sampling plant at Prince Rupert.

QUEEN CHARLOTTE ISLANDS MINING DIVISION.

There were no active operations in the division during the year.

SKEENA MINING DIVISION.

Princess Royal Island Area.

Surf Inlet Consolidated Gold Mines, Ltd.—Angus McLeod, manager.

Active operations continued throughout the year. The mine worked 364 days and produced 17,418 tons of ore.

The old *Surf* mine was reopened on the 900 level, the level being cleaned up and retimbered to beyond the old main shaft. Two stopes have been opened in ground which was left by the old company.

In the *Pugsley* mine considerable development has been done on the 700 and 1,000 levels and a fair reserve of ore was being built up. During the last three months of the year development was stopped, with the result that their ore reserves have been considerably reduced.

The mill equipment is being completely overhauled and considerable new equipment added, which should improve the recovery and will increase the capacity to about 90 tons per day.

Porcher Island District.

Porcher Island Mines, Ltd.—T. M. Waterland, superintendent.

The Reward Mining Company, Limited, acquired the *Surf Point* mine from the N. A. Timmins Corporation and continued with the operation. In addition they started to open a property adjoining known as the *Edye Pass* mine. The *Edye Pass* mine was closed and operations confined to the *Surf Point* mine. In June a fire destroyed the mill and power plant at *Surf Point* mine and operations had to be suspended. A new company was formed, The Porcher Island Mines, Limited, which took over both properties. A new mill was built at the *Edye Pass* mine which went into operation during December. A total of 2,350 tons of ore was mined from *Edye Pass* and 1,180 feet of drifting and raising done.

Terrace District.

Thornhill Mountain.

Globe Group.—Kenny and partners. Some prospecting was done and a small shipment made to the sampling plant at Prince Rupert.

Omineca Mining Division.

Usk Area.

*Grotto Group.**—This group comprises the following claims, held by location by T. Bell, Lee Bethurem, George Alger, and L. Brash, of Usk: *Gwen, Gwen No. 1, Poes, Grotto, Grotto No. 2, Senaca, Coselite, Gap Eagle, Talus, Monsoon, Canyon,* and *Minerva.* It is referred to in the Annual Reports of the Minister of Mines for 1916, 1929, 1931, 1937, Bulletin No. 1, 1932, and Department of Mines and Resources Paper 36–20, 1936, and Memoir 212, 1937.

The property is in the valley of Hardscrabble Creek, about 2 miles south-westward from Pitman Station on the Canadian National Railway.

The main showings along the creek consist of quartz veins ranging from a few inches to 3½ feet wide, striking north-eastward and dipping north-westward. They are mineralized with pyrite, chalcopyrite, specularite, sparse sphalerite, and small amounts of petzite (silver-gold telluride), hessite (silver telluride), and cosalite (lead-bismuth sulphide).

A report by the Department of Mines, Ore Dressing and Metallurgical Laboratories, Ottawa, on a small test-shipment indicates that " 75 per cent. of the gold, 74 per cent. of the silver and 96 per cent. of the copper can be recovered in a rougher flotation concentrate. On cleaning a shipping product was made assaying 3.5 oz. gold per ton, 125 oz. silver per ton, and 25 per cent. copper.

" Agitation of the reground flotation tailing in cyanide solution gave an over-all recovery of 96 per cent. of the gold, 96 per cent. of the silver, and 96 per cent. of the copper."

At 575 feet elevation and about 150 feet south-eastward from the cabin, No. 1 adit has been driven on a vein striking north 52 degrees east and dipping 40 degrees north-westward. For 22 feet the vein is well mineralized across widths of 1 foot to 3.8 feet. During 1938 the vein was stoped to the surface along this 22-foot stretch and the cobbed product shipped to the sampling plant at Prince Rupert.

No. 2 adit is at an elevation of 590 feet, on the southerly side of the creek and about 300 feet along a bearing of south 63 degrees from No. 1 adit. It extends 21 feet along a vein striking north 48 degrees east and dipping 70 degrees north-westward. In 1938 the No. 2 vein was mined from creek-level, 582 feet, below No. 2 adit, to a point (July 15th) 9 feet from and 8 feet below the face of No. 2 adit. A sample of the vein in the face across 12 to 24 inches assayed: Gold, 0.58 oz. per ton; silver, 12.2 oz. per ton; copper, 3.4 per cent.; lead, *nil;* zinc, trace.

Test bulk-samples and tonnage lots were shipped to the sampling plate at Prince Rupert from Nos. 1 and 2 adits. Details of them are given in the sampling plant report under *Grotto* group.

New workings since the 1937 Annual Report of the Minister of Mines are on No. 3 vein, which outcrops in the face of the bluff bordering the edge of the creek at 585 feet elevation and 74.8 feet north 86 degrees east from No. 2 adit-portal. At this point an open-cut and short adit is driven on a bearing of south 54 degrees west, and an acute angle across a fault which strikes south 66 degrees west and dips 40 degrees north-westward. The vein strikes south 54 degrees west in alignment with the adit and dips 70 degrees north-westward. On the foot-wall side of the fault the vein is offset about 18 inches, is 10 inches in width and moderately mineralized with pyrite, chalcopyrite, and some sphalerite. A sample of vein, 10 inches in width in the face, assayed: Gold, 0.06 oz. per ton; silver, 2.3 oz. per ton; copper, 0.1 per cent.; lead, *nil;* zinc, trace.

No. 4 vein outcrops in the face of the bluff bordering the creek at 595 feet elevation and 26 feet north 55 degrees west from No. 2 adit-portal. At this point an open-cut and adit 15 feet in length, about 5 feet above the creek and bearing south 44 degrees west, exposes the vein 12 inches in width, striking south 44 degrees west and dipping 70 degrees north-westward. The vein is moderately mineralized with pyrite and is on the foot-wall side of a fault which strikes south 54 degrees west at an acute angle across the adit and dips 30 degrees north-westward.

On the *Poes* claim, between 1,300 and 1,465 feet elevation and 1,800 to 2,100 feet south-westward from No. 2 adit, some strippings and open-cuts expose three north-eastward-striking veins. However, most of the work has been concentrated on No. 1 and No. 2 veins and these latter ones have been but partly explored.

* By J. T. Mandy.

SILVER-LEAD DEPOSITS.

Alice Arm District.

Dolly Varden.—D. Falkoner, lessee, employed three men during the summer months mining some high-grade silver ore from the old glory-hole at the mine.

COPPER DEPOSITS.

Anyox Area.

Consolidated Mining and Smelting Co. of Canada, Ltd.—Dan Matheson, superintendent. Diamond-drilling adjacent to the old *Hidden Creek* mine indicated a considerable ore-body.

Exploratory work into the new ore-body is being carried on from the old *Hidden Creek* mine. The Victoria hoist was put back into service and the hoisting shaft reopened. Drifting into the new ore-body was carried on from 385, 150, 120, and 360 levels. A total of 2,072 feet of drifting and 8,637 feet of diamond-drilling has been done. A total of seventy-five men is employed.

PYRITE DEPOSITS.

Skeena Mining Division.

Ecstall River Area.

Northern Pyrites, Ltd.—Charles R. Cox, superintendent. The property is on the east side of Ecstall River about 45 miles from Port Essington and is reached by small river-boat from that point. The river has a flat grade and is shallow, the last 10 miles near the mine-landing can only be navigated at high tide.

Considerable diamond-drilling had been done on the property by the Granby Company in previous years. During 1937, interests represented by F. W. Guernsey, Vancouver, acquired the property. During that year a geophysical survey was made and some diamond-drilling done to check previous drill records which indicated a considerable body of ore.

During 1938, a 750-cubic-foot air compressor and a small lighting unit were taken in and installed and several permanent buildings constructed. A development adit 9 by 8 feet in section was started and is to be driven approximately 2,800 feet.

As the only means of transportation at present is by river which freezes up in winter, operations were suspended late in the year and will be resumed as soon as the river is open for navigation in the spring. Twenty-three men were employed.

PLACER-GOLD DEPOSITS.

Atlin District.

All the active operations in the Atlin district are placer. The camp is fairly active, with a great deal of interest being shown by outside interests. There are forty-five operations in the district, of which thirty-three are underground drifting on bed-rock.

Spruce Creek.

This is the most important creek in the district. All of the operations except the steam-shovel operation of the Columbia Development Company are underground; there being twenty-one separate underground operations on the creek.

Columbia Development Co., Ltd.—James Eastman, manager. This is a steam-shovel operation working on the *Olalla* lease, using two shovels, one on overburden and the other on the bed-rock gravel. Two shifts were working and a total of thirty-five men were employed.

Colpe Mining Co., Ltd.—E. Grey, manager. Nos. 1 and 2 shafts have ceased active operation but a lay has been given to some miners on No. 1 shaft. The tailings from Nos. 1 and 2 shafts were rewashed. It would appear from the recovery being obtained in rewashing that about 30 per cent. of the gold is lost in the first sluicing. This is apparently due to the clay in the gravels retaining a portion of the gold and carrying it through the sluice-boxes. After being on the dump for some time this clay disintegrates and on being resluiced a large percentage of the first loss is recovered.

No. 4 shaft which had been idle for some time was unwatered and operations resumed. On December 29th, a fire, apparently originating from an overheated stove, destroyed the shaft-house. No damage was done to the shaft itself. There was no one in the mine at the time.

Clydesdale Lease.—McDonald, McKay, and Munro, lay-men. Adjoins the *Chance* and *Goodwill* leases of the Colpe Mining Company, Limited. Pillar-extraction was being carried on along the *Chance* boundary-line. An order was issued under section 7 prohibiting drifting or pillar-extraction along the *Goodwill* lease boundary-line until the requirements of General Rule 60 (*a*) had been complied with. The order remains in force.

Wolf Lease.—Vickstrom and partners, lay-men. Only the three lay-men were drifting into bench on the south side of creek.

Croker Lease.—Fred Ohman and partners, lay-men. Four men, all partners in the lay, are engaged driving two drifts into the bench. On April 28th, 1936, an order was issued under section 7 prohibiting work along the boundary of the old Brown workings until the requirements of General Rule 60 (*a*) had been complied with.

On October 31st, 1938, application was made by Fred Ohman requesting the withdrawal of the order. As the proposed method of connection through to the old Brown workings was approved, the order was withdrawn on November 2nd. Mr. Matthews, owner of the lease, wired requesting that the order prohibiting the connection be re-established. As the requirements of the "Metalliferous Mines Regulation Act" had been complied with, it was considered that the Inspection Branch had no further jurisdiction in the matter and so advised Mr. Matthews. An injunction was obtained through the Supreme Court by Mr. Matthews prohibiting the lay-men from working this area.

Dream Lease.—J. W. Noland, owner. This is the deepest shaft in the district, being 208 feet to bed-rock. Two drifts are being carried up-stream. The attention of the management was drawn to the need for better ventilation.

The *Friendship, Sally, Joker, Keno, Peterborough, Gladstone, Pillar Fraction, Hardscrabble, Elk, Lynx, Jewel,* and *St. Quentin* leases were also inspected. General conditions on the creek were fairly good.

Boulder Creek.

Consolidated Mining and Smelting Co. of Canada, Ltd.—MacLeod White, superintendent. This is a hydraulic operation employing twenty men, and working three shifts. Lack of water constitutes a considerable handicap.

O'Donnel River.

Grace M. Lease.—N. Murphy and son, owners. Only the owners are working on the property. This is the only property actively producing to any extent. There are several other groups employed on the creek, prospecting in the benches. None of these have, so far, found a definite channel.

Pine Creek.

Bessbrook Lease.—Gus Boquist, lay-man, has three other men employed drifting in two drives up-stream. The ground had been worked previously. All old workings were standing in good shape.

Anna C. Lease.—E. Woodean, owner. Only the owner is working, driving into the bench and is now in over 500 feet. He is endeavouring to locate the channel indicated as striking into the bench from lower Pine Creek. So far he has not located any definite channel.

Atchinson Brothers did some drilling on Pine and Willow Creeks and started this year on a hydraulic operation. They have plenty of water and have taken out a good-sized pit with satisfactory results reported. Ten men were employed.

Wright Creek.

Artic and Lynderbergh Leases.—Hodges and partners, lay-men. This is a hydraulic operation. There is very little water in the creek, only sufficient for four runs of thirty minutes each per day. After several disappointing years they have at last struck good pay.

There are several other groups prospecting farther up-stream on the creek.

Ruby Creek.

Surprise Lake Mining Co.—Matson and partners, lay-men. This is a hydraulic operation having ample water. Six men, all partners in the lay, are employed.

Farmer Lease.—E. Turnquist, lay-man, is working alone taking out pillars. He expects to finish this season.

Blackstone Lease.—E. Krumbeigal, lay-man. There is a shaft on this property down 160 feet. Nothing had been done this season. The bottom of the shaft still is about 30 feet above bed-rock.

Birch Creek.

There are six operations on the creek, all ground-sluicing and doing fairly well. There is one underground operation. The owner works this during winter and engages in ground-sluicing during the summer months.

McKee Creek.

Atlin Gold Mines, Ltd.—Adams and partners, lay-men. This is a hydraulic operation; seven men, all partners in the lay, are employed.

Otter Creek.

Compagnie Française des Mines d'or du Canada.—Walter Sweet, manager. This is an underground operation run by lay-men. There are six men interested in the lay and in addition they employ eleven men. The main drive up-stream had developed a heavy squeeze, owing principally to their method of mining. In the area involved there had been some good pay and they had taken everything there, which gave them about 40 feet width at one point. This ground has now started to settle. It will be impossible to keep a road open through the squeezed area. A new drift will have to be driven up-stream along the rim to reach the up-stream workings.

Squaw Creek District.

Several groups were engaged in ground-sluicing and prospecting on this creek. The district was not visited.

LIARD MINING DIVISION.

There was considerable activity on Boulder Creek and other creeks tributary to the Turnagain (Little Muddy) River. Considerable equipment is being taken in during the winter by the Barrington interests of Wrangell for drag-line operations on Boulder Creek. The district was not visited.

STIKINE MINING DIVISION.

Unuk River District.

Blanton and associates, of Ketchikan, did considerable prospecting on their placer-ground on Sulphurets Creek, employing several men during the summer season. The district was not visited.

DEPARTMENT OF MINES SAMPLING PLANT, PRINCE RUPERT.

BY

J. T. MANDY.

A sampling plant was constructed by the Department of Mines, Victoria, at Prince Rupert during the summer of 1937. The plant is on a portion of the "Lumber Dock" leased from the Canadian National Railways and is accessible by railway or steamship. It has a coarse crushing capacity (to 1 inch) of about 16 tons per eight-hour shift and a continuous sampling capacity of average ores, by hand-methods, of about 4 tons per day. The first shipment of ore was received at this plant on August 20th, 1937.

The service of the sampling plant is free and its function has been organized to assist prospectors and operators in the finding, exploration, and development of mining properties, by the following means:—

(1.) Bulk test-sampling of mineral deposits to ascertain the mineralization and values and to establish the commercial or non-commercial aspects of these deposits.

(2.) Guidance through information concerning the factors governing the markets and marketability of the content of mineral deposits, together with assistance in the sale of ores to the smelter or ore-buyer.

(3.) Guidance in the exploration and development of mineral deposits of commercial importance, through contact and advice in the field.

(4.) Assistance through the advantageous purchase, grading, assembly, and marketing of shipping-grade ores by the plant during the preliminary stages of exploration and development of mineral deposits.

The objective of the plant is to promote and foster the actual production of ore and in this way bring mining properties into continuous profitable production. As bearing on this, the all-important matter of freight rates and transportation costs covering shipments of ore from properties to sea-board or the railway is carefully considered. The railway and steamship companies have co-operated in this regard and grant preferential freight tariffs applied to shipments destined for the sampling plant at Prince Rupert. To assure this, a shipping permit signed by the sampling plant manager is, on application, mailed to intending shippers. On presentation of this to the transportation company agent, the shipper is granted the advantage of the preferential freight tariff. In this way many prospectors and small operators have been enabled to profitably mine, ship, and market small lots of ore, and by this means secure funds for further prospecting, exploration, and development of properties.

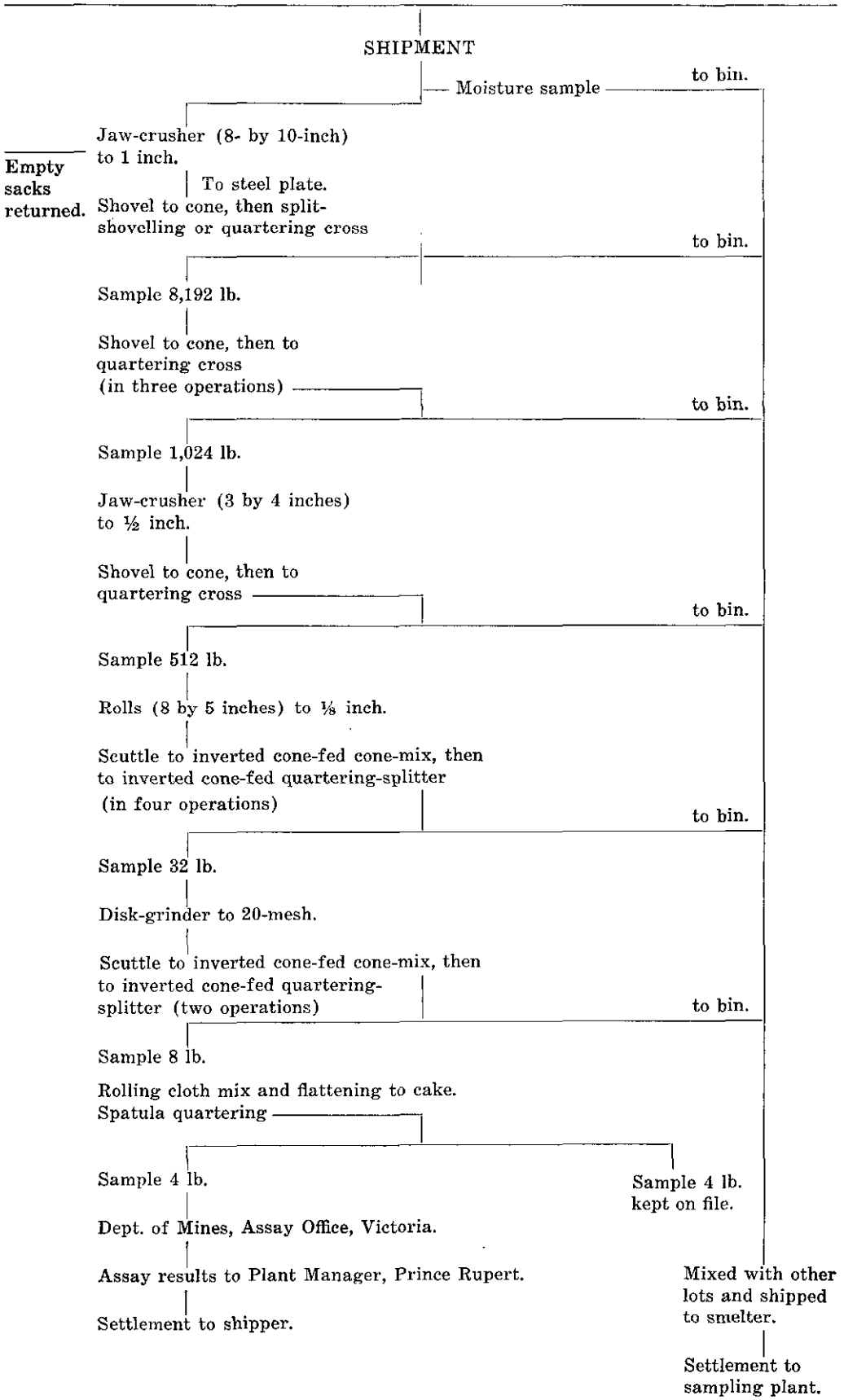
Shipments to the sampling plant are divided into three categories:—

(A.) Assay lots.

(B.) Bulk test-sample lots.

(C.) Tonnage lots.

The following is an example of a general flow-sheet followed at the plant for tonnage lots. The flow-sheet for bulk test lots follows the same general principle, adapted to the weights and sizing of the lots. Individual flow-sheets for different lots may vary to suit the characteristics of each individual lot.


SHIPMENT
Moisture sample
to bin.
Jaw-crusher (8- by 10-inch) to 1 inch.
Empty sacks returned.
To steel plate.
Shovel to cone, then split-shovelling or quartering cross
to bin.
Sample 8,192 lb.
Shovel to cone, then to quartering cross (in three operations)
to bin.
Sample 1,024 lb.
Jaw-crusher (3 by 4 inches) to ½ inch.
Shovel to cone, then to quartering cross
to bin.
Sample 512 lb.
Rolls (8 by 5 inches) to ⅛ inch.
Scuttle to inverted cone-fed cone-mix, then to inverted cone-fed quartering-splitter (in four operations)
to bin.
Sample 32 lb.
Disk-grinder to 20-mesh.
Scuttle to inverted cone-fed cone-mix, then to inverted cone-fed quartering-splitter (two operations)
to bin.
Sample 8 lb.
Rolling cloth mix and flattening to cake.
Spatula quartering
Sample 4 lb.
Sample 4 lb. kept on file.
Dept. of Mines, Assay Office, Victoria.
Assay results to Plant Manager, Prince Rupert.
Settlement to shipper.
Mixed with other lots and shipped to smelter.
Settlement to sampling plant.

Immediately on arrival at the sampling plant all shipments are carefully weighed on an approved and inspected Fairbanks platform scale of 2,500-lb. capacity. Following this, each lot is crushed to 1 inch in a primary 8- by 10-inch jaw-crusher and proceeds through an elaborate and detailed system of hand-sampling and reduction with interval mixing, crushing to ½ inch in a secondary crusher, reduction in rolls to ⅛ inch, and final grinding of the reduced sample to 20-mesh. The final sample is split into two parts, each weighing from 3 to 6 lb., one of which is forwarded to the Department of Mines' Assay Office at Victoria for assay and analysis and the duplicate being retained at the plant for reference. Hand-sampling permits a maximum flexibility in the selection of the sampling flow-sheet. This is worked out to suit the characteristics of each individual lot and when deemed necessary multisampling of the entire lot (duplicate, triplicate, or quadruplicate) is done. Immediately the assay and analysis results are received from Victoria they are studied and, based on these and all other observations, correlative advice with all necessary calculations and settlement is immediately submitted to the shipper.

Lots in category " A " embrace small preliminary samples of a few pounds in weight taken from outcrops and working-faces. The purpose of these is to find or indicate values that might be of commercial or shipping-grade.

Lots in category " B " comprise samples weighing from about 100 to several hundred pounds. The purpose of these is to determine more definitely the probability of a commercial or shipping-grade ore.

If a shipping-grade has been previously established, these bulk test-samples are submitted for the purpose of guidance with regards to the values and type of ore that is in process of being sacked for shipment to the sampling plant or being prepared for direct shipment to the smelter. Based on the examination of these lots and the results of the assay and analysis, shippers are advised concerning the commercial aspects of the ore. In the case of prospective shipments to the sampling plant or direct to the smelter, advice is proffered relative to sorting and cobbing to achieve the required grade and the selection of ore-type to suit the specific requirements of the particular smelter schedule to which the ore is indicated as being best adapted for the achievement of the best returns.

In the case of any lots in categories " A " or " B " in which a shipping-grade is indicated, a " *pro forma* per ton calculation " in accordance with the indicated smelter schedule is forwarded to the shipper by the first mail. On this sheet all items such as weights; assay and analysis results; metal prices; smelter payments, penalties, charges, and deductions; freight and incidental costs, are cited in detail and the net return per ton for the grade and type of ore represented is shown. If the results from bulk test lots indicate that better returns would accrue to the shipper by shipment direct from the property to the smelter, especially in car-load lots, rather than via the sampling plant, he is specifically advised to that effect. At the same time the service of the plant is available to him for guidance in the preparation of such direct shipments, through the shipment of interval bulk test lots.

If deemed necessary for certain cases in category " A," and in all cases in category " B," in which the ore is shown to be not of shipping-grade and a deficit or loss to the shipper would be incurred through shipment, the same " *pro forma* per ton calculation " with correlative advice is submitted to the shipper for his information and study. It is hoped that besides demonstrating the profit or loss accruing from the shipment of ores, all property-owners who avail themselves of this service will also become thoroughly conversant with the various factors governing the commercial aspects of mineral deposits.

Any commercial content of these bulk test lots is immediately paid for in full by the sampling plant; and appended to the " *pro forma* per ton calculation " is a detailed " settlement calculation for the test lot " covering the weight of the lot and showing exactly how the value is arrived at, with a cheque attached to cover the amount. Accompanying these sheets is a letter embodying any further information that may be deemed necessary for the shipper in connection with his particular problem and operation. Because the value of lots in categories " A " and " B " is not known at the time of shipment, the freight on these must be prepaid.

Lots in category " C " comprise shipments weighing from several hundred pounds to 15 or 20 tons which have been shown by assays and analyses of previous relative bulk test-samples or other forms of approved sampling and relative assays to be of shipping-grade.

After these tonnage lots are sampled and assayed, a "settlement calculation" sheet in accordance with the smelter schedule which, with freight costs, shows the highest returns for the type of ore, with accompanying cheque for the net value, is forwarded to the shipper by the first mail. On this sheet all items of weights; assay and analysis results; metal prices; smelter payments, penalties, charges, and deductions; freight and incidental costs, are cited in detail to enable the shipper to understand clearly how the net value is calculated. Accompanying these settlement-sheets is a letter embodying any extra elaboration or advice that may be deemed necessary for the further information of the shipper in connection with his particular operation.

Before shipping lots in category "C," shippers are requested to complete and forward to the plant a "shipping application form" on which is set out the approximate grade of the intended shipment and the basis on which this is determined. If these determinations are approved by the sampling plant manager, a shipping permit is forwarded to the intending shipper. On presentation of this permit to the railway or steamship agent the shipper is enabled to consign the lot to the sampling plant, freight collect. The freight is then deducted from the calculated net value of the lot.

In some cases shipments in category "C" may be for the purpose of determining the grade, type, and smelter suitability or commercial aspects of ores without previous bulk test-sampling in accordance with category "B." In such cases the freight costs to the sampling plant must be prepaid.

The sampling plant, through its manager, is at all times in intimate contact with the prospectors and operators who avail themselves of its service. This is done either through correspondence or by personal contact at Prince Rupert or in the field. In this way the problems involving each particular individual and property are known and it is possible to proffer fitting advice and information.

The advantages accruing to shippers of ore for marketing through the Department of Mines' sampling plant as opposed to direct shipment to the smelter, are:—

(1.) The service of technical advice and information covering the entire operation:
(2.) Security of the shipper from loss, through the previous determination of grade by bulk test-samples:
(3.) Guidance of the shipper in the matter of required grade, through interval bulk test-sampling during the process of sacking:
(4.) Reduced freight rates for small lots. This enables:—
  (*a.*) The profitable shipment of lots, the freight-rate on which would otherwise be prohibitive;
  (*b.*) The elimination of the necessity to produce car-load shipments, with their appreciable capital outlay and deferred payment, which factors are generally impossible for the average prospector to meet;
  (*c.*) Quick and frequent payments from the shipment of small lots:
(5.) Determination of the export market giving the highest returns:
(6.) Reduced smelter and export charges through mixing and bulk export from the sampling plant. This involves the following factors:—
  (*a.*) Elimination of smelter sampling charge;
  (*b.*) Elimination of smelter extra charge for small lots weighing up to about 5 tons;
  (*c.*) Elimination of smelter extra charge for handling ore in sacks;
  (*d.*) Complete or part elimination of smelter penalties, by mixing at the plant with penalty-free ores;
  (*e.*) Reduced smelter base-treatment charge on high-grade ores by mixing with lower-grade ores;
  (*f.*) Elimination of smelter representation cost;
  (*g.*) Elimination of gold export permit and insurance costs:
(7.) Salvage of empty sacks and their return immediately on completion of sampling:
(8.) Full settlement of the net return within about two weeks from the date of the arrival of the shipment at the sampling plant.

So far, the most advantageous markets are offered by the Tacoma smelter for gold-silver-copper ores, and by the Trail smelter for silver and silver-gold ores with a high lead content and high-grade zinc ores.

In view of differences in the schedules of these two smelters and the bearing of transportation and freight costs from various localities, careful and detailed calculation is required to determine the disposition of shipments. For instance, it is frequently found advantageous to forgo payment for appreciable quantities of lead which would be paid for by Trail and divert certain gold-silver-lead ores to Tacoma, which smelter does not pay for lead. Again, in certain gold-silver-lead-copper ores, it may be found advantageous, when all factors are carefully calculated, to forgo payment for either lead or copper and dispose of the lot accordingly.

During the year much research was also carried out to find advantageous markets and freight avenues for antimony, molybdenum, bismuth, and manganese to fit conditions relative to certain localities and properties.

For the initial period of operation of the sampling plant—August 20th to December 31st, 1937—seven tonnage lots totalling 34.186 dry tons from six different properties, sixteen bulk test lots totalling 1.4582 dry tons from fourteen different properties, and four assay lots totalling 0.009 dry ton were received at the plant.

The following is a synopsis of the operating data of the plant for the year 1938 from January 1st to December 31st:—

	Number of Shipments.	Different Properties.	Total Weight.
			Tons.
Tonnage lots	24	12	97.1355
Bulk test lots	90	35	7.03705
Assay lots	47	24	0.08875
Totals	161	61	104.2613

Shipments from plant to smelter: Number of shipments, six; dry tons, 147.8411.

Comparative Returns.

Dry tons shipped from plant	147.8411
Dry tons paid for by smelter	148.2335
Paid out by plant	$7,685.24*
Received from smelters	$7,536.75

* From this should be deducted $68.44 for freight absorbed by the plant on account of special circumstances governing three lots, which reduces this figure to $7,616.80. The difference of $80.05 between this total and that received from the smelter, is accounted for by the variance in the price of metals at the time of purchase and the time of sale.

The details of the tonnage and bulk test lots, with relative assay and analysis results follow.

Tonnage Lots.

Property.	Shipper.	Locality.	Dry Tons.	Gold.	Silver.	Copper.	Lead.	Zinc.	Arsenic	Antimony.	Sulphur.	Iron.	Silica.
				Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Cariboo-Thompson	Endimak, J. P.	Barkerville	9.9615	3.71	1.25	*Nil*	1.4	0.7	7.1	*Nil*	23.4	23.5	35.1
D. and N. Group	Donaldson, J. G.	Telkwa	2.4355	0.105	95.0	2.9	*Nil*	0.55	*Nil*	2.5	4.5	6.3	58.15
Esperanza Mines, Ltd.	Payne, T. H.	Alice Arm	4.195	0.20	124.6	Trace	2.7	1.9	0.5	*Nil*	5.0	5.9	73.5
Glacier Gulch	Campbell, S. F.; Banta, W.; and Loveless, G.	Smithers	12.062	2.80	0.4	*Nil*	*Nil*	Trace	*Nil*	*Nil*	0.13	1.6	58.0
Glacier Gulch	Campbell, S. F.; Banta, W.; and Loveless, G.	Smithers	5.671	3.70	0.55	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	0.4	0.7	57.0
Globe Claim	Kenney, E. T.	Thornhill Mountain	1.94	1.95	0.8	*Nil*			*Nil*		22.5	35.7	18.5
Golden Eagle	Heenan, D.	Topley	0.297	0.16	248.6	1.0	17.4	12.4	*Nil*	*Nil*	10.5	4.3	44.4
Golden Eagle	Heenan, D.	Topley	0.303	0.16	291.2	2.2	20.0	12.0	*Nil*	*Nil*	10.4	6.0	28.4
Golden Eagle	Heenan, D.	Topley	0.2495	0.10	168.8	0.9	12.1	12.1	*Nil*	*Nil*	10.4	4.5	50.2
Golden Eagle	Heenan, D.	Topley	0.4185	0.12	209.6	1.2	12.0	14.0	*Nil*	*Nil*	12.0	4.0	42.0
Gold Leaf	Flynn, James	Anyox	1.679	4.65	2.03	*Nil*	Trace	1.0	*Nil*	*Nil*	1.33	3.56	85.7
Gold Leaf	Flynn, James	Anyox	2.169	13.67	4.33	*Nil*	0.17	0.63	Trace	*Nil*		3.57	84.2
Gold Group	Chisholm, A.	Topley	3.6	0.02	18.4	1.8	26.0	10.0	*Nil*	*Nil*	17.1	8.4	30.2
Gold Group	Chisholm, A.	Topley	2.645	0.02	17.2	1.8	32.6	10.5	Trace	*Nil*	17.6	7.5	24.4
Gold Group	Sam, M.	Topley	0.139	0.06	77.4	0.9	Trace	0.2			0.6	6.0	86.0
Gold Group	Sam, M.	Topley	0.1875	0.10	60.8	Trace		3.0				5.0	75.6
Grotto Group	Bell, J.	Pitman	17.795	0.36	21.0	5.0	*Nil*	2.0	*Nil*	*Nil*	18.5	20.0	48.0
Grotto Group	Bell, J.	Pitman	5.677	0.52	30.0	3.5	*Nil*	1.1	*Nil*	*Nil*	20.9	21.2	47.5
Grotto Group	Bell, J.	Pitman	6.240	0.80	20.5	4.4	*Nil*	0.3	*Nil*	*Nil*	20.4	22.1	46.9
Grotto Group	Bell, J.	Pitman	7.7145	0.93	20.8	4.3	*Nil*	0.6	*Nil*	*Nil*	22.0	19.2	43.0
Lucky Luke	Moody, L. E.	Usk	0.4680	0.22	7.0	39.2					9.1	7.6	22.8
Lucky Luke	Moody, L. E.	Usk	2.6555	0.787	14.25	23.7					7.1	8.6	43.95
Silver Pick	Elmsted, A.	Smithers	6.109	0.60	340.0	9.4	2.4	5.9	*Nil*	*Nil*	11.9	8.9	36.0
Snowshoe Group	Raymond & Berg	Smithers	2.524	0.2	69.0	0.1	10.3	13.4	3.0	*Nil*	11.2	9.6	34.9

Test Lots.

Property.	Shipper.	Locality.	Dry Tons.	Gold.	Silver.	Copper.	Lead.	Zinc.	Arsenic.	Anti-mony.	Sulphur.	Iron.	Silica.
				Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
August Group	Johnson, A.	Ritchie	0.00035	0.10	2.4	4.7							65.2
Bermaline Group	Johnson, A.	Ritchie	0.028	0.05	8.4	2.7	13.7	0.5					68.5
Bermaline Group	Johnson, A.	Ritchie	0.0015	Trace	0.6	0.2							93.1
Black Bull No. 1	Hagen, J.	Copper River	0.0505	0.03	4.0	Trace	0.5	4.0	*Nil*	*Nil*	1.4	4.0	72.5
Black Bull No. 2	Hagen, J.	Copper River	0.049	0.06	13.5	0.5	13.8	3.7	*Nil*	*Nil*	5.0	3.9	66.3
Blue Ribbon	Edlund, N.	Stewart	0.017	0.02	87.0	0.4	6.8	19.5	1.0	0.1	15.3	19.2	5.3
Bolton No. 2	Dyer, J.	Gardner Canal	0.414	0.04	0.6	0.8	*Nil*	*Nil*	*Nil*	*Nil*	Trace	9.3	40.6
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.035	2.2	12.3	8.0	0.3	1.9	*Nil*	*Nil*	19.3	9.0	40.0
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.033	4.75	5.4	8.4	1.7	6.9	*Nil*	*Nil*	16.8	14.8	39.4
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.025	3.95	7.1	9.3	1.8	6.8	*Nil*	1.4	19.0	16.8	31.0
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.0255	5.5	26.8	9.0	*Nil*	2.0	*Nil*	*Nil*	26.0	19.4	32.8
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.016	1.32	18.0	19.0	Trace	5.0	*Nil*	*Nil*	22.6	27.0	13.2
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.017	0.14	2.6	0.1							
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.029	5.60	8.5	9.0	0.1	1.8	*Nil*	*Nil*	20.0	19.0	37.6
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.030	4.05	5.4	7.2	0.2	5.8	*Nil*	*Nil*	18.0	16.5	41.0
British Lion Mines, Ltd. (Homestake)	Smith, A. F.	Alice Arm	0.026	3.54									
Cordillera	Darby, J.	Usk	0.045	0.46	3.1	6.5					1.8	2.7	77.6
Cordillera	Darby, J.	Usk	0.0075	0.68	3.2	4.2					1.2	2.1	90.2
Cordillera	Darby, J.	Usk	0.0042	21.1	9.0	7.8						2.7	85.6
Coronado	*Goodacre, C.*	*Hudson Bay Mountain*	*0.0600*	*0.06*	80.3	0.3	26.5	8.0	*Nil*	*Nil*	15.8	5.0	8.6
Coronado	Goodacre, C.	Hudson Bay Mountain	0.0565	0.06	29.7	0.2	9.2	16.0	0.1	*Nil*	11.2	12.0	23.0
Coronado	Goodacre, C.	Hudson Bay Mountain	0.060	0.32	42.9	0.2	15.8	16.0	*Nil*	*Nil*	15.0	10.0	14.0
Cougar M.C.	Johnson, A.	Ritchie	0.00275	Trace	8.2	2.9							73.2
Empire Group	Simpson, Mrs. D. C.	Smithers	0.056	0.15	50.0	0.5	15.0	16.4	0.2	*Nil*	17.3	7.0	17.0
Eureka	Michaud, J. A.	Terrace	0.096	Trace	Trace	*Nil*	*Nil*	1.0	*Nil*	*Nil*	10.5	3.0	40.4
Georgia	Bissonette, Mrs. J.	Copper River	0.0195	0.06	124.0	5.1	Trace	0.5	*Nil*	*Nil*	11.1	13.0	48.1

Test Lots—Continued.

Property.	Shipper.	Locality.	Dry Tons.	Gold.	Silver.	Copper.	Lead.	Zinc.	Arsenic.	Antimony.	Sulphur.	Iron.	Silica.
				Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Gem No. 1	Hagen, W.	Copper River	0.037	0.64	1.4	*Nil*		Trace				6.0	72.6
Gem No. 1	Hagen, W.	Copper River	0.0395	0.37	2.2	*Nil*	*Nil*	0.1	*Nil*	*Nil*	6.8	10.2	79.2
Glacier Gulch	Campbell, S. F.	Smithers	0.175	3.0	1.2	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	0.37	1.6	56.0
Glacier Gulch	Campbell, S. F., and Banta, W.	Smithers	0.091	0.64	4.4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	0.1	0.9	59.3
Glacier Gulch	Campbell, S. F., and Banta, W.	Smithers	0.0870	0.18	4.4	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	0.1	0.8	55.9
Gold Group	Simonds, O. F.	Topley	0.025	0.01	26.7	2.8	61.2	3.7	*Nil*	*Nil*			
Gold Group	Simonds, O. F.	Topley	0.012	0.02	29.7	3.0	26.8	14.4	0.8	*Nil*			
Gold Group	Simonds, O. F.	Topley	0.0045	0.05	1.6	0.2	3.6	3.9	0.4	*Nil*		8.5	62.6
Gold Group	Simonds, O. F.	Topley	0.0445	0.02	17.4	1.0	57.7	7.3	Trace	*Nil*			
Gold Group	Simonds, O. F.	Topley	0.06	0.02	16.4	1.0	58.1	7.0	*Nil*	*Nil*			
Gold Group	Simonds, O. F.	Topley	0.048	0.04	21.7	4.1	38.2	13.0	0.7	*Nil*			
Gold Group	Simonds, O. F.	Topley	0.0275	0.03	40.4	3.9	11.1	12.2	0.4	*Nil*			
Gold Group	Simonds, O. F.	Topley	0.045	0.03	26.0	4.5	24.5	9.3	0.2	*Nil*	20.7		21.6
Gold Group	Simonds, O. F.	Topley	0.0025	0.02	7.0	6.2	42.9	8.6	*Nil*	*Nil*	25.1		2.4
Gold Group	Simonds, O. F.	Topley	0.0445	0.06	31.0	2.3	51.7	5.6	*Nil*	*Nil*	19.0	6.9	9.0
Gold Group	Simonds, O. F.	Topley	0.018	0.04	14.2	2.4	31.9	15.6	*Nil*	*Nil*	20.0	7.9	17.9
Gold Group	Simonds, O. F.	Topley	0.0425	0.04	21.5	1.8	43.9	9.8	*Nil*	*Nil*	18.4	7.5	16.1
Gold Group	Sam, M.	Topley	0.045	0.065	460.0	3.0	0.3	0.4	*Nil*	0.2	2.6	4.5	77.2
Gold Group	Sam, M.	Topley	0.159	0.065	394.0	2.8	0.4	0.5	*Nil*	1.8	3.4	4.9	71.7
Gold Group	Sam, M.	Topley	0.093	0.18	211.2	1.9	Trace	1.1	Trace	*Nil*	3.9	6.1	74.7
Gold Group	Sam, M.	Topley	0.144	0.06	124.5	0.88	0.4	1.0	*Nil*	*Nil*	0.63	4.7	80.8
Gold Group	Sam, M.	Topley	0.349	0.06	71.6	0.5	*Nil*	*Nil*	*Nil*	*Nil*	2.2	5.4	74.9
Gold Group	Sam, M.	Topley	0.097	0.02	69.0	0.5	Trace	0.7	Trace	*Nil*	1.0	5.0	81.3
Gold Group	Sam, M.	Topley	0.076	0.04	62.8	0.4	*Nil*	*Nil*	*Nil*	*Nil*	1.1	5.1	78.3
Gold Group	Sam, M.	Topley	0.144	0.04	67.0	0.4	*Nil*	Trace	*Nil*	*Nil*	1.0	5.0	78.0
Gold Group	Sam, M.	Topley	0.052	0.26	32.1	4.4	8.5	6.0	2.2	*Nil*	20.0	16.0	12.0
Gold Leaf	Flynn, J.	Anyox	0.00375	104.34	30.0		Trace	*Nil*	*Nil*	*Nil*	1.8	3.0	83.4
Gold Leaf	Flynn, J.	Anyox	0.027	30.24	12.9	*Nil*	0.4	2.0	*Nil*	*Nil*	4.9	8.0	66.4
Golden Eagle	Heenan, D.	Topley	0.508	0.20	253.0	0.9	11.1	11.4	*Nil*	*Nil*	11.2	5.2	44.8
Grotto Group	Bell, J.	Pitman	0.04775	0.42	25.4	5.9	*Nil*	*Nil*	*Nil*		20.6	20.6	44.8
Grotto Group	Bell, J.	Pitman	0.0055	1.35	44.4	6.21							
Grotto Group	Bell, J.	Pitman	0.035	0.18	8.2	0.5	*Nil*	*Nil*			6.0	8.0	73.5
Grotto Group	Bell, J.	Pitman	0.0275	1.18	4.5	5.3	Trace	*Nil*	*Nil*	*Nil*	22.8	23.1	44.8
Grotto Group	Bell, J.	Pitman	0.006	0.40	29.3	6.5	*Nil*	Trace	*Nil*		21.8	21.8	42.8
Grotto Group	Bell, J.	Pitman	0.001	0.46	23.5	7.2	*Nil*	*Nil*	*Nil*		25.3	26.5	35.2
Grotto Group	Bell, J.	Pitman	0.00075	1.40	104.0	Trace							

Grotto Group	Bell, J.	Pitman	0.002	0.72	26.5	5.2			*Nil*		15.6	15.0	49.6
Grotto Group	Bell, J.	Pitman	0.0015	1.07	23.0	7.0			*Nil*		18.2	18.0	52.4
Grotto Group	Bell, J.	Pitman	0.004	0.76	21.6	6.8			*Nil*		26.6	24.0	36.8
Homestead	Turner, T. M.	Terrace	0.0489	0.01	0.4	*Nil*							
Homestead	Turner, T. M.	Terrace	0.0519	Trace	0.2	*Nil*							
Kimsquit No. 3	Jorgenson, J. P.	Bella Coola	0.1309	0.02	0.4	1.6	*Nil*	Trace	*Nil*				
Last Chance Claims	Donaldson, J. G.	Telkwa	0.0695	0.11	203.5	5.0	*Nil*	1.0	*Nil*	3.0	3.1	8.3	47.0
Last Chance Claims	Donaldson, J. G.	Telkwa	0.1955	0.20	77.0	2.5	*Nil*	1.0	*Nil*	*Nil*	3.0	6.0	58.6
Loveless	Loveless, G.	Smithers	0.142	0.013	27.6	19.3	*Nil*	*Nil*	*Nil*	*Nil*	7.7	4.9	51.4
Lucky Luke	Moody, L. E.	Usk	0.029	0.56	14.6	24.5						8.5	43.0
Motherlode	Felber, J.	Terrace	0.0245	0.24	20.5	0.8	14.0	3.0	*Nil*	*Nil*	10.8	8.0	59.0
Nicholson Creek Mining Corporation	Uhland, A.	Usk	0.374	1.26	44.0	16.3	*Nil*	*Nil*	*Nil*	*Nil*	8.6	7.8	49.6
Nicholson Creek Mining Corporation	Uhland, A.	Usk	0.327	0.01	1.4	4.7	*Nil*	*Nil*	*Nil*	*Nil*	6.3	8.5	62.4
Snowbird Group	Ostrem, A. J.	Fort St. James	0.299	0.04	0.2	*Nil*	*Nil*	Trace	*Nil*	53.5			20.0
Spider	Collart, J. E.	Stewart	0.035	1.04	236.0	0.1	6.0	9.1	*Nil*	*Nil*	6.1	2.4	72.9
Spider	Collart, J. E.	Stewart	0.0315	1.36	260.0	0.2	6.9	12.7	*Nil*	*Nil*	7.8	2.5	65.4
Silene Claim	Frizzell, Gladys	Jap Inlet	0.051	Trace	2.0	9.6	*Nil*	0.6					
Silver Bow	Clore, A.	Zymoetz River	0.057	0.12	3.8								
Silver Bow	Clore, A.	Zymoetz River	0.0595	0.10	0.1	*Nil*		*Nil*				6.0	86.2
Surf Inlet	Hermanson, H.	Butedale	0.041	Trace	2.4				*Nil*	*Nil*			
Stevens Island	Warren, N.	Prince Rupert	0.0005	Trace	Trace	Trace							
Stevens Island	Warren, N.	Prince Rupert	0.0035	0.02	Trace	Trace							
Victory Group	Simpson, Mrs. D. C.	Smithers	0.276	0.18	33.0	0.5	12.8	13.3	0.8	*Nil*	15.9	4.1	20.0
Victory Group	Simpson, Mrs. D. C.	Smithers	0.563	0.52	36.1	0.9	24.5	12.3	5.4	*Nil*	16.1	9.3	15.8
Victory Group	Simpson, Mrs. D. C.	Smithers	0.127	0.20	69.6	0.7	44.7	12.1	2.4	*Nil*	14.8	5.0	7.6
Victory Group	Simpson, Mrs. D. C.	Smithers	0.100	0.33	39.2	0.25	28.3	7.7	5.7	*Nil*	12.0	8.7	23.6
Wold	Wold, C.	Topley	0.096	0.01	5.8	*Nil*	*Nil*	3.7	*Nil*	*Nil*	2.5	8.4	40.2
Zymoetz	Turner, T. M.	Topley	0.027	0.34	1.7	Trace	3.7	21.2	Trace	*Nil*	14.8	8.2	43.3

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VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

2,825-639-9994

PART C

ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1938

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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1939.

BRITISH COLUMBIA DEPARTMENT OF MINES.

VICTORIA, B.C.

Hon. W. J. ASSELSTINE, *Minister.*

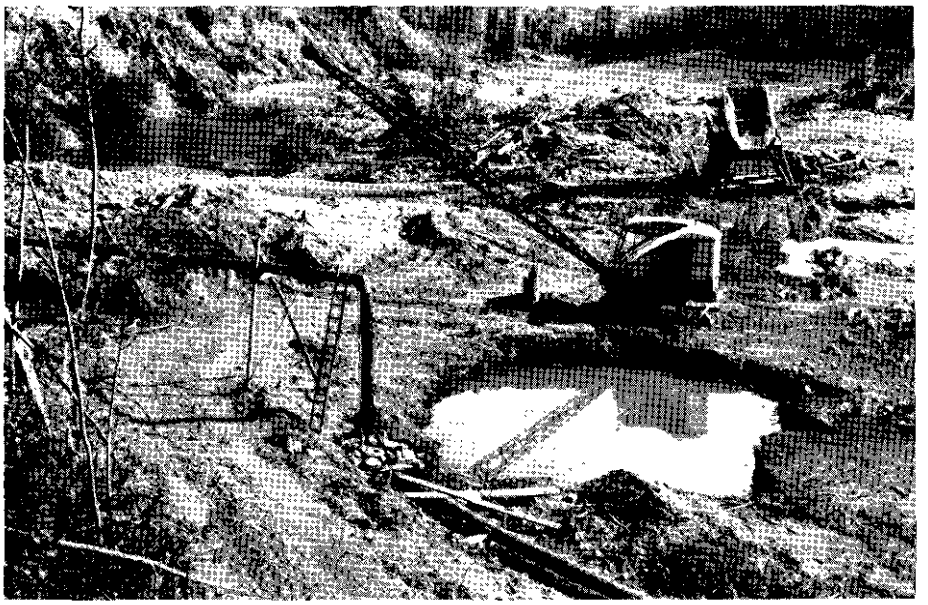
JOHN F. WALKER, *Deputy Minister.*

JAMES DICKSON, *Chief Inspector of Mines.*

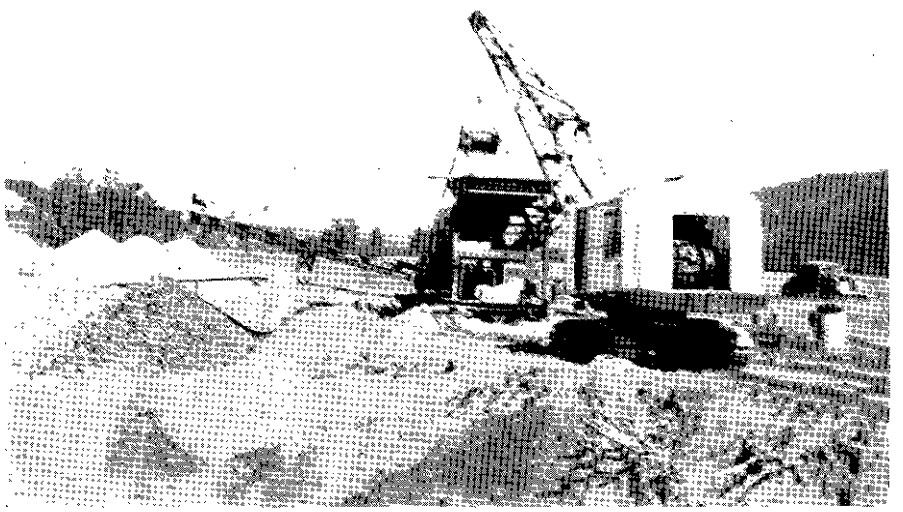
D. E. WHITTAKER, *Provincial Analyst and Assayer.*

P. B. FREELAND, *Chief Mining Engineer.*

R. J. STEENSON, *Chief Gold Commissioner.*



Operation of Venture Exploration Company (East Africa), Ltd. Drag-line set-up at old townsite of Germansen.



Mobile digging and sluicing plant of Canamco, Ltd., in operation on Fraser River, 5 miles above Quesnel.

Operation of Germansen Mines, Ltd. Face of hydraulic pit on Germansen River.

Faulted Tertiary river-gravel on Baker Creek, near Quesnel.

PART C.

NORTH-EASTERN DISTRICT.

BY

DOUGLAS LAY.

SUMMARY.

During the year the chief activity centred on lode- and placer-gold properties. An increase in lode gold resulted from the steady operation of Cariboo Gold Quartz Mining Company, Limited, and Island Mountain Mines, Limited. The former company stepped up its daily milling rate to 275 tons, while the latter maintained its normal milling rate of about 125 tons daily. There was considerable activity in the area extending from Cow Mountain to Round Top Mountain and thence to Yanks Peak. With the provision of transportation facilities into this area greater activity is anticipated.

In the Hixon Creek area the Quesnelle Quartz Mining Company, Limited, installed a 25-ton test-mill for the purpose of sampling their property.

Lode-gold development in the Uslika-Aiken Lake area north-west of Manson Creek is awaiting transportation facilities which were commenced this year with the construction of *about 70 miles of winter road.*

The Cariboo district and Manson section experienced the driest season for very many years. It hampered both large and small placer operations and its effects will be reflected in the output.

This year marks the keenest search to date for dredging and drag-line properties. The interest is evinced almost solely by Californian interests, and there is every likelihood that possibilities in connection with such enterprises will be closely investigated.

A new type of drag-line plant, characterized by mobility, and a digging unit separate from the recovery unit was tried out in the Cariboo this year. This type of plant was evolved in California for use on areas with insufficient yardage to justify dredging and the results of the operation initiated in the Cariboo will be watched with interest.

In the Manson section large-scale hydraulic operations were carried out by Venture Exploration Company (East Africa), Limited, following completion of flume and ditch-line that conveys water from the upper part of the Germansen River to the company's property at the lower part of this river. Germansen Mines, Limited, planning material increase in hydraulic operations, commenced the construction of a large ditch-line—the largest in this district—to convey approximately 200 cubic feet of water per second from the South Fork of the Germansen River to the property. This ditch-line will be not less than 15 feet wide in the bottom, and is being dug by a bulldozer working in conjunction with a power-shovel.

After remaining inactive since 1922, the *Silver Standard* mine at Hazelton was reopened in May by Canadian Cadillac Gold Mines, Limited. Towards the end of the year, after cleaning out existing workings, renovating camp buildings, and repairing roads, the company installed an air-compressing plant.

A new development of interest is a cinnabar property at Pinchi Lake, near Fort St. James, staked by A. J. Ostrem, of Fort St. James. Discovery of this mineral was made by J. G. Gray, of the Geological Survey, Canada. (*See* Paper 38–14, 1938.) This is the first recorded occurrence of this mineral in place in the north-eastern part of the Province.

Considerable activity was manifested by individual operators in the Omineca Mining Division, and a number took advantage of the benefits accruing under the Government's ore-purchasing scheme, and made shipments to the sampling plant at Prince Rupert.

Coal-mining was carried on at the Bulkley Valley Colliery, near Telkwa.

The writer desires to express his cordial thanks for the co-operation and kind hospitality extended by prospectors and mine operators in the course of his duties.

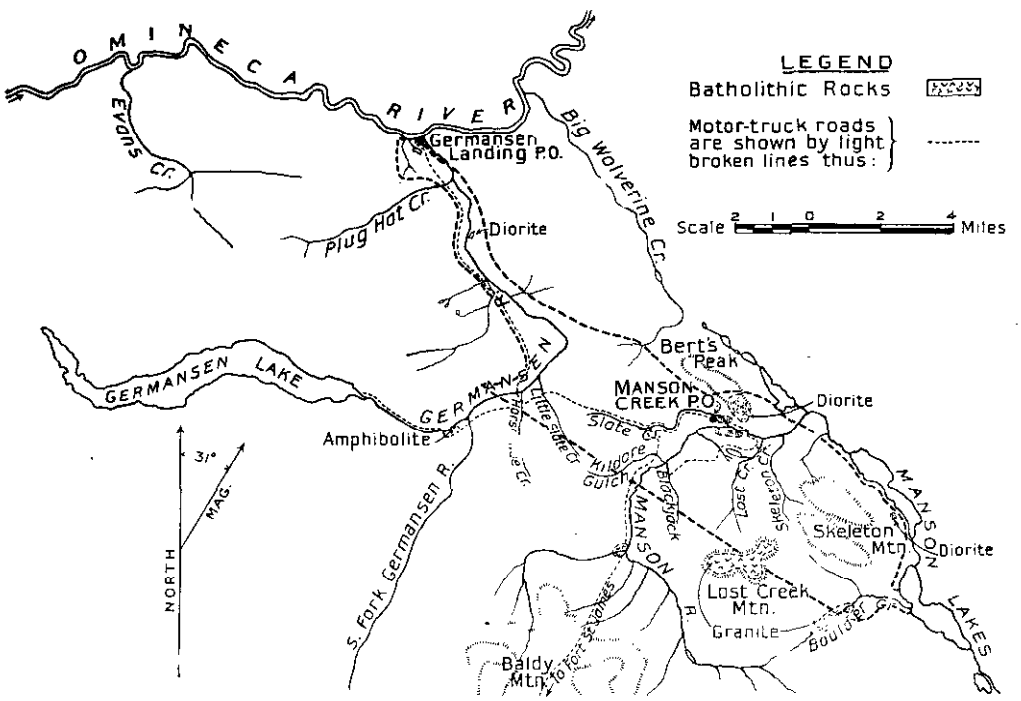
LODE-GOLD DEPOSITS.

MANSON CREEK AREA.

Introduction.

Manson Creek area is defined to include the drainage areas of the Manson and Germansen Rivers. It excludes the Wolverine Range, which borders the area on the east. The area lies in the eastern part of the larger Manson section, a strip of country about 15 miles in width, that lies south of the Omineca River and extends from Takla Lake to the Manson Lakes.

Since the discovery of gold in 1869, mining activity in the Manson Creek area, as in the western part of the Manson section, has centred almost entirely on the placer deposits, to which it is still confined. However, a large number of quartz veins are exposed in the area, and as the placer deposits considered by themselves, although distributed by glaciation, indicate derivation from a local source, an examination of the chief exposures of the quartz veins was made during the year. This included a reconnaissance which throws considerable additional light upon two well-known apparent anomalies in placer occurrence; namely, the fact that important placer deposits are not found either on (*a*) the Manson River above Kildare Gulch, or (*b*) the north-eastward-flowing part of the Germansen River, with one exception.



Manson Creek Area. Heavy broken line bounds area examined in 1938.

The area examined is shown on the accompanying map and includes all the most important placer deposits in Manson Creek area, although placer occurrence is known on Big Wolverine (Jackfish) and Evans Creeks.

The area may be reached by the road now in course of construction between Fort St. James and Slate Creek, a distance of about 120 miles. The road is now passable throughout for motor-trucks and, in dry weather only, for passenger-cars with high clearance. The journey from Fort St. James occupies about twelve hours. At Slate Creek the road joins a local road system passable for cars, whereby all important properties are readily reached.

Alternatively, this area may be reached in about one hour by aeroplane from Fort St. James; good landings are offered by Germansen Lake and by the stretch of quiet water on

the Omineca River at Germansen Landing. Landings are also regularly made on the first Manson Lake, but events have demonstrated that landing on Wolverine Lake cannot advisedly be made.

There are two post-offices, Manson Creek on the right bank of Slate Creek, about half a mile above the mouth, and Germansen Landing on the Omineca River, at the mouth of the Germansen River. At both, there is a weekly mail delivery by aeroplane during the summer months, and at Germansen, the camp of Venture Exploration Company (East Africa), Limited, there is a telegraph-office.

Geological maps of the area, together with an account of the general geology and placer occurrence therein, are found in Geological Survey, Canada, Summary Reports, 1927 and 1933, Part A. A topographical map of the area, Manson River Sheet (East Half), Map 446A, was published this year by the Bureau of Geology and Topography, Department of Mines and Resources, Ottawa. The names of creeks and rivers in this report are those given in maps of the Department of Lands, British Columbia. Names in brackets after these are taken from Map 446A.

The Annual Reports, Minister of Mines, British Columbia, 1933 and 1936, contain a general account of the Manson section and detailed accounts of certain placer deposits on the Germansen and Manson Rivers.

Topography.

The area is mountainous, but the mountains, although reaching elevations of over 5,000 feet, have rounded or flat and rolling summits. Dissection by the contained streams is deep, the maximum relief exceeds 2,000 feet.

The pattern of the drainage system is remarkable. Both the Germansen and Manson Rivers occupy valleys, which form large U-bends, with the closed ends towards and within a few miles of each other. These valleys are connected by two wide valleys, Slate Creek and McCorkell Valleys. A wide master-valley, Big Wolverine Valley (Jackfish Creek Valley), connects the Manson River and Omineca River Valleys. The floor of Big Wolverine Valley (Jackfish Creek Valley) is actually 30 feet below the Manson River at the mouth of Dry Gulch. However, the lakes in it drain into the Manson, owing to the fact that the river falls away rapidly down-stream. The Big Wolverine (Jackfish Creek Valley) and Manson River Valleys form a straight continuous valley for over 20 miles.

The region is covered with heavy timber-growth and dense vegetation, save at the higher summits. Owing to the fact that the rivers and all their tributaries are involved, with all other Arctic-slope drainage, in the master-rejuvenation in progress on the Peace River, an extensive system of post-Glacial gorges and canyons has been incised. They reveal the formation at a number of points, and afford excellent cross-sections of it. Above the gorges the valleys are generally wide.

The area is flanked on the east by the more rugged and lofty Wolverine Range, to which it bears much the same topographic relationship that the Barkerville area does to the Cariboo Mountains.

Glacial Geology.

That an ice-sheet overrode the area is definitely proved by the fact that on the flat granite summit of the mountain at the head of Lost Creek (named "Lost Creek Mountain" on the accompanying map), at 5,300 feet elevation, erratics of black carbonaceous limestone were found. The indicated movement of the ice-sheet is therefore presumably south-eastward as this formation outcrops abundantly to the north-west. In the account of the formation flanking the Wolverine Range north of this point, given in Geological Survey, Canada, Summary Report, 1933, Part A, no mention is made of this black carbonaceous limestone, which, if present there, would indicate a southward movement of the ice-sheet.

The accumulation of ice was great; large volumes of water with correspondingly greater power, must have flowed during the retreats of ice. A striking instance of this is demonstrated on Boulder Creek. The valley of this creek is floored with enormous granite boulders (which, incidentally, are a great impediment in the way of working the good placer-ground on this creek), borne by the valley glacier from the large stock of granite at the upper reaches of the creek. Large pot-holes, several feet in diameter and depth, have been formed in some of the boulders in this assemblage by the post-Glacial water. The immense empty gorges incised on Government Creek, and adjacent to this on the right bank of Manson River

and at other points, also indicate the great carrying power of the post-Glacial streams. With such volumes of water flowing it is evident that any once-existent glacial debris has been partly removed from the lower-lying parts of the area.

Bed-rock Geology.

The area borders the eastern flank of the Eastern batholith, a granitic mass trending north-westward, and extending from the eastern part of the Cariboo district, through Mount Milligan and Baldy Mountain, and the headwaters of the Osilinka, Mesilinka, and Ingenika Rivers, to the Two Brothers Lake region. Close to this area it is deeply unroofed, and outcrops prominently and continuously for many miles south-east of this area to Mount Milligan and north-west across the Omineca River from Duck Creek onwards. In the south-eastern part of the area, that part enclosed by the U-bend of the Manson River, there are three large stocks and other smaller ones. This fact, coupled with the intense hydrothermal rock-alteration and recrystallization, can leave but little doubt that the remaining cover of roof-rocks is thin. The cover, so far as could be determined, probably increases in thickness in the north-western part, in the area drained by the Germansen River.

There is a noteworthy absence of any extensive dyking, but at a number of points definite evidence is afforded that the older rocks of the area are intruded by the batholithic rocks. Apparently intrusion to some considerable extent consisted in injection of magma along planes of schistosity, and recrystallization, accompanied by intense hydrothermal alteration of volcanic rocks.

Within the area examined there are belts of schistose sediments, hydrothermally-altered rocks, volcanic flow-rocks, tuffs, and serpentine. The sediments consist mainly of quartzite, fissile, grey and black carbonaceous limestone, and argillite. This assemblage is considered by the Geological Survey, Canada, to be of Palæozoic age. Much of the so-called "slate" of the area is black carbonaceous limestone that bears a strong superficial resemblance to slate, because of its highly-developed cleavage and colour. These rocks strike from north-west almost to west, and generally dip northward in the south-east part of the area, but on the Germansen River the dip is mainly southward and only occasionally northward. The dip is steep, generally over 60 degrees. Some members of the assemblage have undergone intense hydrothermal alteration and carbonatization and weather to a rusty-red colour. When so altered they may contain quartz and in places show large patches of a green-coloured mineral, chlorite. A number of samples of this green mineral were analysed and found to contain about 0.1 per cent. nickel. Frequently the altered rocks contain numerous quartz gash-veins, some of quite large size. Some of these veins are barren, some are mineralized with pyrite and small amounts of galena and sphalerite, and others mainly with tetrahedrite.

This alteration extends across wide bands, in some cases hundreds of feet in width. The excellent cross-sectional exposures of the formation afforded by the gorges incised by Manson and Germansen Rivers and by Lost Creek well illustrate the striking contrast between these rocks and the adjoining sediments and other rocks.

Some outcrops resemble dolomite, and contain magnesium and calcium carbonates. The igneous origin of the primary rock is, however, indicated by several exposures. On the right bank of the Manson River, near Elmore Gulch, exposures of andesite grade into a recrystallized form, merging finally in the highly-altered rock. On Boulder Creek chlorite schists merge in a highly-altered rock of the same type, in which small granite tongues are plainly visible. At the upper part of Government Creek, a band of serpentinized rock merges in the highly-altered rock.

It is therefore quite possible that some of these highly-altered bands may be in whole or in part sills. Exposures strongly suggestive of sills occur at the following points: On the right bank of Slate Creek, about 2 miles above the mouth, a band about 1,000 feet in width is exposed; in the north-eastward-flowing part of Germansen River; and in one of the hydraulic pits of Germansen Mines, Limited, where a band, only a few feet in width, conforms in strike and dip with the enclosing schistose argillite. At the first-mentioned point, the extensive display of green-coloured mineral is striking. Microscopic examination by the departmental staff indicated that such a rock might be hydrothermal alteration of, or vein-like material traversing, serpentinized ultrabasic rocks.

Many of these highly-altered rocks are medium to coarsely crystalline, and may be described as quartz-carbonate-chlorite rocks. On microscopic examination they are seen to be composed of quartz, ankeritic dolomite, and green chlorite. As previously mentioned, a number of samples of the green mineral were analysed and found to contain small amounts of nickel up to 0.18 per cent., which is suggestive of original identity as serpentine. The green-coloured mineral in these rocks is frequently mistaken for either garnierite or malachite.

Similar rocks on the south side of the Middle River are described and classified as altered intrusive serpentine in Geological Survey, Canada, Paper 38–10, 1938, pages 11 and 19.

Although the rocks described are undoubtedly the result of hydrothermal alteration, it is desired to point out that in Tertiary time, the percolation of ground water in the upper parts of serpentine would yield outcrops closely resembling dolomite. There are small deposits of calcareous magnesite tufa at the present time, on and near outcrops of serpentine, adjacent to the Germansen River. A sample from one of these was analysed and contained: Magnesia, 23.38 per cent.; lime, 18.66 per cent.

The limestone in the area, with the exception of one outcrop, is schistose, thinly bedded, and grey to black in colour. The black limestone is carbonaceous, and superficially simulates slate, in outcrops where cleavage is well developed. This limestone shows no evidence of hydrothermal alteration. The exception, massive limestone, is in a prominent outcrop on the left bank of Slate Creek, about 3 miles above the mouth. This outcrop is white in colour, finely crystalline, and contains a small amount of a green-coloured mineral of pearly lustre. This rock most closely resembles a sediment of all those observed containing the green mineral.

The evidence is, therefore, that these highly-altered rocks are *mostly* of igneous origin, either volcanic or intrusive.

Serpentine frequently occurs within the area; some is mineralized with pyrrhotite containing a small amount of nickel. It quite possibly results from the alteration of an ultrabasic intrusive. Other exposures are possibly alteration phases of ultrabasic flow-rocks. Asbestos is found in serpentine at the head of Elmore Gulch and in the lower canyon of Germansen River. Small deposits of calcareous magnesite tufa occur on the west valley-slope of the Germansen River at Mill Creek, and in the lower canyon

Quartz veins, although most numerous in the volcanic and hydrothermally-altered rocks, also occur in the sediments. They range in width from a few inches up to 16 feet. The largest veins observed are those on Boulder Creek. With few exceptions, the veins are lensy and discontinuous. Some are essentially of gash-vein type, having frozen walls and no regularity of strike or dip. Others strike and dip with the enclosing formation, or abruptly turn across it.

Many quartz veins are barren or nearly so; mineralization is heavy in only a few. The best mineralized veins are those exposed west of Blackjack Gulch, on the north-west slopes of Lost Creek Mountain, on the property formerly named *Black Hawk*.

The character of the mineralization divides the veins into three types: (1) Those mineralized with pyrite, galena, sphalerite, and chalcopyrite, or one or more of these minerals, as all are rarely present in any one exposure; (2) those containing chiefly tetrahedrite or a noticeable amount of this mineral; (3) those containing a pyrrhotite-sphalerite-galena mineralization confined to veins on one property, formerly named the *Black Hawk*.

The distinction between these three types is of fundamental importance, irrespective of the degree of mineralization, because it is only veins of type (2) that are pronouncedly auriferous. The other types were found to contain insignificant amounts of gold. Veins of type (2) were observed only in the highly-altered rocks. It is to be noted, however, that very little work has been done on the quartz veins, except in the case of one property, and at only two has a small amount of underground development been carried out.

The group of rocks, with its contained quartz veins, has undoubtedly a direct bearing on the placer deposits of the area. It supplied the gold for the formation of commercial placer deposits on bed-rock in Tertiary time, and may be correctly described as the " Manson Creek Gold Belt." In fact, the area well illustrates the interdependence of lode-gold and placer occurrence. The evidence of this is obscured, although by no means obliterated by the effects of glaciation.

Although examination during the present year was mostly confined to the area shown on the accompanying map, it is apparent that the width of this belt of rocks is limited in the south-eastern part of the area. On the north-east it is terminated by the Wolverine Range and on the south-west by a batholithic mass, which outcrops on both sides of the Manson River. In the north-western part of the area, between the upper canyon on Germansen River and a point about half a mile above Horseshoe Creek, massive greenstone outcrops on both sides of the river. This rock does not evince the same degree of metamorphism as the rocks of the "Manson Creek Gold Belt," and may be intrusive into them. Intercalated schistose, black carbonaceous limestone, and altered rocks are exposed at the head of the upper canyon of the Germansen River. The altered rocks contain small quartz veins. This assemblage resembles the rocks of the gold-bearing belt.

It is significant that the South Fork of the Germansen River (South Germansen River), contained in a valley of mature relief, apparently does not erode a gold-bearing terrain, as no important placer deposits are reported on it.

Summary.

The important points may be summarized thus:—

(1.) Of the large number of veins sampled, only a few contain appreciable gold values. These veins, with one exception on Slate Creek, occur at two different parts of the Germansen River: about 3,000 feet up-stream from the point at which the river turns sharply to the north-west; and near the head of the lower canyon, about 3½ miles above the mouth of the river. These veins are all of type (2) mentioned previously, that is they contain chiefly tetrahedrite, or a material amount of this mineral. They occur in highly-altered rocks, possibly in sills in the volcanic rocks.

(2.) Although no veins were found to carry commercial values, there seems every justification for close prospecting in the regions where distinctly encouraging values have been found in the mineralization exposed at the points indicated.

(3.) In general, the covering of the underlying batholithic rocks has been deeply eroded in the south-eastern part of the area, and therefore, aside from specific discoveries, the north-western part, where erosion does not appear to have removed such a thickness of cover-rocks, offers greater promise. In the south-eastern part, however, the south-eastern slopes of Skeleton Mountain are worth prospecting.

It is important to note that prospecting is greatly simplified by the fact that the conspicuous rusty-red outcrops reveal the promising host-rock. It merely remains to search such for quartz veins containing tetrahedrite.

(4.) All the placer-bearing streams of the area cut across the belt of schistose rocks, but unless the hydrothermally-altered bands, with their contained quartz veins, are cut, the placer deposits are unimportant. The Manson River above Kildare Gulch does not cut these bands and placer deposits are markedly less rich, whereas down-stream the altered bands are prominently exposed on both banks of the river, and some of the best placer deposits of the area were originally found in that part.

(5.) In the north-eastward-flowing part of the Germansen River, from a point about half a mile above Horseshoe Creek down-stream, the river cuts the gold-bearing formation, from which assays of samples of mineral gave good gold values, and yet, with one exception, the river is devoid of placer deposits. This anomaly is explained by the fact that this part of the river occupies a post-Glacial channel. A former channel, not cut by the river, is definitely indicated as lying buried in the left bank.

Quartz Veins.

A detailed account of the various veins examined is given in the paragraphs that follow. It should be noted that only ten mineral claims are in good standing at the present time in the entire area. No owner was on his property at the time of this examination. Consequently, from available information it is not possible to identify, with certainty, the present ownership of the exposures examined.

In all veins examined samples of *selected mineral* were taken in order that the contrast between the different types of veins might be emphasized. This point is of particular importance. The context shows that some additional samples were taken, where considered advisable, across full vein-widths.

Boulder Creek.

NOTE.—The following account adheres to creek nomenclature given in the Department of Lands map (and in the accompanying map). To avoid confusion, alternative names given in Map 446A are not inserted.

Boulder Creek rises in meadows in the wide pass between Lost Creek Mountain and Skeleton Mountain, and flows south-eastward into the third Manson Lake. Down-stream from the pass the gradient steepens, the valley narrows, and for part of its length the creek is contained in a gorge. Below the gorge the valley widens towards the point of mergence in the Manson River Valley.

About 2 miles above its mouth the creek receives a tributary, the South Fork, which flows north-eastward at the south-eastern base of Lost Creek Mountain. The volume of water in the South Fork is considerably in excess of that in Boulder Creek. Immediately above its junction with Boulder Creek, the South Fork is contained in a deep and narrow gorge, some hundreds of feet in depth, incised in granite. The granite intrudes the chlorite schist at the lower end of the gorge, which continues up-stream for more than half a mile. The granite in the South Fork Gorge is so jointed that it disintegrates in large cube-shaped masses, of which the talus slopes in the gorge are largely composed.

The formation is well exposed on Boulder Creek and consists of chlorite schist, which strikes from north 60 to 80 degrees west, and dips 60 degrees north-eastward. Rarely is the dip towards the south-west. The chlorite schist is intruded by small tongues of granite on the higher reaches of the creek, and shows intense metamorphism and a greater amount of chlorite. Granite also intrudes the formation on the South Fork.

The largest quartz veins observed in the Manson Creek area occur on Boulder Creek. The mineralization is confined to small bands, and is generally sparse, save in one instance. The mineralization is chiefly galena and pyrite, but one or two veins contain a small amount of chalcopyrite. No pronounced gold values were found in the mineral in these veins. All vein-exposures examined are on the banks close to the creek.

About a quarter of a mile down-stream from the junction of the South Fork, on the left bank of the creek, a large quartz vein of maximum width of 10 feet is exposed for a length of 180 feet along its strike. This vein has free walls, and conforms in strike and dip with the enclosing chlorite schist, which at this point strikes north 56 degrees west and dips 60 degrees to the north-east. This vein, the largest continuous exposure of quartz observed in the area, shows little mineral.

On the same side of the creek, 1,500 feet below the junction of the South Fork, a quartz vein 5 feet in width is exposed for a short distance. It strikes north 86 degrees east, dips 65 degrees south, and cuts across the chlorite schist. It contains muscovite but no sulphides.

On the right bank of the creek, about 1¾ miles above its mouth, there is a small rock knoll about 40 feet in height, and whose dimensions at the top are about 75 by 50 feet. Three intersecting quartz veins outcrop on the apex and sides. The largest, 12 feet in width, has a vertical dip, strikes north 69 degrees west, and is exposed at the top of the knoll for a length of 50 feet. It intersects another quartz vein about 5 feet in width that outcrops on the east side of the knoll, strikes north 61 degrees east and dips north-west. This latter vein is intersected by a small quartz vein, 12 to 18 inches in width, also outcropping on the eastern side of the knoll. The two larger veins are oxidized and show no material amount of sulphides. The smallest vein contains a band of galena about 2 inches in width, a sample of which assayed: Gold, trace; silver, 30 oz. per ton; lead, 48 per cent. The walls of these veins are mainly free.

There is a caved open-cut on the left bank of the creek about 700 feet down-stream from the last-mentioned exposure. It is in highly-oxidized rock. Beside the open-cut is a small pile of little pieces of massive pyrite containing galena, somewhat suggestive of replacement mineralization. A sample of this assayed: Gold, trace; silver, 1.4 oz. per ton; copper, *nil;* lead, 3 per cent.

Down-stream 660 feet from the last exposure, on the left bank of the creek, a vein 5.5 feet in width conforming in strike and dip with the enclosing chlorite schist is exposed by natural agencies and one open-cut for 50 feet along its strike. Mineralization consists of pyrite and galena. A sample taken from the open-cut across a width of 2.5 feet assayed: Gold, trace; silver, 4.4 oz. per ton; copper, *nil;* lead, 4 per cent.

About 750 feet down-stream from the last exposure, on the right bank of the creek, on the face of a steep rock-bluff, natural exposures aided by open-cutting and stripping 35 feet above creek-level expose a quartz vein along its dip. The vein is 12 to 16 feet in width, strikes north 43 degrees east, dips 60 degrees south-east, and cuts across the enclosing chlorite schist, which strikes north 80 degrees west and dips 60 degrees north. It is oxidized, has free walls, is exposed along its dip over a vertical range of 40 feet, and is accessible only at the level of the open-cut. Mineralization consists chiefly of galena with some pyrite, and is more abundant in the open-cut. A chip sample taken across 12 feet assayed: Gold, trace; silver, 15.5 oz. per ton; lead, 3.2 per cent. However, in the absence of further investigation this sample cannot be taken as representing the average vein-width.

Adjoining the vein on the hanging-wall side for a distance of 75 feet, there is a succession of closely-spaced lensy quartz veins, which in part follow and in part cut across the planes of schistosity of the enclosing formation. Some of these veins contain small bands 3 inches in width chiefly of galena, but the total amount of mineral present is small. A sample of one of these bands assayed: Gold, 0.04 oz. per ton; silver, 75.6 oz. per ton; lead, 36 per cent. The samples taken indicate that although only low gold values are present, the silver-lead ratio is noteworthy.

Lost Creek.

Lost Creek rises in a large basin on the north slopes of Lost Creek Mountain and flows northward. The basin becomes gorge-like at its lower extremity, and from it the creek emerges to flow across a wide depression trending east and west across the mountain. It then enters a lower gorge, the rims of which rise abruptly from the depression. The lower gorge is roughly 5,800 feet long. It ends abruptly at the instream edge of an extensive rock-bench along the right bank of the Manson River.

The rock exposed in the upper gorge is argillite. In the lower gorge bands of hydrothermally-altered rocks alternate with bands of grey to black fissile limestone and argillite. Some apparently barren lensy quartz veins up to 5 feet in width are exposed at several points. Lensy quartz veins mineralized with a little galena and pyrite outcrop at a point 440 feet up-stream from the mouth of the creek, on the steep west rim of the lower gorge. Three lenticular quartz veins are exposed by a caved open-cut at a point 100 feet above creek-level, on the steep west rim of the gorge. They occur in hydrothermally-altered rocks, strike north 62 degrees west and dip 70 degrees north-east. They range in width from 6 to 30 inches and are sparsely mineralized with galena and pyrite. A sample of selected mineral assayed: Gold, trace; silver, 0.6 oz. per ton. An adjoining open-cut a few feet above this point exposes two veins of irregular strike for a length of 18 feet. They are only a few feet apart, and range in width from 14 to 34 inches. Distant 138 feet in a direction due east, another open-cut exposes a vein with a vertical dip. It ranges from 15 inches to 3 feet in width, and has two small spurs. Small bunches of galena have been found in this vein, and there is a small pile of mineral at the mouth of the open-cut. A sample of mineral assayed: Gold, trace; silver, 10.2; lead, 18 per cent. A few feet above creek-level below these open-cuts, a short adit 20 feet in length, driven by placer-miners, exposes a small quartz vein 4 inches in width. A sample of this assayed: Gold, trace; silver, 0.8 oz. per ton.

A number of quartz lenses are exposed at different points in the schistose sediments on Manson River between Slate Creek and Dry Gulch. Most of them are barren. On the right bank of the river opposite the mouth of Dry Gulch are several oxidized quartz veins which contain a small amount of pyrite. They conform in strike and dip with the enclosing argillite and range in width from 1 to 3½ feet. Samples were taken from two of the best mineralized of these, and assayed: Gold, *nil;* silver, *nil.*

Lost Creek Mountain.

Lost Creek Mountain is one of the highest mountains in the area, the elevation of the flat rolling summit, composed wholly of granite, is 5,300 feet.

A group of claims, formerly named *Black Hawk* group, and formerly owned by Germansen Development Syndicate, Limited, now defunct, is west of Blackjack Gulch, on the north-western slopes of Lost Creek Mountain. The present ownership is not known. It is reached by following the wagon-road from the end of the motor-road at Mosquito Lake to Blackjack Gulch, whence a trail, 1½ miles in length, ascends the 20-degree mountain-slope to a cabin on the property at 4,125 feet elevation.

Near all the mineral showings save one, the mountain slopes at about 10 degrees, but falls away more sharply in the region of the lowest showing. It is covered with light timber-growth and dense vegetation.

A number of quartz veins, ranging in width from 15 inches to 5 feet, occur within a belt 650 feet wide. Six of these strike north-eastward, with steep dips either to the south-east or to the north-west. One vein strikes west of north with a north-east dip. Strike and dip of two other veins are not determinate from the exposure. Another exposure may be of one quartz vein or two lenses *en echelon*. The vein-walls are free, and generally the veins are well-mineralized; in two, the mineralization is heavy. The mineralization consists chiefly of pyrrhotite with smaller amounts of pyrite, galena, and sphalerite. Gold values are insignificant, but the amount of silver associated with this mineralization is unusually high. This type of mineralization was observed nowhere else in the area. The host-rock is massive recrystallized andesite.

The early history of this property is not known to the writer, but the age of the cabin on the ground indicates that it must have been staked many years ago. It was restaked in 1931, and Germansen Development Syndicate, Limited, was incorporated in that year for the development of it and other properties in the Manson Creek area. The company, in 1931, cleared out and extended some of the open-cuts, but let the property lapse. It is believed to have been subsequently restaked, but from the information available the present ownership is not known.

The surface showings all lie between elevations of 4,120 and 4,185 feet. Two veins are exposed naturally, and the remaining exposures are in open-cuts or surface-stripping.

The showings all lie in a south-westerly direction from a short adit which is a convenient reference point and is the only underground working.

The adit, 18 feet in length, is driven at elevation 4,135 feet on a bearing of south 23 degrees west. It follows a well-mineralized quartz vein 18 inches in width, which is exposed at the portal and which dips at a steep angle to the north-east. At the face, other small quartz stringers are exposed, together with the vein which has narrowed to a stringer 3 inches wide. Mineralization in the vein at the portal is locally heavy, and consists chiefly of pyrrhotite and pyrite, with a small amount of sphalerite. A sample of selected pieces of mineral from a small pile at the portal of the adit assayed: Gold, 0.02 oz. per ton; silver, 43.6 oz. per ton; copper, *nil;* lead, *nil;* nickel, *nil.*

A quartz vein 18 inches in width outcrops at 4,155 feet elevation and 18 feet in a direction south 79 degrees west from a point vertically above the face of the adit. It is sparingly mineralized with pyrite and pyrrhotite. Strike and dip are not clear from the small exposure.

Distant 72 feet in a direction south 79 degrees west from a point vertically above the face of the adit, at 4,155 feet elevation, an open-cut 2 feet deep and 6 feet long exposes small bodies of slightly mineralized quartz at each end. They might be two parallel veins, each about 3 feet in width, striking north 11 degrees east, dipping steeply easterly, or quartz lenses occurring *en echelon.*

Distant 15 feet in a direction south 79 degrees west from the last open-cut, at the same elevation, surface-stripping exposes for a distance of 21 feet along its strike a quartz vein striking north 19 degrees west and dipping steeply north-eastward. The exposed width ranges from 3.5 feet to 5 feet, but both walls are not exposed at any point and the average width may be 5 feet. This vein is well mineralized with pyrrhotite, pyrite, galena, and sphalerite. It is considerably oxidized, and the walls are free. A sample across a width of 5 feet at the point of best mineralization assayed: Gold, trace; silver, 40.8 oz. per ton; copper, *nil;* lead, 3 per cent.; zinc, 3 per cent.; nickel, *nil.* Another sample taken across 3.5 feet at a point 8 feet north-west of the last sample, assayed: Gold, trace; silver, 4 oz. per ton; copper, *nil;* lead, *nil.*

Distant 245 feet in a direction south 70 degrees west, an open-cut at 4,180 feet elevation, 40 feet in length and 10 feet deep at the face, is driven on a bearing south 19 degrees west. A few feet from the mouth the open-cut intersects and subsequently follows a well-mineralized quartz vein, strike north 31 degrees east, dip 78 degrees south-east. Where encountered the vein is 3 feet in width but narrows to 19 inches at the face of the open-cut. For 33 feet beyond the face the vein is exposed by surface-stripping. Its average width is 19 inches and it is heavily mineralized, chiefly with massive pyrrhotite. A sample representative of the

most heavily mineralized parts of the vein, taken at different points along its strike, assayed: Gold, trace; silver, 3.4 oz. per ton; copper, *nil;* nickel, *nil.*

Distant 120 feet in a direction south 87 degrees west from the last-described open-cut, at 4,185 feet elevation, a quartz vein 18 inches in width, somewhat oxidized and sparsely mineralized, is exposed for a few feet along its strike by surface-stripping. This vein strikes north 31 degrees east and dips south-east at a steep angle. The south-west continuation of the vein is apparently exposed by two open-cuts, respectively 45 feet and 70 feet from the surface-stripping. Of these open-cuts the former, now much caved, exposes the vein for a distance of 10 feet along its strike, at a point where its width is 4.5 feet. In it the vein is honeycombed, and well mineralized with pyrrhotite and some sphalerite. A sample of selected pieces of the mineral exposed assayed: Gold, *nil;* silver, *nil;* copper, *nil.* This open-cut exposes another vein lying a few feet to the north-west, of similar strike dipping north-west and 15 inches wide. The open-cut at a distance of 70 feet from the surface-stripping is much caved but exposes a south-eastward dipping vein.

A small body of quartz outcrops at 4,120 feet elevation and 228 feet in a direction north 60 degrees west from the surface-stripping last mentioned. The exposure is small but may represent an unmineralized vein about 3.5 feet in width. Strike and dip are not clearly indicated.

Slate Creek.

A property formerly named *Fairview* and formerly owned by T. Rush, of Prince George, the present ownership of which cannot be identified by the writer from available information, is on the left bank of Slate Creek, about a mile above its mouth. The wagon-road leading from Slate Creek through the McCorkell Valley to the Germansen River passes through the property, and the distance from Manson Creek post-office is about three-quarters of a mile.

The property lies on the lightly-timbered, gently-sloping left rim of Slate Creek Valley. The formation exposed at this point is hydrothermally-altered andesite which contains narrow lensy quartz veins. One of them increases in width from 1.5 feet to a maximum of 6 feet and then narrows to 1.5 feet. It outcrops at various points on the gently-sloping valley-rim. It is irregularly mineralized with chalcopyrite, tetrahedrite, azurite, malachite, and a green-coloured mineral, chromiferous chlorite. A similar green mineral is also prevalent in the host-rock. This vein strikes from north 44 degrees west to north 14 degrees west and dips almost vertically. The walls are partly free, partly frozen. The vein is exposed by two trenches running along its strike. One trench is 30 feet in length, 5 feet in width, and a maximum depth of 10 feet. It is on a bearing of north 44 degrees west, and exposes the vein more or less continuously for 30 feet, the maximum width is 1.5 feet. A gap of 15 feet separates the first from the second, the length of which is 89 feet, depth 3 to 10 feet, width 5 feet, and bearing north 14 degrees west. In the central part of the second, the quartz vein swells to a maximum width of 6 feet, which is maintained for only a few feet and then narrows to 1.5 feet. The best mineralization occurs at the wide point, although it is patchy, and the percentage of mineral in the whole vein is small. The trench beyond the wide point of the vein exposes poorly mineralized quartz 1.5 feet wide for a distance of 29 feet. A sample of selected mineral from the best mineralized part of the vein assayed: Gold, 0.28 oz. per ton; silver, 22.3 oz. per ton; copper, 1 per cent. A long trench in a north-easterly direction does not expose the vein.

Although no exposure at this property is commercial, the fact is brought out that it is the veins of type (2) in the altered rocks, and containing tetrahedrite, that carry appreciable gold values in the Manson Creek area. The advisability of further prospecting in this region is indicated.

Germansen River.

Transportation routes in this region are described in detail in the Annual Report, Minister of Mines, British Columbia, 1936.

Appreciable gold values in mineral in quartz veins of type (2) have been found in two parts of the Germansen River.

(*a.*) On both sides of the Germansen, where it makes a sharp local bend, about 3,000 feet from the down-stream end of the north-eastward-flowing part. The river cuts a wide band of hydrothermally-altered rocks containing abundant chlorite. The altered rock at

some points strongly resembles a quartz-feldspar intrusive. On the left bank of the river at this point occurs a ramification of quartz gash-veins of various widths and of irregular strikes and dips. The largest of these veins is 5 feet wide. The veins are only slightly mineralized with tetrahedrite and stained with malachite. Very little work has been done at this outcrop. A sample of selected mineral, taken by the writer from these veins at this point in 1931, assayed: Gold, 0.44 oz. per ton; silver, 47 oz. per ton; copper, 1 per cent. A group was staked at this point, named the *Mother Lode* group, in 1931 by the now defunct Germansen Development Syndicate, Limited.

Several small quartz veins are exposed on the opposite side of the river, about 300 feet down-stream from this point on a claim formerly known as the *Flagstaff*. From one, 15 inches in width, a sample of selected mineral taken by the writer in 1931 assayed: Gold, 0.10 oz. per ton; silver, 18 oz. per ton; copper, 1 per cent. Mineralization is tetrahedrite with malachite staining. A sample of float picked up on the steep bank of the river below these veins assayed: Gold, 0.6 oz. per ton; silver, 38 oz. per ton; copper, 5.1 per cent. Mineralization consisted essentially of tetrahedrite.

(*b.*) In the north-westward-flowing part of the river, near the head of the lower canyon, about 3½ miles above the mouth of the river. Near an intrusion of diorite a wide bank of volcanic rocks shows considerable shearing and local intense serpentinization. A group of claims in this region was examined in 1931, and the report thereon, published in "Lode-gold Deposits of British Columbia," Bulletin No. 1, 1932, is reproduced herein:—

"Three intensely altered and silicified zones, each about 12 feet in width and about 500 feet apart, strike in a north-west and south-east direction and can be discerned on both sides of the river. Within these altered zones are developed quartz veins, which show a mineralization of chalcopyrite, grey copper (tetrahedrite), and malachite, with promising values in gold, although no noteworthy vein-continuity is apparent.

"On the east side of the river, about 100 feet above the river, one of the altered zones mentioned shows a quartz vein 2 feet in width, mineralized with grey copper (tetrahedrite), chalcopyrite, and malachite. A sample across 2 feet assayed: Gold, 0.8 oz. to the ton; silver, 1.6 oz. to the ton; copper, 0.2 per cent. Exposure is by open-cut. The vein strikes north 39 degrees west and dips steeply north-east. A sample of a small pile of ore lying by the open-cut assayed: Gold, 0.32 oz. to the ton; silver, 15.2 oz. to the ton; copper, 0.4 per cent. About 40 feet vertically below the open-cut, a crosscut-adit, 62 feet in length, run on a bearing north 41 degrees east, passes through a quartz vein 5.5 feet in width, which may be the downward continuation of the vein exposed by the open-cut mentioned, but this shows but little mineral and a sample across the full width of the vein assayed traces only of gold, silver, and copper.

"On the east side of the river, and 575 feet above the latter, an adit 15 feet in length preceded by 20 feet of open-cut is run on a bearing north 66 degrees east, crosscutting one of the altered zones previously referred to. This exposure shows a certain amount of quartz with a little chalcopyrite. A sample of a small pile of mineral lying by this working assayed: Gold, 0.30 oz. to the ton; silver, 0.1 oz. to the ton; copper, trace.

"Distant from the above working about 3,000 feet in a north-west direction, and 135 feet below it, an altered zone 11 feet in width shows a width of 5 feet of quartz and brecciated country-rock, but little mineral is in evidence.

"On the opposite side of the river, at a slightly higher elevation, in the same altered zone, an adit has been run a distance of 21 feet in the zone, bending to the right at the face and passing apparently out of the zone. Silicification and alteration of the country-rock is intense in the zone, and a green mineral apparently chlorite is much in evidence, together with a little malachite. A sample from the adit across a width of 2 feet at the most promising-looking place disclosed a trace only of copper, and no gold, silver, or nickel values."

On the left bank of the river, just below the junction of Plug Hat Creek, there is exposed a large quartz vein 10 to 12 feet in width, which appears to conform in strike and dip with the enclosing schistose sediments, although the latter are cut by numerous spurs of the vein. This vein was formerly covered by the *Sunset* group, which has now lapsed. A report thereon, published in "Lode-gold Deposits of British Columbia, Bulletin No. 1, 1932," is reproduced herein:—

"The vein is sparsely mineralized with pyrite, chalcopyrite, and copper-stain. The foot-wall is a carbonaceous schist and an adit just above water-level follows the vein for a distance of 120 feet. For the first 45 feet the bearing is north 82 degrees west, and for the remaining distance the bearing is south 56 degrees west. The adit exposes the foot-wall rock for almost the entire distance, but it is doubtful if the full vein-width is exposed. At the face of the adit the vein appears to be mainly in the back. A sample of selected portion of mineral assayed: Gold, trace; silver, 0.6 oz. to the ton; copper, 1 per cent."

Bearing of this Examination on Placer Occurrence.—The following facts disclosed by this examination have an important bearing on placer occurrence in the area:—

(1.) Certain topographic features on the Germansen River, not previously known, came to light, and are considered to have an important bearing on placer occurrence on this river. They are:—

(*a.*) North of Plug Hat Creek, a large depression, the lower part of which is occupied by Harding Creek and a morainal lake, trends more or less parallel to the Germansen River. The depression merges northward in the flat terrain flanking the Omineca River, but southward becomes pronounced, and about half a mile west of the river, ellipsoidal outcrops of volcanic rock form its west rim. This large depression with its westerly rock rim is considered an important feature and its presence may assist in localizing the down-stream continuation of the intricate buried former channel-system of the Germansen River.

(*b.*) Just up-stream from, and opposite, Mill Creek, at the upper end of the placer-mining lease of Chester Scott, at an elevation of 330 feet above the river, a very definite depression, about 300 feet in width, bounded by high rock-rims, passes entirely outside and east of the present valley of the river, and again joins it at the head of the lower canyon. This is definitely an early channel-segment of the river. Its length is about 1¼ miles, and its original down-stream continuation undoubtedly lay west of the canyon.

(2.) It is desired to amplify reasons previously given for the paucity of important placer deposits on the Manson River above Kildare Gulch and on the north-eastward-flowing part of the Germansen River.

An examination was made of the north-west slopes of Lost Creek Mountain to a point 3 miles above Kildare Gulch. This disclosed that although the formation consists of alternating bands of volcanic rocks and argillite, the former are massive rather than schistose. These volcanics do not exhibit the hydrothermal alteration which characterizes not only the host-rocks containing the quartz veins with mineral of pronounced auriferous content, but which is also the formation eroded where the best placer deposits are found. Further, it was apparent that the region is close to the main batholithic mass.

With reference to the paucity of placer in the north-eastward-flowing part of the Germansen River, down-stream from Horseshoe Creek: This examination disclosed that the formation eroded is of distinct promise for the discovery of auriferous quartz veins. There is every reason to anticipate that in the absence of ice-scour, gold-bearing bed-rock gravels would be found in a Tertiary channel incised in such formation. The paucity of placer deposits is readily explained by the fact that the present channel of the river in this region is definitely not of Tertiary age. Local topographic features indicate that an extensive segment of a former channel lies buried in the left bank of the river. This buried channel may not be older than Pleistocene. The Germansen River in this region now occupies a channel completed in post-Glacial time, although incision may have commenced in the Pleistocene.

(3.) It is desired to draw attention to the significance of the points at which mineral of pronounced gold content occurs in veins, in relation to any buried channel system there existent. This is particularly evident in the north-eastward-flowing part of the river, down-stream from Horseshoe Creek, and in the north-westward-flowing part of the river, near the lower canyon. In the latter case the argument appears to apply with particular force, inasmuch as there is much to suggest that west of the canyon in this region the members of the intricate buried channel system are likely to unite.

PLACER-GOLD DEPOSITS.

HORSEFLY AREA.

Introduction.

Horsefly is reached by a motor-road 31 miles in length, branching from the Cariboo Highway half a mile north of the 153-mile House; the distance from Williams Lake is 45 miles. There is a good system of local motor-roads in the area that gives access to all the more important properties.

The size and undoubted antiquity of the deposits of residual "white channel" gravel, composed largely of quartz pebbles, contained in the several exposures of the buried ancient Horsefly River drainage system, has long aroused much interest. The age of these deposits has been definitely established at points where they are buried under Tertiary volcanic flows.

Some possible connection between the seemingly detached placer deposits of the *Miocene*, *Ward's Horsefly*, and *Hobson's Horsefly* mines, on which all important history of the area centres, was sought at the time these properties were operated about forty years ago. It has since been the subject of discussion, although no major activity has subsequently taken place in this area.

It is apparent that these ancient gravel deposits—similar to the "white channel" gravel of the unglaciated Klondyke—invest this area with more than local interest. Apart from their commercial significance, their antiquity brings up the question of the course of the river in which they were deposited, at points far down-stream from Horsefly. As the direction of flow of the large tributaries of the Fraser River—namely, the Quesnel, Cottonwood, Willow, Bowron, West Road (Blackwater), and Chilako Rivers—is not in accord with that of their present parent stream, a possible reversal of drainage in the Fraser River Valley is suggested. It is therefore a rational hypothesis that in early Tertiary time a river, possibly the Horsefly River, may have flowed northward in or adjacent to the present Fraser River Valley, as a tributary of the antecedent Peace River. It is apparent that the latter is now in active rejuvenation as far as Summit Lake north of Prince George.

During the year, about six weeks was occupied in a general reconnaissance of the Horsefly River, as far as the mouth of its tributary the Mackay River (formerly named the South Fork); and of McKinley Creek, including Elbow, McKee, and Crooked Lakes. The more important placer deposits were examined in detail.

As the result of this examination new and important facts were brought to light, but for reasons made clear subsequently, the buried drainage system is involved. Although its broad outline can readily be perceived, many details cannot be determined in the course of field-work. Many important facts regarding the *Miocene*, *Ward's Horsefly*, and *Hobson's Horsefly* mines are not given in existing accounts of these old operations, and now cannot be obtained. Consequently, certain inferences are supported only by indirect evidence.

Summary.

For clarity, an outline of the Horsefly River drainage pattern is first given, followed by a summary of the inferences conveyed by the more important facts ascertained by field-work. Details follow in the body of the report.

In its broadest aspects, the drainage is by a large river flowing in a region of low relief. It turns unexpectedly, at right angles to its former course, at a point near Horsefly. The turning-point is where the upper end of the large valley of Beaver Creek, the dominating feature of the surrounding topography, virtually merges in the Horsefly River Valley. The inference is that the Tertiary channel of the Horsefly River lies buried in, or closely adjacent to, the Beaver Creek Valley.

Although the facts indicate that this view is substantially correct, they also indicate that the abrupt turn is not due to damming by glacial debris, as might appear at first, but to volcanism in Tertiary time.

It is further apparent that there were two different periods of volcanism. Following each, lava dams caused the river to occupy a local course different from its former channel.

The difficulty of deciphering the buried drainage system is further increased by changes attributable to the Glacial epoch, when temporary channels, differing from those now occupied, were successively followed owing to damming by glacial debris.

Summary of the important conclusions: In Eocene or earlier time, the Horsefly River, down-stream from Woodjam Creek, flowed in a valley which was continuous with that of Beaver Creek. This former valley continuation, between that part of the river-valley above Woodjam Creek and the upper end of Beaver Creek Valley, is now obscured by the Tertiary formation underlying the elevated plateau on the left bank of the river and at the head of Beaver Creek Valley.

Prolonged erosion of gold-bearing terrain in Eocene or earlier time was interrupted by volcanic eruptions that dammed the part of the valley mentioned above, and caused the river to deviate locally from its former channel. This damming is expressed by the Tertiary formation mentioned in the previous paragraph. Lakes were formed, probably by actual damming by erupted lava. A feature of the volcanism was the enormous quantity of volcanic ash that was deposited in the lakes, producing tuff beds of great thickness.

Contorted beds are overlain by flat-lying beds. It is evident that there were two periods of tuff deposition and that contortion of beds followed the first period, whereas no great disturbance followed the second.

As the result of volcanism, the valley down-stream from Woodjam Creek was blocked with lava. Finally the river worked its way round the obstruction, now expressed in the form of an elevated plateau, and presumably rejoined its former course in the Beaver Creek Valley. Evidence now remains of only a part of the deviated course of the river at the time. This is afforded by the *Miocene* and *Senator Campbell* shafts and workings. Proof of continuation of deep ground up-stream in the vicinity is given by the Keystone-drilling carried out by this Department in 1919 and 1920.

After prolonged flow by way of the *Miocene* channel a second period of volcanism was initiated. The river was *again* deflected, presumably by further damming by lava, and followed, it is presumed, down-stream from Horsefly village the channel disclosed by the workings of *Ward's Horsefly* and *Hobson's Horsefly* mines.

It is important to note that both periods of volcanism left *that part of the river above Woodjam Creek* unaffected, in so far as causing any diversion of the river from its valley.

The diagnostic value of the volcanic rocks is all-important, since channels incised wholly in them cannot antedate the volcanism. Thus, such channels as are incised in volcanic ash or tuff beds and disclosed by the old workings must have been formed either during or subsequent to the earlier of the two volcanic periods. If bed-rock is not exposed, correlation must be based upon indirect evidence.

Time intervals were undoubtedly long, as evidenced by the great accumulation of residual " white channel " gravel in the *Miocene* and other channels.

The exposures of " white channel " gravel, marked Nos. 1 to 5 on the accompanying map, occur on the elevated plateau. They are apparently remnants of ancient drainage, by way of Beaver Creek Valley, that doubtless included the large tributary Moffat Creek, which possibly had no existence at the time of the first period of volcanism (in Eocene or earlier time). These exposures at widely-separated points cannot be correlated with any degree of certainty, as bed-rock is not exposed. Indirect evidence, however, suggests the possibility that the exposure at Triplet Lake is a remnant of the river drainage antedating the first period of volcanism and dammed by it. In Gravel Creek Canyon, beds of residual gravel, 2 to 5 feet in thickness, are overlain and underlain by lava of the second period of volcanism. They indicate that a flow by way of Beaver Creek Valley was dammed or interrupted by lava.

Topography.

The Horsefly River rises in rugged country, falls at an average rate of 12 feet per mile, and receives three large tributaries from the south: In down-stream order, the Mackay River (formerly named the South Fork), McKusky Creek (formerly named the Crooked River), and McKinley Creek. It should be noted that the last two are streams of approximately the same size as the Mackay River, and the term " creek " is inappropriate. The ruggedness of the country at the higher reaches of the river, likewise that of the region drained by its tributaries, decreases progressively down-stream. The wide valley in which the river meanders, between McKinley Creek and Woodjam Creek, is one of subdued relief and mature aspect. There are falls in the river just above Harvie Creek, near Sawley Creek, and about 1 mile below Club Creek. At the first point the falls are about 8 feet in height. Near Sawley Creek,

the total drop is 90 feet in a distance of about 275 yards; the fall being in four steps, the highest of which is about 15 feet. Below Club Creek in a distance of about three-quarters of a mile, there is a total drop of about 120 feet; the fall is in three steps of which the highest is about 65 feet. The length of the rocky gorge below the falls is about 500 yards.

Near these falls the topography clearly indicates that an older channel of the river lies buried instream, probably in the right bank and at great depth. McKusky Creek occupies a mature valley and enters the Horsefly a foot or so below its level, with the result that the water backs up in McKusky Creek for some distance. The valley of McKusky Creek is more mature than that of Mackay River and it is suggested that McKusky Creek at one time was the headwaters of the Horsefly River. Both McKusky Creek and the Horsefly flow on valley-fills and it is evident that originally McKusky Creek entered the Horsefly River Valley at a lower level.

Two depressions, shallow and wide, at respective elevations of about 750 and 250 feet above the river, occur in the north rim of the valley and extend east and west from Black Creek. Both trend parallel to the river for some miles. The former is clearly incised in rock; both rims are traceable for some miles. The latter is separated by knolls from the Horsefly River Valley, but these knolls may be of unconsolidated materials. These features indicate the presence of earlier river-channels the ages of which are quite indeterminate from facts now known. The higher *may* be quite old, and continuance of the present operations on Black Creek will likely yield important information concerning it in the immediate future.

A key feature of the topography is the abrupt closing-in of the wide valley, immediately below the junction with Woodjam Creek. At that point the river flows to the north of its former course, and enters what is locally known as the "canyon." In this region the river is quite shallow, only a few feet in depth, and the valley is incised in intercalated beds of volcanic tuff and lava. For a distance of about 4 miles this formation is exposed at intervals in the bed of the river, and bluffs of it up to 100 feet in height extend along the banks. South of the river there is an elevated plateau between 250 and 350 feet above the river. Below the "canyon" the valley again widens. Immediately up-stream from Horsefly the river meanders through an accumulation of glacial debris in the central part of the valley, flanked by glacial banks up to 60 feet high. When only little more than a mile from the upper end of the large Beaver Creek Valley, the river turns at right angles to its former course. Beaver Creek Valley is a master-valley trending north-westerly from this point for a distance of 40 miles to Beavermouth. Beyond, the Quesnel River Valley is continuous with it for another 20 miles. After making the turn, the Horsefly River flows almost due north into Quesnel Lake. It traverses a region of low relief, save for one discordant feature, seen immediately up-stream from *Hobson's Horsefly* mine, 5½ miles below Horsefly. There the river passes through a rock-walled gorge incised in tuff beds, the left bank rises quite sharply from the river to a height of from 125 to 175 feet. Ratdam Creek is contained in a hanging-valley, and cascades over falls 60 feet in height, which are situated at the end of a deep embayment in the river-valley 600 feet in length. The falls are incised in tightly-cemented gravel, and presumably expose the up-stream continuation of *Hobson's Horsefly* channel.

About three-quarters of a mile east of Horsefly, a depression trends north-easterly parallel to the river and finally north-westerly, emerging again in the Horsefly River Valley at the junction with the Little Horsefly River. About three-quarters of a mile east of this depression, and separated from it by a rock knoll, there is another approximately parallel depression, which at Arms Lake bends north-westerly, and to the north-west merges in the other depression. These may be Pleistocene channels of the Horsefly River.

Bed-rock Geology.

The Horsefly area in the lower reaches of the river is one of very low relief and is occupied by a number of ranches. Except for these clearings, the lower elevations are generally well covered with vegetation and timber-growth which obscure rock-outcrops. The formation is exposed mainly at higher elevations.

The formation eroded by the river and its large tributaries in its upper reaches consists of a north-westerly-striking belt of schistose rocks, chiefly sediments, including slate, argillite, and quartzite. These contain numerous quartz veins in the area drained by the large tributaries and are bordered on the west by a band of schistose greenstone. Adjoining these

rocks, down-stream between Club Creek and Woodjam Creek, the formation is seen to consist of an assemblage of flow-rocks, chiefly andesitic. They do not exhibit the same degree of metamorphism as the schists and may be of Mesozoic age. The region lies directly along the trend of the Central batholith which, however, is not continuously exposed in this region. Igneous tongues intrude the volcanic rocks at several points. The formation changes with the abrupt change in the topography at Woodjam Creek. Down-stream from Woodjam Creek for 6 miles below Horsefly the formation, where exposed, consists almost entirely of tuff or flow-rocks of Tertiary age. In subsequent paragraphs, details are given of the Tertiary formation exposed in this region. It is considered that upon the correct interpretation of the topographic change, and of the adjacent exposures of Tertiary formation, rests in large measure the solution of the complicated Tertiary drainage system of the section.

Slate and quartzite outcrop on the summit and high southern slopes of Big Slide Mountain. Schistose argillite and quartzite are exposed on the right bank of the river almost continuously between Harvie and Sawley Creeks. Slate is exposed above the mouth of McKusky Creek, and schistose greenstone below. An extensive area in this region is underlain by sediments. The contact between schistose greenstone and slate occurs just west of McKee Lake, and was followed in the course of reconnaissance for some miles to the northwest. East of the contact, sediments outcrop at several points between McKee and Crooked Lakes. The formation along the Mackay River (South Fork) area is thus described in the Annual Report, Minister of Mines, British Columbia, 1938, page 139, ". . . a well-defined belt of old sedimentary rocks, for the most part black slates and schists with occasionally argillaceous limestone. These strike in a general north 50 degrees west direction. On the western boundary of the sedimentary rocks, granite-mica gneissic rocks are found occurring interbedded as sills in the slates. A large pyroxenite dyke was noted on the eastern end of the belt of sedimentaries, near the head of Fraser Creek. Throughout the slates on all the three creeks examined in detail (Fraser, Slide, and Eureka) occur many quartz veins. These quartz veins for the most part are only a few inches to a few feet in width, averaging possibly up to 3 or 4 feet, and occasionally being as wide as 60 feet. They strike north 60 to 70 degrees west, or approximately with the bedding-planes of the slate country-rock, and dip about 30 to 50 degrees to the west. Several samples . . . were taken, but in all cases the samples upon assay returned *nil* for both gold and silver."

Auriferous quartz is known to occur in the vicinity of McKee Lake and is described on page C 32 of the Annual Report, Minister of Mines, British Columbia, 1934, under *Timber Line*. At the head of the falls on Sawley Creek, two small slightly-mineralized quartz veins 5 and 8 inches wide respectively are exposed in schistose argillite on the right bank of the river. Assays returned insignificant values.

It appears that the quartz veins are largely confined to the sediments, none are known to occur in the belt of volcanic rocks bordering the sediments on the west. However, they may be obscured by glacial debris, or if once existent, may have been entirely removed by erosion. The rocks between Club Creek and Patenaude Creek, are intruded at several points by tongues of igneous rock. At the upper end of the falls near Club Creek andesite is intruded by pyroxenite, also near this point by a small acid tongue. At the base of the falls a porphyritic granitic tongue intrudes andesite and is mineralized with slightly auriferous pyrrhotite. At 4,000 feet elevation, about a mile east of the East Fork of Black Creek, a large pyritized quartz-feldspar dyke is exposed, a sample of which assayed a trace of gold.

For a distance of about 4 miles below Woodjam Creek the river in a number of places flows over beds of white or cream-coloured Tertiary tuff. Outcrops are prominent on the banks of the river and range from a few feet to 100 feet in height. The tuff contains intercalations of lava. It is overlain by post-Glacial gravel or glacial debris; the total overlie of unconsolidated material usually ranges from 3 to 6 feet in thickness.

About 1¾ miles down-stream from Woodjam Creek intercalated lava and tuff beds are exposed on the left bank of the river. Beds of basalt exposed at river-level are overlain by tuff beds 30 feet in thickness striking north 37 degrees east, and dipping 60 degrees southeast. The latter are overlain by basalt 6 feet in thickness, which is overlain by tuff beds capped by 2 feet of gravel and soil.

About a quarter of a mile down-stream from the last exposure tuff beds are exposed on the left bank for a length of 250 feet and a height of 100 feet above the river. The lower

beds, 60 feet in thickness, are intensely folded and overlain by flat-lying beds. The latter are capped by only 1 foot of unconsolidated gravel and soil.

On the right bank of the river, opposite the mouth of Deerhorn Creek, tuff beds are exposed continuously for a length of approximately 400 feet. The bank ranges in height from 25 to 35 feet. These beds are horizontal, and are overlain by 3 to 6 feet of poorly-sorted post-Glacial gravel and glacial debris. Other smaller outcrops of tuff beds occur in this vicinity on both sides of the river.

Between Deerhorn Creek and Horsefly the formation near the river is obscured by glacial debris and vegetation.

At *Ward's Horsefly* mine, there is a small outcrop of rock identified by microscopic examination as sandstone.

On the opposite side of the river, at the point shown on the accompanying map, a dove-coloured, fine-grained diorite is exposed. This rock also forms the bed-rock at Campbell and Boswell's hydraulic pit.

In the vicinity of *Hobson's Horsefly* mine, a canyon, 300 yards in length, is incised in white-coloured tuff beds striking north-easterly and dipping 25 degrees south-easterly. Below this canyon, on both sides of the river, are outcrops, 5 to 10 feet high, of red andesite porphyry. A small island in the river at this point is composed wholly of it. Tuff beds form the eastern rim-rock at *Hobson's Horsefly* mine and apparently directly overlie the andesite porphyry. In the hydraulic pit some exposures suggest that the tuff beds and lava may be intercalated, but it is not possible to determine this point, owing to sloughing since hydraulic operations were suspended. At some points the tuff beds are undeformed and contain fossils, at others they are contorted.

About half a mile down-stream from *Hobson's Horsefly* mine, an old adit, now caved and inaccessible, is stated to have been driven several hundred feet from a point 35 feet above the river, on its left bank. Examination of the dump at the portal of the adit shows that tuff beds were encountered.

The elevated plateau lying immediately south of the Horsefly River and west of Woodjam Creek (on which occur the exposures of residual gravel marked Nos. 1 to 5 on the accompanying map) is largely covered with vegetation and glacial overburden. This obscures rock-outcrops save locally. Between Triplet and Starlike Lakes there is one small bluff of basalt. On Moffat Creek the residual gravel (exposure No. 3) underlies the lava, which is immediately overlain by glacial debris. There are two falls on this creek about 1¼ miles apart. The upper falls are incised in basalt, and the lower falls and gorge below in red andesite porphyry and breccia. On Gravel Creek beds of residual gravel (exposure No. 5), 2 to 5 feet in thickness, are both underlain and overlain by basaltic lava. China Cabin Creek, immediately below China Cabin Lake, has incised a deep gorge in red-coloured porphyritic andesite lava. A similar lava outcrops prominently on the west shore of China Cabin Lake, adjacent to exposure No. 5 of residual gravel, and immediately underlies a large part of the bench on the leases of R. N. and A. B. Campbell at the head of Beaver Creek Valley.

The creeks cascade over falls down the northern and western slopes of this plateau. The creek canyons are of post-Glacial age. No tuff beds were observed on this plateau west of Woodjam Creek.

Steeply-inclined beds of Tertiary tuff are exposed on a large knoll on the right bank of Woodjam Creek on Pre-emption Lot 9577. On a north-westerly-flowing tributary of Woodjam Creek, and on Woodjam Ridge at 3,960 feet elevation, are exposed fossiliferous tuff beds containing many plant remains and one small seam of lignite. Another lignite seam, 2 feet thick, outcrops at 4,000 feet elevation. Tuffs are exposed in the valley of this creek more or less continuously through a vertical range of 400 feet. The beds are horizontal or nearly so. At one point lava occurs in the tuff. Immediately west of this creek the summits of some of the higher-lying knolls are composed of tuff, the elevation of the highest examined being 4,470 feet, or 1,720 feet above the river at the mouth of Woodjam Creek. The south side of the river was not examined up-stream from the points mentioned. No outcrops of Tertiary lava or tuff were observed on the north side of the river up-stream from Woodjam Creek. Tertiary lava is, however, known to cap high peaks at the head of Frasergold (formerly named Fraser) Creek.

The tuff described in the foregoing paragraphs is prevailingly light-coloured, white, grey, light green, or dove-colour, occasionally it is darker. It is fissile, thinly-bedded, and composed of fine ejectamenta; occasional beds contain coarse particles up to half an inch in size. Locally it is fossiliferous and contains beds of lignite. Large pieces of petrified wood were found in the talus slope at the base of one exposure, and presumably they came from the tuff beds. Microscopic examination discloses that the tuffs are composed of semi-angular to rounded quartz grains, fragments of partly devitrified volcanic glass, and a few grains of altered feldspar. The evidence indicates that these tuffs were formed from ejectamenta deposited in relatively still water.

Fossils obtained from the tuff beds were forwarded to the Bureau of Geology and Topography, Department of Mines and Resources, Ottawa, and Dr. W. A. Bell reports as follows:—

"Lot 2929B: From Woodjam Creek; contains *Taxodium occidentale* Newberry and *Myrica diforme?* (Sternberg) Chaney.

"Lot B: From Woodjam Creek; contains *Taxodium occidentale* Newberry.

"Lot A: From *Hobson's Horsefly* Mine has *Alnus sp.* The species may be compared with *Alnus kefersteinii* (Goeppert) Berry from Chu Chua district although the leaf is considerably larger.

"Lot 2983B: From Horsefly River, 5 miles down-stream from Horsefly; contains *Taxodium dubium* (Sternberg) and a leaf of the same species of *Alnus* as present in Lot B.

"Whilst the flora is meagrely represented by these lots there is little doubt that the age is not earlier than Upper Eocene or later than Lower Miocene. I am inclined to favour an Oligocene age, although Berry could doubtless consider the age as Upper Eocene or at most not later than lower Oligocene. I would say also that the beds of Woodjam Creek are about the same age as those from Horsefly River."

A fossil fish was also sent in for determination but was considered too fragmentary for positive identification. However, Cope has described two species—namely, *Amyzon brevipinni* and *A. commune*—from the Horsefly River and this fish is possibly one or the other.

It is apparent that up-stream from Woodjam Creek the terrain eroded by this river in Tertiary time was capable of supplying gold for the formation of deposits of placer on bed-rock. It is also a fact of interest that channels incised in tuff, such as *Hobson's Horsefly* mine, wherein no resorting is evident, contain bed-rock values, indicating the distant up-stream source of the gold. The quartz vein terrain was doubtless the source of the residual quartz pebbles contained in the several large exposures of "white channel" gravel.

Glacial Geology.

The mantle of glacial debris now remaining in the valley at elevations only a few hundred feet above the river does not appear to be thick. Round-topped knolls at elevations as high as 4,500 feet were found to be covered with only a few glacial erratics. The evidence suggests that the accumulation of ice during the Pleistocene period must have been very thick, and that it probably covered the very rugged high terrain at the headwaters of the river and its tributaries. Enormous volumes of water must have flowed down the valley during retreats of ice. Evidently in the final retreat of ice the river succeeded in clearing its valley to a large extent of glacial debris, which is now apparently thickest in the immediate vicinity of Horsefly.

In consequence of the removal of glacial debris, finally effected by post-Glacial water, there is now revealed in the valley for some miles above Woodjam Creek a picture similar to that which must have existed at the time of the lacustrine conditions in the Tertiary. In this part of the very wide valley there are, even now, several small lakes, and it can readily be understood that a dam at any point would cause the formation of extensive sheets of water within the valley.

Glacial striæ were found west of Black Creek, at an elevation of 650 feet above the river. They indicate a westward movement of ice within the valley.

Tertiary-drainage History.

The Tertiary rocks of this area are of fundamental importance. Upon them hinges the correct interpretation of the Tertiary-drainage history. A review is therefore given of

information published by the Geological Survey, Canada, concerning the two periods of volcanism, separated by one of sedimentation, exemplified more especially in the Fraser River Valley. It is considered that similar periods are found in the Horsefly River Valley.

In the Fraser River Valley the two periods of volcanism are represented by the Lower Lavas and the Upper Volcanics, and the intervening period of sedimentation by the Fraser River formation.

The Lower Lavas were assigned by Dawson to the Miocene, and were divided by him " into two portions separated by a period of sedimentation during which certain fine-grained tuffaceous beds were deposited." These Lower Lavas, with details of a section with intercalated tuffs including white volcanic ash, are described by Reinecke on pages 11 and 12 of Memoir 118, Geological Survey, Canada, 1920. Reinecke also described the Upper Volcanics on pages 17 and 18, and the intervening Fraser River formation on pages 13–17 of the same publication.

Cockfield has, however, shown that the age of the Fraser River formation is late Eocene, and that of the Lower Lavas, Eocene or earlier (Summary Report, 1931, Part A 1, Geological Survey, Canada, page 59), and also confirms Reinecke in assigning the Upper Volcanics to the Miocene (Summary Report, 1932, Part A 1, Geological Survey, Canada, page 85).

The Upper Volcanics consist mainly of fresh-looking, flat-lying, or gently-inclined olivine basalt that is black in colour. They occur either in topographically high positions, capping valley-rims, as for example in the Fraser River Valley and on Moffat and Gravel Creeks; or as valley-fill, for example in the lower part of the Beaver Creek Valley, described by Cockfield and Walker in Geological Survey, Canada, Summary Report, 1932, Part A 1, page 84. No white tuff has been found in the Upper Volcanics.

The Lower Lavas, considered in the aggregate, are less basic and are more disturbed than the Upper Volcanics. They also evince a greater degree of metamorphism. It is considered that the assemblage of purple or reddish-coloured volcanic rocks exposed at the lower falls on Moffat Creek and in the gorge below these falls, at China Cabin Creek Gorge, on the leases of A. B. and R. N. Campbell, at the upper end of Beaver Creek Valley, in and adjacent to the Horsefly River at *Hobson's Horsefly* mine, and in the hydraulic pits at this property can be correlated with the Lower Lavas. At the last point some of the lava appears to be intercalated with tuff beds, but owing to the highly-disintegrated condition of the exposures it cannot be exactly determined. Some of the above-mentioned exposures are much altered andesite, some are tuffaceous, some porphyritic with phenocrysts of plagioclase feldspar, and some are breccias. A large amount of reddish-brown hematite is present in all, and at some points they contain native copper. The intercalated lava-flows in tuff beds belong to the Lower Lavas.

The sharp distinction between the eruption of the Lower Lavas and sedimentation may not be found in the Horsefly area to the same extent as it is in the Fraser River Valley, but the evidence is strong that the river was involved in both periods of volcanism. No exposures of the Upper Volcanics were observed capping tuff beds. In the Horsefly area exposures indicate that eruption of the Lower Lavas at first alternated with tuff deposition. Later, there was a long period of tuff deposition when lava eruption practically ceased. The whole period, represented in this area by eruption of the Lower Lavas and deposition of all tuff beds, is thought to correspond with the Lower Lavas and the Fraser River formation in the Fraser River Valley. The topographic and geographic position of exposures is significant. For example: The low topographic position of the Lower Lavas at the head of Beaver Creek Valley indicates that they blocked the valley; the Upper Volcanics on Gravel Creek, with intercalated exposures of residual gravel, indicates blocking of this valley at a *down-stream* point at a later period.

From the foregoing it is evident that exposures of *bed-rock* are fundamental to determination of the *age* of the channel system. Thus, the *bed-rock* of a channel interrupted by the first period of volcanism must have been incised in formation older than the Lower Lavas. In the absence of exposure of *bed-rock*, age-determination can only rest on indirect evidence, taken in conjunction with the nature of the contained gravel.

In this connection reference is invited to the description given in this volume of a river-channel, under " Property of R. Blair." The exposure is of a river-channel incised in rocks of Carboniferous age. The gravel contains lava beds correlated with the Lower Lavas. The suggestion is that the river was dammed by lava at the time of eruption of the Lower Lavas.

History.

All important history centres on the three old properties, the *Miocene, Ward's Horsefly,* and *Hobson's Horsefly* mine, as they have for the sake of brevity long been termed. Their full names are, respectively, the Miocene Gravel Mining Company of Cariboo, Limited; Horsefly Gold Mining Company, Limited; and Horsefly Hydraulic Mining Company, Limited. At all these properties operations were terminated between the years 1899 and 1902, and subsequently no major activity has developed in the area.

A small amount of Keystone-drilling was done about 1902 on Moffat Creek by R. T. Ward, and in 1911 in the area contiguous to *Ward's Horsefly* mine by an eastern syndicate. At the latter property a short-lived renewal of activity by the International Dredging and Exploration Company took place in 1918, in which year B. R. MacKay, of the Geological Survey of Canada, made an examination of the area, an account of which is given in Summary Report, 1918, Part B, Geological Survey, Canada, pages 54 and 55. In 1919 and 1920 a campaign of Keystone-drilling, in the vicinity of *Ward's Horsefly* mine, was carried out by this Department, full information of which is given in the Annual Reports, Minister of Mines, British Columbia, 1919 and 1920. This disclosed rich ground only in one hole, but hole No. 1 located the up-stream continuation of the *Miocene* channel.

In subsequent years activity was largely confined to individuals, chiefly R. N. Campbell, G. Kuchan, A. N. Walker, and others, whose efforts have afforded valuable information at several different points. In 1930, following some preliminary shaft sinking, G. Kuchan, J. Mikklesen, and associates carried out some deep Keystone-drilling at the exposure of residual gravel at Triplet Lake. This work is stated to have found encouraging gold values extending to considerable depth. In 1934 R. W. Tarp installed a suction-dredge on the river below *Hobson's Horsefly* mine and subsequently a drag-line at the same point. These operations, however, were not of long duration.

This year, interest in the area was revived by the operations of Sig Johnson and associates on Black Creek (subsequently described in detail), which disclosed important facts bearing on dredging possibilities.

Detailed accounts of the early operations at the *Miocene, Ward's Horsefly,* and *Hobson's Horsefly* mines will be found in the Annual Reports, Minister of Mines, British Columbia, for 1902, 1918, and 1920. It is unfortunate, however, that certain important information concerning these properties is lacking and cannot now be obtained owing to inaccessibility of workings. In only one case, apparently, has a map of the workings been preserved. Comment herein given concerning these properties is based upon particulars of workings given in the reports cited, together with such other information as could be secured from first-hand observation. Details considered to be unimportant are omitted.

Miocene Mine.

It is important to note that the workings of this property consist of *two* deep shafts, not one, as is generally supposed. These are known as the *Miocene* and the *Senator Campbell* shafts. (The latter, named after the late Senator R. H. Campbell, manager of the company concerned, should not be confused with other shafts marked *Campbell* shafts on maps of *Ward's Horsefly* mine in early reports.) Both these shafts are situated in the village of Horsefly, the former at the western end and the latter 1,500 feet to the north-west. They are at approximately the same elevation, as shown on the accompanying map, and are on an extensive bench on the left bank and about 25 feet above the Horsefly River.

Both shafts explore the deep *Miocene* channel, whose eastward continuation up-stream is plainly indicated by Keystone-drill hole No. 1 put down by this Department in 1919. The westward or down-stream continuation of the channel is not known from direct evidence, but is inferred, from evidence cited later in this report, as having been by way of Beaver Creek Valley.

The *Senator Campbell* shaft was sunk in 1897, and in the Annual Report, Minister of Mines, British Columbia, 1902, is thus described: " The shaft was sunk vertically for about 275 feet, when it struck bed-rock, which was found to be still pitching deeper. This shaft was continued 50 feet deeper into bed-rock, at which point, 325 feet below the surface, a drift 150 feet long was set off to and into the gravel, but the bed-rock was still found dipping to the west. From the bottom of the shaft an incline, 200 feet long and gaining 125 feet in depth, was put down in the country-rock, and another drift was run to the gravel, which was

found in a distance of 60 feet, but with bed-rock still dipping away at an angle of 30 degrees. At this point, 450 feet from the surface, very fair prospects are said to have been obtained from the gravel, but no further work was done here, and the shaft was abandoned."

The *Miocene* shaft was sunk vertically in 1899 to a depth of 490 feet, bottoming on rim-rock sloping at 15 degrees. It was deepened in rim-rock to a total depth of 555 feet, at which point a crosscut, 500 feet long, was driven in the direction of and under the channel. From this crosscut raises 20 and 15 feet high reached the channel at points 400 feet and 500 feet respectively from the shaft. When the second raise holed through to the channel, "there was a rush of water and gravel, which drove the men out, but they managed to bulkhead the crosscut."

Unfortunately this operation was abandoned immediately after this untoward occurrence, when slight additional expense possibly would have given access to bed-rock, on which the chief concentration of gold values was logically to be expected. "In sinking this shaft the gravel was found to be capped with about 100 feet of blue clay, and nearly 400 feet of gravel was passed through containing gold but not in paying quantities. The gravel is free and very uniform in size, being composed almost entirely of smooth, worn, white quartz pebbles. As seen on the dump, the gravel from this shaft is particularly noticeable, first for its light colour, occasioned by the absence from the quartz of all pebbles of slate or basaltic rock, and secondly for its remarkably uniform size, while the individual pebbles are rounded and not flattened. In all these points it varies materially from the wash as seen at Ward's Horsefly hydraulic or at Hobson's Horsefly." (Annual Report, Minister of Mines, British Columbia, 1902.)

Unfortunately no maps of these shafts are available, and reports do not state the bearings of the various underground workings. This information would have thrown additional light on the direction of the channel and of the character of the bed-rock. At the time of the present examination, samples were obtained by digging in the dumps at the collars of both shafts. Microscopic examination of these revealed that the formation encountered in the workings from both shafts were undoubtedly either volcanic ash or tuff. As these dumps have been exposed to the weather for forty years, it was not possible to differentiate between the two rocks.

The down-stream course of the *Miocene* channel is indicated as having been by way of the Beaver Creek Valley, because the exposures in Gravel Creek Canyon demonstrate that a stream-flow was dammed at that point by lava of the *second* period of volcanism. Although the exposure cannot be positively identified as that of this channel, and might be that of its tributary Moffat Creek, the view is supported that a flow by way of Beaver Creek Valley, following the first period of volcanism, was finally arrested and diverted by the second period of volcanism. Presumably it was the second volcanic eruption that locally diverted the river from its former path.

There is insufficient evidence to determine if upon abandonment of the *Miocene* channel, the river flowed by way of Ratdam Lake before following the *Ward's Horsefly-Hobson's Horsefly* channel. There is residual gravel on the north shore of Ratdam Lake that may indicate such was the case. This point can only be determined by additional field-work.

Up-stream from the *Senator Campbell* shaft, the Department's Keystone-drill hole No. 1, topographic features, together with consideration of the conditions then obtaining, indicate that the course of the channel approximately coincided with the edges of the plateau that lies west of the river down-stream from Woodjam Creek. Down-stream from Woodjam Creek, therefore, the channel presumably lies deeply buried, somewhat north-east of the present river, although approximately parallel with it. Up-stream from Woodjam Creek the channel must lie within the present valley.

There seems no reason why gold should not be found in the bed-rock gravel of this channel. However, it should be borne in mind that creeks, not rivers, are the agencies whereby bonanza concentrations of placer gold are laid down on bed-rock. Nevertheless, it is known that there are gold values in the bed-rock gravel in *Hobson's Horsefly* mine. In the *Miocene* channel better bed-rock values than the latter might justifiably be expected, as the gravel represents more prolonged erosion of the same terrain. Access cannot now be gained to any workings of this mine, consequently particulars given here are taken from the Annual Report, Minister of Mines, British Columbia, 1902.

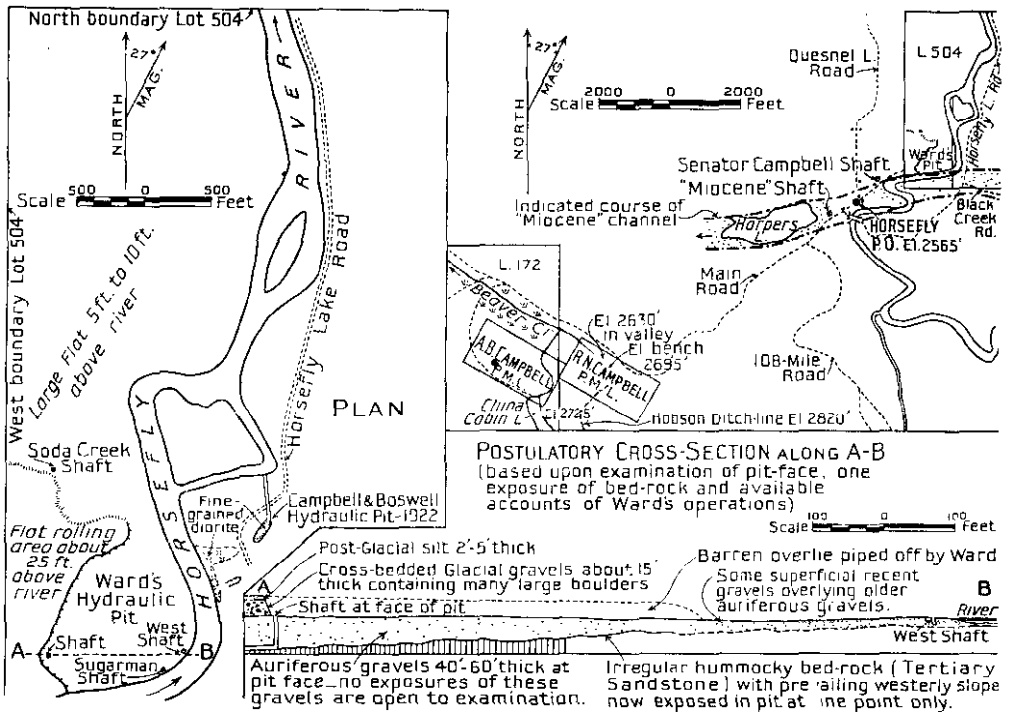
Ward's Horsefly Mine.

This operation is on Pre-emption Lot 504, a ranch owned by A. F. Dogherty, on the left bank of the Horsefly River, immediately down-stream from the village of Horsefly. Placer-mining Leases Nos. 2884 and 2923, standing in the names of A. Carfrae and C. R. Carfrae, of Horsefly, now cover the site of the earlier hydraulic operations.

The property is readily accessible and is reached from Horsefly by a motor-road a few hundred yards in length.

The region embraces a low-lying area of considerable extent on the left bank of the river. In this section the river has been deflected considerably east of its original course by deposition of tailings.

The river is flanked by an extensive bench only 5 to 10 feet above it and a smaller one about 25 feet above. The area is covered partly with grass, partly with brush, and partly with a few stands of light timber. *Ward's Horsefly* hydraulic pit is at the up-stream end of this ground.



Ward's Horsefly Mine and neighbouring properties.

Much information concerning the exact nature of the material encountered and removed by Ward's operations is now lacking, and accounts are somewhat conflicting in certain important details. Consequently the views expressed herein are subject to limitations, although in part they are supported by first-hand observation.

The placer occurrence is apparently part of a largely buried river-channel incised in sandstone. The sandstone, although irregular to some extent, dips westward and away from the river at an angle ranging from 10 to 30 degrees. The upper part of this buried deposit has been resorted and enriched due either to passage of inter-Glacial waters over it or to the fact that the channel crossed the *Miocene* channel. It is inferred that originally the exposures gave a cross-sectional view of part of a buried channel of great indicated width. The channel trended northward, and only part of the eastern rim with its overlying gravels was revealed. Similarity of the cross-section of such channel to that exposed at *Hobson's Horsefly* mine, 5 miles down-stream, is evident.

Originally, rich bed-rock gravel was, according to reports, discovered in the bed of the river at " Harper's Bar," the barren glacial material having been entirely removed by the

river. The prevailing westerly slope of the rim-rock, and an increasing thickness of barren overlie, defeated first the efforts of the earliest miners, and later those of R. T. Ward, to follow the pay-gravel for more than a short distance instream and westerly. It is to be noted, however, that all early and late investigation was directed on the assumption that the rich gravel encountered in this region originated from an earlier and resorted westerly-flowing channel. No investigation, save the *Soda Creek* shaft (mentioned subsequently), was directed towards ascertaining if this gravel continued northward.

Ward's operations consisted of hydraulicking, followed by elevation of gravel by hydraulic elevator to the sluice-flume. These operations are stated to have resulted in the recovery of gold to the value of $500,000. In 1911 an Eastern syndicate Keystone-drilled the area contiguous to this ground. This was followed by the installation of a drag-line by the International Dredging and Exploration Company in 1916. The operation apparently involved the reworking of tailings from the previous work. Keystone-drilling was undertaken by the Department in 1919 and 1920, a full account of which will be found in the Annual Report, Minister of Mines, British Columbia, 1920. This disclosed important values in only one hole, No. 4c, at the edge of the river on the left bank. Attracted by the values in hole 4c, different individual operators made two unsuccessful attempts to sink shafts in its immediate vicinity. These shafts are known as the "West" and "Sugarman" shafts. In 1936, interest in the region was revived by the fact that A. N. Walker and associates, under agreement with the leaseholders, unwatered the old *Soda Creek* shaft on Placer-mining Lease No. 2923. It is stated that in the sixties this shaft was sunk to a depth of 75 feet. A. N. Walker reports that on reopening the shaft values of several dollars per cubic yard were encountered at some points. Operations were discontinued, after a considerable amount of drifting was done, because of the expense of working under adverse conditions. Unfortunately this shaft was under water and could not be examined.

The face of Ward's hydraulic pit indicates that a thickness of from 15 to 20 feet of barren overburden must have been piped off before pay-gravel could be elevated to the sluice. It is further evident that immediately down-stream from Ward's hydraulic pit this overburden has been largely removed by post-Glacial water. The collar of the *Soda Creek* shaft is at the southern extremity of the low-lying part of the area.

An examination of the face of Ward's hydraulic pit shows, at the top, a thickness of from 2 to 5 feet of silt; underlying this is about 15 feet of cross-bedded gravel containing numerous large boulders; and below is now visible only the top of the resorted auriferous gravel, known locally as "blue gravel." The "blue gravel" was mined by Ward and the early miners. It rests on bed-rock and it is stated gradually increases in thickness away from the river until it reaches a maximum of 40 to 60 feet at the pit-face. Microscopic examination of a specimen from the one exposure of bed-rock now remaining in the pit shows it to be a fine-grained, iron-stained sandstone composed predominantly of semi-angular to rounded quartz grains. The bedding could not be seen in the small exposure.

The uppermost layer of silt exposed at the face of Ward's pit is undoubtedly of post-Glacial age, and the underlying cross-bedded gravel with large boulders is Glacial. The underlying resorted gravel, the auriferous "blue gravel," is considered possibly to be of inter-Glacial age. The post-Glacial silt betokens sluggish movement of the waters at the time. When the down-stream obstruction was removed, rapid cutting resulted in the more or less complete removal of the underlying glacial materials down to the top of the inter-Glacial gravel; e.g., down-stream, near the *Soda Creek* shaft.

Available accounts, although somewhat conflicting, indicate that the auriferous gravel was richest in its upper part, and that this was more pronounced at instream points, although values were also encountered immediately overlying the bed-rock. This may indicate resorting of the upper gravel of this channel by inter-Glacial water, or enrichment may be due to the intersection of the *Miocene* channel.

It is notable that the lowest point of the gently-sloping bed-rock of this channel is far *below* river-level, and that the centre of the channel must be lower still, whereas it is probable that the bed-rock of *Hobson's Horsefly* is above river-level. Early accounts of Ward's operations emphasize the similarity between its gravel and those of *Hobson's Horsefly* mine. The bed-rock at *Hobson's Horsefly* mine is higher than at *Ward's Horsefly* and this would suggest a southward flow; however, the evidence available indicates that the flow of the

drainage system was northward. Therefore the higher bed-rock at *Hobson's Horsefly* mine suggests it is a different channel or that, if the same, warping or faulting has elevated it.

Ratdam Creek cascades over falls in the cemented gravel of *Hobson's Horsefly* channel 60 feet in height, indicating rejuvenation of the drainage system *after* deposition of gravel. The rich gravel of *Ward's Horsefly* mine presumably resulted from a resorting of upper gravel strata of this channel in one or other of the two ways mentioned; *Hobson's Horsefly* channel was not so affected.

It seems reasonable to assume that gold values in the *Miocene* channel would be mainly confined to gravel immediately overlying bed-rock, and therefore below the reach of the resorting influence of the water of *Ward's Horsefly* channel. If such were the case, resorting must be attributed to inter-Glacial water.

It is desired to emphasize the fact that opinions expressed concerning *Ward's Horsefly* mine, and its possible relationship to *Hobson's Horsefly* mine, can only be regarded as tentative, because important criteria have now been entirely obliterated. For example, it is not *now* evident, from exposures, that the picture originally presented at *Ward's Horsefly* mine was that of part of a large channel resting on bed-rock sloping gently west (away from the river), although it is not, of course, suggested that such was not originally evident. On the other hand, it is now evident from exposures in Campbell and Boswell's hydraulic pit that on the right bank of the river, almost directly opposite, part of a large channel with bed-rock sloping gently eastward is exposed. The possible relationship of this to the *Hobson's Horsefly* channel is a matter for consideration and is discussed in the paragraphs immediately following.

Operations of R. N. Campbell and W. J. Boswell.—In connection with the foregoing discussion regarding *Ward's Horsefly* mine, the results obtained on the opposite side of the river by R. N. Campbell and W. J. Boswell are informative.

Following Keystone-drilling by this Department in 1920, that indicated comparatively shallow ground immediately north of the deep *Miocene* channel, R. N. Campbell and W. J. Boswell, deriving a water-supply from a small lake, opened up a hydraulic pit on the right bank of the river and about 385 feet distant from it. The pit is about 35 feet above river-level and is shown on the accompanying map. The pit exposes 6 feet of mainly glacial material, overlain by 2 feet of river-silt, and underlain by 2 feet of coarser semi-residual gravel which rests on bed-rock. The bed-rock gravel in part presumably originated from the *Miocene* channel.

The rock is water-worn and slopes at a gentle angle away from the river towards a high bank of glacial gravel flanking the river. This slope of the rim defeated the efforts of Campbell and Boswell to follow the pay-gravel eastward and instream. It is reported that fair values were encountered. The rim-rock at this point is fine-grained diorite. Precisely similar rock outcrops at several points, in a distance of about 300 feet, on the right bank of the river, south-west of the hydraulic pit.

Near by, to the north and south of this point, are older workings, adits, and shafts, now caved, that indicate early miners did considerable prospecting in this region.

Exposures are of a cross-section of part of a large channel whose bed-rock slopes gently eastward away from the river. The significance of this channel is a matter of interest. The gravel resting on bed-rock is overlain by glacial materials and must, therefore, be of inter-Glacial or pre-Glacial age. There is no evidence, in the form of a secondary placer deposit, between Campbell and Boswell's workings and *Hobson's Horsefly* mine to indicate that the up-stream continuation of *Hobson's Horsefly* channel is cut by the Horsefly River. Apart from this, there is nothing known to the writer incompatible with the suggestion that the Campbell and Boswell channel *might*, like *Ward's Horsefly* channel, be the up-stream continuation of the *Hobson's Horsefly* channel.

The bed-rock of the Campbell and Boswell channel presumably slopes instream under the high knoll about three-quarters of a mile wide at its base that separates the river from the more westerly of the two well-defined depressions trending more or less parallel to the river, and previously mentioned in paragraphs relating to topography. These two depressions are separated by a rock knoll near Arms Lake. Whether the more westerly of these has any relationship to the Campbell and Boswell channel is a matter of conjecture.

In the historical summary given on page 32 of "Placer-Mining in British Columbia," Bulletin No. 2, 1930, it is recorded that in 1859 the early miners found "Horsefly Creek (now named Little Horsefly River) leading to Horsefly Lake, and discovered on this creek the richest placers found up to that time in the basin of the Quesnel." No remaining evidence of this discovery is known to the writer, but it appears that the Little Horsefly River cut through an old channel.

In the absence, however, of any definite evidence that the Horsefly River itself cut the up-stream continuation of the *Hobson's Horsefly* channel between *Hobson's Horsefly* mine and *Ward's Horsefly* mine, it seems more likely that the channels exposed at these two properties are parts of the same channel than that the Campbell and Boswell channel is related to the *Hobson's Horsefly*. At the same time, the latter possibility can not be overlooked, although the supporting evidence now obtainable is meagre. It is to be noted, however, that this alternative correlation does not affect the main outline of the drainage history of the Horsefly River.

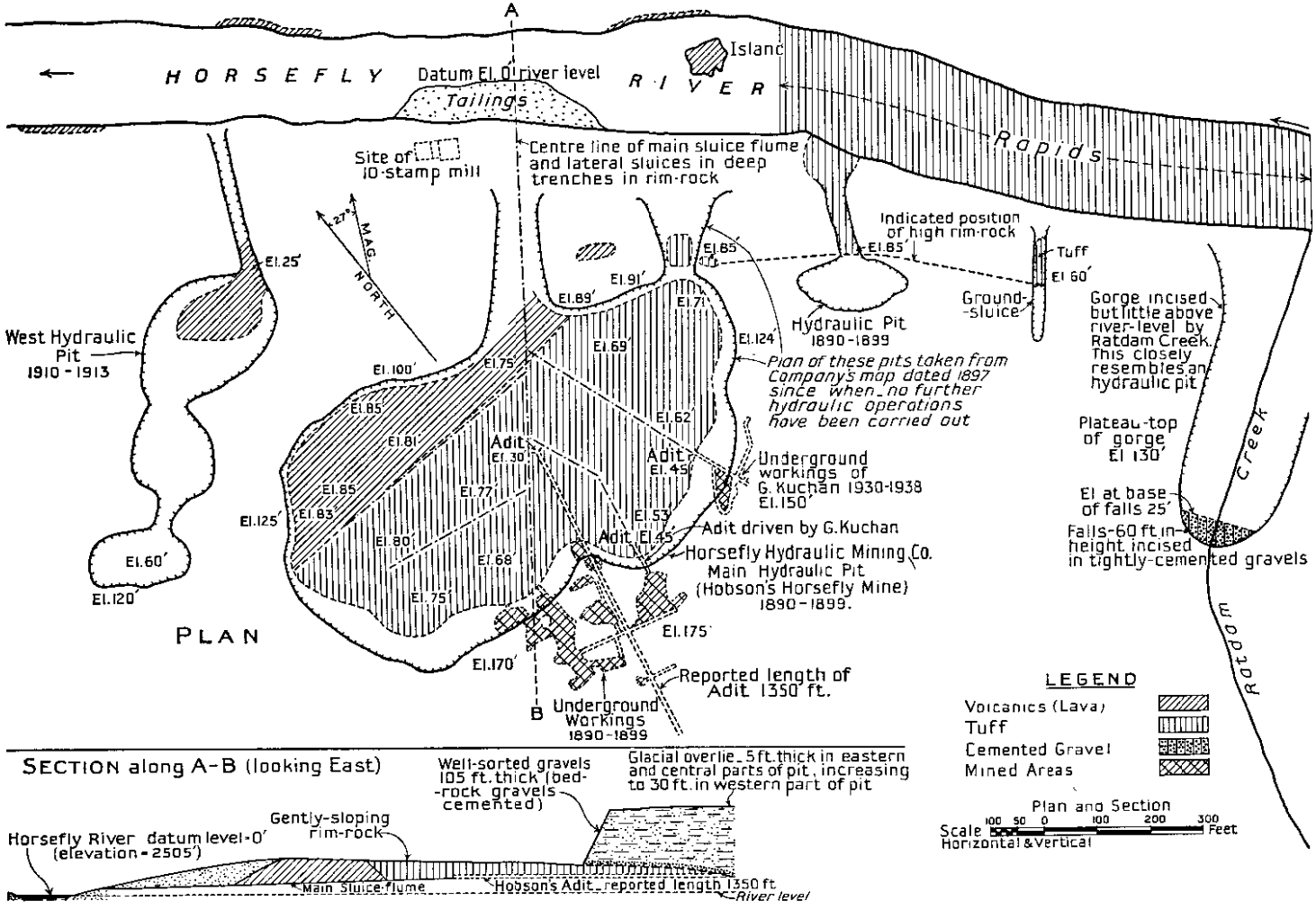
Hobson's Horsefly Mine. This property was originally operated by the Horsefly Hydraulic Mining Company, Limited, of which the late J. B. Hobson was manager. The ground is now covered by leases held by G. Kuchan and associates. It is situated on the left bank of the river about 5½ miles down-stream from Horsefly, and is reached by a motor-road from Horsefly.

The topography offers a sharp contrast to that at other near-by points along the river. The left bank of the river rises quite sharply from the water's edge to a height of between 150 and 175 feet. The opposite bank does not exceed 50 feet in height and rises much less sharply save in the canyon mentioned below. Immediately above the property the river flows through a canyon about 300 yards in length, incised in tuff beds that strike north-eastward and dip south-eastward at 25 degrees. Below the canyon for some hundreds of feet the river flows over a red-coloured porphyritic volcanic rock which also forms a small island in the middle of the river. It is also exposed on both banks of the river below the canyon. Near the head of the canyon Ratdam Creek enters the river in a deep embayment, extending instream but little above river-level for a distance of 650 feet. At this point the creek cascades over falls of a total height of 60 feet. The creek is incised in tightly-cemented gravel, evidently the up-stream continuation of the gravel deposit exposed down-stream on this property.

The placer deposit is a buried river-channel, incised in tuff, lying immediately adjacent to the Horsefly River but separated from it by a high rim composed mainly of tuff and volcanic flow-rock. The hydraulicking operations in the main pit expose the channel at a point where its down-stream continuation diverges to the north-west (away from the river). Up-stream the rim can be traced to within a short distance of Ratdam Creek, as shown on the map accompanying this report. Above Ratdam Creek the subdued relief of the region and absence of informative exposures make it difficult to trace the channel up-stream. Had the channel been intersected by the river between that point and *Ward's Horsefly* mine, it is probable that there would be evidence of it in the form of a gold concentration in the bed of the river and gravel deposits on the banks. The inference is, therefore, that the channel continues up-stream just west of the present river, and the available evidence indicates that it is possibly the down-stream continuation of the channel exposed at *Ward's Horsefly* mine.

The excellent exposure of this channel in the main hydraulic pit reveals for several hundred feet the eastern rim sloping at an angle of only a few degrees. A maximum thickness of somewhat over 100 feet of fine well-sorted gravel rests on the bed-rock. It is composed almost entirely of pebbles of the same formation as is cut by the Horsefly River above Woodjam Creek. The proportion of quartz pebbles amounts to about 15 per cent. (by volume) of the whole. There are very few boulders and no large ones. The gravel is overlain by boulder-clay and glacial material 5 to 35 feet in thickness. A noticeable amount of lignitized driftwood is present in the gravel strata. The bed-rock gravel and that immediately above it is tightly cemented. Petrified wood, cemented within gravel lying on rim-rock, has been formed by circulating carbonate solutions.

The first attempt at operation was by hydraulicking. It was defeated by the cemented gravel and lack of dump for tailings. Finally, the cemented gravel was drifted and milled in a stamp-mill. An adit was run from the hydraulic pit, at a point 30 feet above the river,



Hobson's Horsefly Mine (now owned by G. Kuchan).

for a total distance of 1,350 feet. Early accounts of this property state that at 550 feet from the portal, " The surface of the bed-rock was down to the track-level of the tunnel, but it soon rose again." It therefore appears likely that the bed-rock of the channel at this point is possibly somewhat above, and certainly not far below, the level of the river. The cross-sectional dimensions of the channel are such that very slow cutting is indicated, further shown by the nature of the gravel, which may be termed " semi-residual." These features, differing fundamentally from those of Pleistocene channels, suggest that it is of pre-Glacial age.

As previously mentioned, the evidence in this vicinity indicates that a block was uplifted and tilted south-east as demonstrated by the attitude of the tuff. In the Annual Report, Minister of Mines, British Columbia, 1897, it is reported that the gravel shows evidence of disturbance subsequent to its deposition. This is no longer apparent. For these reasons it is considered a Tertiary channel, but younger than the *Miocene* channel, and that its up-stream continuation is possibly the channel exposed at *Ward's Horsefly* mine. The difference in bed-rock levels at the two properties is attributed either to faulting or warping. Down-stream from *Hobson's Horsefly* mine, although the course of the channel is purely conjectural, it seems most likely that it continued north-westward before finally rejoining Beaver Creek Valley.

Up-stream from *Ward's Horsefly* mine the course of this channel, although supported by indirect evidence only, probably coincided with that of the *Miocene* channel, but at a higher level.

The gold values in the gravel are largely confined to the few feet immediately overlying bed-rock; they also occur in the bed-rock itself. The values are clearly shown by the particulars given in the Annual Report, Minister of Mines, British Columbia, 1902, in which it is stated that " in the progress of opening up the mine as a drifting proposition, some 9,900 tons of gravel, soft bed-rock, etc., mined in the various drifts were put through the stamp-mill and produced $14,564.21, or about $1.46 per ton." It will be noted that the value is the *recovered* value, the price of gold then was $20.67 per ounce.

The present owner of this ground, since acquisition some years ago, has mined a considerable yardage of rim-rock gravel immediately adjacent to the face of the hydraulic pit. These workings are shown on the accompanying map. He states that values in the area mined are about $3 per cubic yard, at the present price of gold.

That this channel bends north-westward near the main hydraulic pit is proved not only by appearances at the north end of the pit, but also by another hydraulic pit, the *West* pit, opened up from the river immediately down-stream, by E. J. West and associates in the years 1909 to 1913. Although there has been much sloughing in this pit it exposes gravel of a totally different character, resting on reddish andesitic rim-rock. This gravel is overlain by much glacial material, and therefore presumably was deposited by an inter-Glacial stream. Remnants of similar gravel are to be found on small rock-benches at points up-stream. The benches are cut in the rim-rock, dividing the *Hobson's Horsefly* channel from that of the present river.

" The total amount of material mined by E. J. West is said to have been 390,000 cubic yards, of which 40,000 cubic yards was gravel which yielded 25 cents to the yard, the remainder being clay, etc., which ran less than 2 cents to the yard." (Annual Report, Minister of Mines, British Columbia, 1913, page 62.)

Many years ago the belief existed that what may be termed the continuation of the " West Channel," described above, lay buried instream and west of the river at down-stream points. An adit, known as the " Thompson tunnel," was driven about 35 feet above the river at a point about half a mile down-stream. This adit, which has now caved, is stated to have been driven for a considerable distance and then abandoned. Examination of the dump at the portal reveals that tuff beds were encountered.

Opposite, and for a considerable distance down-stream from *Hobson's Horsefly* mine, G. Kuchan reports that good gold values are found in the bed of the river. It is reasonable to assume, in the first place, that such would be the case, as the river almost certainly cut across gravel lying on high parts of the east rim of *Hobson's Horsefly* channel, and effected a reconcentration of gravel contained in the inter-Glacial " West Channel." Furthermore, there has undoubtedly been a considerable deposition of fine gold resulting from disintegra-

tion of cemented gravel, the tailings from the hydraulic operations at *Hobson's Horsefly* mine. Whenever the stage of water permits, the owner of this ground reports satisfactory results by shovelling the gravel, within reach at the edge of the river, into a sluice-flume supplied with water from a near-by source.

In this region of reconcentration, although there are glacial banks on the right bank, the left bank is low and the valley wide, so that opportunities for wing-damming are good. Some drilling done at this point two years ago is reported to have yielded encouraging results, and the region merits investigation.

In this part of the river, R. W. Tarp installed a suction-dredge in 1934, and subsequently a drag-line, but these operations were only of short duration.

Leases of R. N. and A. B. Campbell.

Two placer-mining leases at the extreme head of Beaver Creek Valley, owned by R. N. and A. B. Campbell, of Horsefly, are under option to A. N. Walker and associates, of Horsefly. The property is on the south slope of Beaver Creek Valley, immediately east of China Cabin Creek, which flows from China Cabin Lake, elevation 2,725 feet, into Beaver Creek Valley. (" China Cabin " is an old cabin, now an historic landmark, situated at the junction of the Beaver Valley road with the main road.) The main road from Williams Lake to Horsefly passes through the property, which is distant about 1¾ miles from Horsefly. A short branch road, about 300 yards in length, leads from the main road to the workings on the south side of the valley.

The chief topographic feature is a bench at an elevation of 2,695 feet, between 300 and 400 feet in width, narrowing at one point to about 70 feet, and about 2,000 feet in length. It lies about 65 feet above the floor of the Beaver Creek Valley and trends in a general direction north 73 degrees west, approximately parallel to the valley and on its south side. The bench is lightly-timbered and slopes down to the valley at an angle of about 14 degrees. The ground rises rather more sharply at the back of the bench to the plateau-level about 125 feet above it (elevation 2,820 feet), on which the old Hobson ditch-line is situated. This ditch-line was constructed over forty years ago to carry water from Moffat Creek to *Hobson's Horsefly* mine.

The bench is mainly covered with vegetation, but the formation is exposed at several points: above the bench on Hobson's ditch-line; on the slope at the back of the bench in the central and south-eastern parts; at the eastern and central part of the bench; on the slopes below the bench; and is well exposed in the gorge incised by China Cabin Creek immediately below China Cabin Lake. Exposures are of reddish-coloured andesitic porphyry and breccia.

The placer deposit is a post-Glacial concentration in gravel overlying boulder-clay, save at some points, where it immediately overlies the volcanics.

After discovering the ground in 1936 R. N. Campbell, the discoverer, and his associates carried out a large amount of preliminary testing by ground-sluicing. A supply of water for this purpose was conveyed from China Cabin Lake by a flume and ditch-line built along the slope about 20 feet above the bench.

In 1937 these leases were optioned by O. T. McShane, who devoted the entire season to testing the gravel systematically by sinking about thirty-five shafts and separately washing the entire yardage from each shaft. The object was to ascertain the average values down to the boulder-clay or bed-rock. All shafts were stopped after boulder-clay was reached. The greatest depth of any shaft was 18.5 feet, most were considerably less. The shafts were sunk at about 100-foot intervals on cross-sectional lines from 300 to 350 feet apart.

This year an option was secured by local interests—A. N. Walker and associates—who took advantage of the old Hobson ditch-line, a happy feature of this property, inasmuch as Moffat Creek affords a large supply of water. The ditch-line was repaired, hydraulic plant installed, and operations commenced. By the end of September upwards of 5,000 cubic yards had been hydraulicked from a pit in the central part of the leases.

The auriferous material overlying the boulder-clay or bed-rock consists of poorly-sorted fine and coarse gravel containing quartz pebbles and boulders. The minimum depth of the overlying auriferous material is about 2 or 3 feet. The maximum depth is not known, but the shafts proved a thickness exceeding 18 feet in the western part of the ground. Average values are not known to the writer, but it is stated that from 162 cubic yards of gravel taken from one of the preliminary pits 6 oz. of gold was recovered. The gold, although fine, is stated to be easily recovered in a sluice-flume.

As the bench is 65 feet above the floor of Beaver Creek Valley there is dump for hydraulicking, unless the top of the boulder-clay is found to be unduly low at certain points in the western part of the bench.

There must have been a large, temporary flow of water down Beaver Creek Valley during the melting of the ice, and post-Glacial gold concentrations on this property were formed by it. It is also stated that values meriting investigation exist at various points in the gravel on the north slope of Beaver Creek Valley.

Black Creek.

Black Creek has engaged attention at different times, not so much because of the superficial placer deposits found in the bed of the creek, but because these deposits apparently resulted from a large buried channel that crosses the creek at right angles. The underlying presence of this channel is indicated by a pronounced but shallow depression whose surface lies about 750 feet above the Horsefly River. This channel is described in greater detail in the subsequent text.

The creek cuts across another wide depression which can be traced eastward and westward for some miles. It lies about 250 feet above the Horsefly River and appears to represent a former channel of it. It is separated from the Horsefly River Valley by knolls covered with gravel and is entirely floored with unconsolidated material. No investigation of it has yet been made so far as is known. There is no evidence that it is incised in rock or that it is of pre-Glacial age. It might possibly be of Pleistocene or later age, and might have been of brief duration, representing a flow of the river diverted from its course by the accumulation of glacial debris that must have formerly occupied its valley.

These channels, however, invest this region with interest because they invite further investigation to determine if dredging possibilities are presented.

Leases of Sig Johnson and Associates.

Five leases held by G. Armes, M. Armes, A. Armes, H. Armes, and G. Hockley are under option to Sig Johnson and associates, of Horsefly. The leases are on Black Creek, about 1 mile above its mouth. They cover a length of 1 mile and a total distance of 1½ miles east and west of the creek. The property is reached by a motor-road about 1 mile in length. It branches from the Horsefly-Black Creek road, at a point close to the end of the latter. The total distance from Horsefly is about 19½ miles.

Black Creek flows due south and drains the steep south slope of Black Mountain. Near the leases it cuts across a pronounced wide but shallow depression. The depression is about 750 feet above the Horsefly River, occupied by small muskegs, trending east and west across the creek. The creek then enters a short rock-walled canyon, from which it emerges to enter another canyon after flowing for a short distance in a valley in which no formation is exposed. The lower canyon, an outstanding topographic feature, is V-shaped, save in its upper part, and incised to a maximum depth of 175 feet. At the end of the lower canyon, before joining the Horsefly River, the creek flows across another wide depression occupied by extensive meadows, at an elevation of about 250 feet above the river. This depression is separated from the valley of the Horsefly River by gravel-covered knolls. It lies outside the above-mentioned leases.

The region is well covered with second-growth poplar and spruce, and underbrush. There are only occasional stands of good timber, as a bush fire swept through this area some years ago.

Where exposed the formation consists of andesite. There are three types of placer occurrence at this property: (*a*) A buried river-channel, presumably a former channel of the Horsefly River; (*b*) a buried creek-channel, trending south-eastward, apparently cut by Black Creek between the canyons; (*c*) placer deposits lying in the bed of the creek, and resulting from the reconcentration by Black Creek of either of the two first-mentioned.

(*a.*) The buried river-channel is indicated as underlying the wide, shallow depression mentioned. It is evidently a former channel of the Horsefly River, and was traced during the present examination westward as far as Patenaude (Marten) Lake and eastward to the Horsefly River Valley, a total distance of about 7 miles. It could possibly be traced farther westward, but time for doing so did not permit. Its eastward continuation, if such exists, beyond the Horsefly River Valley is not clear owing to the gap in the terrain due to erosion

by the river. Where cut by Black Creek, the depth from the surface to bed-rock has been determined by the drilling undertaken by the present operators of this property to be somewhat under 100 feet. The channel is undoubtedly incised in rock, because the south rim can be traced for a considerable distance east and west of Black Creek. East of the East Fork of Black Creek the depression lies north of a prominent rock knoll that separates it from the Horsefly River Valley. Assuming that the stated depth of bed-rock is correct, it is evident the bed-rock cross-section of the channel is wide and shallow, indicative of its slow cutting and age. It may quite possibly be a Tertiary channel, whose gravel is not exposed. Well-rounded quartz pebbles on the east shore of Patenaude Lake suggest a Tertiary channel, but any definite opinion as to age cannot be given until further information is gained. There is but little evidence of the gold values contained, beyond the fact that the channel is auriferous. It is cut not only by Black Creek but by the East Fork of Black Creek, and on both creeks old workings exist at or near the point of intersection. Reasons are given below why the results of Keystone-drilling in 1918 are not conclusive.

(*b*.) Part of a former channel of Black Creek is indicated as lying buried in the right bank of the creek near the lower end of the upper canyon. The former channel is apparently crossed obliquely by Black Creek. Its general trend is south-easterly, and its continuation may therefore lie in the left bank of Black Creek. Between the point of apparent intersection and the head of the lower canyon the depth to bed-rock on Black Creek is unknown. It has not yet been bottomed by the hydraulic operations. The down-stream continuation merits careful investigation.

(*c*.) Placer deposits in the bed of the creek were worked by early miners. Some were unworked; present operations are at or below the points of creek intersection of deposits (*a*) and (*b*).

The earliest operations on this creek were apparently those of early miners, mainly concerned with the superficial deposits in the bed of the creek. At that time three adits, all now caved, were driven in the right bank of the creek at or close to creek-level. One is below the upper canyon in the gap in the rim-rock, in the buried segment of the former channel of Black Creek, and the other two lie close together at the upper end of the upper canyon; the purpose of these last two was evidently to investigate the buried river-channel. In one of the latter it is stated that values of ½ oz. to the set were obtained. The results apparently did not invite continuation of the adits, or they were discontinued because of difficulties encountered.

In 1918 P. Fraser, for the Western Mines Exploration Syndicate, of Vancouver, put down five Keystone-drill holes at right angles to the direction of the channel at the top of the east valley-rim of Black Creek. In the Annual Report, Minister of Mines, British Columbia, 1918, it is stated that drilling did not disclose appreciable gold values, but that the deepest hole did not reach bed-rock. It is desired, however, to point out that if this channel is an old channel it is entirely reasonable to suppose that the gold would be mainly concentrated on and near bed-rock, and the upper gravel is likely to consist largely of glacial material, which is unlikely to carry appreciable gold values. The drilling was inconclusive because of the uncertainty of holes that did not reach bed-rock, and the incompleteness of one cross-section of holes. It is possible, of course, that this channel may have been eroded by ice. Some distance west of Black Creek glacial striæ indicating westward movement of ice were found in the rock forming the south rim of this channel. The continuation of the present operations on this creek should, however, afford much valuable information concerning this river-channel.

In 1927 this ground was owned by G. Mackeracher, and was in that year operated by him in a small way. In the following year the ground was acquired by Rountree Mines, Limited, plant was installed and hydraulicking commenced at the upper end of the lower canyon. Attempts to reach the bed-rock of the creek at that point failed then, and subsequently, in spite of efforts to reach it by blasting out a trench in the canyon and so lowering the sluice-flume. Hydraulicking was continued up-stream above bed-rock, but was discontinued after a few years.

In the early months of this year an option on the ground was obtained by Sig Johnson and associates, who first did some drilling with an Airplane drill (obviously the first necessary step) in that part of the creek where it crosses the buried river-channel. It is

stated that bed-rock was found at quite shallow depth, indicating that the bed-rock of the river-channel is somewhat under 100 feet below the surface, as given on the accompanying map. Accordingly preparations were made to hydraulic the bed of the creek and as much of the river-channel as it is found possible to reach. A storage-dam was constructed upstream from the crossing of the river-channel, and the pipe-line was moved and installed in the new position. The monitor is set up at the south rim of the river-channel—that is, at the upper end of the upper canyon.

Undoubtedly the operations have been of very great informative value, and have greatly heightened interest in the possibilities of the exposed buried river-channel and, indirectly, in the lower buried channel.

Unfortunately, the water-supply is not suitable for any major hydraulic operation. Present operators derive the supply from Black Creek alone, and there is no satisfactory storage on the steep terrain whereby the run-off can be controlled.

The present abnormally dry season has greatly impeded the progress of the present operations, the results of which are likely to reveal facts of great importance.

Residual Gravel Exposures.—The widely-separated exposures of residual gravel, numbers 1 to 5 on the accompanying map, on an elevated plateau, are doubtless remnants of the Tertiary drainage of the Horsefly River and its tributary Moffat Creek. There are a number of reasons, however, apart from the fact that they are widely separated, why correlation cannot be made with any degree of certainty, and why inferences from these exposures must be drawn with caution. Moreover, as has been previously mentioned, a block to the north of Horsefly has been uplifted and tilted south-east. It is also quite possible that Moffat Creek had no existence in Eocene time, when interruption to flow was first occasioned by eruption of the Lower Lavas. Again, distance between the exposures increases uncertainty attaching to attempts to correlate.

There appears nothing incompatible with the suggestion that a large river resists with great obstinacy attempts to turn it aside from a former path. Some of these exposures may possibly be remnants of a path followed by the river after damming and before it was caused to flow by way of the *Miocene* channel. In that event there must be an underlying, still more deeply-buried remnant of the Horsefly River system antedating the extrusion of the Lower Lavas. The bed-rock of such a channel would be incised in an older formation than the Lower Lavas; an example is seen at the "Property of R. Blair."

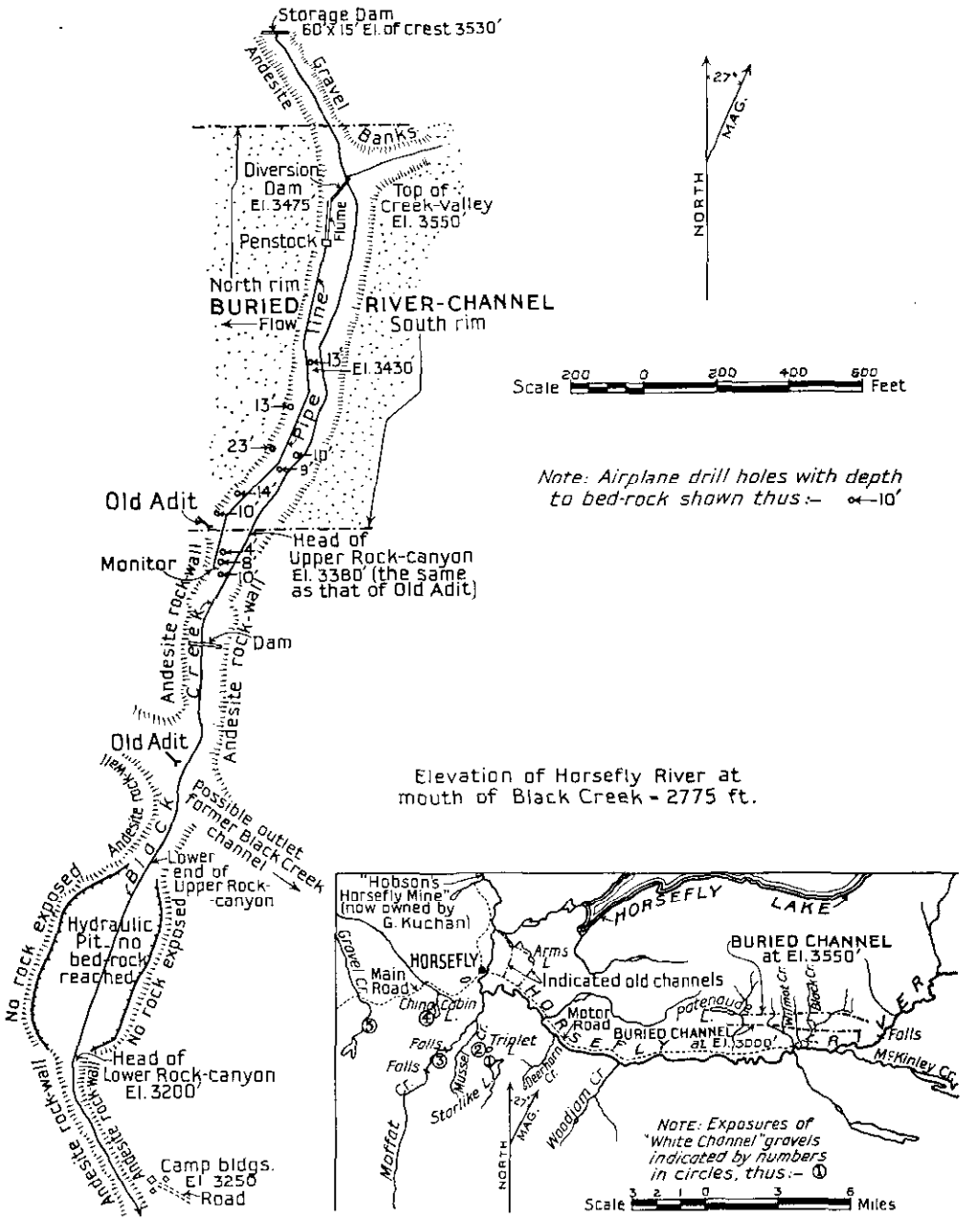
Infallible proof of age can only be afforded by exposures of bed-rock (lacking in the case of all these exposures) considered in conjunction with other facts.

The known facts as to these exposures and the inferences that may be reasonably drawn therefrom are:—

Rock-exposures on or near the summit of the elevated plateau, although few in number, as the plateau is covered with dense vegetation, are invariably olivine basalt of the Upper Volcanics series, whereas on the northern and western slopes they are andesitic rocks of the Lower Lavas, and at the north-eastern base are inclined lava and tuff beds.

Erosion subsequent to the eruption of the Upper Volcanics has probably left only a thin veneer of them on the summit. It is likely that the residual gravel exposures are remnants of channels partly incised in the Lower Lavas. Bearing on this point is the fact that, about thirty-five years ago one hole was drilled by R. T. Ward in the residual gravel at locality 3, on Moffat Creek, just above the lower falls. It is stated that a volcanic rock was struck at a depth of 80 feet which contained material amounts of native copper. No gold values were found to overlie this rock. Although details beyond the facts given are lacking, it seems evident that the formation reached was the Lower Lavas. However, it does not necessarily follow that true bed-rock was reached, as the formation encountered might quite possibly, even probably, have been a lava-flow intercalated with the gravel. The fact that no values were encountered on bed-rock might even be cited as an indication that bed-rock had not been reached, as the existence of no gold values on true bed-rock seems improbable. In fact, it is hardly assuming too much to say that available information concerning this drilling indicates, if anything, damming by the Lower Lavas, as true bed-rock could hardly be expected at the shallow depth cited.

In 1930 some Keystone-drilling was carried out by George Kuchan, J. Williams, and J. Mikklesen at Triplet Lake, locality 2. This followed the sinking of two shafts by way of



Sketch-plan of Horsefly Area and detail along Black Creek.

preliminary testing. One shaft, it is stated, reached a depth of somewhat over 40 feet and encountered a seam of lignite in the residual gravel. Exact drilling-data are not known to the writer, but it is stated that good values were encountered to a considerable depth below the surface. Below the auriferous gravels much lignitized material was met. Sulphurous water also, it is reported, issued from the drill casings. Sulphurous water was also observed by the writer at the time one of the shafts was being sunk some years ago. Possibly this originates from the decomposition of iron sulphide and its reduction by organic material. The presence of lignite and the residual gravel affords evidence of the Tertiary age of these deposits.

The reported presence of gold values in the upper strata is worth investigating. It is conceivable that sufficient yardage and values for a drag-line or dredging operation might be demonstrated, as there is a large area of residual gravel uncapped by volcanic rock. It is understood that one hole reached a depth of nearly 200 feet. The lignitic material encountered below the auriferous strata might indicate temporary lacustrine conditions.

Available information at this exposure is not discordant with the view that this might be a remnant of the Eocene channel of the river, dammed by the Lower Lavas and subsequently restored to its original course, before it was compelled to follow the *Miocene* channel. The Lower Lavas are not, of course, exposed, but the reported lignitic material suggests an arrested flow and their possible underlying presence. Presumably the once-existent capping of Upper Volcanics has been removed by erosion.

Exposure No. 4, on the south-west shore of China Cabin Lake, is in contact with reddish-coloured andesitic volcanic rock of the Lower Lavas. Quite possibly the channel rims, at any rate, are incised in that formation.

The one conclusive exposure is on Gravel Creek Canyon, previously described, where beds of residual gravel and intercalated lavas, of Upper Volcanics age, undoubtedly indicate a flow dammed by these lavas. The thickness of the overlying basalt suggests complete stoppage.

Whether it is an exposure of the buried Horsefly River or its tributary is immaterial, as the presence of either indicates a flow at the time down the Beaver Creek Valley. This exposure, considered in conjunction with valley-fill occurrences of the Upper Volcanics at down-stream points (mentioned in Geological Survey, Canada, Summary Report, 1932, Part A 1, page 84), and exposures of the Lower Lavas at up-stream points (on leases of A. B. and R. N. Campbell), strongly supports the view that the flow in this valley was interrupted by two volcanic periods.

Evidence of Down-stream Continuation of Tertiary Horsefly River.—The possible presence of the buried Tertiary Horsefly River at down-stream points in the Beaver Creek Valley is suggested by placer deposits on Big Lake Creek (flowing northward into the valley) and by residual gravel exposed in Quesnel River Valley by early hydraulic operations three-eighths of a mile down-stream from Beavermouth. Additional facts must be secured before a former northward continuation of this river, in or adjacent to the Fraser River Valley, can be proved. It is significant that there is an ancient valley close to the Fraser River Valley on its east side. This valley is now occupied by Dragon and Ten-mile Lakes and the lower part of Canyon Creek. Evidence of a buried river crossing the Cottonwood River is cited on page C 19 of the Annual Report, Minister of Mines, British Columbia, 1936. Pertinent, doubtless, also is the presence of "Rich Bar" on the Fraser River, about 7 miles below Quesnel. The placer deposits of this bar, which engaged the attention of the early miners, are possibly due to the intersection of an ancient channel by the Fraser River. This view finds support in the evidence of the buried river-channel cut by Baker Creek, and described in this volume under "Property of R. Blair." It is possible, of course, that two different channels may have been occupied at different periods, in or near the Fraser River, owing to disturbances in Tertiary or earlier time.

Note re "Concretions" in the Horsefly River Valley.—A few comments seem to be called for respecting the curious disk-like objects, frequently found in the gravel in this valley. Although similar objects obviously originating in the same way are known to occur in other valleys, they are of some diagnostic value in correlating widely-separated channel-remnants of this river. The objects referred to consist, in most cases, of disks of laminated material about half an inch and upwards in thickness, locally termed "teapot-stands," for which purpose they are well fitted. In some cases they are spherical segments composed of similar

laminated material. Both types may or may not have a hole directly in the centre. These objects have been quite erroneously deemed "concretions," and have attracted considerable attention as they have an artificial appearance, accentuated in some cases, by remarkable approach to a circle. Similar but smaller objects, almost invariably with a hole in the centre, occur in immense numbers on Pesika Creek, a tributary of the Finlay River. A great many of these objects are being produced to-day on the Nechako River, a few miles from Vanderhoof. A visit some years ago to a clay deposit near there, aided by the investigation of the owner, G. Ogston, afforded convincing proof of the way in which these objects are produced. Invariably a great gulf of time is associated with the operation of mineral-forming processes; consequently, it is indeed surprising to learn that the time occupied in forming these objects is only a few seconds.

The required setting for their production is a bank of thinly-bedded material, slightly plastic, such as clayey slum, adjacent to a creek or river, but standing somewhat back from the water, so that there is a talus slope of considerable length at the base of the bank. Pieces of the bank become detached, roll down the talus slope and reach the bottom in the form of a cylinder, with more or less rounded ends. A high bank produces cylinders of smaller diameter than a low bank, as the rolling process is continued longer. In a number of cases, by pure chance, a cylinder is produced in which the laminæ are exactly at right angles to the long axis of the cylinder. Those that fail to reach the water dry out and split into a number of disks; the ends of the cylinder form the spherical segments. The disks and spherical segments harden, some are buried in situ, and in time become well indurated. Some disks, near the water, become fashioned by wave action into fantastic shapes. These have been erroneously deemed "fossils" by some.

In some cases a root of grass or other vegetation growing in the laminated material is detached with the piece that rolls down the talus slope. In some, this piece of root lies lengthwise in the centre of the cylinder formed. In such cases when the cylinder splits open on drying the root decays, and the result is a number of disks with a hole in the centre.

These objects could obviously be formed at any period given the right conditions, but in Pleistocene and post-Glacial times doubtless the number of slum deposits favoured their production.

Baker Creek.

Property of R. Blair.

A discovery claim, owned by R. Blair, of Quesnel, is at the lower end of Baker Creek Canyon, near the south boundary of Pre-emption Lot 8651. The property is 3¼ miles from Quesnel, and is reached by a road passable for cars. It follows Baker Creek Valley at creek-level, leads directly across this property and extends 1¼ miles farther, to the hydro-electric plant of Quesnel Light and Power Company.

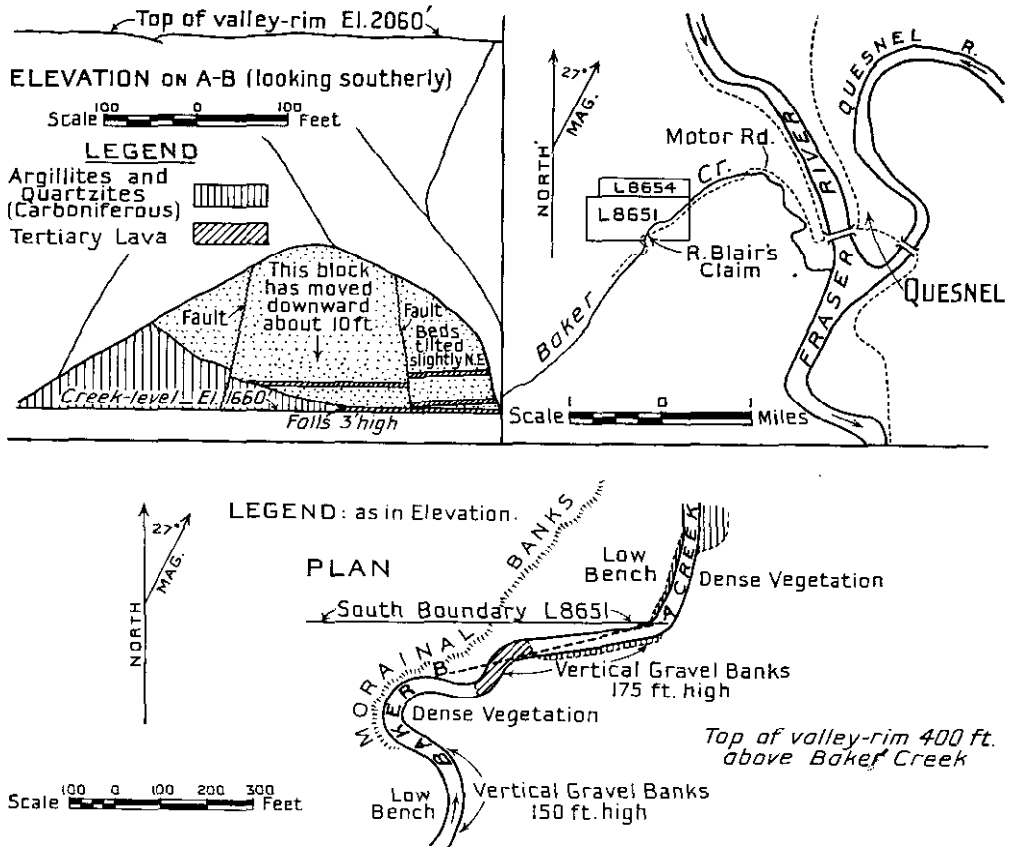
Baker Creek, at a point 1¼ miles above the property, is contained in a narrow rock-walled canyon incised to a depth of many hundreds of feet in the Fraser Plateau. Downstream the canyon becomes a gorge which merges in the wider valley. Both rock-rims are frequently and prominently exposed until they end and more or less abruptly at the lower end of this property, which marks the mouth of what is known as "the canyon." Farther downstream, for about half a mile, low-lying rock benches flank the creek; beyond, it winds through much glacial debris which mainly conceals the underlying formation. The valley is lightly timbered; the underbrush is dense save where the formation outcrops.

The geology is described by Reinecke in Geological Survey, Canada, Memoir 118, 1920. In the region examined this year the formation consists of interstratified much-folded quartzite and argillite (the latter carbonaceous in part) of the Cache Creek series of Carboniferous age. Conspicuous features of the valley are the numerous kaolinized rock-pillars of this formation on the north-west side of the valley, and the rampart-like exposures of basalt of the Upper Volcanics series of Miocene age, which cap the valley-rims and immediately underlie a shallow cover of glacial material.

The placer deposits at this property occur as: (*a*) A buried river-channel, exhibiting unusual features, cut deeply and approximately at right angles by Baker Creek; (*b*) post-Glacial concentrations on low-lying rock benches of Baker Creek, resulting from the intersection of the buried channel by Baker Creek.

The existence of this buried river-channel has apparently long been known. The Annual Report, Minister of Mines, British Columbia, 1899, records the fact that no work was done in that year by The Golden Province Mines Company, a company apparently incorporated for the purpose of investigating this channel. An old adit, known as " Law's tunnel," now caved, driven in the left bank of the creek and 50 feet above water-level, apparently marks this early mining effort.

In 1934 R. Blair discovered that the gravel on low-lying rock benches down-stream from the exposed river-channel was auriferous, and has since prospected at various points on his discovery claim.



Property of R. Blair, Baker Creek.

River-gravel with intercalated beds of volcanic agglomerate is exposed near the lower end of Baker Creek Canyon. It lies on the right bank of the creek, extends for a length of about 750 feet, and rises almost vertically to a maximum height of 175 feet above the river. The central part of the channel is obscured by dense vegetation which extends from creek-level, at 1,660 feet elevation, to the top of the steep valley-slope, at 2,060 feet elevation. At this point the river-gravel has been almost entirely removed from the left bank of the creek, which is flanked by a low-lying rock bench, at the back of which are banks of glacial debris.

The ancient gravel strata are faulted in the northern part of the exposure; there are two faults about 200 feet apart. It is evident that the block between the faults has moved downward about 10 feet. Owing to inaccessibility, the exact amount of movement could not be determined. The gently-sloping northern rim of the buried channel is composed of interstratified carbonaceous argillite and quartzite of the Cache Creek series of Carboniferous age. It is exposed almost to creek-level, where it is in contact with volcanic agglomerate and breccia over which the creek flows, and in which it has formed falls about 3 feet in height. The rim is exposed to a height of about 90 feet above creek-level, but is obscured by

dense vegetation; but as the Cache Creek sediments are exposed at a point 225 feet farther up-stream, the distance from rim to rim of the ancient channel at creek-level is probably not more than about 1,000 feet.

The material on the northern rim-rock consists of lignitized pieces of wood resting beneath clay-beds. Overlying the latter are beds of sub-angular gravel whose pebbles are 3 to 4 inches in diameter and consist mostly of lava. At about 35 feet above creek-level there is a more or less horizontal bed of volcanic agglomerate about 8 feet thick, in which are discontinuous veins of a fibrous mineral identified as aragonite, containing some manganese. This fibrous or columnar mineral is white in colour and translucent. Each vein is 3 to 4 inches in width and several feet in length, and close examination discloses that a number of veinlets branch from each vein within the agglomerate. These discontinuous veins occur in practically the same horizontal plane, and offer the curious appearance of slabs inserted at intervals in gravel strata. The beds of agglomerate weather to leave the contained sub-angular pebbles in bold relief, so that viewed even from a few feet they closely simulate gravel-beds, and their real identity can only be determined by close examination. Doubtless, originally there was one main vein of aragonite, which was ruptured by the faulting subsequent to the extrusion of the lava. The part of this agglomerate bed that was not involved in the faulting is plainly discernible immediately south of the more southerly of the two faults; it also contains a vein of aragonite.

Above the agglomerate bed, extending to the top of the exposure, are finer apparently well-sorted gravels. Owing to the precipitous nature of the exposure access to all save the lower parts cannot be gained. Viewed from the opposite bank of the creek this finer, well-sorted gravel appears to be capped by a thin soil-cover at the highest parts of the exposure, and near the north rock-rim by a few feet of glacial material.

About 20 feet below the above-mentioned agglomerate bed, in that part of the exposure immediately south of the more southerly of the two faults, a slightly-inclined bed of agglomerate occurs within the gravels. It also contains a vein of aragonite 3 to 4 inches in width, having approximately the same strike and dip as the lava bed.

This exposure indicates that a river approaching lacustrine conditions was dammed, or at any rate impeded in flow, by extrusion of lava, following which a gentle flow was again restored. It is clear that the lower part of Baker Creek Canyon was in existence at the time of extrusion of this lava. The age of the latter is presumably that of the Lower Lavas of Eocene or earlier age, inasmuch as the Upper Volcanics series, of Miocene age, invariably overlies the Fraser River formation. In the Fraser River Valley there is no known or recorded instance of intercalated gravel and lava-flows of the Upper Volcanics series. It is, however, particularly to be noted that in the report on the Horsefly Area in this volume there is cited an exposure in Gravel Creek Canyon of intercalated residual river-gravel and lava-flows of the Upper Volcanics series, which proves that the Horsefly River drainage system was obstructed by eruption of the Upper Volcanics. In this area, however, indirect evidence strongly supports the view that obstruction was also earlier, occasioned by eruption of lavas of the Lower Lavas series. The Baker Creek exposure is particularly informative in revealing conditions which must also have occurred in the Horsefly River Valley. Further light might also be thrown on the matter by a more detailed investigation of Baker Creek Valley than was possible at the time of the present examination.

The original direction of flow of water in this channel cannot be proved from the gravel-exposure itself, as there is no imbrication. A northward flow is, however, indicated by the direction of the Tertiary valley of Baker Creek. It is not in accord with a southward-flowing parent stream. Farther down-stream this creek bends around to flow south-eastward, winding through much glacial debris in a region where it is virtually in the Fraser River Valley. This bend is similar to that made by the Quesnel River in the same region.

It is of interest to note that the lacustrine conditions indicated by this exposure also find expression in the beds of diatomite on Pre-emption Lot 906, and other diatomite deposits to the north and lignite beds to the west and south. The general course of the channel, so far as is evident, appears to be northward and southward across Baker Creek. It would seem that the lacustrine conditions were promoted primarily by volcanic eruptions.

The commercial aspects of this property seem to lie chiefly in the low-lying rock benches flanking Baker Creek, immediately opposite and down-stream from the exposure of

Tertiary volcanics. These benches are underlain by argillite and quartzite of the Cache Creek series. On these benches may be expected superficial placer deposits resulting from the resorting of ancient channel gravel by Baker Creek. True bed-rock of the river-channel may be found under the rock bench on the left bank of Baker Creek, opposite the gravel-exposure, although the gravel thereon may be overlain by lava flows. A shallow pit exposes lignite on a low-lying rock bench on the left bank of the creek about half a mile down-stream from the channel-exposures. This may possibly mark another point on the rim of the river-channel and merits further investigation.

The owner reports encouraging values on rim-rock at the edge of the rock bench opposite the exposure, but, with the means available to him, has been unable to follow this gravel instream owing to inflow of water.

No systematic testing of the low-lying rock benches has been carried out. A small amount of drilling would throw much light upon the commercial aspects.

Distant 100 feet down-stream from the north rim of the river-channel, on the right bank of Baker Creek, a thickness of 4 feet of fine and coarse well-imbricated gravel, of possible post-Glacial age, rests on argillite. The imbrication indicates resorting by powerful northerly-flowing water. Behind this gravel the bank of the creek rises sharply to the top of the valley, but the nature of the material composing the valley-slope is entirely obscured by dense vegetation. At a point about 100 feet farther down-stream quartzite outcrops prominently and marks the end of Baker Creek Canyon. In the absence of further exposures it is not possible to express a definite opinion concerning the origin of this gravel, but it seems unlikely that there would be any active circulation of northward-flowing post-Glacial waters in this region other than those in Baker Creek Valley.

Cottonwood River and Lower Part of Swift River.

During the year about two weeks was occupied in an examination of the Cottonwood River, up-stream from that part examined in 1936. A general reconnaissance was made of the lower part of the Swift River, as far as the junction of Sovereign Creek, and the adjacent country on the north bank of the river.

The area is part of a strip of country some miles in width, trending north-west and south-east, between Wingdam and Likely, to which attention has previously been drawn in the publications of this Department. The formation underlying the area examined this year consists wholly of Mesozoic rocks.

An account of placer occurrences along the Cottonwood River, between the Quesnel–Barkerville and Prince George–Quesnel Road crossing, and particulars of roads and trails thereto, is given in the Annual Report, Minister of Mines, British Columbia, 1936.

The lower part of the Swift River is reached by the Foster Road, which branches from the Quesnel-Barkerville Road at a point about 2½ miles east of Cottonwood, crosses Lightning Creek at the boundary-line between Pre-emption Lots 437 and 438, and continues to the Swift River at Placer-mining Lease 2061, somewhat over 2 miles from the starting-point. The road is passable for cars in dry weather as far as Placer-mining Lease 2061, but onwards is only a wagon-road. On Placer-mining Lease 2061 the road ascends the right bank of the Swift River to the plateau, and continues on it for about 5 miles as far as Pre-emption Lot 1235, save for a steep descent to, and ascent from, Sovereign Creek.

An alternative route is by a road, passable for cars in dry weather, which branches from the highway at Coldspring House, 4½ miles east of Cottonwood, crosses Lightning Creek, and ascends the south bank of this creek to the plateau, where one branch leads to the property of H. G. Jamieson on Gagen Creek, and the other joins the Foster Road about 1½ miles from Lightning Creek.

The valleys of the Swift and Cottonwood Rivers are continuous; no topographic feature marks the end of one valley and the commencement of the other. The distinction is one in name only, the name Swift River being applied to the river above the junction of Lightning Creek.

Down-stream from the junction of Lightning Creek the Cottonwood River occupies a wide, well-timbered valley of mature relief. It enters a rock-walled canyon, about 2½ miles in length, commencing at the Quesnel-Barkerville Road crossing. This feature, coupled with the fact that a deep embayment trends instream north-westward for about half a mile

at the head of this canyon, on the north side of the river, plainly indicates that a pre-Glacial channel-segment of the river lies buried in the right bank. The down-stream end of this buried channel-segment coincides with the present valley between the 2-Mile and 3-Mile posts. There, old workings on the right bank of the river, near the boundary-line between the leases of A. M. Davis and associates, and those of E. McMillan and Mrs. McMillan, indicate the intersection of the former channel by the river. The canyon is largely, if not entirely, of post-Glacial age, although incision may have commenced in Pleistocene time.

The formation exposed in the canyon consists of alternating bands of sediments (chiefly argillite) and volcanic rocks. This assemblage is intruded at several points by tongues of porphyritic diorite, and at one point by granodiorite. Argillite on the left bank of the river, between the 2-Mile and 3-Mile posts, is fossiliferous, and at one point contains a well-preserved impression of an ammonite, about 8 by 5 inches. No quartz veins of appreciable size were observed in the region, although outcrops of existing veins may be concealed by vegetation or glacial debris.

The Swift River, at and down-stream from Sovereign Creek, occupies a steep rock-walled gorge 2 miles or more in length and incised to a depth of about 200 feet in the plateau. Down-stream from the gorge the right bank rises abruptly from the river to the plateau which flanks it for a further distance of about 1 mile. It then merges in a large flat a few feet above river-level. The left bank is flanked by a gently-rising valley-slope which opens out to another large low-lying flat on that side of the river. These two flats are covered by Placer-mining Leases 2061 and 2062. At the down-stream end of the former, about three-quarters of a mile above the junction of Lightning Creek, the river flows through a short low-walled rock-canyon in its valley, which reaches a width of about 1,500 feet in this section. Lightning and Sovereign Creeks, flowing westward, parallel to each other, between 3 and 4 miles apart, also occupy rocky gorges of considerable length that are incised to a depth of about 200 feet in the plateau. The one on Lightning Creek ends about 1½ miles above its junction with the river. The canyons and gorges on the Swift River, Lightning, and Sovereign Creeks are all of post-Glacial age.

The Swift River Valley is well timbered, and rock-outcrops are infrequent on the plateau; they are obscured by vegetation and glacial debris. The latter is probably not thick except locally. The formation is well exposed in the gorges and consists of alternating bands of sediments, chiefly argillite, and volcanic rocks. These rocks are intruded by tongues of acid igneous rock on the Swift River, and by hornblende-diorite in Lightning Creek Gorge, in the hydraulic pit on Gagen Creek, and also on Sovereign Creek. Quartz veins do not appear to be numerous in the region, although they may be obscured by vegetation and glacial debris. Some are exposed in the hydraulic pit on Gagen Creek; one vein is 4 feet in width.

From the topography it is clear that the region to the east of Swift River has been subjected to post-Glacial uplift. It is indicated that former north-westward-flowing streams, on the plateau adjacent to the right bank of Swift River, have been subjected to stream piracy. In rejuvenating, the Swift River appears to have shifted west of its former course. Indications of earlier channels of this river exist on the plateau in the form of depressions, trending more or less parallel to the river, and occupied mainly by meadows and swampy ground. Chief of these are the "Moose Pasture," immediately south of Sovereign Creek, a depression about 2 miles in length, in which is situated a lease owned by G. S. Gagen; another marked depression about 1 mile in length, occupied by a small creek entering Swift River 2 miles below Sovereign Creek; and the depression now occupied by Lost Valley Creek, which may be the north-westerly continuation of the first-mentioned.

Placer deposits in this area occur as:—

(1.) Post-Glacial concentrations on indurated false bed-rock material, consisting mainly of inter-Glacial slum and gravel deposits. The Cottonwood River Valley is floored with such indurated material for a distance of not less than 10 miles, and the Swift River Valley for a distance of about 1 mile in the part examined.

(2.) Buried channels, indicated as lying instream on both rivers.

(3.) Post-Glacial concentrations of a different type to that cited under (1) above, and also buried channels, exhibited at individual properties, such as that of H. G. Jamieson, on Gagen Creek.

Of these, the first two are the most important commercially, and warrant considerable investigation.

Both the Cottonwood and Swift River Valleys are underlain apparently for considerable distances, save in the canyons, by indurated material, chiefly slum and gravel. It is thought to be mostly of inter-Glacial age, and on it post-Glacial deposits of auriferous gravel of comparatively shallow depth have been laid down in the bed of the river and on low-lying flanking benches. Indurated material underlies the Cottonwood River Valley, up-stream from Pre-emption Lot 9670, as far as the lower end of the post-Glacial canyon, down-stream from the Quesnel-Barkerville Road crossing, and is possibly present in the valley above this road-crossing, but time was not available for examination of that part of the river. In the Swift River Valley, in the vicinity of Placer-mining Leases 2061 and 2062, the bed of the river and large benches on both banks are floored with indurated slum.

This deposit is important, for although gold values are known to vary widely at the different points it forms a false bed-rock of wide extent and underlies a large volume of gravel. Detailed testing is warranted to ascertain if dredging or drag-line possibilities are offered, either locally or considering the valleys of these rivers as a whole. The physical properties of the indurated material are favourable to either type of operation.

Because the deposits forming this false bed-rock are well indurated, resemble glacial rather than Tertiary deposits, and contain small seams of lignite, they would appear to be mainly of inter-Glacial age. It is, of course, quite possible that some exposures may be Tertiary. The seams of lignite are of considerable value in tracing this deposit up-stream. The presence of well-carbonized lignite in unconsolidated material in the lower part of Lightning Creek Valley, near Coldspring House, has long been known. It is understood that some lignite was used as fuel in the early days of mining. This lignite was apparently obtained from the south bank of Lightning Creek, opposite Coldspring House, and detailed mention is made of it on page 29, Geological Survey, Canada, Memoir 149, 1926. This exposure has apparently been subsequently covered up, or washed out by the river, as no evidence of it could be found this year. In 1934, Keystone-drilling for placer on the eastern part of Pre-emption Lot 443 disclosed lignite beds of great thickness in unconsolidated material on the north bank of the creek. Last year application was made for rights in this region, under the "Coal and Petroleum Act," by Consolidated Gold Alluvials of British Columbia, Limited, with a view to the possible utilization of this lignite as fuel at Wingdam. This company, in 1937, drove an adit on the right bank of Lightning Creek, about 15 feet above creek-level, at the base of the flat on which the Keystone-drilling was done. The adit is 21 feet in length and is driven on a bearing north 5 degrees east, in line with a row of holes drilled on a due north bearing. It discloses for its entire length interstratified clay and lignite beds, apparently striking due east and dipping south at 45 degrees. Near the portal the overlie is only 2 feet in thickness and consists of soil and gravel. Whether this lignite is in place or not is indeterminate from the exposure. There is a likelihood, however, that the lower part of Lightning Creek Valley is floored with inter-Glacial deposits.

There is much evidence of early mining of post-Glacial bench deposits. Some of these are quite extensive, notably on the right bank of the Cottonwood River, somewhat above the 3-Mile post (where the river cuts across its former channel, previously mentioned as lying buried in its right bank, up-stream from this point); on the right bank of Lightning Creek, up-stream from the mouth for about 1½ miles; and on the right bank of Swift River immediately down-stream from Sovereign Creek. Subsequent to these early operations, the numerous bars and benches of the Cottonwood and Swift Rivers have long engaged the efforts of numerous prospectors at favourable stages of water.

On Placer-mining Leases 2061 and 2062 on the Swift River, Keystone-drilling was carried out by G. A. Dunlop in 1922. In Geological Survey, Canada, Memoir 149, page 177, it is stated: "In all, thirty-six holes were put down. All the gold is in the surface gravels, which average 13 feet in thickness and have a maximum depth of about 25 feet. Two or three holes were put down about 75 feet, but did not reach bed-rock, the surface gravels being underlain by hard silt and boulder-clay carrying no gold. Mr. Dunlop estimates that the drilling proved approximately 4,000,000 yards of ground having an average value of 31 cents a cubic yard. The surface is fairly heavily timbered in places, but a large part is grass land. The surface gravels are fairly coarse, but contain few, if any, large boulders. The gold is concentrated

mainly on the clay, the surface of which is nearly level, and is mostly flaky, but not very fine, and is easily saved." A suction-dredge, from which favourable results were hardly to be expected, was installed on this ground in 1924, but this operation was short-lived. On the same ground, in 1932, C. H. McDonald installed a Sauerman high-line plant that was not in operation for any length of time. Subsequently this ground has lain idle.

In 1932 attention was directed to the plateau immediately south of Lightning Creek by G. S. Gagen's discovery of rich superficial gravel on the right bank of Gagen Creek. Subsequently, Sovereign Creek Gold Mines, Limited, incorporated in 1934, acquired this ground, brought in a water-supply by ditch and flume from Sovereign Creek, installed plant, and commenced hydraulicking. The latter was of short duration, and confined to an area about 500 by 375 feet. This ground was acquired in 1936 by H. G. Jamieson, who has since done considerable testing. The property is described in the Annual Report, Minister of Mines, British Columbia, 1934, pages C 28 and C 29.

This year a considerable amount of systematic testing was done by W. J. Noon on the leases of E. McMillan and Mrs. McMillan, on the Cottonwood River (described in Annual Report, Minister of Mines, British Columbia, 1936, pages C 27 and C 28). A number of shallow shafts were sunk by the caisson method, followed in the late autumn by Keystone-drilling. The result of this investigation is not fully known to the writer.

The origin of the gold in the post-Glacial deposits of this area is a matter of considerable interest and importance. At certain points it is due to intersections of earlier channel-segments. Below Wingdam numerous old workings on Lightning Creek indicate the existence of post-Glacial deposits not attributable to channel intersection.

During the year, the operations of Consolidated Gold Alluvials of British Columbia, Limited, have demonstrated that the gold in the rich bed-rock gravel of Lightning Creek at Wingdam is of exactly the same character as that in the up-stream higher-lying gravel, of presumably inter-Glacial age, which constitutes the Sanderson mine. The post-Tertiary age of the bed-rock gravel has been established by fossil evidence. The rich bed-rock deposits are indicated as having resulted from resorting of the inter-Glacial gravels. The latter must have resulted from resorting of glacial material, and the size of the deposit at Wingdam indicates the large amount of rich debris which must have been resorted.

With regard to a possible local source of gold to which placer occurrence, generally within the area, might be attributable, reference is invited to the Annual Report of the Minister of Mines, British Columbia, 1933, pages 115, 116, and 117. It will be noted that the Mesozoic rocks bordering those of Precambrian age on the west are invaded at a number of points by stocks and tongues of the Central batholith. Instrusives also occur in the Precambrian rocks. The fact that in the south-eastern part of this area auriferous quartz veins occur in both Precambrian and Mesozoic rocks suggests that this may also be the case, at other points, along the Wingdam-Likely belt.

Leases of W. D. and J. W. Jones and Associates.

Six Placer-mining Leases Nos. 3783, 3784, 3834, 3831, 3899, and 3900, held by W. D. and J. W. Jones and associates, of Cottonwood, are situated on the Cottonwood River at and down-stream from Umiti (Deep) Creek. The ground covered lies mostly on the north side of the river, and on Umiti Creek. The property is reached either by a go-devil trail, 3½ miles in length, which branches from the Quesnel–Barkerville Road at the top of 18-Mile Hill, 18 miles from Quesnel, or by a pack-trail, 7 miles in length, which branches from the Quesnel–Barkerville Road at the bridge across the river and follows the north side of the latter. The go-devil trail is the only route over which any heavy supplies can be taken to the property. It crosses the plateau in a northerly direction, descends the river-valley on a fair grade, and reaches the river opposite Umiti (Deep) Creek.

Up-stream from Umiti (Deep) Creek for somewhat less than a quarter of a mile, and down-stream from this creek for about half a mile, there is an extensive bench, terraced in part, that rises above river-level to a maximum height of 35 feet. This, so far as is indicated by such testing as has been carried out to date, is underlain by indurated material at an average depth of 10 to 12 feet. The overlie consists of an upper stratum of barren silt up to 4 feet in maximum thickness, overlying post-Glacial auriferous gravel lying on the false bed-rock. It is stated that nine pits sunk at various points on this flat indicated encouraging values. At certain points near the river considerably better values have, it is stated by the

owners, been obtained. At one point, from 800 cubic yards of gravel gold to the value of $1,200 is reported to have been recovered.

At the back of this bench, west of Umiti (Deep) Creek and about 25 feet above it, there is another bench, about half a mile in length and about 300 yards in width. It is underlain at its east end by indurated material and near its west end by altered andesite, a formation that is prevalent in this region. This higher bench is partly covered by the leases and partly by one held by David V. Sanders. Rock-exposures on it are scanty, but there is concentration of gold on the false bed-rock and on the altered andesite. The overlie of well-washed gravel is from 15 to 18 feet in thickness, with a certain amount of silt and surface soil on top.

Considerable work has been done on the south side of the river directly opposite Umiti (Deep) Creek. Bench deposits overlie indurated material; values are stated to be good, but considerable trouble was experienced owing to sloughing of the valley-slopes over working-faces.

Down-stream about half a mile from Umiti (Deep) Creek a large U-bend of the river surrounds an extensive low-lying bench on three sides. No great amount of testing has been done on it, but it is of potential promise and warrants testing. Opposite one side of this bench, on the north side of the river, there is another low-lying bench of considerable size, and down-stream on both sides of the river there is a considerable amount of low-lying bench-ground that warrants testing.

It is considered that sufficient testing has been carried out to date to warrant more detailed investigation to determine if dredging or drag-line possibilities exist.

Lease of S. Svenson.

One lease, owned by S. Svenson, of Cottonwood, is on the right bank of the Swift River, adjoining Placer-mining Leases 2061 and 2062, about 2½ miles down-stream from Sovereign Creek. It is reached either by a foot-trail, about half a mile in length, that follows the right bank of the river from Placer-mining Lease 2061, or by a branch trail, a few hundred yards from the Foster Road, that passes along the plateau immediately above the workings, on the right bank of the river.

The lease covers a somewhat irregular low-lying bench varying in width from 50 to 150 feet, flanking the right bank of the river, at the back of which the river-bank rises sharply at most points to the plateau, about 210 feet above the river. There is a very marked large depression trending south-eastward from the river-bank and outer edge of the plateau. It becomes rapidly shallower and less distinct on the plateau. The region is well timbered and there are no bed-rock outcrops in the immediate vicinity.

The placer occurrence at this property consists of post-Glacial concentrations on indurated glacial material immediately adjacent to the river and resorted by the river. Instream in the pits, auriferous gravel overlies hard-pan and is overlain by boulder-clay and glacial material. It therefore must be of Pleistocene or earlier age, unless the boulder-clay has sloughed to its present position after the gravel was resorted by the river. The gold is fairly coarse, one nugget valued at $4 is stated to have been recovered. The owner states that when one lot of placer gold weighing 71 dwt. was screened, it was found that 44 dwt. failed to pass a 16-mesh screen. The coarse character of the gold, coupled with the existence of the depression in the river-bank at this point, suggests that the source of the gold may be from a tributary channel, but insufficient work has been done to pass a definite opinion on this point.

The workings lie along the river-bank within a distance of somewhat over 300 feet. By using the water supplied by an underground spring, the owner has opened up two pits by ground-sluicing, aided by shovelling. The face of the down-stream pit exposes 10 feet of glacial debris overlying a 5-foot stratum of poorly-sorted cemented gravel, which in turn overlies 15 feet of washed but poorly-sorted auriferous gravel. No bed-rock, true or false, is exposed beneath the lowest gravel.

The up-stream pit is about 75 by 75 feet in size. The pit-face exposes 2 to 3 feet of well-washed auriferous gravel underlying 15 feet mainly of boulder-clay, and overlying indurated finer gravel and clay or hard-pan. About 3,000 cubic yards of material has been removed from this pit, from which the owner states that about 20 oz. of gold was recovered.

At a point 120 feet up-stream from the last ground-sluice pit and 6 feet above river-level, the face of a 5-foot adit at the end of a 60-foot open-cut exposes hard-pan overlain by 3 feet of washed gravel and 3 feet of surface debris.

Morehead Creek.

Priority Mines, Ltd.

The property of this company consists of three claims and two leases, situated on Morehead Creek, about 3 miles below Morehead Lake. It is reached by a motor-road, 2½ miles in length, which branches from the main road to Likely, immediately north of Morehead Lake. Morehead Creek flows from Morehead Lake north-westward in a well-timbered valley of mature relief for about 2 miles before it is joined by Warran Creek, which drains the extensive flat terrain to the west. Somewhat over half a mile below this point Morehead Creek cascades over falls, turns sharply, and from this point to its junction with Little Lake Creek trends north-east in a steep-sided valley, some hundreds of feet in depth. In this valley the rock-walls are continuous save for a length of somewhat over 500 feet, commencing 2,700 feet below the falls. Although the banks of the creek's containing-valley are steep at all points, on the left bank at the up-stream end a gap in the rock-walls about 250 feet in length is occupied by a steep bank of clayey gravel. The right bank is flanked by a flat 10 feet above the creek, about 100 to 150 feet in width, at the back of which is a small bench of maximum width 50 feet, at a height of 40 feet above the creek. Behind this rises the steep eastern valley-slope, the underlying formation being obscured for a distance of several hundred feet by dense vegetation. The formation outcrops again on the right side of the creek at the down-stream end of the low-lying flat where the creek again cascades over falls. The superficial placer deposits found on this flat engaged the attention of the earliest miners, and to this part of the creek mining effort has been subsequently confined, and on it the present operations are centred.

The geology of this region is described in Geological Survey, Canada, Summary Report, 1932, Part A 1, pages 81 and 82, and on pages 101 and 102 an account is given of this property.

The formation exposed in the vicinity of the workings consists of volcanic rocks.

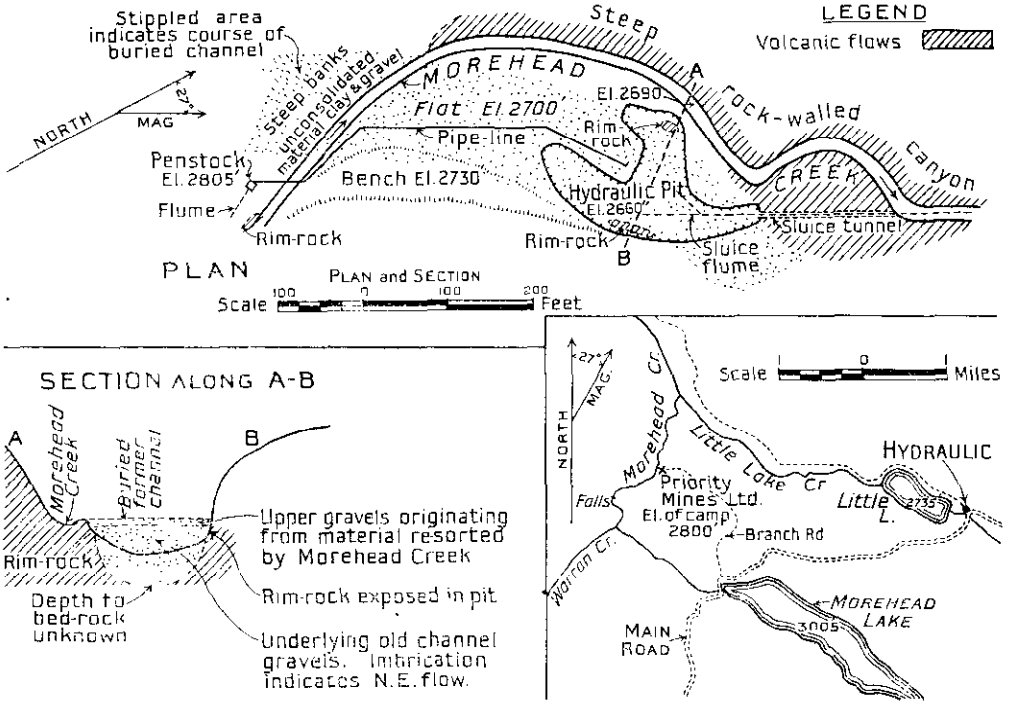
The placer deposits at this property occur as:—

(*a.*) A buried channel of prevailing north-easterly flow, cut obliquely by Morehead Creek.

(*b.*) Post-Glacial deposits on the low-lying bench on the right bank of the creek near the intersection of the buried channel. These attracted the attention of the early miners, and were formed by Morehead Creek in cutting through the upper gravel-strata of the buried channel, and such overlying glacial debris as must formerly have occupied the valley.

The superficial placer-deposits on the low-lying flat flanking the right bank of the creek must have been largely worked out by the earliest miners, who left no evidence apparently of any attempt to reach bed-rock. In the eighties, R. D. Davis endeavoured to reach the bed-rock of the buried channel by sinking, at the northern end of the flat. He failed because of the water encountered. Subsequently a tunnel driven at the base of the falls below the flat proved to be above bed-rock in the channel. In more recent years the ground was acquired by S. Prior, who utilized water from Morehead Creek to wash some of the upper gravel strata. In 1933 the property was acquired by Priority Syndicate, which was recently incorporated as Priority Mines, Limited. This syndicate and company drove a tunnel 150 feet in length, below the former tunnel at 2,625 feet elevation, through the rock that forms the right bank of Morehead Creek, and penetrated the left rim of the buried channel above bed-rock. A storage-dam was constructed on Warran Creek, and a supply of water for hydraulicking brought in by a flume from the top of the upper falls on Morehead Creek. The penstock at the end of the flume, at 2,805 feet elevation, gives a head at the monitor of 145 feet. By placing a sluice-flume in the tunnel and continuing the sluice-flume beyond the tunnel in Morehead Creek a further distance of 400 feet a considerable yardage of upper gravel has been piped out. The maximum depth of the hydraulic pit at the head of the sluice-flume, below the low-lying flat, is 40 feet. It has been found that to continue hydraulic operations it will be necessary to lengthen the sluice-flume, owing to the accumulation of tailings. It is therefore proposed to increase the length by another 1,500 feet, and to put steel plates in the lower end. The grade of Morehead Creek to its junction with Little Lake

Creek has been ascertained by the management as being 3.7 per cent. No attempt has been made by this company to reach bed-rock, because it is considered that as bed-rock gravel can only be mined by some form of drag-line installation, the removal of a large amount of overlying gravel is the first step necessary. It is therefore the intention to continue hydraulicking to afford the necessary space to accommodate a drag-line, should investigation of bed-rock values be found to justify its installation. Encouraging values are reported in the overlying gravel.



Priority Mines, Limited, Morehead Creek.

It is clear that up-stream from the workings this channel lies buried in the left bank of Morehead Creek. From examination of the region it seems likely that the up-stream continuation lies considerably instream from Morehead Creek, in a direction about south 39 degrees west from the hydraulic pit. Down-stream from the workings, the continuation of the buried channel lies in the right bank of Morehead Creek, and presumably it emerges in Little Lake Creek Valley. It seems likely that this buried channel is a former channel of Warran Creek, which was then a tributary of Little Lake Creek. Both rims of the buried channel are exposed in the hydraulic pit, but the bed-rock is not, and its depth is unknown beyond that it is below Morehead Creek. It is apparent that the canyon of Morehead Creek is largely of post-Glacial age, although incision may have been commenced in inter-Glacial time. Exposures are as yet inadequate for one to form an opinion as to the age of the buried channel, but the well-imbricated gravel leaves no doubt that the direction of flow was north-eastward.

It is apparent that within the hydraulic pit and that part of the creek under investigation, all gravel, and any once-existent glacial material, has been well resorted down to the level of Morehead Creek by this creek. It is only on the north-eastern edge of the hydraulic pit and at the up-stream end of the low-lying flat that glacial overlie is exposed. It is heavy at these points, but operations are not now concerned with it.

The cross-section of gravel in the pit shows that hydraulic operations have gone beneath the range of sorting by Morehead Creek water and have exposed the well-washed coarse and fine gravel of the ancient channel. These gravels show pronounced imbrication indicative of an original north-easterly flow of water. In these gravels are layers of indurated gravel,

which serve as false bed-rocks and prevent gold from sinking in the course of hydraulicking. The overlying gravels, resorted by Morehead Creek, have a maximum thickness of about 22 feet, and are composed of the following strata: At the top, a bed about 4 feet in thickness of sorted gravel with a few large boulders; below this 6 feet of medium-size and fine well-washed gravel; below this, a 2-foot bed of sand; and at the bottom about 10 feet of coarser well-washed gravel. The gravels are derived partly from local rocks and partly from rocks foreign to the immediate vicinity.

PROGESS NOTES.

LODE OPERATIONS.

BY

J. A. MITCHELL.

Cariboo Area.

Cariboo Gold Quartz Mining Co., Ltd.—R. R. Rose, general manager; R. E. Vear, mine superintendent; Les Walker, mill foreman; P. Johnson, master mechanic; C. Boulding, mill superintendent. During 1938, No. 2 shaft was sunk an additional 54 feet to allow sinking operations to be carried on at any future date without interrupting operations on the 1,900 level. No. 1 shaft was sunk 71 feet and the 1,800 level opened up.

At No. 2 shaft, drifting and crosscutting was continuous throughout the year on the 1,800 and 1,900 levels. As yet no stoping has been started on these levels. The extensions of several veins were developed on the 1,500 and 1,700 levels and these are now being stoped. No development on the 1,500 level and the 1,200 level was directed toward testing the ore possibilities on the hanging-wall of the Lowhee fault in the Pinkerton zone. Some work was also done on the 1,500 level under the surface outcrops in the Butts zone. The 1,500 main haulage-level was extended along its original course for a distance of 1,194 feet.

A concrete portal extending for approximately 100 feet was erected at the entrance of the 1,500 main haulage-level.

Underground development during the year consisted of 7,065 feet of drifting, 7,665 feet of crosscutting, 1,281 feet of raising, 125 feet of shaft sinking, and 10,355 feet of diamond-drilling.

On the average throughout the year 212 men were employed underground, thirteen in the mill, seventy-nine on the surface, and there were thirty-two salaried officials.

During 1938, milling was at the rate of 250 tons per day for January and February, and then stepped up to 275 tons per day. During August and September the tonnage was generally increased to 300 tons per day in October, at which rate it has been maintained. A total of 102,539 dry tons of ore was milled in 1938, with a production of approximately 42,808 fine ounces of gold and 3,249 oz. of silver.

In the power-house a Clarkson-Thimble exhaust-heat boiler was connected to the 375-k.v.a. unit. There are now two of these in operation.

On the surface, additions were made to the machine-shop, dry- and bunk-houses.

Island Mountain Mines Co., Ltd.—M. D. Banghart, manager; T. H. Munn, general superintendent; E. W. Johnson, mill superintendent; H. Hewat, mine superintendent. The mine and mill operated continuously during the year. The mill, which has a daily capacity of 125 tons, treated a total of 44,916 tons of ore during the year and produced 18,351 oz. of gold and 2,637 oz. of silver.

Stoping operations and development were carried out over a vertical range of 750 feet, from 250 feet above the main or 4,000 level to 500 feet below the main level, with development being vigorously advanced on the bottom or 3,500 level. During the latter part of the year and the first two weeks of 1939, the main operating shaft was deepened to 1,079 feet below the collar and additional levels opened at the 3,375, 3,250, 3,125, and 3,000 elevations. During the year 7,364 feet of drifting and crosscutting, 1,300 feet of raising, 473 feet of

shaft sinking, 147 feet of shaft stations and pockets, and 23,233 feet of diamond-drilling were done.

The average number of men employed underground and on the surface throughout the year was 111 men.

Cariboo Consolidated Mining Co., Ltd.—This property did not operate during 1938.

Cariboo Thompson Gold Mines, Inc.—C. E. Gordon Brown, manager. A small crew, maximum 10 men, was employed during the year in erecting camp and driving tunnel.

The *Cariboo Thompson* property adjoins the holdings of the Cariboo Hudson Gold Mines, Limited, and the camp is below the Hudson mine-road, about 22 miles south of Barkerville.

Comfortable living-quarters were established and other buildings are contemplated. A 321-foot crosscut was driven and intersected the objective, a small quartz vein occurring in a north-striking fault-fracture which is well mineralized with finely-crushed pyrite. This vein has been followed by drifts respectively 35 feet north and 98 feet south from the crosscut.

A small fan has been installed to control the ventilation in the drifts.

Cariboo Hudson Gold Mines, Ltd.—J. D. MacDonald, superintendent. During the year development-work was continued on the 200 level, a 100-foot winze was driven, and the 250 and 300 levels were started from this winze. A raise-connection on the vein was made between the 300 and 250 levels.

From the Simlock Creek side the 600 level crosscut, 400 feet below the 200 level, was driven. This drive intersected several quartz veins including what is considered the downward continuation of the main vein on the 200 level. A raise is now being driven on this vein between the 600 and 200 levels.

During the year numerous necessary additions were made to the camp. A 100-ton mill was erected and at the end of the year this mill was treating 50 tons daily.

Bralco Group.—E. Parr, engineer in charge; E. Hansen, superintendent. The Pioneer Gold Mining Company of B.C., Limited, took an option of this property which adjoins the *Cariboo Hudson*. A crew of fourteen men was employed at surface-stripping, but results were discouraging and the option was relinquished.

Snowshoe Gold Mines, Ltd.—John Matson, mine manager. The *Snowshoe* is a new operation financed by Fred Wells and associates. The property is 1 mile north of Yanks Peak and is approximately 7 miles due west of the *Cariboo Hudson* mine.

An extensive building programme, including bunk-house, power-house, warehouse, blacksmith-shop, and dry was completed during the latter part of the year. A small steam-sawmill was erected to cut lumber for the camp construction and will be used for future contemplated extensions to the present camp.

Preparations are being made to carry out an extensive development plan using power-drills, but to date the main exploration adit has been advanced by hand-drilling approximately 100 feet into the hill.

A Diesel engine and Ingersoll-Rand compressor are on the ground but are not yet installed. A crew of twenty-nine men is employed at the camp.

During the year a Government road was laid out from Barkerville over the main divide to Keithley. A considerable amount of grading has been completed.

About 250 tons of freight, chiefly mine-supplies, were taken over this road to the Snowshoe camp. Diesel caterpillar-tractors were used for grading the roads and hauling the freight.

The development adit now being driven will cross some of the smaller veins and tap the larger quartz-bodies at considerable depth.

Cariboo Midas Mines, Ltd.—(Amparo Mining Company, Inc., Philadelphia, U.S.A.) J. B. Knaebal, manager; P. Behnsen, superintendent. In the late fall operations commenced at this property, which is near the summit of Yanks Peak on the north slope, and an extensive building campaign was under way at the end of the year.

The present programme calls for a 1,000-foot adit. Fifteen men on three shifts are employed in driving this heading. A 3800 Diesel and compressor have recently been installed to supply compressed air to the drills. The adit is in 290 feet and is ventilated by a gasoline-driven blower and 8-inch vent-pipe.

Supplies at first were freighted in from Barkerville over the road leading to the *Snowshoe* mine, but are now brought in via Keithley then to the mine on pack-horses.

Quesnelle Quartz Mining Co., Ltd.—T. Norton Youngs, manager; Russell Ross, general superintendent. In the period from June, when underground operations were resumed, until the end of the year, the following development-work was accomplished at this mine: 192 feet of drifting; 192 feet of crosscutting; 251 feet of raising. In addition, several stopes were opened up and equipped with chutes and manways. A complete assay plant is maintained at the property and an intensive sampling programme has been carried out.

During the summer a cyanide plant was constructed and put into operation on November 27th. The milling equipment consists of a 275-ton coarse-ore bin at the head of the surface tram from the mine-shaft head, a 9- by 15-inch Allis-Chalmers jaw-crusher, and a 40-foot conveyor to a 100-ton fine-ore bin.

The 4½- by 7-foot Allis-Chalmers ball-mill is driven by a 75-horse-power General Electric motor and operates in closed circuit with a 3- by 15-foot Dorr Simplex classifier. The classifier overflow is sent by gravity by a 12- by 19-foot Dorr combination washing-thickener (top tray), then to two 10- by 14-foot Dorr agitators, and back through the second, third, and fourth compartments of the thickener before being pumped to the tailings launder. The gold solution is clarified and treated in a Merrill-Crowe, bog-type, precipitation unit. The precipitate is refined in a Monarch tilting-pot furnace.

The crushing and grinding units are capable of handling up to 100 tons per twenty-four hours and although the present tank-capacity is 25 to 30 tons the addition of further thickeners and agitators would make an increase in tonnage a simple and comparatively inexpensive matter.

The mill machinery is all electrically driven by 440-volt motors with power supplied from a 125-k.v.a. generator driven by a 120-horse-power Vivian Diesel engine.

During the year an average of thirty men was employed; eight in the mine, thirteen at the mill on construction, seven on the surface, and two salaried officials.

Cariboo Yankee Belle Mining Co., Ltd.—W. F. Cameron, manager; C. R. Cameron, foreman. The main development tunnel, planned to intersect the Corban series of quartz veins at a depth of approximately 700 feet, was advanced to 1,643 feet from the portal before operations ceased for the year.

Marriner Group.—L. H. Hinton, engineer in charge. The N. A. Timmins Corporation took an option on this property during 1938 and did considerable exploratory work in the form of deep trenches and open-cuts. It is understood that the option was relinquished.

Golden Ore Syndicate.—Forbes A. Clarke, general manager. At the time of inspection, three men were employed in driving two short adits.

*Bell-Holm Group.**—Alfred Holmwood, of Prince George, during the year unwatered a shaft sunk a number of years ago to explore some intersecting quartz veins of maximum width 3 feet contained in schistose greenstone. The property is near the north end of the boundary-line between Pre-emption Lots 1602 and 1601, and is reached by following the Prince George–Hazelton Road south-westward for a distance of 6½ miles, at which point a wagon-road 3½ miles in length leads to the property. Sampling disclosed material gold values at one point.

BY

CHARLES GRAHAM.

Zymoetz River District.

Some prospecting was done in the *Zymoetz* and *Big Bull* groups and small shipments made from each to the sampling plant at Prince Rupert.

Usk District.

Small shipments were made from the *Cordillera* and *Lucky Luke* to the sampling plant.

A lease has been given on the *Columario Mine* to W. Duncan, of Usk, who expects to commence work early in the year.

Pitman District.

Grotto Group.—Considerable prospecting has been done and several shipments made to the sampling plant. Work is being continued through the winter months. This property is about 6 miles east of Usk.

* By Douglas Lay.

Hazelton District.

Silver Standard Mine.—Canadian Cadillac Gold Mines, Limited. A. S. Williamson, manager. This property, from which considerable tonnage has been mined some years ago, was reopened.

Nos. 4 and 5 crosscut tunnels have been cleaned up and retimbered. They are now in good shape. These tunnels are each in about 950 feet and intersect several veins.

Ore-extraction in previous years had been on the 400 level, No. 4 adit, where considerable stoping had been done.

Some additional work was done on all veins by hand, principally for sampling purposes. No underground mining operations were carried out.

The old camp was cleaned up and the necessary repairs made to the various buildings. There is nothing definite yet with regard to a future programme.

Smithers District—Hudson Bay Mountain.

Glacier Gulch.—Campbell, Loveless & Banta continued operations on their claims and made a shipment of ore. Prospecting was also done on the *Snowshoe, Coronada, Victory,* and *Empire* groups.

Babine Mountain.

Prospecting was done on the *Valhalla, Rainbow, Driftwood, Victoria, Lorraine,* and *Silver Pick* groups.

Telkwa District—Dome Mountain.

Babine Gold Mines, Ltd.—Nothing was done on this property during the year.

Grouse Mountain.

Prospecting was done on the *D. & N.* and *Last Chance* groups.

Topley District.

Some prospecting was done on the *Gold Group, Golden Eagle,* and several other groups during the summer.

Aiken Lake District.

Croydon Group.—Consolidated Mining and Smelting Company of Canada, Limited. E. Brunland, superintendent.

Considerable prospecting was done during the summer, eight men were employed. Work was discontinued in September when a bush fire destroyed the camp.

MERCURY DEPOSITS.

Fort St. James District.

Mercury Group.—O. J. Ostrem, owner. Under option to Consolidated Mining and Smelting Company of Canada, Limited. Eight men under the direction of E. Brunland carried on active prospecting on this group. This is being continued during the winter months.

ANTIMONY DEPOSITS.

Snowshoe Group.—O. J. Ostrem, owner. Some prospecting has been carried on by the owner on this group.

TUNGSTEN DEPOSITS.

BY

J. A. MITCHELL.

Hardscrabble Mine.—Columbia Tungstens Company, Limited. A. E. Pike, manager; D. D. Fraser, consulting engineer. During the early part of the year, underground development was carried on with a skeleton crew of fifteen men. In May the power-house, pilot-mill, and adjoining buildings were completely destroyed by fire.

Underground work was suspended and rebuilding was commenced during the summer with the erection of a power-house 24 by 42 feet. The plant installed consists of a 120-horse-power Ruston Diesel to drive a 100-k.v.a. General Electric generator, and a 60-horse-

power Ruston to drive a Holman 312-cubic-feet compressor. Starting equipment and a small auxiliary lighting plant were also installed.

A new frame structure bunk-house, 24 by 56 feet, was built and a new office building erected. All buildings were wired and connected to water-mains.

An electric hoist is being installed and is being equipped with safety devices as required by law.

Because of suspended operations during the rebuilding period, underground development was light and consisted of only 80 feet of sinking, 166 feet of crosscutting, and 255 feet of drifting, a small part of which was in the overburden.

PLACER OPERATIONS.

BY

J. A. MITCHELL.

(N.B.—A general shortage of water curtailed the production of placer gold during 1938.)

Cariboo Area.

Consolidated Gold Alluvials of B.C., Ltd.—A. M. Richmond, general manager; E. E. Mason, general superintendent; J. K. Halley, mine engineer. This company operates the *Wingdam* mine at Wingdam; workings are known as the *Sanderson* and *Melvin* mines.

The *Sanderson* mine-workings are in inter-Glacial gravel at an elevation of 2,960 feet. Access to them is by one vertical and one incline shaft, both driven in gravel. The pillar-and-stall method of mining is used, with close timbering. The workings now cover an area of 20 acres. Haulage is by means of a storage-battery locomotive. About ninety men are employed. During the year 52,435 cubic yards of gravel was extracted, yielding 7,046 fine ounces of gold.

The *Melvin* workings were projected to mine the narrow, deep channel of Lightning Creek. They consist of a drainage and service level in rock at 2,800 feet elevation, and drives in the deep channel at 2,875 feet elevation, connected to the former by raises and sub-levels in rock. Entry is had by a 270-foot shaft sunk in rock. During the year, three entries were made into the deep channel and 224 linear feet of reef drives and 1,050 feet of gravel drives were completed. These workings were flooded by the waters of Lightning Creek on March 22nd, 1938. Since that date no further work has been done.

Conditions at the *Sanderson* mine are entirely different; there are no bodies of slum to contend with and the gravels are thoroughly drained. Provided experienced men are in charge these gravels can be safely worked without difficulty.

The *Sanderson* workings are separated from the *Melvin* workings by an 18-inch reinforced concrete bulkhead at the top of the connecting raise. The level of the water in the *Melvin* workings is kept below this bulkhead by the use of a 500-gallon-per-minute Pomona pump located at the collar of the *Melvin* shaft. This is capable of handling the flow but a 1,000-gallon-per-minute Johnson pump is in reserve for emergency use.

Hixon-Quesnelle Placers, Ltd.—Brian Briscoe, managing director; A. C. Stewart, superintendent. Fourteen men and a No. 6 monitor under 126 lb. pressure were employed at this operation at the time it was inspected.

Quesnel Mining Company, Ltd.—Chas. S. Buck, superintendent. An average of thirty-five men was employed at this operation during the summer.

Deriving water from Spanish Creek, this company has opened up a hydraulic pit on the Cariboo River, on the *Ruby* lease, down-stream from Spanish Creek, proving the existence of a former channel of the river lying buried instream in the south bank of the latter. The bed-rock is about 25 feet above the river. So far as is known, this is the only hydraulic that experienced no water-shortage during the year, the supply being adequate for the continuous operation of one 8-inch and one 7-inch nozzle throughout the season.

Placer Engineers, Ltd.—Ernest F. Lang, manager. It is reported that twelve men and and one monitor were employed at this operation during the summer.

Bullion Placers, Ltd.—Ray F. Sharpe, general manager; J. A. Ryland, superintendent; J. Forman, mine foreman. An average of seventy-five men and two monitors were employed at this operation during the summer.

The abnormally dry season resulted in an unavoidable curtailment of yardage-output, and at the latter part of the season probably would not exceed 1,250,000 yards. The wisdom of the campaign of Keystone-drilling carried out in recent years has been demonstrated, as it has been of a particularly informative character, revealing unexpected features, and enabling future operations to be planned with certainty. The *Bullion* pit has now holed through to the upper part of the *South Fork* pit.

Pine Creek Mining Co., Ltd.—There were ten to twelve men and one monitor employed during the year.

Burrard Placers, Ltd.—There were ten to twelve men and one monitor employed at this operation during the year.

Sangdang Placers.—Wm. H. Hong, general manager. A No. 5 and No. 2 monitor under 60 lb. pressure and an average of fifteen men were employed at this operation. As was general throughout the area, the lack of water seriously curtailed the production. The banks are up to 80 feet high.

Last Chance Placers.—Wm. Hong, manager. One No. 3 monitor, working under a 100-foot head of water, and three men were employed at this operation. The banks are up to 70 feet high.

Montgomery Creek Placers.—Wm. Hong, manager. One No. 1 monitor, working under a 100-foot head of water, and three men were employed at this operation. The banks are up to 60 feet high.

The Ketch Mine.—Russel McDougall, superintendent. One No. 4 monitor, working under a pressure of 70 lb., and an average of fifteen men were employed at this property.

Dragon Creek Placers.—Russel McDougall, manager; D. Smith, foreman. One No. 2 monitor, working under a 40-lb. pressure, and a maximum of five men were employed at this operation.

Eastman Red Gulch Placers, Ltd.—A. F. Eastman, general superintendent. One monitor and seven men were employed during 1938.

French Creek Hydraulic Placers, Ltd.—Ivan I. Felker, superintendent. This placer is worked by one monitor at 120 lb. pressure and eight men are employed.

Barkerville Gold Mines, Ltd.—C. A. McPherson, superintendent. Work at this placer was confined to construction-work and ditch-making. Nine men were employed.

Slade Placers, Ltd.—Maury Caldwell, superintendent. This placer was worked by one No. 2 monitor until the water-supply failed. Work was then confined to construction-work. Three dams were built and the ground is in good shape for next year's operation. Six men are employed.

McMillan Leases.—Fraser & Peers, of Quesnel, B.C., acting for Portland interests, drilled seventeen holes and put down nineteen shallow shafts preparatory to further drilling. This work ceased when the option was relinquished.

No Name Placer Mine.—Operating for the same account as on the McMillan property, Fraser & Peers, employing a crew of three men, put down four shafts to bed-rock on this ground.

A new discovery of coarse gold was made during the year by D. Pearson on a small creek locally named No Name Creek, flowing north-eastward and eastward into Beaverpass Creek, north of the mouth of Baldhead Creek. The property is about 3½ miles, by the Beaver Pass trail, from Beaver Pass House. By sinking in old Chinese workings, which followed post-Glacial gravels down to a false bed-rock of boulder-clay, the owner discovered coarse gold on true bed-rock only a few feet below the clay. The total recovery to date from ground-sluicing operations is reported as being very encouraging, including one nugget weighing 18 dwt. The continuation of operations will doubtless reveal the full significance of this discovery, which is not now clear from exposures, beyond the fact that it is of undoubted merit.

Gagen Creek.—Still for the same account, Fraser & Peers, with a crew of men, are drilling and sinking a shaft on the leases owned by H. G. Jamieson.

Lowhee Mining Co., Ltd.—Chas. W. Lea, general manager; Henry Lea, manager; Joseph House, superintendent. At the time of inspection two No. 6 monitors were at work under 65 lb. pressure per square inch. There were twenty-seven men at work, but the average number of men employed during the 1938 season is reported to be about fifteen.

The effect of the dry season was severely felt at this property, at which hydraulic operations have now been carried on for *forty years*, the hydraulic pit and sluice-flume now reach a length of 1⅛ miles.

BY

DOUGLAS LAY.

Cariboo Placers, Inc.—This company, a Seattle incorporation, holds fourteen leases on the right bank of Antler Creek, adjoining and down-stream from the property of Guyet Placers, Limited. There is every topographic indication that a former channel of Antler Creek, some miles in length, lies buried in its right bank at a height of about 260 feet above the creek. Investigation seems warranted to determine if dredging or hydraulic possibilities exist.

Devil's Canyon.—A new discovery was made during the year by R. R. Moffat, immediately east of Devil's Canyon, on the Quesnel–Barkerville Road. At this point, there is a considerable amount of meadow-land at the Chisholm Creek-Devil's Lake Creek divide on both sides of the latter. Early miners worked off post-Glacial deposits situated on top of the east wall of Devil's Canyon. The new discovery was made at the north end of a meadow considerably farther instream. A small hydraulic plant was installed by the owner, water for the purpose being pumped from one of the small lakes in Devil's Canyon.

Canamco, Ltd.—This company, of which E. B. Skeels is president, for some weeks operated a drag-line plant of modern design on a large bench on the left bank of the Fraser River, on Pre-emption Lot 502, 5½ miles north of Quesnel, after which the plant was moved to Canyon Creek. This installation, of movable land-plant type, consists of a digging unit comprising a boom drag-line caterpillar shovel with 1-cubic-yard bucket capacity operated by a gasoline-engine, and a recovery plant mounted on caterpillar tracks, operated by a Diesel-electric unit. The recovery plant comprises receiving hopper; double-screen trommel (holes 1 inch round and ¼ by 1 inch slotted); four 36-inch Ainlay centrifugal bowls with rubber riffles, for recovering gold, taking trommel undersize; sand-pump which stacks the tailings from the Ainlay bowls; and coarse tailings stacker. In this case wash-water was pumped from the river by a Jaeger self-priming centrifugal pump. The capacity of this plant is about 75 cubic yards per hour and four men per shift are required for its operation.

Property of D. B. Wallesen.—Two leases held by D. B. Wallesen on the west side of the Fraser River, in part situated on Pre-emption Lots 6170 and 82, are 5 miles by motor-road from Quesnel. Placer occurrence is typical of former river-bar deposition, now expressed in the form of elevated benches of considerable extent. Much ingenuity is reflected in the inexpensive and efficient plant devised by the owner for the recovery of gold. This comprises a mobile bucket-elevator with pulleys on 18-foot centres, delivering gravels shovelled by hand into its boot at an "A" grizzly, with bars three-quarters of an inch apart, the undersize passes to a blanket-table covered with expanded metal riffling, 7 feet long, inclined at a slope of 3 inches in 12 inches. The total power required for the operation of this plant is 4½ horse power, which includes the power required (3 horse-power) to pump sluice-water from the Fraser River. The total consumption of gasoline per shift is 4 gallons, and three men suffice for the operation of this plant, which has a capacity of upwards of 20 cubic yards per shift.

Operations of A. P. Himmelman.—A considerable yardage was mined by drag-line installed by A. P. Himmelman on Placer-mining Lease 3150, situated on Pre-emption Lot 716, on the left bank of the Fraser River, between Chimney and Pablo Creeks, and distant 14 miles from Williams Lake by highway and branch motor-road. At this point a bench approximately 100 feet above the river, of considerable extent, offers excellent dump facilities. Extensive old workings at the up-stream end of the bench indicate that this was formerly a favourable point for deposition of gold. During the year gravels were mined to a maximum depth of 35 feet, which suggests a possible underlying former channel of the river in this region.

Cottonwood Canyon Gold Mines.—The leases of H. Bellos and associates on the Cottonwood River, described on page C 25, Annual Report, Minister of Mines, British Columbia, 1936, have been acquired by a syndicate named Cottonwood Canyon Gold Mines. A small hydraulic installation utilizing water from Hush (May) Lake was completed during the year,

giving a head of about 200 feet at the monitor, set up on a rock bench on the right bank of the river, about 45 feet above the latter, where dump facilities for tailings are good.

Leases of J. Coreau.—J. Coreau, of Cottonwood, holds two leases on Norton and Mary Creeks, tributaries of John Boyd Creek. The property is reached by a wagon-road 5 miles in length, which branches from the Quesnel–Barkerville Road at Cottonwood. One lease on Norton Creek covers the old *San Juan* mine, reopened a few years ago under the direction of H. McN. Fraser, but subsequently again closed down after considerable work. The present owner reports encouraging values in gravels overlying a rock bench about 2,000 feet in length and somewhat under 200 feet in width on the right bank of Norton Creek.

Manson Creek District.

BY

CHARLES GRAHAM.

Lost Creek.

Dunsmore Gold Mining Co., Ltd.—J. M. Dunsmore, manager. This is an underground operation, the only one in the district. There is a shaft 90 feet deep on the East Bench of Lost Creek. The shaft is connected to an old adit-level driven over twenty years ago which serves as drainage and provides a second opening. Water for sluicing is pumped to the shaft by a 450-gallon centrifugal pump. A camp has been built.

Lost Creek Placer Gold, Ltd.—Bert McDonald, manager. This is a surface operation using a combination shovel and drag-line. Water is very scarce, not being sufficient to provide for sluicing. They have started to build a ditch to bring water from Manson Creek.

Manson Creek.

The *Northern Gold Placers* had a steam-shovel operating last year, but have apparently suspended operations. There are several individual operators working on the creek.

Slate Creek.

Consolidated Mining and Smelting Company of Canada, Ltd.—W. M. Ogilvie, manager. This is a drag-line operation working three shifts and employing thirty-five men. A bulldozer is used to break the ground into the drag-line pit.

Germansen Creek Area.

Germansen Ventures, Ltd.—Frank deGanahl, manager. This is a hydraulic operation. Three pits have been opened up, but only two of them are being operated. A ditch and flume 11 miles in length was constructed during the winter to bring water from Germansen Lake. The ditch has a capacity of 200 second-feet. A slide took out about 250 feet of flume which caused considerable delay in the early part of the season. A flume section had to be built in around the slide. The company completed a road from their camp on the Omineca River about 8 miles up Germansen Creek, built a bridge across the creek and connected the road with the road built by the Consolidated Mining and Smelting Company of Canada, Limited, from Germansen Lake to Slate Creek, thus giving a road through from Fort St. James to Germansen Landing on the Omineca River. Supplies can now be taken in by truck.

Germansen Mines, Ltd.—A. A. McCorkell, manager. This is a hydraulic operation on Germansen Creek employing about ten men.

Takla Lake District.

Tom Creek.

Tom Creek Placer Mining Co.—J. J. Warren, manager. This is a surface operation using a steam-shovel. About twenty-two men are employed.

Harrison Creek.

Harrison Creek Ventures, Ltd.—Frank deGanahl, manager. The property did not operate during the year, the gravel from the previous winter's underground work was sluiced.

Vital Creek.

Northern Ventures, Ltd.—Frank deGanahl, manager. This is the only underground operation in the district. It did not operate during the year.

Quartz Creek.

Several groups of prospectors worked on this creek during the season.

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VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

2,825-339-8416

The Annual Report of the Minister of Mines is now issued in parts as follows:—

Part A.—THE MINING INDUSTRY (STATISTICAL REVIEW). John F. Walker.

Part B.—NORTH-WESTERN DISTRICT. Joseph T. Mandy.

Part C.—NORTH-EASTERN DISTRICT. Douglas Lay.

Part D.—SOUTH CENTRAL DISTRICT. M. S. Hedley.

Part E.—SOUTH-EASTERN DISTRICT. R. J. Maconachie.

Part F.—SOUTH-WESTERN DISTRICT. H. Sargent.

Part G.—INSPECTION OF MINES. James Dickson.

PART D

ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1938

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

BRITISH COLUMBIA DEPARTMENT OF MINES.

VICTORIA, B.C.

Hon. W. J. ASSELSTINE, *Minister.*

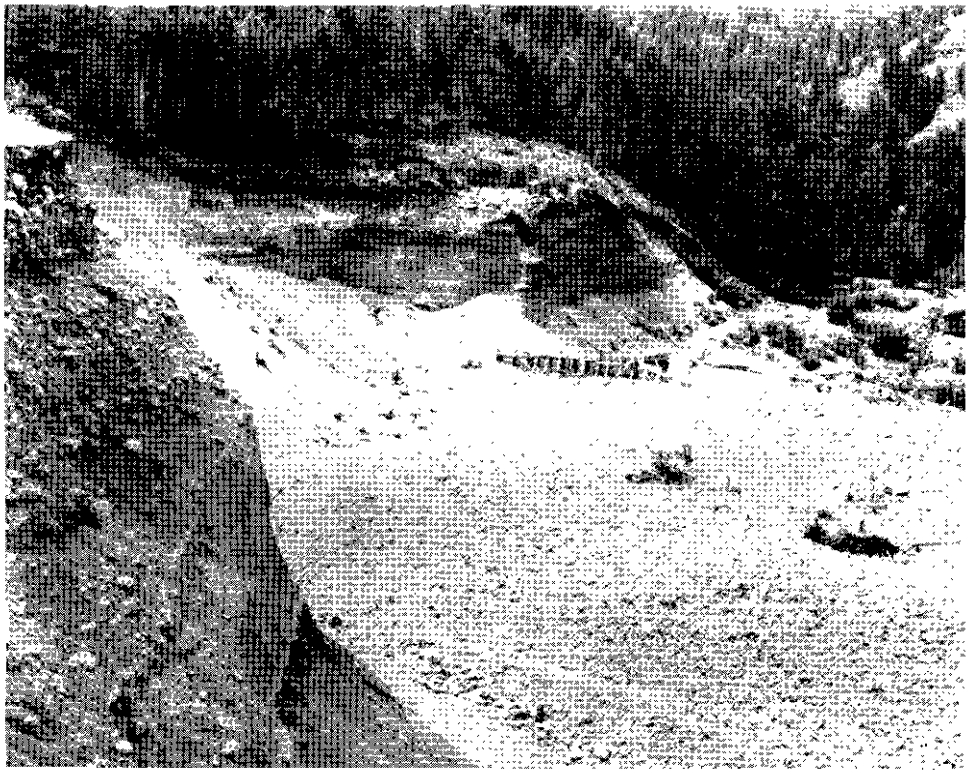
JOHN F. WALKER, *Deputy Minister.*

JAMES DICKSON, *Chief Inspector of Mines.*

D. E. WHITTAKER, *Provincial Analyst and Assayer.*

P. B. FREELAND, *Chief Mining Engineer.*

R. J. STEENSON, *Chief Gold Commissioner.*



Lower Rock Creek. Stratified gravel above rock bench.

Upper Jolly Creek. Incline track from drift workings.

Headwaters of Azure River (left) and Raush River (right), looking north-west.

Looking down Hobson Creek Valley from Blue Ice property. Claim post is in right foreground at edge of glacier.

PART D.

SOUTH-CENTRAL DISTRICT.

BY

M. S. HEDLEY.

GENERAL SUMMARY.

Capacity operation by the Granby Company was responsible for a greatly enlarged metal output for the South-Central District. Gold production from other sources was also greater than in 1937, owing to aggressive development by the operating companies and to activity by lessees.

Hedley Mascot Gold Mines, Limited, explored by means of a new lower adit totally new ground indicated by diamond-drilling. Kelowna Exploration Company, Limited, increased production, and Canty Gold Mines (Hedley), Limited (N.P.L.), pressed development from the completed 450-foot shaft.

Several large companies took an active part in the search for new mines and Anglo-Huronian, Limited, optioned the *Blue Ice* group on Hobson Creek.

In the Beaverdell Camp development by the Sally Mines, Limited, was disappointing, but Highland Bell, Limited, has shown that the ore is not limited by depth. Beaverdell-Wellington Syndicate investigated ore possibilities on the *Bounty*, *Duncan*, and other claims.

Throughout the southern and central parts of the district it is very gratifying to see many individuals and groups, chiefly from the Boundary country and Rossland, engaged in leasing old properties. These men deserve a great deal of credit and are of great value to the country. Among such may be mentioned those busy at the properties of Dentonia Mines, Limited, and Kalamalka Gold Mines, Limited, in the Kettle River and Twin Lakes areas; and on the *Copper King* (Kamloops) claim, and others. These men create money and employment, and maintain or rekindle interest in many camps on ground not sufficiently attractive at the present time to be taken up by the larger operating companies.

On the other hand, prospecting has fallen off. Although a good deal of the district has been combed, there are still areas which have received little attention. In areas where a new discovery has been made, or where there is revival of an old camp, numbers of experienced prospectors materialize, but there are few who go to the trouble and expense of searching in new fields.

LODE-GOLD DEPOSITS.

AZURE RIVER-HOBSON CREEK AREA.

References.—Annual Reports of the Minister of Mines, British Columbia, 1923, 1927, 1929, 1933; J. R. Marshall, Geological Survey, Canada, Summary Report, 1927, Part A; N. F. G. Davis, Geological Survey, Canada, Summary Report, 1929, Part A.

Introduction.—This area is in the north-west corner of Kamloops Mining Division, in a mountainous region at the headwaters of Hobson Creek and of Azure and Raush Rivers. The mountains are part of a system which has no definite name, but they are doubtless a south-eastern continuation of the Cariboo Mountains; they extend south-eastward to the north-south valley occupied by North Thompson River, east of which are the Columbia Mountains.

Drainage from the area is south by Azure River and west by Hobson Creek. These streams flow into Clearwater Lake, which is drained by Clearwater River into the North Thompson River. Drainage to the north is by Raush River, which flows into the Fraser near McBride, some 40 miles distant. The headwaters of the North Thompson River lie a few miles to the east.

There are three natural routes into the area: First, by way of the North Thompson River from Gosnell on the Canadian National Railway, a distance of 45 miles; second, 16 miles by trail up Hobson Creek from the head of Hobson Lake; the third route, over which there has been no travel for years, is up the valley of the Raush River to its headwaters, a distance of about 50 miles.

The trail up the North Thompson River is 45 miles in length from Gosnell to the *Summit* group. It is poorly located, although quite passable. From Gosnell, at an elevation of 2,500 feet, the trail follows the bottom of the North Thompson River Valley for a distance of 30½ miles. The first 20 miles of the route is through heavy stands of cedar and spruce and, after climbing over a ridge on the mountain-side near Thunder River, the upper section follows less heavily timbered and partly meadow-land. Many mud-holes in the trail make going heavy in wet weather.

The river is forded at an elevation of 3,450 feet, a crossing difficult or impossible at high water. The trail then climbs in 3 miles to Summit Lake, elevation 5,200 feet, past which it drops gradually for 2½ miles through an open pass and then steeply for 1½ miles into Azure River Valley, elevation 4,350 feet. The valley-bottom is followed for 4 miles through spruce and balsam woods, open meadows, and some rocky hillsides to an elevation of 4,800 feet, at which point a branch leads to the *Summit* group. The trail continues up the Azure River for some 4 miles, where, at the north end of open meadows, it drops rapidly into the deep valley of the main Raush River.

The main cabin on the *Summit* group is at an elevation of 5,335 feet, nearly a mile from the river. Above the cabin the trail follows above timber-line through an open pass leading to Hobson Creek, at the west end of which is a second cabin. There is no trail down this branch of Hobson Creek. Above the second cabin a trail leads steeply up a talus-covered hillside, attains an elevation of about 7,000 feet, and drops down on the southern part of the *Blue Ice* property. The trip from Gosnell to the *Blue Ice* usually takes four days with lightly-loaded pack-horses, and the *Summit* group can be reached in three fairly heavy days.

The trail between Gosnell and Azure River has never been properly located and is merely an outgrowth of the original trapper's trail. Relocation, notably at Leos Creek, Thunder Basin, and Pass Creek, would doubtless make for a shorter, much easier trail, but there are great obstacles to be overcome in road-construction, owing principally to the wetness of the climate and also to the high pass at Summit Lake.

The writer has no direct knowledge of the Raush River route, but it is known to be, in its lower stretches, one of gravel footing in a relatively dry terrain. A trail, approximately 50 miles in length from railroad to Azure River crossing, was built ten years ago, but there has been no travel over this route for several years. It is understood that in the upper stretches of the main Raush Valley difficulty is encountered in repeatedly crossing the powerful stream which meanders through the heavily glaciated, steep-sided valley-bottom, and that in the uppermost section the steep climb through rocky country to the headwaters of the Azure River presents considerable difficulty to road-construction.

The third route, via Hobson Creek, was built to within 1½ miles of the *Blue Ice* property in November of 1938, when further work was stopped by heavy snowfall. A pack-trail was cut out along the bottom of Hobson Creek from the lake and the climb made by easy grade above and south of that branch of the creek fed by the Blue Ice Glacier. There do not appear to be any serious obstacles in the construction of a road over this route, and it is without a doubt the most efficient means of access to the area of the *Blue Ice* property. It is reported that the trip from Hobson Lake will, upon completion of the trail, be made by pack-horses in a day. The boat trip on Quesnel Lake is 70 miles long and that on Hobson Lake 5 miles; there is a truck-road 5½ miles in length between the two lakes.

Topography and Climate.—The area lies amongst high, glacier-capped mountains which rise to elevations in excess of 8,000 feet. Few peaks in the general vicinity exceed 9,000 feet in elevation, but some rugged summits north of Raush Glacier and at the head of North Thompson River may be considerably higher. All of the higher peaks and most of the more prominent ridges bear glaciers which, as on the north part of the area and a few miles to the south, may coalesce to form extensive ice-fields.

Azure River heads in a large meadow in an open, through valley at an elevation of 5,250 feet. A branch of Raush River heads also in this meadow, from the north edge of which it falls precipitously some 2,000 feet in a distance of 3 miles to join other branches in the large, gravel-filled valley at the foot of Raush Glacier. The Raush River Valley trends north-west for a few miles and then swings to the north through less high mountains. Azure River Valley is steep-sided and is between 3,000 and 4,000 feet deep. From the headwaters to the junction with Braithwaite Creek, 10 miles to the south, there are only two open passes, that via Summit Lake to the east and that to Hobson Creek on the west.

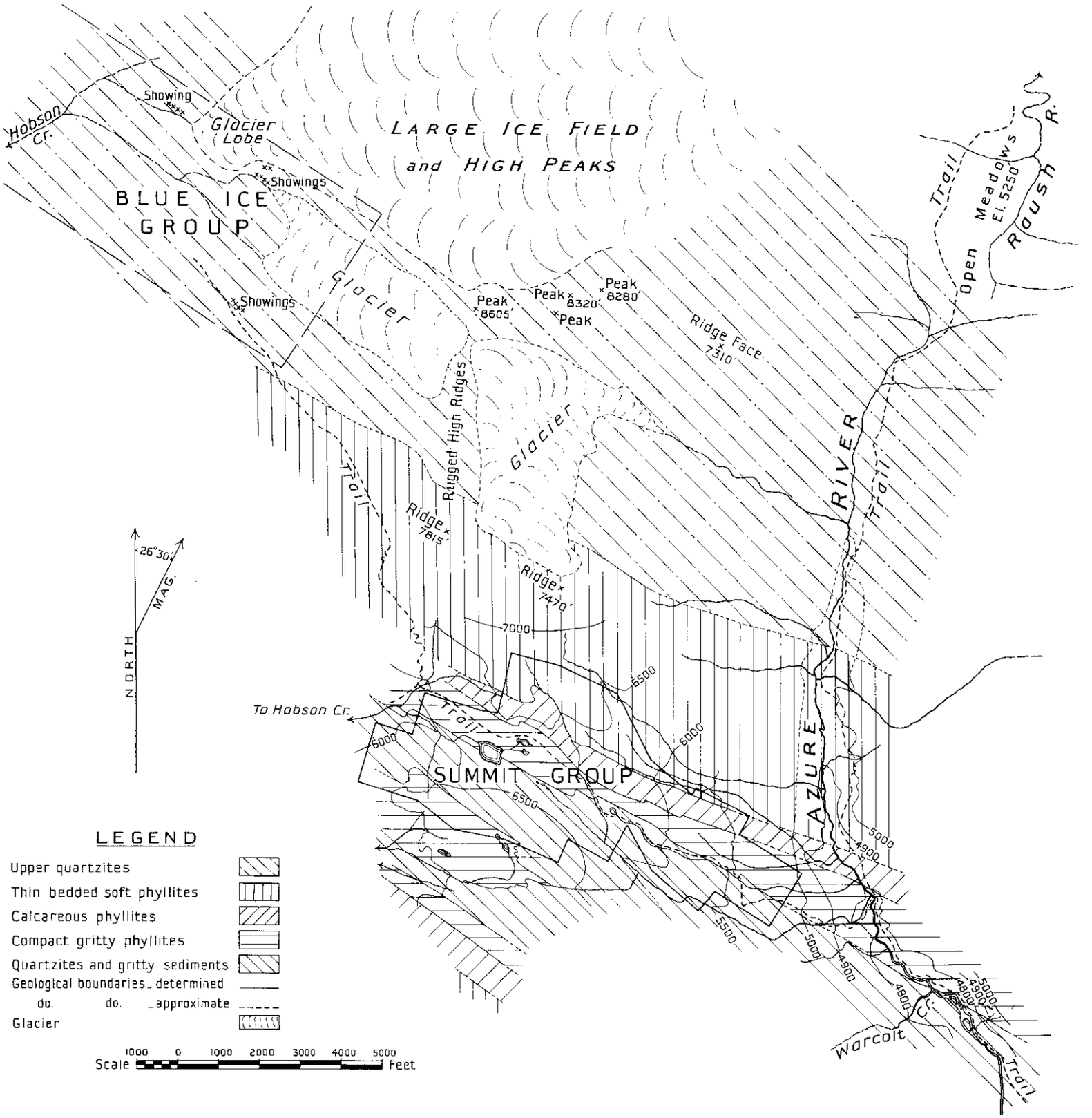


Fig. 1. Sketch-map of country at headwaters of Hobson Creek, Azure River, and Raush River.

Hobson Creek has two main branches, heading in ice-fields to the north and south of the area; two smaller branches, one joining the south branch and the other the north branch, head on the *Summit* and *Blue Ice* properties respectively. Each of these hangs above the parent branch. The names of these members of Hobson Creek are not known and existing maps throw little light, so they are here left unnamed. That branch which heads on the *Blue Ice* property is perhaps rightfully named Fredwells Creek.

The accompanying map, Fig. 1, is based on a plane-table survey of the Crown-granted *Summit* group and was extended to include a part of the Azure River (reduced from Fig. 2). Those peaks of which elevations are given are located by plane-table triangulation, and all other detail is sketched. All elevations are based on altimeter readings and are believed to be reasonably accurate.

The climate is one of heavy precipitation. It is reported that in wetter years rain may fall throughout a considerable part of the summer but that July and August are commonly clear. Marshall reports that in the field season of 1927 only the period from mid-July to late August was without much rain. In 1938 rain was falling on entry to the country on July 10th but clear, warm weather obtained from July 12th to August 1st, when rain fell daily until August 21st, after which there was fine weather until leaving, six days later. There may be, in late summers, considerable snow remaining at elevations in excess of 6,000 feet on July 1st, and snow may come to remain at the end of September. Work at higher elevations is often hampered by heavy clouds that roll in from the lakes to the west and north, and greatly obscure vision above 6,000 feet.

Timber-line proper is at an elevation of 6,000 feet. The growth includes balsam, fir, and spruce, in sizable stands locally to elevations in excess of 5,000 feet. Brush is not excessively thick in the upper parts of the valleys.

Of game, caribou, once said to be abundant, are not now plentiful. Occasional moose and some deer are reported, and goat are found in localities both north and south of the area. Grizzlies frequent the higher slopes in the autumn.

History.—The first mention of the area is in the Annual Report of the Minister of Mines for 1919, when it was stated that an Edmonton syndicate had obtained an option on the *War Colt* group and built a trail from the Canadian National Railway to the camp. In 1923 the area was visited by A. W. Davis, Resident Mining Engineer, at which time all of the present stakings had been made, and by H. G. Nicholls, who succeeded Davis, in 1927 and 1929. J. R. Marshall, of the Geological Survey of Canada surveyed the general area in 1927 and a short report was written; the results of this work and of further surveys in the general Clearwater Lake area by N. F. G. Davis was published in full by Davis in 1929. The present writer spent the months of July and August, 1938, in making examinations, the results of which form the basis of this report.

The area seems to have been first visited by trappers about the year 1913, notably by Adolph Anderson, of Albreda, B.C., who made his way from North Thompson River to the head of Azure River. The *War Colt* group was staked by Anderson and Lewis Knutson about 1914, and this seems to have been the first location, although not much work was done until 1918.

At about the same time, what is now the *Summit* group was staked by G. S. Stewart and Angus Horne, of Blue River, and in 1920 it was reported that considerable work was done on the several properties. Fred Wells staked a part of what is now the *Blue Ice* group in 1923, but did not return, and other stakings were known in this locality in the same year. Several engineers reported on the various holdings in 1926 and 1927, and in 1928 Joseph Errington, of Toronto, optioned all stakings in the area and made several new locations. Under the direction of his brother, W. Errington, a pack-trail was built from Raush Valley near McBride on the Canadian National Railway, up Raush River to Azure River, a distance of perhaps 50 miles. A trail was built from the *Summit* group to the *Blue Ice*, and a main camp was built at Azure River crossing. The options were relinquished in 1931 and the Raush River trail was abandoned. In 1933 Albreda Holding Company, Limited, a private company with head office in Vancouver, acquired the *Blue Ice* and *War Colt* groups, but apparently little work was done and the groups were allowed to lapse.

In 1934 Western Investments, Limited, acquired the holdings of Angus Horne, G. S. Stewart, and W. R. Johnson, of Blue River, formerly known as the *Summit* and *Grizzley*

groups. This property, now known as the *Summit* group, was surveyed in 1936 and Crown-granted in 1937. It was reported on by the company's engineer, Ned E. Nelson, in 1936, and was examined by Pioneer Gold Mines of B.C., Limited, in 1938. Some surface work was done in these years, and the " Stewart Tunnel " adit was advanced.

The *Blue Ice* group, owned by W. R. Johnson and associates, of Blue River, was relocated in 1938 and, as the result of an examination by A. G. Langley, of Vancouver, the group was optioned to Anglo-Huronian, Limited. A trail was constructed from Hobson Lake almost to the camp, where a cabin was built, when further work was prohibited by heavy snowfall in November. It is reported that a diamond-drill and supplies were stored at Hobson Lake in readiness for an early start on a campaign of exploration in 1939.

General Geology.—The rocks within the area are all members of the Azure River series, so named by N. F. G. Davis. This is a sedimentary series of great thickness which is believed to be Precambrian in age, partly because it is unfossiliferous and also because it is lithologically similar to the Cariboo series in Barkerville area and to the Barriere series in North Thompson Valley area.

The rocks are predominantly quartzose, in which quartz grains form a chief or important constituent. Argillite and limestone are rare. To quote Davis* " The main rock-types are quartz-pebble conglomerates, massive and schistose quartzites, quartz schist, quartz-chlorite schist, and phyllite. In the lowest exposed parts of the formation grey, green, and reddish-brown quartzites and somewhat metamorphosed quartz-pebble conglomerates or grits are the dominant types. . . . In the upper parts of the formation fine-grained schists and phyllites are dominant. . . .

" The finest-grained types are crinkled and crenulated dense phyllites, varying from dark green and black to light green and pearly white . . . Some break in thin plates along the plane of foliation and reveal crenulations on a lustrous surface. On some types only a very fine puckering or crinkling is seen. The phyllites are composed of very fine-grained quartz with considerable chlorite and some sericite."

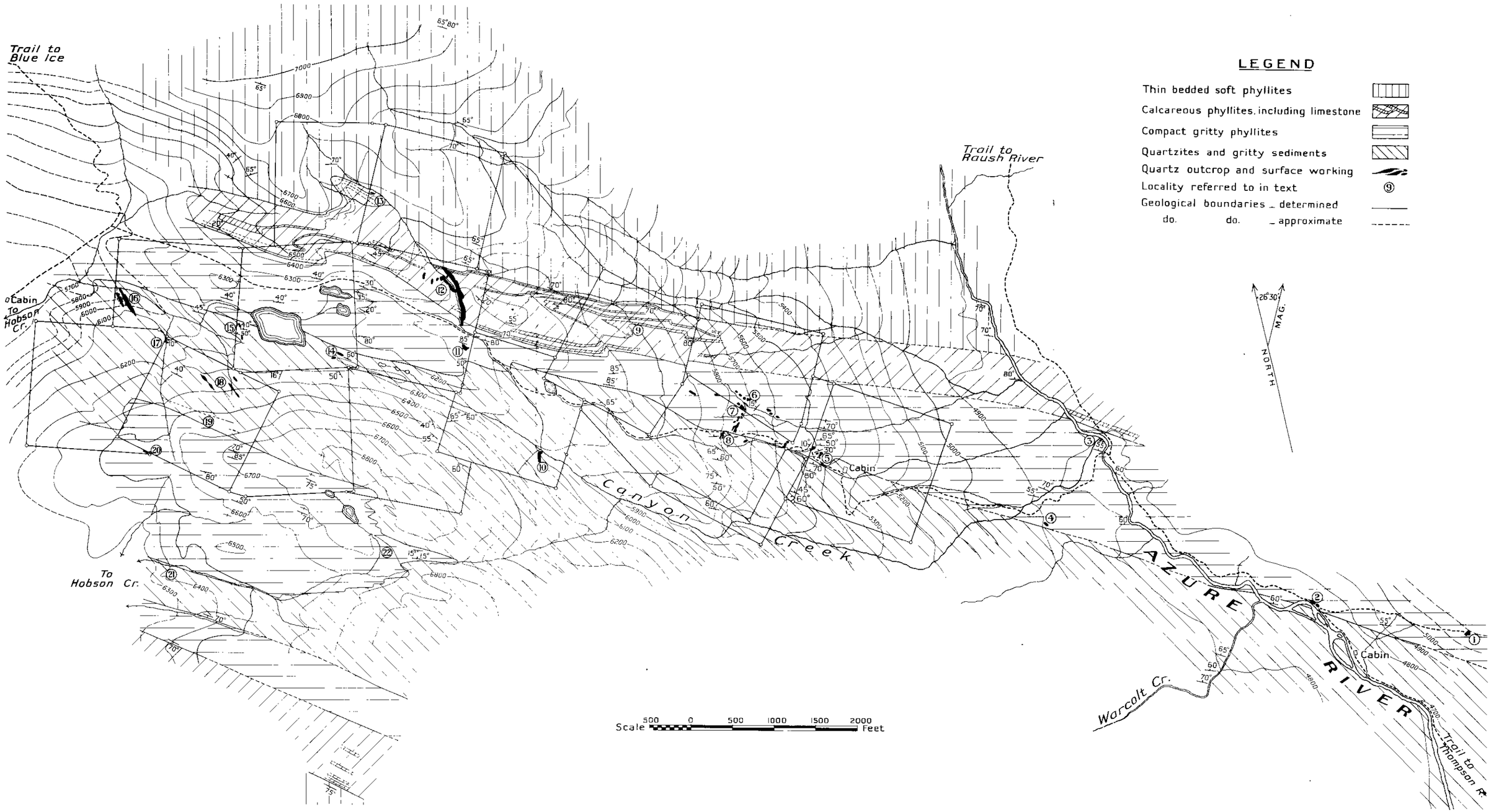
Davis has done considerable petrographic work not attempted by the writer, who prefers to lay emphasis on structure. The quartz-pebble conglomerates are rocks which contain a large proportion of quartz grains from the size of rice to, in rare cases, peas; the grains are commonly surrounded by what was originally silty material, now largely sericite. These rocks may, however, contain a matrix of fine quartz sand, in which case they may be difficult to distinguish from quartzite proper. The writer believes that no misunderstanding will arise if all of these quartzose rocks showing plainly visible quartz grains are collectively referred to as quartzites.

All of the rock-types above enumerated by Davis may be found to alternate and intergrade, and all may vary in degree of fissility or schistosity with their structural location. To be more precise, any given bed may be seen to vary in this respect whether it is involved in the limb or apex of a fold or whether or not it is caught up in a zone of minor, complex contortion.

There is to the south a body of granodiorite: a medium-grained, grey rock containing abundant quartz and biotite. It occupies a lake basin at the head of Braithwaite Creek and extends to the ridge summit about 1½ miles south of the *Summit* group. This body was not mapped, but it appears to be about half a mile wide and some 3 miles long, in a north–south direction, and is last seen as a dyke-like continuation to the south at a high elevation above and east of Braithwaite Creek. In the lake basin, dykes of the same rock but finer in texture are common, but there is very little evidence of contact metamorphism. The granodiorite is presumed to be Mesozoic in age.

The Azure River series, where closely studied by the writer on and adjacent to claims of the *Summit* group, has been subdivided into four members. These comprise: (1) Lower " quartzites " including quartzites proper, quartz-pebble conglomerates, and gritty to arkosic rocks, together with interbands of phyllite and schist. These are exposed in the crest of a major anticline and grade upwards into (2) fine gritty phyllites with rare interbeds of quartzite. These are compact, strongly-bedded rocks with a flaggy cleavage. (3) Above, is a calcareous member including phyllite, calcareous phyllite, and four or five major bands of limestone from 5 to 30 feet in thickness. This horizon is reported by Davis to be traceable to

* Geological Survey, Canada, Summary Report, 1929, Part A, pp. 286–7.



LEGEND

- Thin bedded soft phyllites
- Calcareous phyllites, including limestone
- Compact gritty phyllites
- Quartzites and gritty sediments
- Quartz outcrop and surface working
- Locality referred to in text ⑨
- Geological boundaries — determined
- do. do. — approximate

Fig. 2. Geological map of part of Hobson Creek-Azure River Divide, showing Summit group and location of former War Colt group.

the summit of the ridge north-west of Summit Creek. (4) An upper phyllite member is of soft, thinly-bedded and highly-cleavable rocks which verge locally on chlorite- and sericite-schists. They are characterized by lustrous, crinkled cleavage surfaces, and produce abundant fine, glistening talus.

Above this last member is a tremendous thickness of quartzites displaying all of the varieties named above. No attempt has been made to subdivide these upper quartzites because of the time involved, and it is doubtful whether subdivision of an order comparable to the foregoing is worth while. Above this large member is an upper phyllitic to schistose member seen both east and west of the north end of Azure River meadows. These last rocks make up the summits at the head of Raush and North Thompson Rivers and produce reddish and brownish-coloured bluffs and talus-slopes. They are fine-grained, glistening, and crenulated micaceous rocks which, when closely folded, form intricate structures.

Thicknesses are difficult to determine owing to folding, but rough estimates may be made. Of the lower quartzites, several hundreds of feet are exposed in the anticline which extends down Azure River Valley to Summit Creek, and the member is many times this thickness. The lower gritty phyllites are between 250 and 400 feet thick. The calcareous phyllites are about 300 feet thick. The upper phyllites are between 2,000 and 3,000 feet thick. The upper quartzites are in the neighbourhood of 5,000 feet thick. The uppermost phyllites are at least 1,000 feet thick. The rocks exposed between Summit Lake and the headwaters of Raush River and of Hobson Creek represent a stratigraphic thickness of at least 10,000 feet.

Structure.—The rocks have a regional strike of north 60 degrees west, and major folding into broad anticlines and synclines has occurred along this direction. The axis of one such major anticline extends from the summit immediately south of Azure-Hobson pass (*see* Fig. 2) to about the mouth of Summit Creek on Azure River; the fold plunges to the north-west at a low angle (10 to 15 degrees). Another major complex fold passes through the large ice-field at the head of Azure River. The upper quartzites dip steeply to the north-east and are locally overturned immediately north-east of the *Blue Ice* horizon; they are involved in a broad zone of intense contortion in the summits west of the large meadow, and a zone of more normal, synclinal folding in the summits on the east. Abreast of the north end of the meadow dips are again to the north-east, and the quartzites are seen to be overlain by the uppermost phyllitic rocks. The uppermost rocks are believed to flatten in dip farther to the north-east, about the headwaters of Raush River.

This double axis of major folding which passes through the summits about Azure River meadows is clearly seen to extend down the valley of the North Thompson River, in that section above the main trail crossing. Complicated structures along this axis are indicated in high summits to the north-west of the area, in the direction of the east arm of Quesnel Lake.

Fairly detailed study was made of the first major anticline on Azure-Hobson pass, where mineral deposits of the *Summit* group are seen to be clearly related to structure. There, in a well-exposed region of diversified rock-types and accompanying mineralization, is ample opportunity for study of benefit to one working in the area.

In the main, this anticline is seen to be a uniform structure, with its axial plane nearly vertical and with a plunge of about 15 degrees to the north-west; considerable drag-folding has occurred on the limbs near the crest of the fold, in phyllites and also in the uppermost bed of quartzite. The top of the folded quartzite is, in the area mapped, largely covered by a thin blanket of phyllites only in part eroded away. This blanket is caught into a series of numerous minor folds and plications, as at (21), Fig. 2, and casual inspection leads to the impression that the rocks are all steeply dipping, whereas the average dip is quite flat. In the zone of drag-folding as mapped, the individual folds are seen to be irregular and rather discontinuous, owing partly to the fact that they cross rocks of varying character and competency at an oblique angle.

On the north side of the pass the upper, soft phyllites dip steeply (65 to 70 degrees) north-eastward, but a pronounced flattening is seen on the ridge summit 7,815 feet elevation (Fig. 1); the dip there is 35 degrees north-eastward and again steepens farther to the north-east. The dip becomes even steeper (75 to 85 degrees) in the upper quartzite members.

Cleavage is a prominent feature in all rocks but the more massive quartzites. It has a regional trend parallel to the axis of the main folding, and tends to parallel the bedding in

major limbs at some distance from a crest. Consequently, and directly in accordance with theoretical principles, the angular relation between bedding and cleavage ranges from 0 to 90 degrees, and care must at all times be taken to distinguish between cleavage and bedding in a folded area of easily cleavable rocks.

The upper quartzites maintain a very uniform attitude until involved in the next zone of major folding. This folding is synclinal and open, east of the Azure River meadows and to the south-east into North Thompson River drainage basin, but is complex to the north-west. Major contortion is evident on the west side of the meadows, and this zone of contortion is believed to extend to the north-west beneath the ice-field and to continue beyond the head of Hobson Creek.

In the high peaks shown on Fig. 1 abnormal changes in dip may be seen from a distance, and the limestone horizon at the *Blue Ice* was not found to cross the Azure River. A fault is indicated immediately south of the 8,605-foot peak and, although presence of fresh snow on the peaks and lack of time prevented full examination, the writer believes that at this point there is a major fault which must nearly coincide in strike with the formation. Demonstration of the existence of this fault, and determination of its character and extent, is of importance in a mineralized region.

Economic Geology.—Mineralization consists of pyritic deposits containing gold and small amounts of silver. Except for limestone replacement on the *Blue Ice* all mineralization is in quartz-filled fractures. Pyrite is by far the most abundant mineral, but there are also small and variable amounts of galena, sphalerite, chalcopyrite, tetrahedrite, and arsenopyrite. A light-coloured carbonate, which becomes dark on weathering, is a common accompaniment of the quartz; it is siderite, and possibly in part ankerite. So far as is known, the gold is finely divided and free gold is not obtained on panning.

Quartz veins are very common throughout the area and range in size from stringers and gashes to veins 30 and more feet wide. None appears to be very continuous, and individual veins, regardless of width, are no more than several hundred feet long. There are, however, zones of considerable length along which quartz veins are localized as individual bodies or as fracture systems. One such zone follows the north-eastern flank of the southern major anticline at or near the contact of the quartzites with overlying phyllites. Another broad zone passes through the *Blue Ice* property, through the high peaks south-east of that ground, and becomes less prominent past the Azure River. This zone is within the upper quartzites where they are uniformly steeply-dipping, but it seems definitely related to the near-by major zone of contortion and perhaps also to the postulated fault.

In general, the greatest amount of quartz and the most uniform and continuous bodies occur in the quartzites and quartzitic rocks, whereas veins in the softer phyllites tend to occur as irregular kidneys or lenses. In the uppermost phyllites abreast of the meadows there is considerable glassy, crystalline quartz, in widths up to 8 or 10 feet, but with little continuity. The veins are, with rare exceptions, fillings of fractures with little or no shearing, and most of the walls are tightly frozen.

Limestone replacement is, as far as known, restricted to one band 20 feet wide, within quartzites, on the *Blue Ice* property. The several limestone-bands above the main anticline are nowhere seen to be replaced by sulphide, although there is some quartz veining, as at (9) in Fig. 2, and locally a little silicification. Another prominent limestone-band 25 feet wide, 400 feet below the lower contact of the upper quartzites, is similar in this respect.

Summit Group. This group of sixteen Crown-granted claims and fractions is owned by Western Investments, Limited, 543 Granville Street, Vancouver, B.C.; C. W. Bradley, president. It occupies the open pass between Azure River and Hobson Creek, and lies above timber-line except for the south-eastern end. There is trail connection with the Azure River and the *Blue Ice* property.

The pass is open and grass-covered and all parts of the ground are easily accessible, except for a few bluffs on the south side which are fairly difficult to climb; the elevation ranges between 5,000 and 6,800 feet. There are two small cabins; one near the south-eastern end, elevation 5,335 feet, and one just north-west of the property, elevation 5,600 feet.

The mineral-deposits are all quartz-filled fissures containing pyrite, accompanied locally by galena, chalcopyrite, sphalerite, and rare amounts of tetrahedrite and arsenopyrite.

The general geology has already been discussed, at which time it was pointed out that this ground is on the crest and north-east limb of a major anticline which plunges at a low angle to the north-west. The lowest rocks exposed are quartzites, partly roofed over on the crest of the anticline by gritty, competent phyllites possessing a flaggy cleavage. Above is a phyllite member including many calcareous beds and several distinct bands of grey limestone, from 5 to 30 feet thick, not all of which are continuous. Above is a succession of thin-bedded and strongly fissile, soft phyllites which weather to produce many thin, glistening, crenulated cleavage-plates.

There are many drag-folds in these rocks, most of which are irregular, rather discontinuous, and tend to die out in the uppermost phyllites. The lowest phyllites are intricately crumpled in a thin blanket over the quartzites, and in the centre of the pass several of the drag-folds are seen to be complex zones of crumpling, being drags in general form only. In the quartzites the folds are more uniform, but there are some with quite sharp and partly broken crests. Cleavage is prominent in all but the more massive quartzites and is most strongly developed where the folding is most intense. Locally, some of the rock must lithologically be classified as schist but, since it is of local occurrence and directly produced by dynamic forces which have caused rock-flowage, it is best considered merely as an extreme variety of phyllite.

Fig. 2 shows all essential geology and the location of the principal drag-folds, as marked by hooks in the geological boundaries. Faulting is rare, but between localities (19) and (20) a fault which trends north 80 degrees east is seen to displace the rocks about 150 feet. There appears also to have been some faulting along the line of the " Stewart " vein, locality (12), but the displacement is not marked and the fault fades out along its strike.

The quartz veins and masses, all the important ones of which are mapped accurately and designated by number, occur near the north-easterly contact of the quartzites, and are further localized by drag-folds.

The quartz veins all dip steeply and tend to strike in four principal directions. One set of veins parallels the general structure, an average strike of north 60 degrees west. Other sets strike north 20 to 30 degrees west, north, and north 30 to 40 degrees east, or roughly at right angles to the regional strike. This is more a general than particular rule, from which there are many divergencies. Those veins which are in quartzites have many branches which tend to leave the parent in one or more sets and play out at distances from a few inches to 50 feet. Some individual quartzite beds or bands have been shattered and contain a ramifying maze of frozen stringers which are, in such cases, nearly always barren of sulphide. Those veins parallel to the formation tend to be narrow and are generallly unmineralized. Those which strike north 20 to 30 degrees west are among the most prominent as to size and frequently contain some sulphide; at (18) fissuring in this direction tends to be mineralized, whereas fissuring in other directions is not.

All of the wide quartz veins or masses terminate abruptly, and many of those occurring within the softer rocks tend to be irregular pods about which the fissile rocks are warped and buckled. The quartz is white and crystalline, and in it the sulphides are erratically distributed as scattered grains, as veins, and as pockets or " nests " and " smears." In the softer rocks inclusions of schist in quartz are common.

Pyrite, when in solid or almost solid masses, seems to be intercrystallized with quartz and at the same time to be shattered and veined by quartz; pyrite occurs locally as a pyrite-quartz vein within a vein, and although there consequently appears to be a second generation of quartz it is indistinguishable as a rule from the main mass. Sphalerite, galena, and chalcopyrite with associated gold in some cases, notably the " Horne Tunnel " adit, are distinctly later than, and are found as veinlets in, the pyrite.

Siderite, which is light in colour when fresh and weathers to a deep brown to reddish colour, occurs in many veins as a common constituent, in small masses to pockets 2 feet or more in extent. Sericite is occasionally seen, but likely represents the digested remnant of a schist inclusion.

The principal showings will be enumerated in note form. Only passing mention will be made of the surface workings because they are relatively unimportant. The numbers refer to the numbered localities in Fig. 2.

(5) " Horne Tunnel " adit, elevation 5,425 feet, is driven northward into the base of a ridge 35 feet higher. On the top of this ridge is an exposure of quartz on or nearly on the crest of a complex drag-fold. The quartz appears to strike north-westward but is exposed for not more than 30 feet of length, and open-cuts have failed to pick up positive continuations, although apparently unrelated quartz is found to the south and north-west. The exposure is, on the top, practically barren of sulphides, but a shallow working 10 to 20 feet above the adit shows in the quartz a 5-foot cross-vein of almost solid pyrite, and it is on this cross-vein that the adit is driven.

The adit extends 36 feet at north 36 degrees east, and then 20 feet at north 35 degrees west. From 3 to 29 feet from the portal the adit is in quartz and some schist; massive pyrite is on the right wall for the first 9 feet, then for 5 feet on the left wall, and again on the right wall for the innermost 3 feet of this distance; through the remainder the quartz is lightly mineralized with pyrite and includes some schist. From 29 to 35 feet there is massive sulphide only on the right wall. It consists of a fine assemblage of pyrite, sphalerite, chalcopyrite, and galena. The same mineralization continues along the right wall of the north-westerly continuation of the adit, apparently as a vein 18 inches wide, with some additional quartz.

There appears to be, from all evidence, an irregular mass of quartz, some 10 by 30 feet on the surface, but highly irregular in downward continuation and in which there is an irregular north-easterly cross-vein of almost solid pyrite. A north-westerly vein, largely in rock, is composed of an assemblage of fine-grained sulphides. Three samples were taken: (*a.*) Eastern wall of adit, 7 to 12 feet from portal: Gold, 0.14 oz. per ton; silver, 0.3 oz. per ton. (*b.*) Wall, 36 feet from portal, representing a width of about 2 feet: Gold, 1.20 oz. per ton; silver, 1.6 oz. per ton. (*c.*) Across 52 inches on cross-vein on surface, 10 feet above portal: Gold, 0.30 oz. per ton; silver, 0.3 oz. per ton.

(6) At this point there is an open-cut on an irregular mass of quartz on the same fold as the " Horne Tunnel." The quartz is about 20 feet long by a maximum width of 8 feet; it lies east-west and contains considerable siderite, and locally a little pyrite. The quartz is not a continuous single mass but is irregular, and in the anticlinal crest it is clearly to be seen that in harder, quartzitic layers the quartz is stronger and in individual masses as large as 2½ by 4 feet, whereas in softer, phyllitic beds the quartz occurs only as stringers and small lumps.

Small showings of quartz are seen for 200 feet to the north-west along this structural axis and from 250 to 400 feet to the south-east, where stringers and veins up to maximum widths of 3 feet strike parallel to the structure, north, and north 75 degrees east. A forked vein 250 feet south-east of (6), with limbs up to 3 feet wide and 15 feet long, is mineralized with scattered pyrite, galena, and arsenopyrite; a sample of selected material assayed: Gold, 0.88 oz. per ton; silver, 0.5 oz. per ton.

(7) A mass of quartz, known as the " pinnacle," is in warped, schistose phyllites. It is an irregular, pear-shaped mass 25 feet long lying with the formation and with a north-easterly prolongation which gives a maximum width of 22 feet; the quartz appears to have no continuation except as a band 1 foot to 3 feet wide for an additional 25 feet to the south-east.

There is very little pyrite in this mass except at the " shank," where pyrite streaks occur over a width of 8 feet. The pyrite is coarse, up to half-inch cubes, and is shattered and seamed with quartz; a little sphalerite, galena, and chalcopyrite accompanies the pyrite. A selected sample of average solid sulphides assayed: Gold, 2.86 oz. per ton; silver, 0.1 oz. per ton.

A few small open-cuts up and down hill show a little irregular quartz in small widths. Between this locality and (8) there is a series of open-cuts partly exposing five quartz veins from 2 to 6 feet wide and with exposed lengths of from 10 to 30 feet. Of these one strikes north-westward and the others north-eastward; pyrite is present locally and tends to follow the walls.

(8) There are here two large masses of quartz, barren except for local pyrite. One forked vein is 120 feet long with a maximum width of 10 feet and a minimum of 2 feet of solid quartz; with a branch some 60 feet long and 2 to 4 feet wide. The quartz contains a few small pockets of pyrite and some inclusions of schist; it tends to follow directions of north 30 degrees east and north 80 degrees east.

The other large mass trends north 20 degrees east, has a total length of 70 feet and a maximum width of 19 feet of solid quartz at the centre. The walls are of schistose quartzite, some of which has been engulfed by quartz. Mineralization is confined to a single S-shaped veinlet of pyrite, 40 feet long, which crosses diagonally from wall to wall at the widest part. This veinlet is composed of much medium to fine-grained pyrite associated with quartz, and averages about 6 to 8 inches in width. A sample taken over 16 inches at the widest point assayed: Gold, 0.78 oz. per ton; silver, 0.6 oz. per ton.

(10) Is a prominent barren quartz vein several feet wide that strikes north and hooks round to the north-east at the north end.

(11) Is a quartz-body exposed for 57 feet, or nearly its total length, in a north 35 degrees west direction. It is 7 to 12 feet wide and is locally well-mineralized with pyrite, chalcopyrite, galena, and sphalerite, particularly for a length of 25 feet along the western wall. A selected sample, containing 50 per cent. sulphides in white quartz assayed: Gold, 0.32 oz. per ton; silver 0.9 oz. per ton.

(12) This is the "Stewart" vein, the largest body of quartz on the property. The vein is nearly 800 feet long and for the greater part of its length is 20 to 35 feet wide. The strike is approximately north for 400 feet from the southern end, where it splits into two members about 50 feet apart and with a strike of north 25 degrees west. Four isolated masses of quartz west of the western limb have not been traced.

The vein lies mostly in calcareous phyllites at a small angle with a prominent drag-fold along which there has been a slight dislocation. It is made up almost entirely of barren quartz with local, small patches of carbonate and local, small amounts of pyrite occurring in smears and stringers with associated rare chalcopyrite, arsenopyrite, and tetrahedrite. An adit, 54 feet long, is driven to crosscut the larger limb; from 38 feet from the portal to near the face it crosses a zone of quartz stringers and sericitic schist, and the innermost 4 feet is in almost barren quartz. Samples taken include: (*a.*) Chipped across the face of the adit: Gold, trace; silver, 0.2 oz. per ton. (*b.*) Selected from "powder tunnel" on west limb: Gold, 0.18 oz. per ton; silver, trace. (*c.*) Selected across sulphide veining at corner 100 feet south of fork: Gold, 0.12 oz. per ton; silver, 0.1 oz. per ton.

(13) Is a ribbing of quartz which attains a maximum width of 10 feet and is exposed over a distance of some 50 feet.

(14) Mineralization occurs near the crest of a drag-fold in a band of phyllite within the lower quartzites. Several open-cuts show irregular quartz in stringers and in widths to 4 feet locally. The mineralized quartz is apparently restricted to the phyllite, although small, barren and irregular stringers are abundant in the quartzites in this locality. The quartz contains well-mineralized pockets and stringers of galena and pyrite. A selected sample favouring galena assayed: Gold, 0.16 oz. per ton; silver, 20.2 oz. per ton; lead, 45.5 per cent.

(15) Is a north-south zone some 35 feet long (covered by snow at the south end). This is a stringer-zone a few feet wide, with one single band of quartz locally 3 feet in width. Sulphides, including galena, pyrite, and chalcopyrite, are scattered throughout and are abundant at the south end. A selected sample assayed: Gold, 0.26 oz. per ton; silver, 1.3 oz. per ton; lead, 3.3 per cent.

Some 100 feet to the south is a short 4- to 7-foot vein, strike north 15 degrees east, locally well-mineralized with coarse pyrite.

(16) There are here two large barren veins of white quartz locally containing small pockets of siderite. The larger vein, strike about north 20 degrees west, is about 400 feet long and up to 40 feet wide. The smaller mass is some 150 feet long and 15 feet wide, which is actually the main rib of a stockwork of quartz. Cross stringers and masses are irregular, and may be short gashes up to 6 feet wide; the common strike of these is between north 30 and 70 degrees east, with steep south-easterly dip.

(17) Here, in nearly flat quartzites, is a 10-foot zone of quartz stringers, trending northwestward. About 300 to 400 feet south-east of this point frequent stringers, striking northeastward, are mineralized with pyrite.

(18) Here are three veins which strike north 20 to 30 degrees west. The most westerly is about 6 feet wide at the northern end, is 12 to 20 feet wide for 30 feet, and then 1 foot to 7 feet wide to the southern end; a total length of 240 feet. This is part of a stockwork

with many offshoots trending north 30 to 70 degrees east as well as many at all angles. Pyrite is nowhere abundant and is found locally on the main vein, at intersections, and in some cross-veins.

A parallel vein 200 feet eastward is some 160 feet long, the northern end of which for 75 feet is 3 to 5 feet wide. South of a 30-foot extremely narrow section there is a widening to a maximum of 9 feet near the southern end. This vein is well mineralized with pyrite, particularly in the wider sections and at the northern end, where several open-cuts have been made. A selected sample of almost solid pyrite assayed: Gold, 0.34 oz. per ton; silver, 0.3 oz. per ton.

Midway between these two veins is a narrow, discontinuous vein-zone some 250 feet in length, along which there is scattered pyrite. It should be noted that there is definite evidence here of a pattern with wide quartz following a direction of north 20 to 30 degrees west, abundant veinlets and branches striking north 70 degrees east, and fewer striking north 30 degrees east. Pyrite is seen only in or close to the north-westerly set of fracturing, which is a direction of light shearing.

(19) Is a vein following the formation. It is 1,000 feet or more long, up to several feet in width, and contains locally very small amounts of pyrite.

(20) Is a 50-foot barren vein some 5 to 6 feet in width.

Conclusions.—There are on this property many quartz veins, of which some are very wide, none are very long, and many terminate abruptly. It is concluded that they are all fillings of fractures, along the walls of which there is no marked shearing. In the softer rocks, with the notable exception of the "Stewart" vein, the quartz-bodies are pod-like and with poor continuity. In quartzites there is a strong tendency, as at (16), (18), and at (21), south of the property, to form stockworks either at an angle to or parallel with the bedding. Mineralization within the quartzites consists almost entirely of pyrite, and in the softer rocks a complex mineralization is frequently seen.

Although sulphides leach out rapidly, their former presence can be detected readily from the pitted or cellular texture of the white quartz of an outcrop—this is not to be mistaken for the irregular, open pockets produced by the leaching of carbonate.

In many of the veins or masses sulphide occurs only locally, in pockets, veins, or "smears." Some of this pyrite seems to have come in with a later generation of quartz, but one that is hard to detect. It seems to be an important point that in the "Horne Tunnel" the best values are related to copper-lead-zinc minerals that are definitely later than the pyrite.

The different behaviour of the fracturing and, consequently, the difference in form and mineralization in passing through different sorts of rocks should be borne in mind. In a folded region of a heterogeneous assemblage of hard and soft rocks development should proceed with caution.

Azure River Valley.

A few claims were once held under the name of the *War Colt* group near the mouth of Warcolt Creek. The original holdings expanded and in 1933, when owned by Albreda Holding Company, Limited, the number of claims was increased to thirty-six. All of these claims had lapsed by 1938 and the boundaries of the former group are not known, but it is evident that a few years ago all of the upper Azure River Valley was staked, from below Warcolt Creek to the headwaters.

The various showings and workings found by the writer in this general section are no different in general character from those already described. At (1), in schistose phyllites, is a large exposure of quartz on which a little work has been done. This mass has one well-defined boundary trending north 55 degrees east, 45 feet in length; the quartz is about 10 feet wide at each end and a swelling to the south-east reaches a maximum distance of 30 feet from the boundary-line. No serious attempt has been made to trace this mass farther, although these are the apparent limits. The quartz is barren except for a 30-foot band of sulphides up to 30 inches wide along the north-west boundary and a shorter, parallel band 3 feet wide extending from the centre of the mass north-east. Mineralization is not abundant and includes chalcopyrite, tetrahedrite, galena, sphalerite, and pyrite. A selected sample of the heaviest mineral assayed: Gold, 0.84 oz. per ton; silver, 8.8 oz. per ton; copper, 2.9 per cent.; lead, 3.1 per cent.

(2) This is the *War Colt* tunnel, the first discovery in the district. It is a short adit at river-level, driven 16 feet in a north-easterly direction in schistose, quartzitic, and softer beds; at the portal an open-cut extends north-westward for 45 feet, and three small open-cuts lie to the south and south-east. The structure is not clear, and there is more than one body of quartz.

In the adit the innermost 5 feet is in smoky quartz and siderite with one north-south boundary. The north-westerly-trending vein at the portal contains much siderite and is 3 to 6 feet or more wide, pinching out at both ends. Pyrite is locally abundant at the portal and chalcopyrite is abundant to the north-west, which latter mineral is frequently seen to occur in veinlets traversing carbonate, accompanied by films of quartz; there is also some galena and a very little sphalerite. Three selected samples were taken from the dump: (*a.*) Favouring pyrite in quartz: Gold, 0.10 oz. per ton; silver, 2.5 oz. per ton. (*b.*) Favouring chalcopyrite in carbonate and quartz: Gold, 0.12 oz. per ton; silver, 4.1 oz. per ton; copper, 7.3 per cent; lead, 2.5 per cent. (*c.*) Favouring galena in quartz: Gold, 0.06 oz. per ton; silver, 27.5 oz. per ton; copper, 2.5 per cent.; lead, 18.9 per cent.

Quartz shows in two open-cuts near the adit, but there is no obvious connection with the above-mentioned veins and the cuts are in a bad state of repair.

(3) At the junction of Canyon Creek and Azure River there is a showing of quartz and siderite about 10 feet square in plan. A band of pyrite 6 inches wide follows one east-west wall and a parallel zone of pyrite mineralization 1 foot to 2 feet wide traverses the mass. A selected sample of fairly solid pyrite assayed: Gold, 0.08 oz. per ton; silver, 0.3 oz. per ton.

There are other indications of quartz in this locality, but no continuity is proved and some exposures are only doubtfully in place.

(4) Is a barren quartz mass some 6 by 25 feet as exposed, on which a little work has been done. The strike is north-westward.

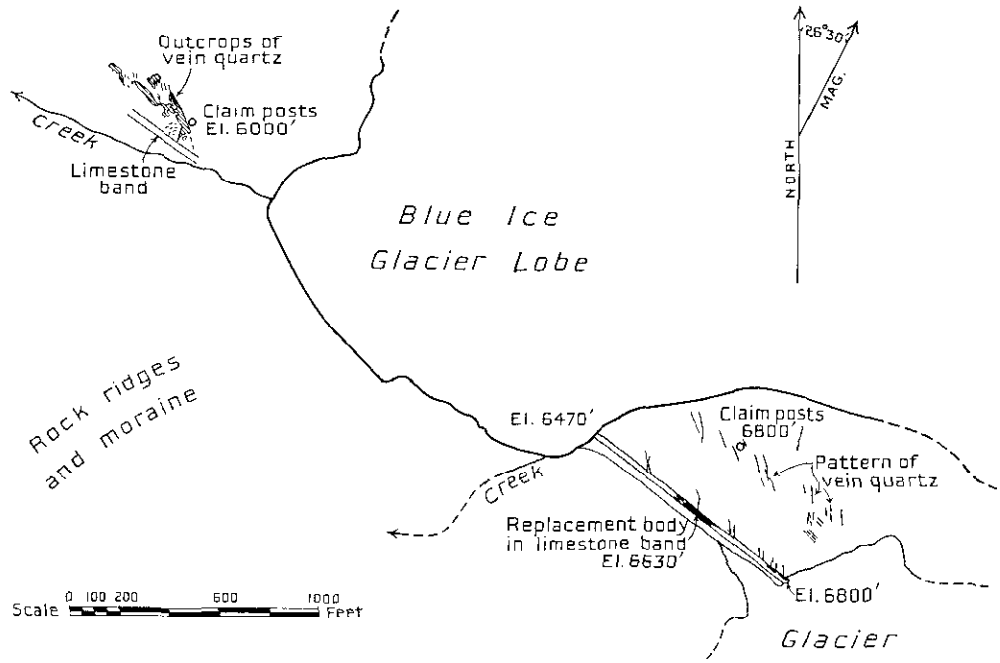
Other, natural, showings in upper Azure River Valley include the already-mentioned broad belt or zone of quartz veins, in the upper quartzites, which passes through the high peaks and crosses the southern end of the meadows. These veins were not closely studied but those seen were largely barren. Many can be seen from a distance on the eastern summits and slopes of the high peaks, down and over the "ridge face," elevation 7,310 feet, and in the glacier basin at the head of the river.

A large vein is seen at an elevation of 6,200 feet in the first big creek north of Summit Creek on the east side of the valley. This point is about 200 feet below the contact of the lower quartzites with overlying phyllites, which contact would seem to be remarkably straight from here to the Hobson Creek pass. The vein is 75 feet long by 15 to 30 feet wide as exposed, and consists of bluish, vitreous quartz cut by stringers of white quartz. Local carbonate and small amounts of pyrite are not related to these stringers, which are barren.

Blue Ice. This group of twenty-two claims is at the head of a branch of Hobson Creek known by some as Fredwells Creek. It was optioned in 1938 by W. R. Johnson and associates, of Blue River, to Anglo-Huronian, Limited. A trail was constructed from Hobson Lake almost to the property, where a cabin was built, and a diamond-drill and supplies were stored at Hobson Lake ready for a programme of development early in the coming season.

The north-eastern corner of the group is on a prominent ridge, surrounded by ice, which leads north-westward from the 8,605-foot peak, and the northern margin crosses a prominent glacier lobe (*see* Figs. 1 and 3). Below the ice-sheets the ground is largely covered by moraine, through which project rock ridges. The southern and western part of the group is one of scantily-timbered hillside. North of the main creek is a prominent steep-sided ridge, and the main creek follows westward then north-westward at the base of this, after falling several hundreds of feet below a rocky platform a quarter of a mile or so below the glacier.

The rocks are all members of the upper quartzites. They are quartz-grain rocks of many types, many have a silty, now sericitic base, and most are thick-bedded. Thin bands of phyllite or quartz-sericite schist are to be seen; these represent more silty phases of the metamorphosed sandstone series. There is one band of dark-grey limestone, about 20 feet wide, which is only locally exposed between stretches of ice and moraine; it is reported to



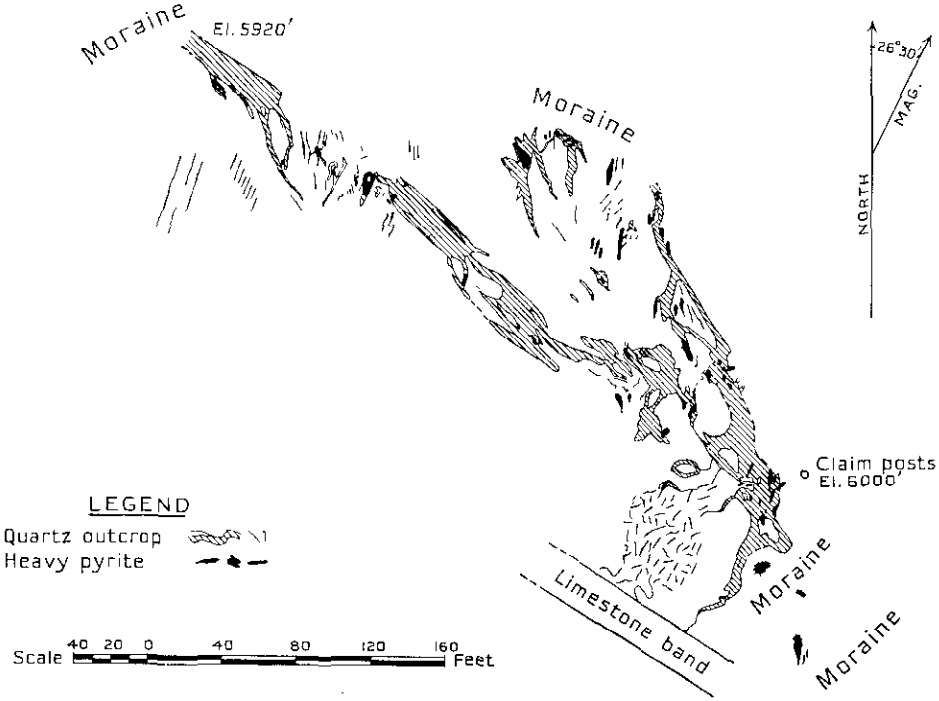


Fig. 3. Blue Ice group at head of Hobson Creek.

Top figure: Distribution of principal showings. Bottom figure: Detail of outcropping of vein quartz in quartzite, as exposed on rock ridge, surrounded by moraine, north-west of glacier.

continue some considerable distance to the north-west, but was not found by the writer to extend as far as Azure River on the south-east. The strike of the formation is about north 55 degrees west and the dip is 80 degrees or more to the north-east. Farther to the north-east the quartzites are vertical or with steep dip either way, and in the high peak north of the glacier are seen to be folded over flatly, about half a mile from the Blue Ice Glacier lobe.

The quartzites, over a belt a mile in width, are traversed by many quartz veins and stringers. Few of these are either large or long, and many are actually narrow, irregular stockworks or more commonly sets of short quartz-filled cracks and gashes crossing the beds nearly at right angles. Carbonate is a common accessory of the quartz veins. Sulphides occurring locally include pyrite and small amounts of chalcopyrite, galena, sphalerite, and arsenopyrite. Mineralization has extended into the limestone-band locally to form an almost solid pyrite replacement.

There are three areas to be described in detail (*see* Figs. 1 and 3). That indicated in the south-west corner of the group is a quartz vein, locally of considerable size, the upper end of which is at an elevation of 6,600 feet, south-east of which there is, probably, a smaller continuation as a vein or stringer-zone for several hundreds of feet.

The vein is well exposed from this upper point for over 600 feet to an elevation of 6,400 feet, along a line trending a little west of north. The upper 200 feet of length ranges in strike from north to nearly east, north of which point there is a split for 150 feet, beyond which the vein continues northward for 250 feet as a single crooked strand 3 to 8 feet wide. At the upper end the vein is 6 to 8 feet wide, and for the remainder of its length it is 4 or 5 feet wide with local enlargements to 15 feet. A dark-weathering siderite, occurring in nests to several feet across, is common.

Mineralization consists of pyrite with, chiefly at the upper end, chalcopyrite and small amounts of galena and sphalerite. Mineralization is restricted chiefly to the uppermost 200 feet as exposed and to the lowermost end. The greater part of the vein by far is barren. Three selected samples were taken at the upper end:—

(1.) From upper open-cut: Gold, 0.62 oz. per ton; silver, 2.4 oz. per ton.

(2.) From second open-cut, fine pyrite: Gold, 2.90 oz. per ton; silver, 0.3 oz. per ton.

(3.) Almost solid sulphide, including a little chalcopyrite and galena: Gold, 0.60 oz. per ton; silver, 7.0 oz. per ton; copper, 2.1 per cent.

A sample chipped across 20 inches of pyrite showing in the lowermost open-cut assayed: Gold, 0.02 oz. per ton; silver, 0.2 oz. per ton.

At the most northerly exposure, at the claim posts, 6,000 feet elevation, is a knoll of quartzite surrounded by moraine (*see* Fig. 3). The mineralization was mapped, as exposed, in considerable detail, although the full complexity is not here reproduced. On the plan the chief concentrations of pyrite in quartz are indicated. The full extent of this complex of quartz-veining is not known.

As shown in the plan, the total exposed length is 460 feet and the greatest width 120 feet; individual widths of quartz are as great as 20 feet. One prominent direction of fissuring is north 55 degrees west, parallel to the formation, another trends about north 30 degrees west, and a third north 15 degrees east; the dip in all is very steep. Quartz parallel to the bedding is mostly barren; that diverging 25 degrees from it is poorly mineralized. Pyrite is found to occur commonly in short quartz veins and lenses, and within the larger quartz-bodies as lenses or veins, which for the most part strike with the third set of fracturing, north 15 degrees east. Short gashes of this set are not infrequently seen aligned as a belt trending north 30 degrees west, and it is judged that they are tension-gashes and that pyrite has largely entered the rocks along fissures produced by tensional stresses, whereas the greatest amount of quartz followed avenues of very light shearing.

There is a sericitic alteration of the rocks in this general zone that is more prominently developed here than elsewhere on the property. Pyrite is locally found in small masses within the sericitized quartzite at or close to bodies of quartz and also, rarely, several feet distant.

Sampling of such a deposit is, of course, difficult, and a few samples only were taken, of selected material in each case:—

(1.) Coarse, cubical pyrite (20 per cent.) in quartz: Gold, 0.06 oz. per ton; silver, 0.1 oz. per ton.

(2.) Almost solid pyrite: Gold, 2.82 oz. per ton; silver, 1.8 oz. per ton.

(3.) Quartz with 3 to 5 per cent. pyrite: Gold, 0.02 oz. per ton; silver, 0.2 oz. per ton.

(4.) Quartz with 75 per cent. pyrite: Gold, 0.18 oz. per ton; silver, 0.2 oz. per ton.

(5.) Pyrite stringer in schist: Gold, 1.44 oz. per ton; silver, 1.6 oz. per ton.

(6.) Pyrite mass in schist: Gold, 0.68 oz. per ton; silver, 0.5 oz. per ton.

(7.) Siderite with trace of pyrite, from quartz stringer: Gold, *nil*; silver, *nil*.

A great number of samples would, of course, have to be taken before generalities could be made regarding the localization of values.

The limestone-band is not here mineralized, and quartz is seen to reach the margins of that body without penetrating it. The intersection of the main mass of quartz with limestone is covered by moraine.

Another area of quartz-veining with local pyrite lies some 2,000 feet to the south-east, at elevations between 6,600 and 7,000 feet. The veining there is much more widely spaced, the generalized pattern of which is shown in the upper part of Fig. 3. The same three sets of fissuring are developed, but that set parallel to the formation is very weak. Pyrite occurs in both of the other sets, but perhaps favours that which strikes north 10 to 20 degrees east. Widths of quartz are extremely variable over lengths up to 200 to 300 feet. Pyrite mineralization is locally almost solid in some veins, over widths from a few inches to several feet and for lengths of a few tens of feet at the most. Samples of well-mineralized quartz include:—

(1.) Almost solid pyrite near claim posts: Gold, 0.16 oz. per ton; silver, 1.4 oz. per ton.

(2.) Across 10 inches of a well-mineralized vein: Gold, 0.80 oz. per ton; silver, 0.4 oz. per ton.

(3.) Across 13 inches of a strongly-mineralized vein: Gold, 0.34 oz. per ton; silver, 0.5 oz. per ton.

(4.) Quartz containing 60 per cent. pyrite, 200 feet north-west of posts: Gold, 0.32 oz. per ton; silver, 2.1 oz. per ton.

(5.) Across 24-inch vein, 80 per cent. pyrite, 200 feet east of posts: Gold, 0.52 oz. per ton; silver, 0.3 oz. per ton.

(6.) Quartz with 60 per cent. pyrite, from north 60 degrees east vein, east of posts: Gold, 0.66 oz. per ton; silver, 4.5 oz. per ton.

This general belt or zone of veining continues in part up the ridge southward along the formation, but mineralization is more scanty; part of the zone is undoubtedly covered by ice.

A section of the limestone-band some 875 feet long is continuously exposed and passes beneath ice at each end. A section of the band is heavily mineralized with pyrite, forming a replacement-body of considerable size near the centre of the exposed band.

The limestone is replaced over the full width of 18 or 19 feet for a length of 110 feet, in addition to which replacement averages 10 feet wide for 40 feet, counting both ends of the main, solid mass. In addition, there are stringer-like prolongations 1 foot to 5 feet in width for 60 feet north-west and 30 feet south-east. Near the south-east end of the limestone a little replacement is seen on the north-east wall and a very short similar section is found near the lower end of the band. The replacement mineralization seems definitely related to small pyrite- and carbonate-bearing cross-fissures in the quartzites.

In the main replacement-body abundant to almost solid pyrite occurs in a carbonate gangue which seems in part at least to be composed of siderite. The margins of the body are definite, and it is only on the extreme south-eastern ragged end that the body consists largely of carbonate with a small amount of pyrite. Pyrite comprises 50 to 90 per cent. of the mass, varying in coarseness from a fine, sugary texture to cubes an inch and more on the edge. A little arsenopyrite is seen locally. Owing to the heavily-oxidized surface and the massive nature of the deposit it is difficult to obtain fresh specimens and, consequently, two specimens were obtained northwest of the glacier from boulders in no apparent respect different from this body. Microscopic examination showed the pyrite to occur in limestone with a carbonate (siderite and possibly including some ankerite) gangue; the pyrite ranged in size down to 5 microns, but in the two specimens examined the size was largely above 315 mesh in one and above 200 mesh in the other.

A sampled was channelled in sections across a width of 18 feet near the centre of the body from the hanging-wall.

(1.) Five feet from north-east wall, nearly solid pyrite: Gold, 0.74 oz. per ton; silver, 0.3 oz. per ton.

(2.) Next 5 feet, 75 per cent. pyrite: Gold, 0.16 oz. per ton; silver, trace.

(3.) Next five feet, 75 per cent. pyrite: Gold, 0.24 oz. per ton; silver, 0.6 oz. per ton.

(4.) Next 3 feet to within 8 inches of foot-wall, 25 per cent. pyrite: Gold, trace; silver, 0.2 oz. per ton. The weighted average of this section gives: Gold, 0.32 oz. per ton; silver, 0.2 oz. per ton. Other samples were taken south-east of this line:—

(1.) Ten feet south-east, almost solid fine pyrite near foot-wall, 2 feet wide: Gold, 1.96 oz. per ton; silver, trace.

(2.) Thirty feet south-east, almost solid coarse pyrite near centre, selected: Gold, 0.62 oz. per ton; silver, 0.4 oz. per ton.

(3.) Forty feet south-east, 5-foot channel to 1 foot from foot-wall, average section: Gold, 0.28 oz. per ton; silver, 0.3 oz. per ton.

(4.) Eighty feet south-east, channel across zone where 5 feet wide and composed almost entirely of carbonate: Gold, *nil;* silver, *nil.*

All samples were taken of fresh material, and a sample of accumulated oxides in a crevice returned low values, so it is not thought that these samples were affected by secondary enrichment. It is reported that later in the season the capping was blown off parts of the body.

It is reported that beneath the present glacier front there were workings in past years, but that a recent advance of the ice has covered these. The work was done, it is said, on "cross-leads." There is evidence of this being so, but there was in 1938 no possibility of climbing beneath the ice. In addition to quartz veins there exists strong evidence of there being a replacement-body beneath the ice in the presence of considerable float in the moraine north-west of the glacier-stream discharge. Small blocks and boulders to half a ton in weight are to be seen, and it is not at all likely that this float came from the body described above.

Development of the *Blue Ice* showings offers considerable difficulty owing to the location. Being in a heavy snow-belt adjacent to an active glacier none but temporary workings on or near the showings are feasible, and the closest possible adit site involves driving about 1,000 feet to reach the upper replacement-body. A protected site for an adit that would reach and ultimately explore all worth-while sections about the glacier can be found, but a considerably longer crosscut would be necessary to reach the north-western edge of the glacier front.

Kettle River Area.

Horseshoe Mountain.

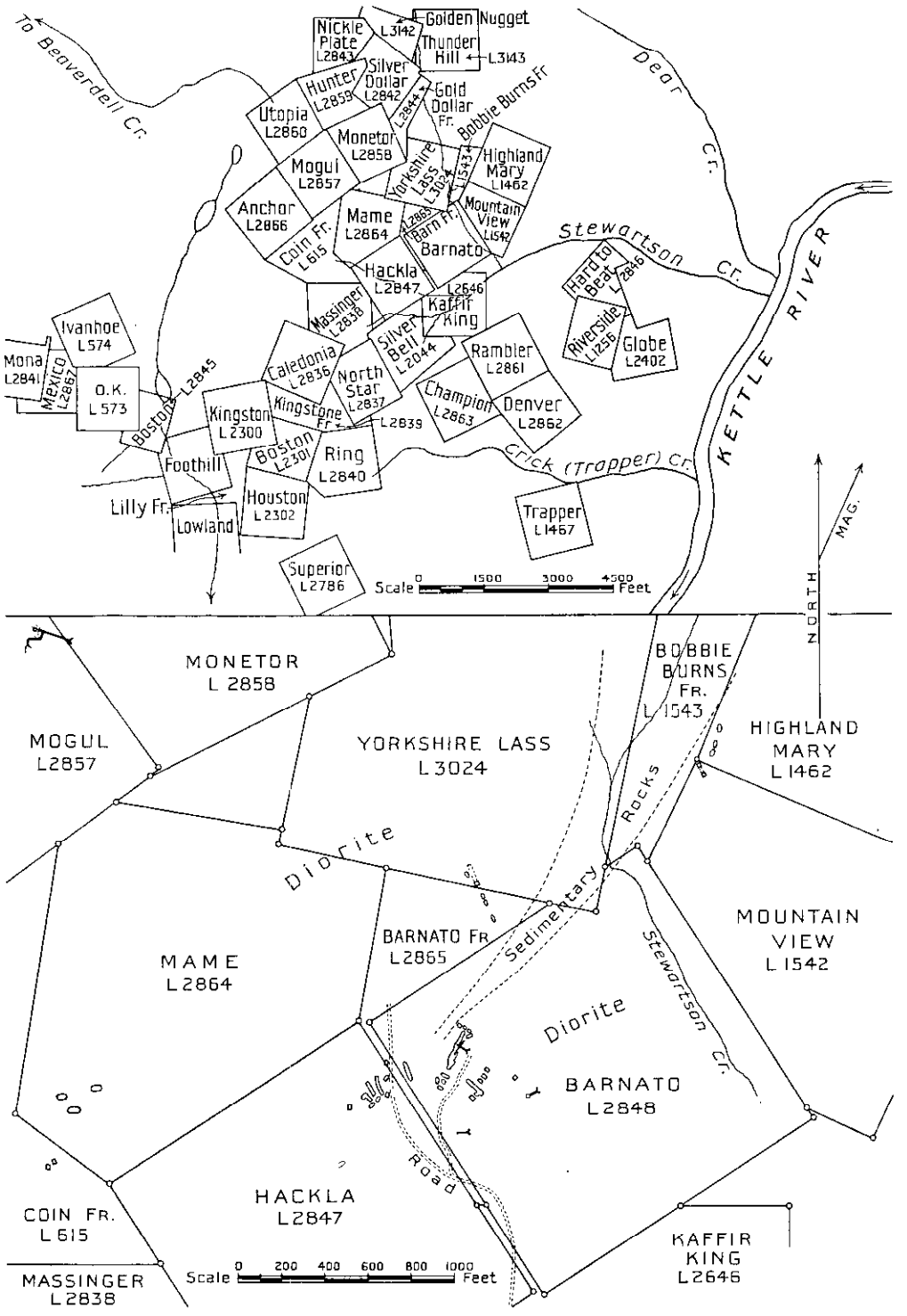
References.—Annual Reports of the Minister of Mines, British Columbia, 1901, 1928, 1929, 1931, 1933. L. Reinecke, Geological Survey, Canada, Memoir 79, 1915.

Horseshoe Mountain is the name given to a broad, flat-topped ridge summit west of Kettle River, at the head of Canyon and Stewartson Creeks. A road leaves the Kettle River road 23 miles north of Westbridge and climbs about 1,450 feet in 3¼ miles to the *Barnato* claim. A rough extension, half a mile in length, leads to the *Mogul.*

This is part of the Interior Plateaux system, rising to an elevation of 4,500 feet, more than 2,000 feet above Kettle River. Slopes are steep on the eastern side above Kettle River Valley and gradual to the valley of Beaverdell Creek on the west. The country is rocky and exposures are plentiful. There is adequate timber on most of the ground. Water is not plentiful, although a sufficient quantity for domestic use can be obtained from Stewartson Creek the year round, and there are springs at scattered points.

The *Mogul* claim was staked in 1896, at a time when there was a great influx of prospectors to the Kettle River drainage area. By 1898 there were many stakings on Horseshoe Mountain and considerable surface and near-surface work was done, but by 1901 activity had waned and no attention was paid to this section until 1928. In that year H. E. Hunnings and Company, of Victoria, started development on the *Mogul* claim and in the next year the Mogul Mining Company, Limited, had acquired many claims on Horseshoe Mountain and concentrated their efforts on the *Mogul* and *Silver Dollar.* In 1933, after 4 or 5 tons of ore was shipped from the *Mogul,* work was stopped.

During the past two years a number of Crown-granted claims have been leased, notably the *Mogul, Barnato, Hackla,* and *Mame,* by miners from Westbridge and Rossland, and several cars of sorted ore have been shipped. Much lapsed ground has been restaked and new discoveries have been made, extending down to the Kettle River. In the fall of 1938 Consolidated Mining and Smelting Company of Canada, Limited, diamond-drilled and test-pitted the



Map of Claims on Horseshoe Mountain, Kettle River.

Top figure: Copy of part of Mineral Reference Map No. 4T300. Bottom figure: Enlarged section showing approximate position of principal workings.

Barnato, but found the results of the work not sufficiently encouraging to exercise options on this and adjoining claims.

General Geology.—The geology of the summit and western part of Horseshoe Mountain was mapped by Reinecke, and is illustrated in his Memoir on the Beaverdell Map Area. The writer found more quartz diorite than is indicated on Reinecke's map, but did not trace any boundaries.

In the area under discussion, a body of Westkettle quartz diorite intrudes lavas and tuffs of the Wallace formation, and both rocks are cut by porphyry dykes. Stratified rocks, including tuffs and some normal sediments, are found principally on the upper and northern slopes, and andesitic rocks and some tuffs predominate on the lower Kettle River slopes. Some phases of the Wallace volcanics are coarse enough to resemble finer and darker-coloured phases of the quartz diorite, but careful scrutiny is sufficient to prove that the former belong to the older series. There are many porphyritic, andesitic to syenitic dykes of which most are post-mineral.

The mineral-deposits have been classed by Reinecke as "stocks" because they are commonly irregular in shape and occur in rock with or without quartz. The term is not in common use to-day, and they are perhaps best considered as mineralized zones of irregular fracturing, in which mineralization is in the form of vein-like bodies and impregnations. Mineralization includes pyrite, pyrrhotite, arsenopyrite, sphalerite, and chalcopyrite, in which the valuable constituent is gold.

There has been little or no shearing, but rather light and irregular fracturing which has produced single or complex fissures or breccia-zones. There is commonly a rock alteration that is marked by sericitization in its weaker phases and by the production of kaolin (dickite), chlorite, actinolite, epidote, and locally diopside in stronger phases. There is in stronger phases secondary quartz and in the *Barnato* veinlets of quartz and secondary microcline. These products of hydrothermal alteration grade into silica and in turn into white vein-quartz, which latter is not abundant. A full study of this alteration would require far more microscopic study than has been attempted.

There are zones of brecciation, chiefly on the lower eastern slopes, which have to date received little attention. The rock is a mottled green and whitish product in which green fragments are rich in actinolite and the light fragments are largely chert, including some chlorite. Mineralization is weak, as a rule, and consists of pyrite and locally pyrrhotite and chalcopyrite.

There is no free gold discernible in hand specimens, but gold may be panned from many of the oxidized outcrops of mineral matter. Arsenopyrite and pyrrhotite were the earliest sulphides formed, and gold has, in some cases, proved to have been introduced at a later date in company with pyrite (and sphalerite). This may well account for the erratic values obtainable in sampling.

Barnato. This Crown-granted claim has been leased by F. O. Peterson, of Westbridge, for three years, and for a short time in 1938 was optioned to Consolidated Mining and Smelting Company of Canada, Limited. It is immediately south of Stewartson Creek and just below the road.

The upper section of the claim, where the workings are situated, is underlain by quartz diorite, and a narrow band of fine-grained sediments extends through this part from the north-east. There are a number of light-coloured porphyry dykes, andesitic in character. Development-work consists of a number of open-cuts and one adit, including 25 feet of a crosscut and 50 feet of drifting. The Consolidated put down four or five diamond-drill holes to explore the principal mineral-zone at depth.

The principal zone is associated with an irregular narrow fissure which strikes north 35 degrees east and dips 70 degrees south-eastward. The fissure is drifted on for 50 feet, elevation 3,800 feet, and is seen to be only locally mineralized; 60 feet south of the adit it is faulted 15 feet to the east, and in the continuation contains patches of heavy arsenopyrite up to 8 inches wide. Open-cuts show what is apparently the same fissure, extending 80 feet northward from the adit and 200 feet southward, as a mineralized zone a few inches in width.

The drift at the southern end is holed through into a large open-cut. There the full width of mineralization is not seen, but it appears to be some 12 feet wide. It consists of bands, stringers, irregular masses, and impregnations of sulphides; this is the strongest

mineralization noted on the property. Two or three bands of sulphide are seen in the drift and in the crosscut. The mineralization is not everywhere directly related to the fissure, but is localized close to it and there is no apparent structural reason for the wide section noted.

The quartz diorite has been strongly altered, first to a bleached, sericitized rock and more intensely to a soft whitish mass consisting almost entirely of kaolin. In the more advanced phases of alteration there is some secondary quartz and microcline and locally a little epidote; the dioritic texture is almost or completely destroyed. Sulphides include pyrite, arsenopyrite, sphalerite, pyrrhotite, chalcopyrite, and galena. Microscopic examination by the Mines Branch, Ottawa, shows the paragenesis to be arsenopyrite, pyrite, sphalerite, chalcopyrite; and by the Mines Department, Victoria, to be arsenopyrite, pyrrhotite, pyrite, sphalerite, chalcopyrite, and galena. The gold is definitely later than the arsenopyrite and is related to pyrite and sphalerite; some of the gold is post-pyrite. There is locally some vein-quartz, but commonly the sulphides occur in rock that is more or less silicified and which grades into dense, watery-looking quartz.

Considerable of the pyrite presents a peculiar feathery to botryoidal appearance and weathers to a cellular "lacy" texture. It strongly resembles marcasite but is definitely pyrite. It is unique, and is fairly characteristic of Horseshoe Mountain.

Other open-cuts to the south-east, and an old adit and shallow shaft, show small widths of chiefly pyritic mineralization. The strike is apparently north-eastward in each, although some of the mineralization is extremely irregular. Open-cuts were being made by Consolidated in September, not all of which are shown on the accompanying sketch-map. These were designed to explore continuations of the principal zone and the possibility of parallel or branch zones.

Several cars of ore that have been shipped by F. O. Peterson gave variable returns in gold, the better assaying more than 1 oz. gold per ton. The better cars however contained considerable oxide and also solid arsenopyrite (with some pyrite) from a narrow, high-grade stringer 60 feet southward of the adit.

Several samples were taken, to illustrate the variation in gold content, as follows:—

(1.) Across 20 inches strong sulphide in drift, 25 feet south of crosscut: Gold, 0.50 oz. per ton; silver, 0.3 oz. per ton.

(2.) In large open-cut at south end of drift, selected "lacy" pyrite: Gold, 1.44 oz. per ton; silver, trace.

(3.) The same, selected solid arsenopyrite, pyrite and sphalerite: Gold, 0.56 oz. per ton; silver, trace.

(4.) From 60 feet south of crosscut, narrow zone of arsenopyrite and trace of pyrite: Gold, 16.48 oz. per ton; silver, 0.1 oz. per ton.

(5.) Open-cut 75 feet north of adit, selected from dump: Gold, *nil*, silver, *nil*.

(6.) Northern face of drift, across 56 inches, small amount of pyrite: Gold, *nil*; silver, *nil*.

(7.) Dump of old shaft: Gold, 0.44 oz. per ton; silver, trace.

(8.) Open-cut, 200 feet southward from adit, small pyritic zone: Gold, trace; silver, trace.

On the *Barnato Fraction* and extending over the boundary of the *Yorkshire Lass* is a line of old workings 240 feet long in a north 25 degrees west direction. A small shaft is on the *Yorkshire Lass*, and there are several old open-cuts. A narrow zone of mineralization is poorly exposed along this line.

Hackla. This claim, at least in its northern part, is underlain by quartz diorite. About 650 feet south of the northernmost corner is an open-cut 7 by 20 feet in a north-easterly direction. A mineral-zone 3 to 4 feet wide in the open-cut is cut off by a porphyry dyke and no extension is proved. Mineralization, within altered quartz diorite, is locally massive and grades into silicified rock. Sulphides include pyrrhotite, pyrite, arsenopyrite, and a little chalcopyrite; pyrite is younger than pyrrhotite and arsenopyrite and is seen locally to contain small cavities surrounded by a rim of pyrite with colloform texture. There is a pile of about 25 tons on the dump and 12 sacks of fine oxide. Samples assayed:—

(1.) Chipped from pile on dump: Gold, 0.38 oz. per ton; silver, trace.

(2.) Grab of fine oxides in sacks: Gold, 0.24 oz. per ton; silver, trace.

A shaft 270 feet northward from this open-cut is perhaps 40 feet deep, now inaccessible. It is sunk on a vein-zone with a strike of north 80 degrees east and a dip of 65 degrees south, 1 foot to 2 feet wide. Mineralization consists of pyrrhotite, pyrite, and arsenopyrite, in silicified quartz diorite, and of pyrite and arsenopyrite in vein-quartz of erratic distribution within the zone. Selected samples from the dump assayed:—

(1.) "Lacy" pyrite in quartz: Gold, 0.10 oz. per ton; silver, 0.1 oz. per ton.

(2.) Favouring pyrrhotite: Gold, 0.34 oz. per ton; silver, trace.

(3.) Favouring arsenopyrite: Gold, 0.26 oz. per ton; silver, trace.

From this shaft in the direction of the upper *Barnato* workings are a number of open-cuts and strippings, some of which are old and some recent. A small old open-cut on the road shows two narrow zones 5½ feet apart, striking north 60 degrees east and with steep dips; these contain a little pyrite and a little quartz to a maximum local width of 10 inches. A second old open-cut and small stripping on the road is probably on the *Barnato Fraction.* Erratic mineralization includes pyrrhotite, arsenopyrite, and pyrite. A selected sample heavy in pyrrhotite assayed: Gold, *nil;* silver, *nil.* A similar sample favouring arsenopyrite assayed: Gold, trace, silver, trace. Other open-cuts and strippings show indications of mineralization.

Mame. On this Crown-granted claim there are three shallow workings in quartz diorite near the south-west corner. The most easterly of these, elevation 4,250 feet, is an open-cut deepened to 14 feet; it is on a zone which strikes north 85 degrees east and dips 65 to 70 degrees south. The zone is a few inches to several feet wide and contains erratic, patchy pyrrhotite and pyrite in silicified rock or in quartz. *There is said to be here a distinct pyritic band of high grade, but this was not distinguished.* There is an ore-pile of about 25 tons on the dump, and from it samples assayed:—

(1.) Chipped from all over dump: Gold, 1.68 oz. per ton; silver, trace.

(2.) Selected "lacy" pyrite: Gold, 0.52 oz. per ton; silver, trace.

The most southerly of the three open-cuts is 5 by 44 feet in a direction of north 60 degrees east. In it a zone, dipping 75 to 80 degrees south-east, is 1 foot to 2 feet wide and contains pyrite and pyrrhotite in silicified rock, together with a little quartz. Below a fault in the bottom of the open-cut there shows an east-west band, 4 to 5 feet wide, of similar mineralization in stringers.

The north-westerly open-cut is 6 by 22 feet long in a direction of north 82 degrees east. A vague, steeply-dipping zone is up to 4 feet wide and the limit of scattered mineralization is as much as 8 feet in width. A sample across 4 feet, including pyrite and pyrrhotite and a little quartz in silicified rock, assayed: Gold, 0.22 oz. per ton; silver, trace.

Highland Mary and Mountain View. These claims, of which the former is Crown-granted, lie north-east of Stewartson Creek on a tongue of quartz diorite with sediments to east and west. There are many porphyritic dykes, andesitic to syenitic in composition, some at least of which are younger than the mineralization. Showings are just within adjacent corners of the two claims at an elevation of about 4,050 feet; there are three open-cuts in line up the hillside and below are two pits at the ends of a 30-foot open-cut.

The uppermost open-cut shows on the south side a 20-inch zone, strike north 25 degrees east and dip 65 degrees eastward, composed of almost solid arsenopyrite; on the north side of the open-cut there is merely a stringer-zone containing narrow bands of arsenopyrite. In the second highest cut is a rusty band 2 inches wide with strike as above and dip 60 degrees westward. In the third open-cut is an arsenopyrite-quartz vein up to 26 inches wide, strike north-east, which is traceable for 30 feet and is cut off by dykes. A sample across 26 inches of this vein assayed: Gold, trace; silver, trace.

In the lowest open-cut, in the pit in the west end, is a zone bearing arsenopyrite, pyrrhotite, and pyrite in quartz; the zone is 2 feet wide, striking north 40 degrees east with vertical dip. In the eastern pit in the same cut, 30 feet distant, is a vein-zone about 9 inches wide, strike north 30 degrees east and dip 75 degrees south-eastward. A sample across 8 inches, containing much arsenopyrite and some pyrrhotite and pyrite, assayed: Gold, 0.50 oz. per ton; silver, 0.3 oz. per ton.

Mogul. This Crown-granted claim is the oldest on the hill and on it most work has been done. It is at an elevation of 4,500 feet on the summit of the ridge. The claim has been leased by Clyde Sherdahl, of Rossland and Westbridge, for three years, and from it he has shipped several car-loads of sorted ore.

A vertical shaft was sunk in early days and later deepened to 50 feet. An adit, collared on *Monetor* ground, is driven north 70 degrees west for 140 feet, where a raise a few feet long breaks into the bottom of the shaft. Fifteen feet short of the shaft a branch leads southward 20 feet, then westward 45 feet, then southward 45 feet. A dyke some 30 feet wide crosses the adit, the western wall of which is followed 15 feet southward to pick up the shaft-vein, 10 to 12 inches wide, strike east and dip vertical. This is followed 16 feet when it is faulted a few inches and the strike changes to north 65 degrees east for 16 feet; past a second fault of small displacement the east-west vein is followed for 20 feet, and the crosscut to the south crosses a quartz vein 24 to 30 inches wide and 10 feet distant. About 50 feet from the portal of the adit on the northern wall is a short section of vein 6 inches wide, strike north 65 degrees east, dip 70 degrees south-eastward.

Mineralization consists of pyrite, pyrrhotite, and a little arsenopyrite in silicified quartz diorite, with little true vein-quartz. The vein-zone is from a few inches to 2 feet wide and is most irregular; it is seen in the shaft to be offset by and perhaps associated with flat faults, and the shaft has been glory-holed in order to follow the short sections. A sample across 28 inches, 10 feet below the collar of the shaft, assayed: Gold, 1.68 oz. per ton; silver, trace. A sample across 13 inches, 50 feet from the portal of the adit, on mineralization not apparently related to that in the shaft, assayed: Gold, 1.50 oz. per ton; silver, trace.

The same vein-zone is traced positively on the surface for some 200 feet at south 60 degrees west, where it is offset by a large dyke. It ranges from a stringer to a local maximum of 3 feet.

Ivanhoe. This Crown-granted claim near the Triple Lakes is leased by Stan Peterson and associates, of Westbridge. It is reached by a narrow-gauge road about 2 miles in length from the main Horseshoe Mountain Road. The claim is in an area of Wallace formation, but quartz diorite outcrops locally.

Old workings, at an elevation of 4,350 feet, were seen before much new work had been done on them and it was difficult to size up the deposit. There is, in quartz diorite, an irregular narrow vein-zone, vertical and with variable northerly strike. It is a few inches wide to locally a foot or so, and consists of glassy quartz containing pyrite, arsenopyrite, and a trace of chalcopyrite, as well as stringers of pyrite in rock. There may be two zones, which show in two 15-foot pits, or a single zone which has been faulted. There are a few very old and now obscure open-cuts near-by.

Several tons were on the dump, partly sacked, and some oxides had been screened. Samples assayed:—

(1.) Grab sample from small pile of "high-grade": Gold, 0.48 oz. per ton; silver, 0.1 oz. per ton.

(2.) Grab sample of oxides: Gold, 0.17 oz. per ton; silver, trace.

(3.) Grab sample from pile of oxidized rock and light mineral: Gold, 0.10 oz. per ton; silver, 0.1 oz. per ton.

(4.) Grab sample from sacked ore: Gold, 0.75 oz. per ton; silver, 0.05 oz. per ton.

Maybe. This claim is on the Kettle River Road, elevation 2,350 feet, on Crick (Trapper) Creek. It is part of a group of locations and Crown grants owned and leased by O. Berglund, of Rossland, and L. Cléry, of Westbridge. The principal showing is at an elevation of 2,600 feet, on the south side of the creek, in andesitic and dioritic rocks of the Wallace formation which are locally brecciated. There is a 20-foot adit and some stripping for 100 feet.

The vein-zone strikes nearly north and dips 50 degrees east; it is a band 20 to 24 inches wide of almost solid sulphide and a small amount of quartz, in addition to which the walls, particularly the foot-wall, contain lightly disseminated sulphide for several feet. The solid sulphide includes pyrrhotite, pyrite, arsenopyrite, sphalerite, and a little chalcopyrite. The pyrrhotite contains abundant rounded to irregular inclusions of quartz, and the suggested paragenesis is arsenopyrite and pyrite, pyrrhotite, sphalerite, chalcopyrite.

A loading-chute has been built to a road a few hundred feet long connecting with the river road, and several cars have been shipped to Tacoma smelter. The first two cars assayed:—

(1.) 40.2 tons: Gold, 0.7075 oz. per ton; silver, 1.12 oz. per ton; copper, 0.13 per cent.; zinc, 0.7 per cent.; arsenic, 2.22 per cent.; silica, 47.1 per cent.

(2.) 43.4 tons: Gold, 0.81 oz. per ton; silver, 0.84 oz. per ton; copper, 0.18 per cent.; zinc, 0.2 per cent.; arsenic, 1.58 per cent.; silica, 26.4 per cent.

Other mineralized showings on this claim are in zones of brecciation and alteration in the andesitic and dioritic rocks. The breccia consists of irregular fragments from several feet across down to a fraction of an inch. The rock has been altered to a dark greenish mass consisting of carbonate, epidote, actinolite, and chlorite, which in extreme cases is composed largely of actinolite and carbonate. Fragments of chert and cherty patches are common, so the rock has a mottled appearance. Mineralization by pyrite and locally also pyrrhotite occurs in the breccia and is restricted to the green alteration-product. Samples of this mineralization carried low values, or none, but the breccia-zones would seem to be worth prospecting.

Hard to Beat, Riverside, and Globe.

Noren and sons, of Westbridge, own a group flanking the river road, including the Crown-granted *Hard to Beat*, *Riverside*, and *Globe*, and extending to *Maybe* ground adjacent to Crick (Trapper) Creek. This ground, along the lower slopes of the valley-side, is underlain by rocks of the Wallace formation, including andesites, dioritic rocks, and cherty sediments, cut by dykes of which a common variety is a light-coloured porphyry, much altered but perhaps andesitic.

There are a number of showings on which a small amount of surface and near-surface work was done in former years. These are irregular mineral-zones which strike north-westward and dip rather steeply to the north-east. Vein-quartz is only in a few instances an important constituent of the zones, some of the mineralization contains a siliceous base and some is in rock without very strong alteration. Sulphides include pyrite and pyrrhotite, arsenopyrite, sphalerite, and chalcopyrite. None of these mineral zones has been traced for more than 200 feet, although elsewhere there are broad belts showing indications of mineralization that would seem to be much longer. Widths and amounts of mineralization are erratic, and it would appear that thorough surface prospecting should precede any underground work.

Other Claims.—On the *Jenny*, a located claim owned by Jack Carlson, of Rock Creek, just north-west of the *Bobbie Burns Fraction*, are two old 10-foot shafts and some recent open-cutting. These are in metamorphic rocks not far from quartz diorite; rocks to the north are sedimentary. The metamorphic rocks are cut by and impregnated with stringers and masses of fine magnetite accompanied by epidote. There is also a narrow quartzose vein mineralized with pyrite and a trace of arseno-pyrite; this appears to be a flat sheet at the surface, but is very irregular.

On the *Trapper*, leased by J. G. Creelman, of Greenwood, there are a number of old workings in Wallace formation rocks on the central and south-eastern part of the claim. Irregular zones, none of which has been traced any distance, strike northward and are mineralized with pyrite, pyrrhotite, and some chalcopyrite and arsenopyrite. On the northern part of the claim just above the creek is a breccia-zone, similar to those on the *Maybe*, but of unknown extent. Here one or more northward-striking stringers to quartz veins 10 inches wide are mineralized with pyrite and a little sphalerite and arsenopyrite.

Old workings are to be seen over much of the upper slopes of Horseshoe Mountain. These include open-cuts and shallow shafts, most of which are isolated and most of which are about 40 years old. They are on zones of fissuring, brecciation, and more or less alteration and silicification; they contain vein-quartz only locally and are mineralized with varying proportions of pyrite, pyrrhotite, and arsenopyrite. The sulphides occur in stringers, lenses, patches, and disseminations.

Similkameen River.

Copper Creek Section.

Copper Creek flows into Similkameen River 26 miles from Princeton on the Hope–Princeton Road, at an elevation of about 3,075 feet. The river flows in a steep-sided canyon from

the mouth of Pasayten River nearly to Princeton, with an open section half a mile in length at the mouth of Copper Creek. Timbered slopes rise from the canyon-edge to form the upland surface of the Interior Plateau. A prominent bench, level with the upper rim of the canyon and half a mile wide, extends from opposite and above Copper Creek to more than a mile below.

The rocks in the canyon in the neighbourhood of Copper Creek are correlated by Cairnes with the Tulameen series of Triassic age (Geological Survey, Canada, Summary Report, 1923, Part A). They comprise sedimentary and volcanic rocks with, in this vicinity, a regional strike of about north 15 degrees east and vertical dip. There are two dominant types of volcanics, a dark green augite andesite porphyry and a light green to greyish andesite porphyry, both of which are strongly altered, although in hand specimen they appear comparatively fresh. Many of the volcanic types are fragmental; both flow breccias, and breccias with rounded fragments that grade into sedimentary materials. The true sediments are slaty argillites. These rocks are covered west of and above the river by andesitic to basaltic lavas of Tertiary age.

Some placer-gold has been taken from this section of the river, but no mineral-deposits had been found until, in the fall of 1937, high assays were obtained from a narrow vein at water's edge. Before snow was gone in the spring some thirty claims had been staked, but few additional discoveries have since been made.

Silver Moon.

This group of eleven claims and fractions is owned by E. N. Freding and Alex Wagenstein, of Princeton. It was optioned during the year by Kelowna Exploration Company, Limited, and after considerable surface work was done the option was relinquished. A lease was granted to five men late in the year who made a small shipment of high-grade gold ore.

The group covers the original discovery and extends from 400 feet below the mouth of Copper Creek for a mile down-stream. The rocks in the upper end of the canyon include a little slaty argillite but are principally volcanic types, many of which are fragmental. They are cut by shear-zones and by many stringers of quartz or quartz and calcite. The shear-zones are from a few inches to several feet in width and are bands of schist, more or less pyritized and containing locally quartz stringers; tighter and narrower sections may pass into narrow veins. The stringers form a prominent set with a strike of north 70 degrees west and a dip of 60 degrees north-eastward; they are from a fraction of an inch to a foot wide and from a few feet to a few tens of feet in length; they consist of quartz or quartz and calcite, frozen to the walls and commonly barren. Stringers of this set, when close together, form sheeted zones. A second set, striking north 30 degrees west, and with steep dips to the south-west, is not prominent. A third set, of rare occurrence, is almost flat; these stringers are locally mineralized with arsenopyrite and very small amounts of sphalerite, galena, chalcopyrite, and pyrite.

The showings on which work has been done are in the uppermost 800 feet of canyon, close to water's edge and to 100 feet above it. Irregular, branching, and reticulating shear-zones strike roughly north and are vertical; they form two or three principal zones up to 15 feet wide over an exposed width across the river of 160 feet. Many cross-stringers are seen, striking north 70 degrees west and dipping 60 degrees north-eastward; these, with rare exceptions, are barren. Five flat quartz and calcite stringers, to a maximum local width of 16 inches and one with variable dip to the west, have indicated lengths of a few feet to a few tens of feet, and are mineralized, locally, with massive arsenopyrite or with trains of arsenopyrite grains, and a little of the same mineral is seen in or close to slightly schistose walls.

Assays from open-cuts on the shear-zones show them to carry merely traces of gold or none. Of all the cross-stringers exposed naturally or by stripping only one was seen to carry a few specks of free gold; sulphides are rare to absent and values negligible. Exceedingly high assays have been obtained by reliable individuals from the better-mineralized portions of the flat stringers. Three samples taken by the writer assayed: Gold, *nil;* gold, 0.18 oz. per ton; silver, trace; gold, 32.76 oz. per ton; silver, 9.0 oz. per ton.

The highest-grade material consists of massive arsenopyrite fractured and traversed by tiny veinlets of quartz and carbonate. Careful scrutiny with a hand lens frequently discloses tiny specks of gold, some of which are visible to the naked eye. Microscopic examination

suggests that the gold is later than the arsenopyrite, and shows that the gold has a tendency to occur (in sizes to less than 10 microns) in elongate forms aligned on fractures and along arsenopyrite-crystal boundaries. The gold seen in one cross-stringer was isolated in quartz.

Gold-bearing sulphides appear to be restricted to the flattish stringers, and these are not numerous. Although most shear-zones are pyritized they do not appear to carry more than traces in gold.

Ground has been staked for a mile up-river from the *Silver Moon by* Alex. Broomfield, J. W. Gallagher and others, of Princeton and Hedley. The rock in the canyon section is principally light-coloured andesite porphyry, massive to fragmental. There is much less evidence there than below of pattern in shearing and cross-veining. Several shear-zones a few inches to 2 feet in width strike nearly north and are vertical or dip eastward; these contain locally stringers and lenses up to 1 foot wide of quartz and calcite. There are cross-stringers which strike about north 70 degrees west but they are not abundant; one relatively flat shear-zone was seen.

Mineralization is very scanty, although pyrite, arsenopyrite, sphalerite, chalcopyrite, and galena can be seen locally.

Roche River Section.

(*See* Annual Reports of the Minister of Mines, British Columbia, 1901, 1927, 1928. C. E. Cairnes, Geological Survey, Canada, Summary Report, 1923, Part A.)

Red Star.

This group of six claims, of which the *Anaconda* and *Red Star* are Crown-granted, is owned by Charles Bonnivier and Gus Pouwels, of Princeton. The group is on the Hope–Princeton Highway on the north side of Roche River, nearly 2 miles above the mouth of Pasayten River. A prominent flat, elevation about 3,325 feet, is flanked by a hillside sloping at 25 degrees to a flat summit 800 feet higher.

The rocks are part of the Tulameen series which are in this section represented by a schistose-band some 3 miles wide. They are dominantly of sedimentary origin, according to Cairnes, and include light-coloured quartz-sericite schists and greenish talcose and chloritic schists. The average strike is north 15 degrees west and the dip is between 45 and 60 degrees westward. They are poorly exposed on this ground, but there is a band of pyritic mineralization indicated, following the strike, that is perhaps 1,000 feet wide.

There are a number of adits on this property and several open-cuts, but the older workings are largely caved, so that a full examination is impossible. A long adit has been driven from the edge of the flat in an effort to tap at depth mineralization in an adit 480 feet higher in elevation. The upper adit, said to be 250 feet long and driven parallel to the formation, is accessible only for 63 feet in a direction of north 18 degrees west. Near the portal is a raise from another adit 100 feet lower and said to be 415 feet long. Mineralization, apparently parallel to the schistosity, consists of pyrite and a band 8 to 16 inches wide or more also contains considerable chalcopyrite and sphalerite. A sample of heavy sulphide chunks from the dump assayed: Gold, 0.06 oz. per ton; silver, 7.3 oz. per ton; copper, 17.0 per cent.; zinc, 4.0 per cent. A grab sample of heavy sulphides from the next lower dump assayed: Gold, 0.14 oz. per ton; silver, 5.7 oz. per ton; copper, 19.0 per cent.; zinc, 2.5 per cent.

The lowest adit is 1,090 feet long, it is small and sinuous, and work on it has been given up in recent years on account of the lack of ventilation. It is driven in the direction of the upper adit 140 feet at north 60 degrees west and then in an average direction of south 77 degrees west for 950 feet. The line of the adit crosses the projected line (south 18 degrees east) of the upper adit 600 feet to the south of the upper portal, and the face is 330 feet beyond, according to a compass survey. A drift 480 feet from the portal is 65 feet long in a direction of north 52 degrees west.

The rocks throughout are schists, with a strike of north 15 to 20 degrees west; dips are 40 degrees westward at the portal, about 55 degrees throughout most of the length, and 45 degrees westward at the face of the adit. At the drift the rocks are more highly schistose for a distance of about 40 feet, including a few steeply-dipping planes of strong shearing, and mineralization in this section consists of disseminated pyrite, chalcopyrite, and sphalerite. Three samples across a width of 11 feet of mineralization assayed traces in gold, 1 oz. or less in silver, and less than 1 per cent. copper. Two other weaker zones of mineralization are crossed 360 and 460 feet past the drift. Quartz is only locally present, commonly as unmineralized kidneys in the schists.

Assuming that the mineralization in the upper adit occurs strictly parallel to the schists, then the lower adit is close to that horizon. If the strike does not vary and the average dip is 45 degrees, then the lower adit is, according to rough calculation, about 140 feet short of its objective, but projection over such distances on both strike and dip is not satisfactory unless the geology is fully understood. A. F. Tigert, of Princeton, had recently commenced clearing out the upper adit in order to examine the mineral-zone, but only the first 63 feet was accessible at the time of the writer's visit in October.

There are a few other old properties in this section, on which little has been done in recent years. High values in gold are reported to have been obtained locally across narrow widths.

PLACER-GOLD DEPOSITS.

Rock Creek Area.

References.—Annual Reports of the Minister of Mines, British Columbia, 1930 to 1935, inclusive; Index to Annual Reports of the Minister of Mines, British Columbia, 1874–1936, for older, short references; W. E. Cockfield, Geological Survey, Canada, Memoir 179, 1935; C. E. Cairnes, Geological Survey, Canada, "Mineral Deposits of the West Half of Kettle River Area," Preliminary Report, 1937.

Introduction.—Rock Creek flows into Kettle River near the International boundary in Central British Columbia. The main creek heads south of the boundary and the two largest tributaries, McKinney and Jolly Creeks, head on the southern and south-eastern slopes of Baldy Mountain. The area is well served by highways and branch roads, Rock Creek station on the Kettle Valley Railway is close to the mouth of Rock Creek, and the high-tension line of the West Kootenay Power and Light Company, Limited, crosses the area.

The country has been burned over. From the main forks, through the basin of McKinney Creek, west of Jolly Creek Valley, and to the north and west, there is very little green timber left. The climate is one of light precipitation.

Rock Creek drainage was in early days the scene of considerable placer activity. The first discovery was made in 1860 and by 1900 work had almost died out. There was a revival of interest in the upper sections from 1930 to 1935, when interest again waned. The present report is an attempt not so much to point out sections of the creeks where pay-gravel may be found, but is rather an attempt to outline the geology of the area so that generalities may be made of use to placer-men in the district.

The area is part of the Interior Plateaux system, with elevations ranging between 3,000 and 4,500 feet. The ground rises to higher elevations to the north, culminating in Baldy Mountain, elevation 7,558 feet. Kettle River Valley is a broad trench cut into the plateau with an elevation, at Rock Creek station, of 1,978 feet.

The main streams flow in rather narrow valleys, 500 to 1,000 feet deep, in which there are canyon sections; Lower Rock Creek, for its entire length, flows in a steep-sided canyon about 400 feet in depth. The country is neither rugged nor very steep, except north-east of Jolly Creek, and much is a region of low slopes and gravel-covered stretches.

History.—Gold was first mined on Rock Creek in 1860. In that year a census showed 123 persons, and in the next year the Gold Commissioner reported between seventy-five and a hundred men working on the creek. Activity soon waned, and it seems that many men pushed on in search of new fields. The earliest diggings were not phenomenally rich and recovery on the average was about $4 per man per day.

Production figures are very incomplete and it is impossible to obtain an estimate of total recovery from the creek for any period. A report by the Gold Commissioner in 1861 states the known recovery for six months of 1860 to be $83,000. In the early nineties the recovery was several thousand dollars per year.

The history of the creek seems to be that from the earliest discovery there ensued a period of two or three years of intensive mining, following which there was a smaller amount of activity which became more sporadic with passing years. Activity seems to have subsided by the year 1900. Some Chinese were still working in 1903 but most white men had given up, and in 1901 it was stated that the Chinese were "making a small annual output, scarcely amounting to wages."

From 1900 to 1930 only occasional mention is made of the creek, and that referring only to the desultory efforts of a few individuals. From 1924 to 1930 no recovery of placer gold

was reported from Greenwood Mining Division, and in 1931 only 6 ounces. Recovery for the division jumped the next year, when the price of gold advanced.

In 1932 work was done by lessees of Rock Creek Consolidated Placers, Limited, at and near the "Williams" pit, where drifts were put in on a rock rim above the creek-bed, and in the same year work was resumed immediately below the *Old England* mineral claim. During the next year testing was done on Jolly Creek, both above and below the highway crossing, and several men were engaged in working McKinney Creek, near the mouth of Rice Creek, and a short distance below.

In 1934 Rock Creek Consolidated Placers, Limited, a holding company of Penticton and Greenwood, optioned their holdings to Porter and Condit, of Seattle, who did ditching and test-pitting on Jolly Creek above the main road crossing. Further work was done by Lynch Brothers, of Seattle, below the road. On McKinney Creek, M. D. Kinney hydraulicked with pump and engine. At the mouth of Rock Creek, Porter and Condit staked and optioned ground for several miles; a hydraulic pit was worked by these people during the summer of 1935 and was abandoned in 1936.

In 1938 little work was going on. V. J. Melsted was drift-mining on bed-rock below the uppermost canyon for the second season, on ground optioned from Jolly Creek Placers, a local syndicate, and a few individuals were at work on other parts of Jolly and McKinney Creeks.

Geology.—The bed-rock geology of the area is covered by the reports (noted above) of Cockfield and Cairnes, to which nothing need here be added.

There is, at least at lower elevations within the area, no evidence of glacial erosion, but there is abundant evidence of the effects of glaciation in deposits of drift, moraines, stream terraces, and dislocation of the pre-Glacial drainage. Glaciation and stream history are closely linked and both have affected the formation of placers.

The southern and eastern slopes of Baldy Mountain have been heavily glaciated; there are few rock-outcrops, and the country is more or less thickly covered with glacial drift. Morainal ridges are seen to lie parallel to lower Wapiti and Stanhope Creeks, roughly in a north-south direction, and irregular accumulations of drift are abundant.

Upper Jolly Creek is plainly poorly fitted to the topography. Above the uppermost road crossing the creek possesses no marked valley, but flows in a broad trench covered with drift. Immediately below the upper bridge the creek plunges into a canyon, swings in a bend northward, and then round to the south into the main valley. South and south-east of this upper canyon is a poorly-drained area of very low relief, several square miles in extent; it is covered with irregular accumulations of morainal materials, at a general elevation of approximately 3,740 feet. The character of this ground and the evidence of minor terrace remnants points to the fact that, following glaciation, Jolly Creek flowed sluggishly across it in a meandering course and then dropped fairly rapidly to lower drift-covered ground to the north. The meanders became incised in rock in the present canyon, which is cut to a depth of about 200 feet.

At the mouth of the canyon the rock walls end abruptly just south of the placer-workings, elevation 3,375 feet. The creek half a mile farther north then enters a second canyon through which it drops rapidly in a semi-circle to the east and south-east. West and north-west of this second canyon, at a general elevation of 3,565 feet, is an area of typical drift accumulation containing many kettle-holes. This material seems plainly to have blocked the former Stanhope Creek, which now flows southward between morainal ridges and then swings sharply to the east through a small canyon to the southern end of Little Conkle Lake.

The course of upper Jolly Creek is incised in a heavily glaciated topography and bears no relation to the pre-Glacial drainage pattern. The ancient stream-channel is plainly at right angles to the present stream just north of the upper canyon. The old valley above this point is vaguely indicated for a quarter of a mile by an irregular depression in which there is a small and periodic flow of water. It trends eastward through a gravel ridge to meet the main valley, but the exact point of outlet is uncertain. From its exposed portion in the placer-diggings the pre-Glacial stream must have flowed eastward and not south-east or south, because the distribution of rock-outcrops disproves the possibility of such a course.

The main Jolly Creek Valley from Little Conkle Lake to its confluence with McKinney Creek trends north. The valley itself continues northward past Conkle Lake, with only

minor deflections, and it has the appearance of being an ancient topographic feature, perhaps originated by faulting. Although the valley trends north and is comparatively straight, it has not been scoured out by glacial action. There is an upper canyon section, and others such as that at the crossing of the West Kootenay power-line, which could not have persisted had the valley been filled with an active glacier. Whether or not the valley was filled with stagnant ice seems a matter of little importance, although this was likely the case.

McKinney Creek flows in a pre-Glacial valley, broad and open in the upper stretches and narrow in the lowest 2 miles. The bed has been deepened in this latter section and a new course has been cut at the confluence with Jolly Creek. Both these streams have deserted their former courses and, before and after flowing together, have cut a deep and steep-walled canyon just at the entrance to Rock Creek Valley. Rock Creek, from this point to the mouth, flows in an even deeper canyon, but this cannot have been carved post-Glacially because there is no other possible outlet for the pre-Glacial drainage.

There has been post-Glacial deepening of the stream-channels, but it is difficult to measure the amount accurately because of the uncertainty of the exact position of pre-Glacial bed-rock. The amount of deepening is thought to be of the order of 40 feet.

The ground at and near the junction of Rock (Baker) Creek and the combined Jolly and McKinney Creeks was a gathering-ground of ice, from which the topography allowed no ready escape. Consequently, this general area became a site of ponding and morainal accumulation with more or less stratification in local bodies of water. This general section of Rock Creek and also the valleys of McKinney and Jolly Creeks are marked by terraces to heights of 300 feet above the present stream.

The terraces possess a gradient in the direction of, and nearly parallel with, the present streams. The question of the origin, nature of material, and manner of formation of these terraces is not an easy one to answer, but it is believed that many of them represent levelled-off or worked-over accumulations of glacial drift. The creek-valleys were choked and filled with gravels and boulder-clay to a depth of some 300 feet and the subsequent streams filled in inequalities in this general surface and doubtless planed off irregularities, with more or less reassortment of material. The streams gradually deepened and cut down into the morainal materials, leaving high terrace levels.

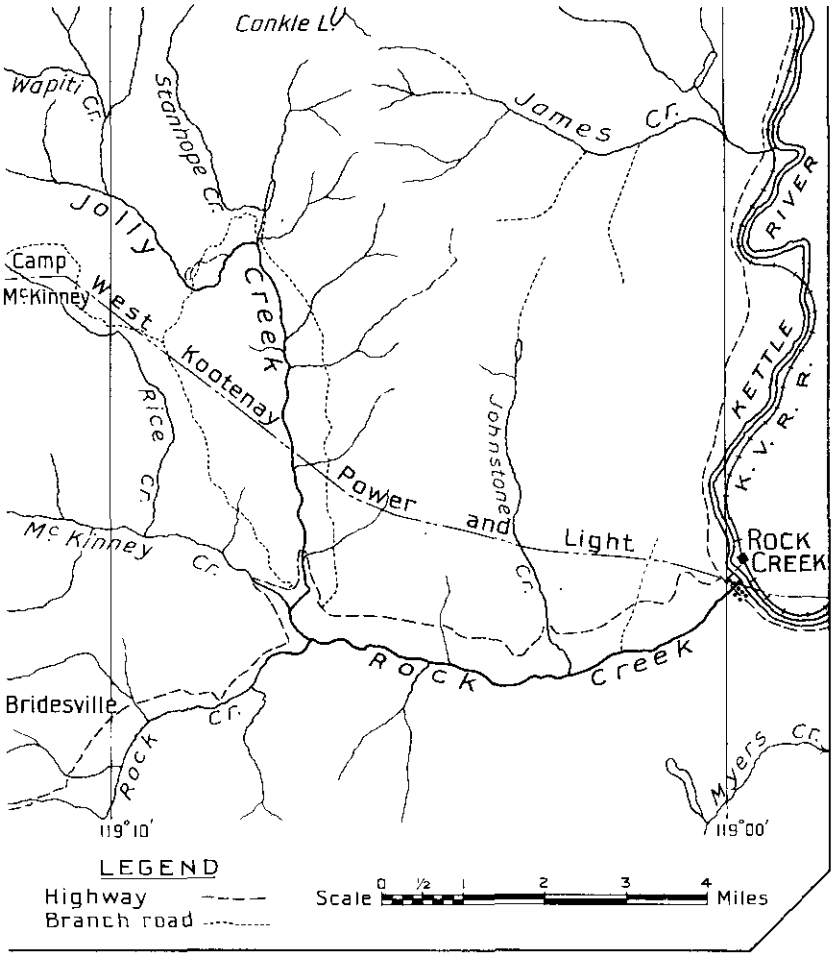
The post-Glacial streams follow almost precisely the ancient valleys, and have, with noted exceptions, reincised their former beds through deep fillings of glacial gravels and drift. Terraces have been formed, and rock rims and benches have locally been left as (possibly) remnants of the former beds.

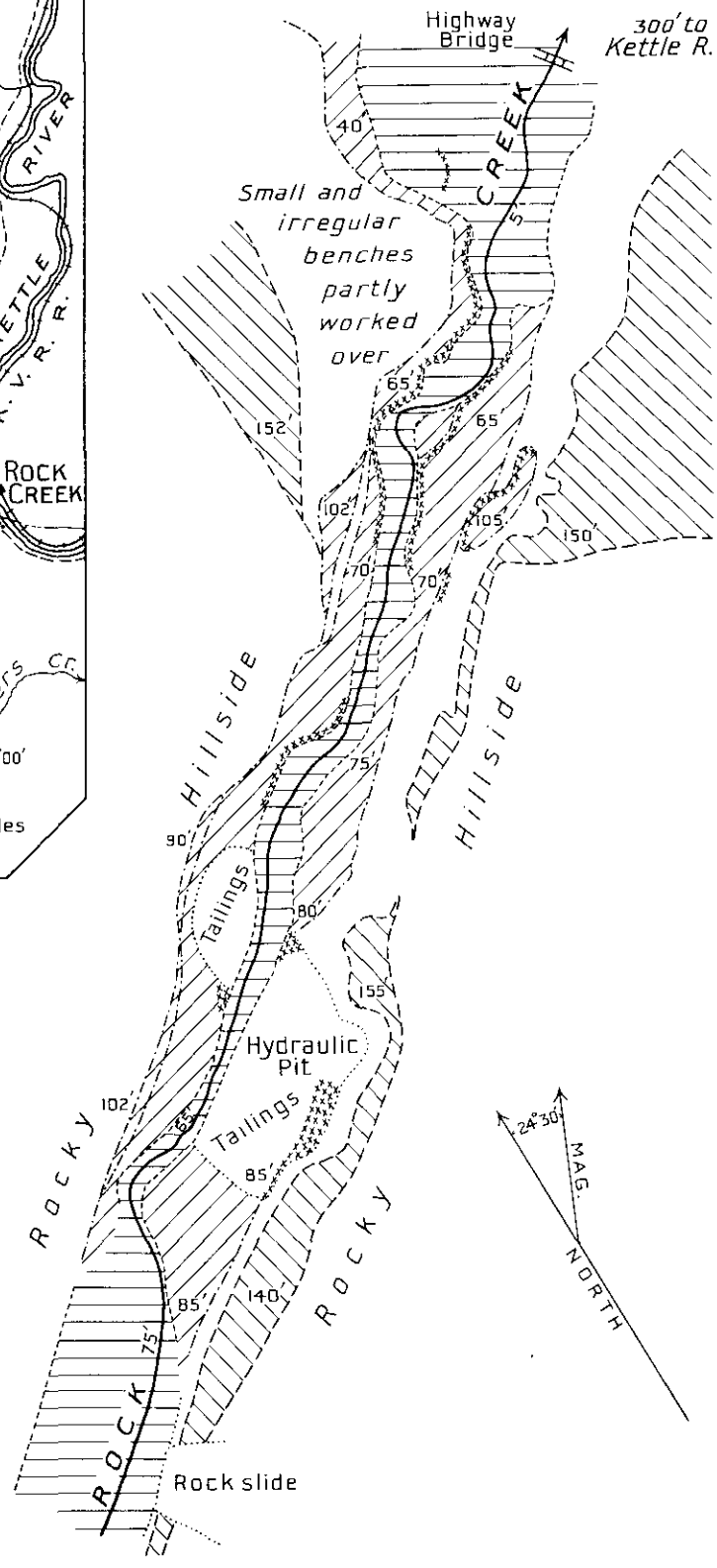
Gravels in the stream-beds are coarse, and boulders are encountered measuring 6 feet and more across. A higher proportion of granitic boulders is found than would now find its way into the present streams, and consequently it appears that many of these have been transported from granitic areas during glacial time. Gravels on bed-rock rims and benches are seen, notably at the "Williams" pit and at the "Melsted" workings on Jolly Creek, to include numbers of decomposed pebbles and boulders, some of which can be broken in the hand. Fine silt or "slum" is reported to be of widespread occurrence and to hamper considerably workings in or close to the present stream-beds.

Gold has been recovered from a few chief sections: Rock Creek at the mouth, McKinney Creek below Rice Creek, Jolly Creek at White and Denver bars, and Jolly Creek below the uppermost canyon north of the *Old England* mineral claim. Of these sections the first was the greatest producer. Other intervening sections produced some gold but in much less quantity.

With the exception of the uppermost diggings on Jolly Creek, where the creek-bed was once worked over, production has come from rock rims and benches above or close to water-level. Shafts have been sunk and ditches dug to bed-rock in a number of places, but the actual stream-beds appear to have been worked in this one section only. Stream gradients are low (2 per cent. on Jolly Creek) so that drainage is difficult and disposal of tailings not easy, and this seems in part to have deterred exploration.

Lower Rock Creek.—Lower Rock Creek is the site of the earliest diggings in the district. These workings extend up-stream for about a mile above the highway bridge, and the accompanying plane-table map is of the lower 3,800 feet of this distance. It is not known





LEGEND

Present creek bed 2-10' above stream level

Terrace and bench remnants

Highest (main) terrace level part of Kettle River system

Bedrock rim and outcrop

Elevation above highway bridge 65'

Scale 200 0 200 400 600 800 Feet

Map of Lower Rock Creek. The site of the earliest and principal placer-workings on the creek. Insert map shows the main Rock Creek drainage.

how much, if any, of the actual creek-bed was here worked, but all ground in the valley lateral to the bed of the present stream seems to have been worked over.

The creek flows in a canyon about 400 feet wide, with rocky sides sloping at from moderate to steep angles. A prominent terrace, about 150 feet in elevation above the highway bridge, is nearly level, and is composed of well-stratified gravels. It is a part of the Kettle River terrace system, locally several hundred feet wide, but in the Rock Creek Valley it exists as a narrow remnant on the eastern side only.

A former level of the creek-bottom forms a prominent bed-rock bench on both sides of the creek at least as far as the hydraulic pit. The bench has been entirely worked over, and from it the greater part of the recovery from this section has come. The grade is about 1 per cent., and into it the present creek has carved a canyon 15 to 50 feet deep to stream-level. The stream gradient is about 2½ per cent., and the depth of gravels in the present bed is not known. Two small, worked-over bench-remnants, elevation 102 and 105 feet above the bridge, are seen on either side at the throat of the valley, and to the north-west, round on to the Kettle River slope, is a series of irregular and discontinuous gravel benches which have been largely worked over.

Southward from the mapped section the bed-rock bench is not seen, but it is very likely closer to the surface than is the present stream-bed. The ground has been worked over as far as a prominent gully on the eastern side, and there remains evidence that the creek was at one time diverted.

The only sections of ground remaining are two narrow rims on the western side, opposite the hydraulic pit, 90 and 102 feet in elevation above the bridge. They have been partly worked over and one short irregular drift has been driven in recent years.

The hydraulic pit was operated by Porter and Condit in 1935 and for a short time in 1936; water was brought from a penstock about 3 miles up the creek. The amount of gravels moved is not known, but it would appear that 100,000 yards is a fair estimate. Difficulty was encountered in disposing of the tailings, and work was abandoned when values were found to be low. It is reported that sluicing of the high-level terrace disclosed old-time drifts at its base on bed-rock.

Melsted Workings.—These are drift workings on the west side of Jolly Creek just below the uppermost canyon, where a former channel is crossed by the present stream nearly at right angles. This is an area of former diggings, the highest on the creek, in which the bed of the creek was turned over and drifts were driven into the banks on both sides.

A bed-rock floor is indicated to be about 800 feet wide at about the level of the present stream. Gravels, including boulders up to 4 feet across, are poorly shingled and include a small amount of sand and pea gravel; they are sufficiently cemented by clayey material that excavation is difficult and systematic timbering unnecessary. This has the appearance of being a stream-channel quickly filled by unassorted, coarse gravels. Bed-rock is commonly weathered as are many boulders, although some boulders are unweathered. Flat gold, 870 to 875 fine, is found in a pay-streak not more than 15 inches thick and commonly right on bed-rock; the pay-streak follows a sinuous course averaging south 56 degrees west and is 10 to 20 feet wide. Values are reported to vary in the pay-streak between 50 cents and $3 per square foot of bed-rock. Excavation is by pressure-hose supplemented by blasting. A crew of two to four men has been employed by V. J. Melsted for two seasons.

The pay is restricted to a surprisingly narrow streak, considering the apparent width of the channel and the evidence that it was choked with very coarse gravels. The pay has been followed for a distance of some 350 feet. The apparent width of channel is much greater than that common to the district, but it may in part be due to softer (serpentine) bed-rock than found elsewhere. Another explanation, not proved, is that formerly Stanhope Creek here flowed into Jolly Creek, instead of near Little Conkle Lake as at present.

Former attempts to drift on this channel down-grade to the east were stopped by water. The outlet on the main Jolly Creek end has not been located, but it is likely to be almost directly across the intervening gravel ridge.

Scattered workings are to be found through the next canyon to the main north-south valley, and at the forks, elevation 3,250 feet, a bar about 10 to 15 feet above the creek has been worked over.

Mid-section of Jolly Creek.—This section was mapped by plane-table for 8,000 feet north of the crossing of the West Kootenay Power and Light Company's high-tension line. It is a section including Denver bar, one of the richest diggings on the creek. The grade of the creek is about 2 per cent.

The most prominent feature of the valley is the high-terrace level which, although incised by many dry gullies, is well-defined throughout on the eastern bank; it is represented on the western bank by one or two remnants. The terrace has a definite gradient to the south which is slightly steeper than that of the present creek. It is at an elevation of 300 feet or so above the creek at the north end and 270 feet above at the south end of the map; it is about 250 feet above the creek abreast of the main highway bridge. There are sub-terraces on the west bank, but none on the east bank.

The character of material making up this terrace is difficult to determine. Only between the two tributaries from the east, where a drift has been put in at a high level, can the material be studied. At this point it is glacial drift, i.e., fine boulder-clay. In other places on small banks it appears to be stratified gravel, but without adequate sections exposed it is very difficult to identify the character of material, and some resorting of the banks by the present streams can easily have occurred.

The creek flows through a canyon at the north and south ends of this section, over the remainder of which bed-rock is only locally exposed. Bed-rock is believed to be very near the surface on the western hillside throughout, and at the lower canyon it is continuous to the east to the main hillside. Through the remainder of the eastern valley-side bed-rock is exposed low down near the "Bennett" drift, on the road above the "Williams" pit, in the first tributary from the east, and in a high rock point north of the second tributary. In the valley-bottom bed-rock is exposed as mapped, forming rims and rock benches from near stream-level to 60 feet above.

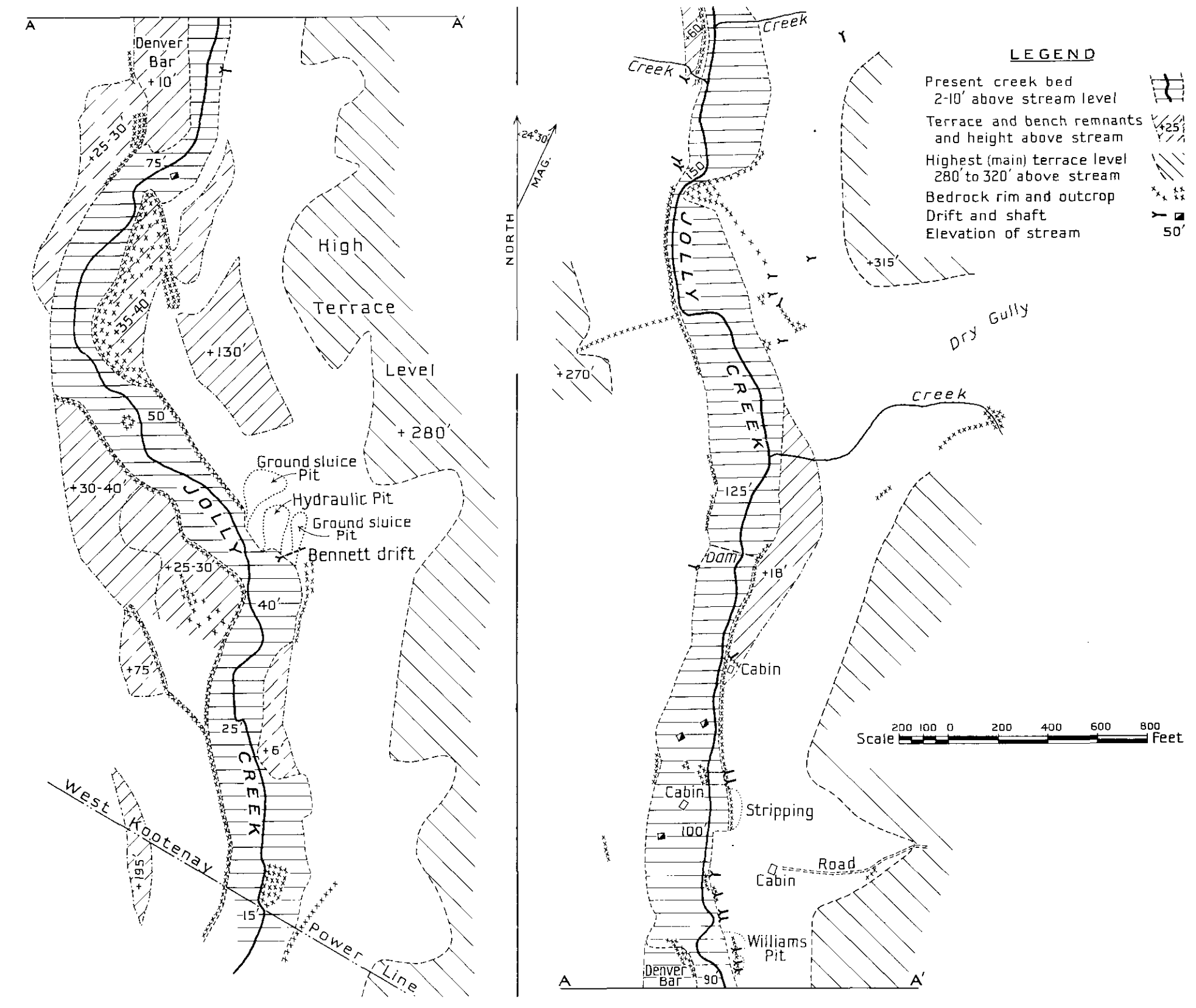
At the extreme north end of the map, on the west side, is a rock bench 60 feet above stream-level. On the east side, just below the southern tributary from the east, is a rock bench about 18 feet above stream-level, and this bench is apparently continuous with a poorly-exposed rock rim some 25 feet above stream-level just north of the road. Definite outcrops are lacking, but this rim appears to continue to the "Williams" pit. Rock is seen at a comparable elevation immediately south of Denver bar on the west side, in a rock bench below and on the east, and again on the west side of the creek to below the "Bennett" drift.

Bed-rock outcrops nearly at stream-level at Denver bar, 700 feet north of Denver bar, and at the "Bennett" drift, at elevations 5 to 15 feet above stream-level; whether or not this represents a second low-level rock rim or bench it is hard to say.

Denver bar, elevation 2,980 feet, was one of the richest diggings on the creek, and from it it is reported $80,000 was taken. It is a rock platform without apparent continuation, some 10 feet above stream-level. The somewhat higher rock point immediately to the south-west has been carefully worked over, and so has the irregular rock bench to the south on the east side of the stream. Other workings to the south, on both sides of the creek, seem to be more haphazard, as if the diggings were not very productive, but it is difficult at this day to tell.

The old-timers seem to have missed, or ignored, the rock rim at "Williams" pit and for several hundred feet up-stream. A number of drifts have been run on this rim, which is said to slope flatly to the east. At the "Williams" pit a semi-circular drift system was later hydraulicked by engine and pump, and it is believed fair values were obtained on bed-rock, although increasing height of bank limits the scope of this method of mining. Reports are conflicting, but it seems certain that the best values found in this section came from cracks within the bed-rock. The rim is apparently continuous, at a flatter grade than the present creek, with the rock bench that extends to the tributary from the east. This bench is thinly covered with gravels and has the appearance of having been carefully tested but not having been worked.

The definite correlation of the "Williams" rim and bench with the rock benches at comparable elevations down-stream or with the rock bench on which the "Bennett" drift is driven is a matter of speculation only. The "Williams" rim may mark the pre-Glacial channel, and in support of this is the fact that much of the gravel is deeply weathered, as exposed in the hydraulic pit.



Map of a part of Jolly Creek, north of West Kootenay Power and Light Company's high-tension line.

The " Bennett " drift is said to be cut into bed-rock and to be about 200 feet in length. No definite idea of the gold content of the gravels is obtainable; bed-rock seems to have been quite level here, and the lowest gravels contained a good deal of silt which hampered working and necessitated the driving within bed-rock. Ground-sluicing and hydraulicking have demonstrated that the upper gravels do not contain much gold.

Shafts have been sunk to bed-rock close to the present stream-bed and, according to report, prove a depth of 20 and more feet of gravels. Water is of course a serious problem in such work, and although it is impossible to tell what values were found in these shafts, it seems definite that the present valley-bottom to bed-rock has never been fully tested.

A number of drifts have been driven into the east bank between the two tributaries, apparently in search of the continuation of the " Williams " rim-rock. Drifts on the west side, to the north, were efforts to prove the existence of a buried channel extending from the present " Melsted " workings.

To sum up, in this section of the creek Denver bar was the only rich diggings of early days, and other rock rims and benches have been worked over or tested leaving, in the opinion of the writer, only one possibility for a completely unexplored section in a straight line between Denver bar and the " Bennett " drift. The creek-bottom has never been worked. In workings on rim-rock most gold has been found on the actual rim and values appear to be less with distance from the creek. It seems, from all available reports, that in bed-rock workings of recent years the greater amount of gold has been found in crevices in bed-rock and that smooth bed-rock has little gold on it.

The fact that gold has been found in this section of the creek and not above for some distance has been argued by some as proof that the gold came in from a lateral, now buried channel. The writer sees a possibility for such a former tributary of the old valley in about the position of the dry gully which trends north-eastward, but he is hesitant to believe that the gold did come in from a tributary. The creek above, for a distance of 1½ miles, flows through a canyon in which whatever gold there is is likely to be found on bed-rock beneath the present stream.

McKinney Creek.—McKinney Creek flows eastward through a broader and more open valley than do the other streams; it heads on the southern slopes of Baldy Mountain. The valley has two prominent terrace levels at elevations of about 170 and 280 feet above the creek; the lower of these is continuous with the main terrace on Jolly Creek and the higher is found only in rare remnants on the west side of Jolly Creek.

The diggings on McKinney Creek were never so profitable as on Jolly Creek, and most of the workings are restricted to the lower 5,000 feet above the highway bridge. In this distance the creek flows through a narrow and shallow canyon carved in the bed of a former level of the stream. At the upper end of this stretch bed-rock nearly coincides with stream-level and in the lower 2,000 feet bed-rock is 20 to 40 feet above the stream. Old workings on this bed-rock bench extend above the road for 1,500 feet, where it is covered by a low terrace remnant once hydraulicked by M. D. Kinney.

Nearly a mile above the road are old workings on a bench on the south side 10 to 20 feet above creek-level which is said to have contained good pay. Here F. W. Winser was engaged, in 1938, in stripping to bed-rock on the north margin of the creek through 12 feet of gravels. He reports the pay to be 4 feet thick on bed-rock, associated with considerable fine silt. He reports also that he encounters local masses of boulder-clay in the valley-bottom; these were not seen by the writer.

Above these diggings, 100 yards, the creek flows in a canyon 50 feet wide with rims 10 to 15 feet high, and for about 1,000 feet up-stream there is evidence of old workings, none of which is extensive. Bed-rock shows locally along this stretch to the mouth of Rice Creek, where McKinney Creek flows in a short narrow canyon, and immediately above is Kirby's bar, worked in 1932 and for two succeeding seasons. Here bed-rock was cleaned at about 3 feet below stream-level for 200 by 100 feet; gravel, including boulders to 6 feet across, is some 10 feet deep. The creek canyon is a post-Glacial channel and Rice Creek does not, apparently, follow its original bed. This seems to be the upper limit of workings on McKinney Creek.

The " Kinney " pit, hydraulicked in recent years, represents an excavation of about 3,000 yards. It was worked to a maximum depth of 20 feet to a hard clay layer about 2 feet thick. A shaft was sunk 13 feet deep in the pit to within about 7 feet of present creek-level, and in

this shaft bones were found in clean gravels near bed-rock, but no gold. The bones are said to be of a Tertiary mammal, but this point cannot be definitely checked.

Recoveries from McKinney Creek in more recent years have not been startling, although it is believed a few have made wages. It is reported that stream-gravels in the southern section near the bridge have been found in one shaft to be 28 feet deep; this would appear to be a low spot, and no gold is reported.

The present stream seems to follow very closely the former bed, into which narrow canyon-gutters have been cut. Not all of the rim-rock has been worked although considerable seems to have at one time been tested, and it may be that a few corners may repay individual effort.

Other Localities on Jolly Creek.—White's bar, a former rich diggings, about half-way between the power-line crossing and the highway, has all been worked over. It is a bed-rock bench 15 to 20 feet above stream-level, originally covered by about 15 feet of gravels. A gravel terrace-level is some 50 feet above the rock bench. It is reported that gold from this bar had considerable associated quartz.

Raby's bar, about 2,000 feet above the highway bridge, is reported to have had some production. Shafts sunk by Porter and Condit showed, according to reports, 40 feet of gravel to bed-rock. An attempt was made by Porter and Condit to drain this ground, and an open ditch was dug by drag-line excavator for about 1,600 feet above the bridge, but an intervening high rim of bed-rock was encountered, so the attempt failed. Drainage had in former years been attempted by drifting.

Below the bridge and above the canyon there are old workings, but it is not certain how much ground has been turned over. In recent years excavating just above the canyon throat found, according to report, smooth bed-rock with very little gold on it. On the south side of the turn above the canyon a shaft has been sunk by C. C. Byers, of Rock Creek. The shaft is 21 feet deep to bed-rock, and from it Byers reports a drift 175 feet to the south, when water stopped the work. All evidence points to this being on the former channel of Jolly Creek, the southern end of which has not been located. Bed-rock in the shaft is at a comparable elevation with that of the creek and is likely higher. At 165 feet from the shaft bed-rock was not found 9 feet below the drift.

Workings in the canyon, just below the mouth of McKinney Creek, include a drift about 20 feet above creek level. This drift, now caved, is said by Joe Pringle, of Rock Creek, to have been productive, and he and others believe it to be on a former channel of McKinney Creek. There seems to be reasonable doubt of this latter point, because the canyon below has every appearance of being carved since the time of terrace formation, and if so the former McKinney Creek must have had a different outlet. Whether the two creeks once flowed side by side into Rock Creek or whether McKinney Creek first flowed into Jolly Creek, the writer cannot say.

Conclusions.—Not all workings have been described in this report, because it is difficult to describe and to assess the importance of old diggings. Old workings, with few exceptions, were on bed-rock higher than that of the present stream-channel. Work in recent years indicates that there is little gold on smooth bed-rock, and that the best values have been found on actual rims and within cracks on bed-rock.

There are two runs of gold in Jolly Creek, that in the Melsted workings being 870 to 875 fine and very flat, whereas that found lower down is about 830 fine and inclined to be " shotty."

On central Jolly Creek there does not seem to be good reason for the distribution of gold, and the writer does not believe that the known concentrations were made by local cross channels or that the gold in White's bar was brought down, except in slight part, with surface wash.

With the exception of the uppermost section of Jolly Creek, the stream-beds have not been worked. Shafts have been sunk at different points, but rumours of the findings in these shafts form an insufficient basis for evaluation of the present creek gravels. Gradients are low, about 2 per cent., so that drainage is difficult and pumping and tailings disposal would always be costly.

Rim-rock may still be found in a few places where not now evident and, if so, will have to be mined by drifting unless the overlying gravels are thin. There does not appear to be any ground suitable for hydraulicking.

Certainly the country is gold-bearing, as witness *Camp McKinney, Dayton Camp, Old England*, and other localities, and the source of the placer gold need be looked for no further than in these veins, and very likely in others not yet found. Of the factors of concentration of gold, local wash, reconcentrations from former channels, and grade and character of bedrock, the latter appears to be extremely important and one not likely much changed throughout stream history.

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PROGRESS NOTES.

BY

JOHN G. BIGGS AND H. C. HUGHES.

LODE-GOLD DEPOSITS.

*Hedley Camp.**

Kelowna Exploration Co., Ltd.—W. C. Douglass, general manager; Floyd Turner, mine manager. This company operates the *Nickel Plate* mine, which is the most important gold-mining operation in the district. The concentrator, machine-shops, and general offices are near Hedley. The mine is at an elevation of 5,600 feet and approximately 4,000 feet above and 4 miles north of the town. Transportation up the side of the mountain is in two sections: a 10,000-foot gravity-tramway from the ore-bin at the mill is operated with skips having a capacity of 6 tons; from the central to the upper terminal it is run by electric motors chain-geared to friction and control wheels that maintain a constant speed during the whole of the operation.

The portal of the mine is 1½ miles north of the top terminal of the tramway and an electric-trolley motor system hauls the ore from the mine to the upper end of the tram.

An active programme of development has been conducted during the year, both in the *Nickel Plate* mine and in the Bulldog tunnel, the portal of which is some 3,000 feet south of the portal of the *Nickel Plate* mine.

This mine is directly connected with the *Hedley Mascot* mine at the No. 12 level, and as the portal of this mine is at a much higher elevation there is a good current of air passing which provides very satisfactory main ventilation for both mines.

There are 190 men employed at this mining operation, ninety men underground and 100 at the surface.

Hedley Mascot Gold Mines, Ltd.—C. W. S. Tremaine, general superintendent. This mine is 1 mile north of Hedley; the concentrator and mine offices are on the east bank of 20-Mile Creek and the camp is on the side of the mountain, 2,795 feet above the mill. The ore is transported down the side of the mountain by a "quad" haul-back aerial tramway, 5,600 feet in length, from the ore-bin at the mine to the mill. The two skips have a capacity of 3 tons each.

The mine has been developed by an 8- by 8-foot adit-tunnel 2,500 feet in length and generally known as the 4,800-foot level; this is the main haulage drift into the *Mascot Fraction*. The major developments are in ore-bodies above the main level. The ore is loaded at the chutes on the drift into self-dumping mine-cars and transported by storage-battery motors to the aerial-tram bins at the mine portal.

The workings of this mine are connected through to the workings of the adjacent *Nickel Plate* mine, and this connection provides excellent ventilation for both.

* By John G. Biggs.

During the year an active programme of development has taken place at this mine with a view to operating at greater depth by driving a lower tunnel, known as the 4,300-foot tunnel, at an elevation 500 feet lower than the present working-tunnel. At the end of the year this new tunnel had been driven 1,600 feet from the portal. Electric power for the mine is provided by the West Kootenay Power and Light Company, Limited. There were 103 men employed, forty-six underground and fifty-seven on the surface.

Canty Gold Mines (Hedley), Ltd.—Charles Bishop, superintendent. This new gold-mining operation is 2½ miles north-west of the *Nickel Plate* mine at Hedley, at an elevation of 6,000 feet, and is reached by a good mountain road from Hedley.

The sinking of the three-compartment (14.4 by 5 feet) vertical shaft was completed to the 427-foot level during the early part of the year and provides two skipways and a manway; ore-pockets were cut in the north side of the shaft at the 200-foot and the 400-foot levels respectively. Work was concentrated on drifting to the north on the 200-foot level, with a view to reaching an area previously explored by diamond-drilling. During the latter part of the year drifting was commenced on the 400-foot level on the north side of the shaft.

Diesel power is at present used at this mining operation and consists of three units. A large double-drum shaft hoist is operated directly by a Gardner power unit and runs two shaft skips provided with safety-catches. They have a capacity of 2 tons and are equipped with automatic skip-dumping arrangements in the head frame at the surface. An International Diesel unit operates a 75-k.v.a. generator and provides power for the mine-fan, machine-shop, and general lighting purposes. A large Ruston-Diesel engine provides power for the operation of a Gardner-Denver 2-stage air-compressor, having a capacity of 750 cubic feet of free air per minute, for the operation of the machine-drills and the steel-sharpener.

There were twenty-eight men employed at this mine.

*Osoyoos Lake Area.**

Osoyoos Mines, Ltd.—J. O. Howells, manager. This mine is in the Osoyoos district, 1½ miles north of the International Boundary. The camp buildings are in the valley, and the mining operations on the adjacent hill. This is a well-maintained camp; the accommodation for the employees consists of several detached small bunk-houses, a large modern wash- and change-room, mine offices, and a dining-room and kitchen.

During the present year mining operations have been concentrated on the *Dividend* mineral claim. They consisted mostly of open-cutting and glory-holing on a large ore-body with strong walls. The glory-hole is connected by raises to the drift on the same elevation as the ore-bin at the mill, to which the ore is trammed by hand. Preparations were also made for increasing the capacity of the concentrator by the installation of a new ball-mill and flotation cells. The tailings from the flotation-mill are further treated by a modern cyanide plant farther down the hill, which was installed during 1937. Power is supplied by the West Kootenay Power Company.

There were fifty men employed.

*Fairview Camp.**

Fairview Amalgamated Gold Mines, Ltd.—J. A. McKenzie, manager. This mine is 3 miles west of Oliver, and comprises the *Morning Star* and *Fairview* gold-mining operations. A 150-ton flotation-mill is situated at the *Morning Star* mine, at an elevation of 2,400 feet, and the mining operations are conducted at the *Fairview* mine, 2 miles south of the mill. The mine is at an elevation of 3,050 feet and the ore is transported from the mine-bunkers to the mill by motor-trucks.

The *Fairview* mine has been developed by a long adit known as No. 5 level, driven on the vein a distance of approximately 2,600 feet from the portal. At 1,000 feet from the portal a raise has been driven through to the surface for ventilation; a fan is installed at the foot of this raise and the air is conducted to the working-places by galvanized pipes. There has been some raising and stoping done on the inside of this drift, the most important being the "B" and "F" stopes.

With a view to developing the vein at greater depth, during the latter part of 1937 the No. 6 adit-drift, situated 1,200 feet north of the No. 5 and 135 feet below in elevation, was commenced. It intersected a large ore-body 850 feet from the portal. Ore-bunkers were

* By John G. Biggs.

installed near the portal of this drift, mining operations are being concentrated in this lower level and the operations in the No. 5 drift confined to the drawing of the loose ore from the stopes.

Power is provided by the West Kootenay Power and Light Company, Limited, and is used for the operation of the mill at the *Morning Star* and an air-compressor at the *Fairview*.

There were fifty men employed at this mine, twenty-six underground and twenty-four at the surface.

*Twin Lakes Area.**

Gold Standard Mining Co.—Joseph Wukelich, manager. This mining property is 24 miles south-west of Penticton and is reached by a good mountain road. Joseph Wukelich has a lease on the *Grandoro* gold mine which has been inactive for several years and is equipped with a good Diesel power plant, steel-sharpening shop, rock-drills, and other equipment necessary for mining operations. During the year most of the work has been done on the *King* mineral claim, situated 1,500 feet north of the *Grandoro* mine. Two small shafts, 30 feet deep, have been sunk on the ore and some drifting done from the surface at a lower elevation with a view to intersecting the ore at greater depth. A portable gasoline-driven air-compressor provides power for this work. The ore is sorted and shipped direct to the smelter.

There were seven men employed, four at the surface and three underground.

*Stump Lake Area.**

Consolidated Nicola Gold Fields, Ltd.—R. A. Petter, manager. This mining operation, formerly known as the *Nicola* mine, is 2 miles west of the Merritt–Kamloops Highway and 30 miles from Merritt. During the year work in this mine has been confined to the development of the *Enterprise* vein at depth. The 320 adit is the main entry and intersects the *Enterprise* vein 800 feet from the portal; a considerable amount of stoping has been done in the vein above this level. This vein has a general dip of 45 degrees and has been developed to the dip by an inclined shaft which during the year was extended to the 950-foot level. The 320-foot drift was extended and development conducted on the 400-, 550-, and 675-foot drifts. The vein was intersected in the 800- and 900-foot drifts. It is the policy of the present management to greatly extend the mine-development before the mill is again placed in operation.

There are thirty-seven men employed at this mine, eighteen underground and nineteen at the surface.

*North Thompson River Area.**

Windpass Gold Mining Co., Ltd.—Allan J. Smith, general manager; Bert Pearson, general superintendent. This mining operation is 5 miles north of Boulder, a flag-station on the Canadian National Railway. The mill and the power plant are at the foot of the mountain at the side of Dunn Lake, at an elevation of 1,825 feet, and the mine is at an elevation of 5,340 feet. The ore is transported from the mine to the mill by an aerial tramway 2½ miles in length; the top terminal of the tramway being located near the portal of the *Windpass* gold mine. This operation consists of two mines known as the *Windpass* and the *Sweet Home*. The *Windpass* is the larger and more important and constitutes the chief mining operation on the property. The *Sweet Home* is 2,500 feet south of the *Windpass* mine and 400 feet below in elevation. It is accessible by a wagon-road from the aerial tramway 4,000 feet below the top terminal where the ore-bin from *Sweet Home* is located. The ore is transported from the *Sweet Home* mine to this ore-bin by a large motor-truck, loaded into the tramway buckets at this bin, and transported to the mill.

The *Windpass* mine has been developed by an adit from which an inclined shaft was sunk 35 degrees to a depth of 900 feet.

During the year work was abandoned in the lower levels and concentrated on the pillars of the upper workings which are comparatively limited.

The *Sweet Home* mine has been developed by a 30-degree inclined shaft driven to the main adit which connects to the 450-foot drift in the foot-wall of the vein. Raises have been driven from the shaft into the vein. The No. 4 ore-pocket is near the foot of the shaft and the main developments are conducted on the Nos. 1, 3, and 4 drifts.

* By John G. Biggs.

Power for this operation consists of a 400-horse-power Diesel electric plant situated near the mill. It provides power and light for the mill and camp. A high-tension line carries the power to the transformers at the mine.

There were sixty-four men employed at this mine, thirty underground and thirty-four at the surface.

*Vernon Area.**

Kalamalka Mine.—James Penney, manager. This mine is south of the Vernon–Lumby Highway, 12 miles east of Vernon, and accessible by a good road; there are good camp buildings and large ore-bunkers. Power is provided by a Belliss and Marcom 2-stage air-compressor having a rating of 360 cubic feet of free air per minute and operated by a 120-horse-power Vivian-Diesel engine.

The mine has been developed by two adits. Some crosscutting, raising, and stoping has been done between these drifts. The ore has good fluxing qualities and is shipped direct to the smelter.

During the year the Penney and Heidler syndicate, comprising six miners from the Rossland district, leased this mine and commenced work during the early part of October with a view to further development and shipment of ore direct to the smelter.

Blue Hawk Mine.—R. A. Mowatt, manager. This mine is 15 miles north of Westbank on Okanagan Lake, and is accessible by a winding mountain road.

The work done is entirely exploratory with a view of proving a quartz-vein exposure. A crosscut had been driven a distance of approximately 500 feet when the vein was encountered and drifting is being continued on the vein.

A small air-compressor belt-driven by a gasoline-engine is in use at the mine for the operation of a drifter. There were five men employed, three underground and two at the surface.

Beaverdell Area.†

Midnight Group.—Situated 1¾ miles south of Beaverdell, just off the highway. Owned and operated by Wm. Youngson and associates, of Beaverdell. One man, employed spasmodically throughout the year, drove about 120 feet of tunnel. A shipment of 2 tons made to Trail returned 2 oz. in gold and 27 oz. in silver.

Kettle River Area.†

Barnato.—Situated on the North Fork of the Kettle River on Horseshoe Mountain, about 23 miles north of Westbridge. Owned by Mr. Reddan, of West Vancouver, and optioned to the Consolidated Mining and Smelting Company of Canada, Limited. The exploratory programme carried out included the removal of 14,763 cubic feet of material in surface-trenching and 1,959 feet of diamond-drilling.

Mogul.—Situated on Horseshoe Mountain, about 24 miles north of Westbridge. Operated under lease by C. and O. Sherdahl, of Westbridge. Two and four men were employed during the summer. A new blacksmith-shop was built near the portal of the low level working-adit. A total of 54 tons of ore, shipped to the Trail smelter, yielded 68 oz. of gold and 12 oz. of silver.

Maybe.—Situated on the main road up the North Fork of the Kettle River, 23 miles above Westbridge. Owned and operated by L. Clery and O. Berglund, of Westbridge. Four men worked, both on the surface and underground, at this property for the greater part of the year. The property was optioned to the Bayonne Consolidated Mines during the year after an examination made by that company. Development-work done by the owners included 120 feet of drifting. In addition a good cabin was built. Ore totalling 186 tons shipped to the Trail smelter yielded 148 oz. of gold and 207 oz. of silver.

Greenwood-Boundary Falls Area.†

Number 7.—Situated in Central Camp, near Boundary Falls. Owned by the Consolidated Mining and Smelting Company of Canada, Limited, and operated under lease by W. E. McArthur, of Greenwood. Four men were employed, with three underground, for several months in the year. Development included 200 feet of raising, 50 feet of sinking, and

* By John G. Biggs.

† By H. C. Hughes.

considerable surface-trenching; 2,453 tons of ore mined and shipped to the Trail smelter yielded 288 oz. of gold and 1,007 oz. of silver.

City of Paris.—Situated on Goosmus Creek, about 15 miles from Grand Forks and just north of the International boundary. Owned by Mrs. Margaret Johnson, of Los Angeles, and operated under lease by Celius Nelson and partners, of Grand Forks, B.C. Three men were employed underground; 138 tons of ore mined and shipped to Trail yielded 13 oz. of gold and 951 oz. of silver.

Crescent.—Situated 2 miles west of Phoenix. Owned by C. King and Mrs. Dukhamel, and operated under lease by E. McGillivary and the Kolinsky family, a total of four, all working underground. The first work done by hand-steel, but a portable gasoline-driven compressor was installed later in the year. A total of 27 tons of ore mined and shipped to Trail yielded 7 oz. of gold and 1,297 oz. of silver.

Jewel Lake Area.†

Dentonia.—Situated near Jewel Lake. Owned by the Dentonia Mines, Limited, and operated under lease by John Halstrom, Eric Sojberg, and Robert Lee, of Greenwood, who employed one man. A total of 1,873 tons of ore mined and shipped to the Trail smelter yielded 614 oz. of gold and 4,307 oz. of silver.

North Star.—Located near Jewel Lake. Operated by the Greenbridge Gold Mines, Limited, with Chas. C. Walker in charge of operations. The mine was reopened in May and operated for the remainder of the year; nine men were employed, with three underground. A mill put on the property last year has not been set up for operation. Development-work included 57 feet of drifting, 151 feet of crosscutting, and 151 feet of raising. A total of 220 tons of ore mined and shipped to Trail yielded 22 oz. of gold and 192 oz. of silver.

Paulson Area.†

Molly Gibson.—Situated in Burnt Basin, about 4 miles from Paulson. Operated by the Molly Gibson Mines, Limited; head office, Calgary, Alta.; under the direction of George H. Tyrrell. A crew of four men, with two underground, was employed for the greater part of of the year. Development included 45 feet of drifting, 304 feet of crosscutting, and 83 feet of raising; 22 tons of ore was mined and shipped to Trail, the returns giving a metal content of 32 oz. of gold and 10 oz. of silver.

Berlin and Inland Empire.—Situated about 5 miles east of Paulson. Operated under lease by the Inland Empire Mining Syndicate; Rudolph Nelson, of Paulson, B.C., being in charge of operations. Ten men, seven of whom worked underground, were employed from October to the end of the year. The property has not been worked for about fourteen years and considerable repair-work is required to put the mine in good condition. The operators plan eventually to ship a large tonnage of low-grade siliceous ore to Trail. A total of 541 tons of ore, mined and shipped to the Trail smelter, yielded 121 oz. of gold and 1,142 oz. of silver.

GOLD-COPPER DEPOSITS.

*Similkameen River Area.**

Red Buck.—Fred Foster, manager. This mine is 13 miles west of Princeton, on the north side of the Similkameen River, and is accessible by a winding trail down the side of the mountain to the river from the Hope–Princeton Highway above. The portal of the main No. 1 adit is at the side of the river and the face is now 700 feet in from the portal; a small amount of crosscutting has been carried on from the main adit and raises have been put up to No. 2 adit some 200 feet above. Work done during the year was generally concentrated on the completion of an aerial tramway from the mine to an ore-bin across the river, and situated near the railway that gives access to the coarse crushing plant of the Granby Company's mine at Copper Mountain. It is a modern haul-back aerial tramway, approximately 1,000 feet in length, with a difference of 350 feet between the upper and lower terminals; the buckets have a capacity of 1.5 tons, and the system is operated by two 25-horse-power electric motors.

† By H. C. Hughes.
* By John G. Biggs.

During the present year a 100-ton flotation-mill was completed near the railway. It is operated by a 212-horse-power Petter 4-cylinder Diesel engine direct-coupled to a Westinghouse electric generator. This power is transmitted to the mill for the operation of the different power units, each unit is provided with a separate drive with the object of avoiding line shafts. The mill went into operation on December 8th.

The power for operating the mine and the aerial tramway consists of a McCormick-Deering Diesel unit coupled direct to a 50-k.v.a. electric generator, and a 112-horse-power Petter Diesel engine coupled to a new Holman 2-stage air-compressor having a capacity of 550 cubic feet of free air per minute for the operation of the drills.

There were twenty men employed on surface construction-work.

Grand Forks Area.†

Fife.—Situated near the outlet of Christina Lake. The property was operated under lease by Chas. C. Walker and associates, who employed two men. The winze from the low-level adit was dewatered and an examination made, but no further work done.

Phoenix-Eholt Area.†

Brooklyn.—Situated near Phoenix. Owned by Robert Forshaw and operated under lease by W. E. McArthur, of Greenwood. A total of twenty-one men, with nine underground, was employed in the mine and the *Providence* mill, now owned by the lessor. Development-work included 100 feet of drifting and 300 feet of raising. In addition, a 200-ton ore-bin was constructed and a new Gardner-Denver compressor driven by a 100-horse-power Diesel was installed. At present the mine is being dewatered to the 250 level with the expectation of an extension of the present ore, which was not found by the former operators. A total of 12,775 tons of ore was mined and treated in the *Providence* mill. The concentrates from this, shipped to the Tacoma smelter, yielded 2,611 oz. of gold, and 2,425 oz. of silver, and 167,395 lb. of copper.

Marshall Group.—Situated near Phoenix. Owned by Robert Forshaw, of Greenwood, and optioned to the Consolidated Mining and Smelting Company of Canada, Limited, who did surface-trenching involving the removal of 38,142 cubic feet of material, and 1,347 feet of diamond-drilling.

Athelstan.—Situated in the Wellington Camp, near Phoenix. Operated under lease by W. E. McArthur, of Greenwood, who employed four men, three underground, for several months of the year. Development-work included 100 feet of tunnelling and a large amount of surface stripping and trenching. Because of the high arsenic content, only selected portions of the ore were mined. A total of 353 tons ore was mined and shipped to the Tacoma smelter. This returned 172 oz. of gold and 284 oz. of silver. A new crosscut tunnel, estimated to be 250 feet long, is being driven to open up the ore at greater depth.

Granby.—Situated at Phoenix. Owned by the Granby Consolidated Mining, Smelting and Power Company, Limited, and operated under lease by W. E. McArthur, of Greenwood, B.C. Except for the removal of considerable overburden and old dumps, very little development-work was done on this property. When mining operations at the *Brooklyn* were suspended because of the dewatering of the lower workings, some 55 tons per day of low-grade gold-copper ore was mined from the old glory-hole and treated in the mill at Greenwood. The concentrates from 4,331 tons of ore mined, when treated at the Tacoma smelter, yielded 337 oz. of gold, 951 oz. of silver, and 72,129 lb. of copper.

B.C.—Situated about 2 miles east of Eholt. Owned and operated by the B.C. Eholt Mines, Limited; A. M. Dockstader, manager. Seven men were employed from May until September, with four working underground. Steam power was used to produce compressed air for underground work. This was confined to a small shaft about 500 feet from the old main workings. This shaft was put in repair and a gasoline-driven hoist installed. About 150 tons of ore was mined from this working but was not treated.

COPPER DEPOSITS.*

Granby Consolidated Mining, Smelting and Power Co., Ltd.—A. S. Baillie, president and managing director; W. R. Lindsay, resident manager; F. Buckle, general superintendent.

† By H. C. Hughes.

* By John G. Biggs.

The *Copper Mountain* mine and the concentrator at Allenby have been in continuous operation since operations were resumed early in 1937 following a suspension of several years. The mine is near the peak of Copper Mountain, at an elevation of 4,000 feet, and is 12 miles west of Princeton; the concentrator is at Allenby, 4 miles west of Princeton. A branch line of the Kettle Valley Railroad, from Princeton, connects all three points.

The main development of the mine is by two main adit haulage tunnels known as Nos. 2 and 6 levels, and a large part of the ore handled on No. 2 level is produced by surface glory-holes; all the ore is passed by haulage and transfer-chutes to No. 6 level on which is the main transportation system of the mine. The ore is crushed at the portal of No. 6 level and carried on the railroad to the concentrator at Allenby, 8 miles distant.

During the year two more levels—Nos. 7 and 8—have been driven 200 feet and 400 feet respectively below the main level. This new development is serviced by a well-equipped vertical shaft from the upper levels.

Development during the year consisted of 8,904 feet of drifting and crosscutting, 9,322 feet of raising, and 3,542 feet of diamond-drilling; 1,223,200 tons of ore was mined and milled, and this produced 29,652,613 lb. of copper, 8,730 oz. of gold, and 214,676 oz. of silver.

Mining generally is by the shrinkage system and a large percentage of the ore is blasted by the multiple-shot method, by which from 2,000 to 3,000 shots are blasted at one time; this type of blasting is carried out at a week-end when all persons are out of the mine except the few required to attend to the final blasting. Power for the operation of the mine and concentrator is produced at the company's plant at Princeton where a modern 2-unit boiler installation supplies steam requirements for three turbines driving three generators of 500 k.w., 2,000 k.w., and 5,000 k.w. respectively at a voltage of 13,800 volts, at which pressure the power is carried to the transformers at Allenby and Copper Mountain. One of the above boilers is fired by pulverized coal and the second by Harrington chain-grate stokers.

GOLD-SILVER-LEAD DEPOSITS.

Greenwood Area.†

Providence.—Situated about 1 mile north of Greenwood. Operated by the Riegel Mines, Limited; O. D. Thompson, manager. The mine was operated continuously from May until the end of the year with a crew of seven men, four of whom were employed underground. Development-work consisted of 875 feet of drifting. A total of 144 tons of ore mined and shipped to the Trail smelter yielded 89 oz. of gold, 20,425 oz. of silver, and 6,072 lb. of lead.

Combination.—Situated about 1½ miles north-east of Greenwood. Operated by W. J. Roger and Pulver, of Seattle, Wash., with R. C. McLanders in charge of operations. A power-house and blacksmith-shop were built and a small semi-portable gasoline-driven compressor was installed. Five men, with three underground, were employed for a short time. It was planned to drive a low-level crosscut to get depth on the vein but very little underground-work was actually done.

SILVER-LEAD DEPOSITS.

Beaverdell Area.†

Highland Bell.—Situated on Wallace Mountain. Operated by the Highland Bell, Limited, with N. M. Mattson as manager. This mine continued to be operated profitably during the year. A crew of thirty-eight men was employed, with twenty-seven working underground. The problem of locating the faulted segments of the ore—this condition being a feature of the Beaverdell area—continues to be successfully met. Late in the year the *Highland Bell* acquired a control in the adjoining *Beaver* claim. Development-work included 700 feet of drifting, 500 feet of crosscutting, 300 feet of raising, and 50 feet of sinking. In addition a geophysical survey of the property was completed during the summer months. A total of 5,100 tons of ore mined and shipped to the Trail smelter yielded 815,249 oz. of silver, 88 oz. of gold, 473,727 lb. of lead, and 614,911 lb. of zinc.

Sally.—This property, adjoining the *Highland Bell*, was operated by the Sally Mines, Limited, with N. M. Mattson in charge. Four men, three underground, were employed for the first part of the year. The work consisted chiefly of cleaning up the old stopes and mining the remains of ore-bodies left by former operators. Development included 200 feet of drift-

† By H. C. Hughes.

ing and 100 feet of crosscutting. A total of 213 tons of ore mined and shipped to Trail yielded 2 oz. of gold, 12,142 oz. of silver, 10,887 lb. of lead, and 22,268 lb. of zinc.

Wellington.—Situated on Wallace Mountain. Operated by the Beaverdell-Wellington Syndicate, Limited. A. J. Morrison, manager, and Geo. Boag, mine foreman. The mine worked continuously throughout the year, an average of twenty men being employed, with twelve underground. Development included 612 feet of drifting, 240 feet of raising, and 12 feet of sinking. A total of 1,647 tons of ore mined and shipped to the Trail smelter yielded 42 oz. of gold, 94,736 oz. of silver, 75,572 lb. of lead, and 109,932 lb. of zinc.

Bounty and Bounty Fraction.—This property adjoins the *Wellington* and is controlled by that company and operated under the same management. Operations were commenced in November and a crew of three men, with two underground, was employed from then on. A new compressor-house was built near the portal of the low-level adit and the *Bounty* Diesel and compressor installed in it. The present management feel that, with their knowledge and experience in local faulted conditions, they will be able to locate blocks of ore overlooked by former operators. Development-work included 120 feet of drifting.

Beaver.—Situated on Wallace Mountain, adjoining the *Highland Bell* and *Sally*. This property, formerly owned by the Beaver Silver Mines, Limited, is now controlled by the *Highland Bell*. It is being operated by Homer S. Nordman and associates under a lease which has two years to run. Four men, with three underground, were engaged on this lease throughout the year. The area being worked under this lease is a considerable distance from the *Highland Bell* line and their operation should in no way interfere with the leasers. Development-work included 320 feet of drifting and crosscutting and 120 feet of raising. Ore totalling 178 tons mined and shipped to Trail yielded 6 oz. of gold, 30,880 oz. of silver, 22,068 lb. of lead, and 38,874 lb. of zinc.

Tiger.—Situated on Wallace Mountain. Owned by the Wm. Law estate and operated under lease by John L. Nordman and partner. Compressed-air, piped from the *Beaver*, was used underground. A total of 53 tons of ore mined and shipped to Trail yielded 1 oz. of gold, 10,131 oz. of silver, 11,741 lb. of lead, and 11,671 lb. of zinc.

Rambler.—Situated on Wallace Mountain. Owned by W. H. Rambo and A. S. Black and operated under lease by the R.S.K. Mining Syndicate, of Beaverdell, with John McDonnell in charge. Three men, all working underground, were engaged in this lease. Development-work included 90 feet of drifting, 40 feet of crosscutting, 15 feet of raising, and 30 feet of sinking. A total of 3 tons of ore was mined and shipped to Trail, yielding 280 oz. of silver, 270 lb. of lead, and 449 lb. of zinc.

Highland Chief.—Situated on Wallace Mountain adjoining the *Highland Bell* mine. Owned by Mark Smith, of Beaverdell, and operated under lease by a local syndicate with Alex. Bell in charge. Three men were employed underground, all work being done by hand-steel. Development included 221 feet of drifting, 91 feet of crosscutting, and 19 feet of raising. All ore mined had to be hauled to the *Highland Bell* road over a raw-hide trail a distance of about half a mile. A total of 3 tons of ore mined and shipped to Trail yielded 281 oz. of silver.

British Silver and Gold Mine Proposition.—This syndicate, composed of Gilbert Prideaux, Perley Russel, and G. G. Lyall, of Princeton, and Manley and Miller, of Grand Forks, controls a group of seven claims on Wallace Mountain adjoining the *Wellington* mine. The syndicate was formed and work done with the idea of prospecting for the possible extension of the *Wellington* vein, along the strike, particularly on the *British* claim. The management believe that although no commercial ore has been found to date, an area of similar geological conditions to those where ore has been mined in the *Wellington*, has been uncovered. Development-work done this season included 400 feet of surface trenching and 77 feet of tunnelling.

PLACER-GOLD DEPOSITS.

Greenwood Area.†

May Creek Placers.—Situated on May Creek, about 16 miles east of Grand Forks. Operated by H. L. Armand, manager, and H. F. and D. E. Butchart and J. G. Johnson, all of Chilliwack, B.C. Water from May Creek was conducted through 1,000 feet of pipe to

† By H. C. Hughes.

operate a monitor. The creek-banks and near-by benches were washed through sluices by this means. The operation was handicapped by lack of water. A 32-volt Delco plant provided light for a two-shift operation. Production was small.

Boundary Gold Placers.—Situated on Boundary Creek, about 5 miles west of Greenwood. Operated by the Boundary Gold Placers, Incorporated; Fred Simpson, of Greenwood, manager. A dam and flume were constructed, the latter being calculated to carry the creek over the ground to be worked. This proved inadequate during the high water, so much so that a great deal of extra work was necessary to save the plant. To lift the gravel from the bottom of the pit at bed-rock a 14-inch Hendy hydraulic elevator was used. Water to operate this was taken from the main supply pipe-line, the headgate of which was located about 2 miles up the creek, and the pressure augmented by a 12-inch discharge Kimball-Krogh centrifugal pump driven by two 100-horse-power Cummings Diesel engines. Gravel in the pit was handled by a No. 4 monitor operating under 186 feet of head. The elevator, capable of handling boulders up to 10 inches in diameter, discharges directly into a 4-foot sluice box which dumped the tailings some little distance down the creek. This arrangement depended on the high water eventually to carry them away. The operation was evidently not successful, for the plant was dismantled late in the summer. Ten men were employed during the summer.

NON-METALLIC DEPOSITS.

Vicinity of Grand Forks.†

Fife Limestone Quarry.—This property is owned by the Consolidated Mining and Smelting Company of Canada, Limited. Twelve men, working on contract, shipped 19,943 tons of limestone from this property to the Trail smelter.

† By H. C. Hughes.

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VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

2,825-439-8926

The Annual Report of the Minister of Mines is now issued in parts as follows:—

Part A.—THE MINING INDUSTRY (STATISTICAL REVIEW). John F. Walker.

Part B.—NORTH-WESTERN DISTRICT. Joseph T. Mandy.

Part C.—NORTH-EASTERN DISTRICT. Douglas Lay.

Part D.—SOUTH CENTRAL DISTRICT. M. S. Hedley.

Part E.—SOUTH-EASTERN DISTRICT. R. J. Maconachie.

Part F.—SOUTH-WESTERN DISTRICT. H. Sargent.

Part G.—INSPECTION OF MINES. James Dickson.

PART E

ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1938

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

BRITISH COLUMBIA DEPARTMENT OF MINES.

VICTORIA, B.C.

Hon. W. J. ASSELSTINE, *Minister.*

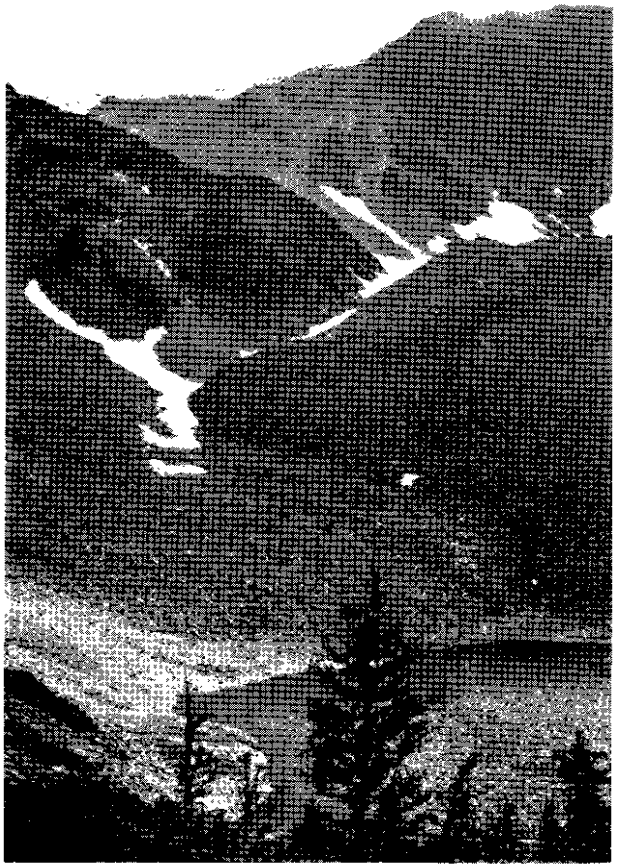
JOHN F. WALKER, *Deputy Minister.*

JAMES DICKSON, *Chief Inspector of Mines.*

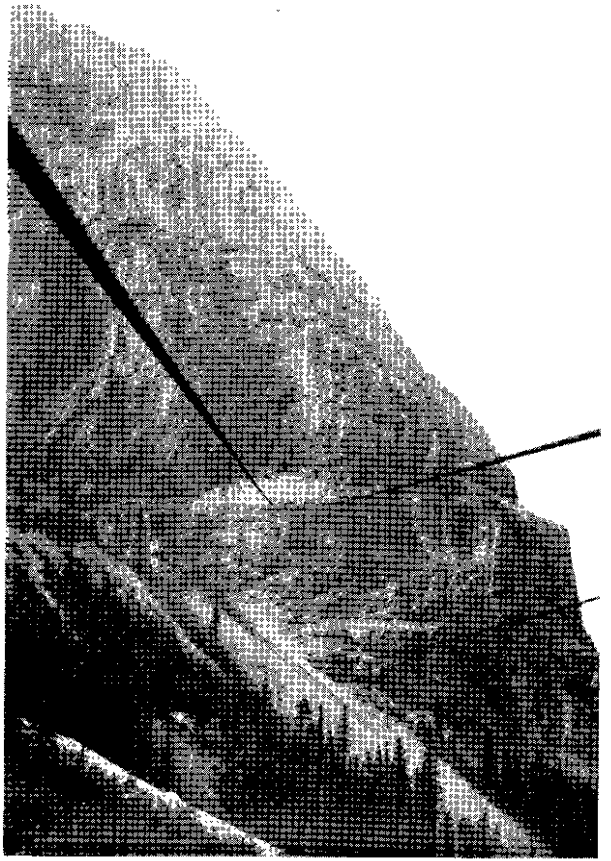
D. E. WHITTAKER, *Provincial Analyst and Assayer.*

P. B. FREELAND, *Chief Mining Engineer.*

R. J. STEENSON, *Chief Gold Commissioner.*



Lake at head of Granite Creek.
Silver Key group.



Monarch Mine, Field.
Looking southward to Monarch portal from mill terminal.

Headwaters of Lemon Creek.

Falls on Movie River at Nero Placers.
Portal of workings at foot of ladder.

PART E.

SOUTH-EASTERN DISTRICT.

BY
R. J. MACONACHIE.

SUMMARY.

Like last year, the properties of the Sheep Creek camp were outstanding among the gold producers, with *Reno, Sheep Creek,* and *Kootenay Belle* continuing operations on established scales. Particular encouragement was found at the property of Sheep Creek Gold Mines, Limited, with the discoveries of additional veins of proved and possible commercial importance. Also of special consequence was the coming into production of the *Gold Belt* property in October where, geologically, conditions apparently compare favourably with those existing in the successful operations adjacent.

At the *Second Relief* gold production was maintained from the main workings, and continued development of the two veins on the west side of Erie Creek was sufficiently encouraging to indicate that further work is warranted.

Production from the Ymir camp was severely curtailed by the closing of the *Ymir Centre Star,* operated by Wesko Mines, Limited, and of the *Howard,* operated by Durango Mines, Limited. Both of these properties were milling gold-silver-lead-zinc ore.

The closing of the *Bayonne* property at the end of the year was particularly unfortunate in that it was the largest and most important operation in that area, and it is to be hoped that interest and prospecting activity will not be entirely diverted from the other smaller properties in the surrounding district.

Several gold properties with previous records have been reopened during the year, partly due to the low rates granted by the Trail smelter on siliceous ore. Examples are the *Daylight,* under option to the Hedley Amalgamated Gold Mines, Limited, and the *Athabasca,* being developed by Noble Five Mines, Ltd., both on Toad Mountain near Nelson; the *Inland Empire* at Paulson; the *Highland Surprise* at Retallack; the *Kilo,* on Chapleau Creek, near Slocan City; and the *Gilman* in the Lardeau. The two last-named operations are described in detail in this Report.

Of new gold discoveries, the most interesting was at Rosebud Lake, south of Sheep Creek. The gold-bearing vein on the *Andersen* property, on Perry Creek, in Fort Steele district, is worthy of mention, for although not discovered this year it was only toward the end of the season that comprehensive development has been undertaken. Both this property and the Rosebud Lake area are herein described. The Nero Placers, on the Moyie River, near Lumberton, are in a similar position in that development carried on over a period of several seasons culminated this year in assuring a working profit and indicating further attractive possibilities.

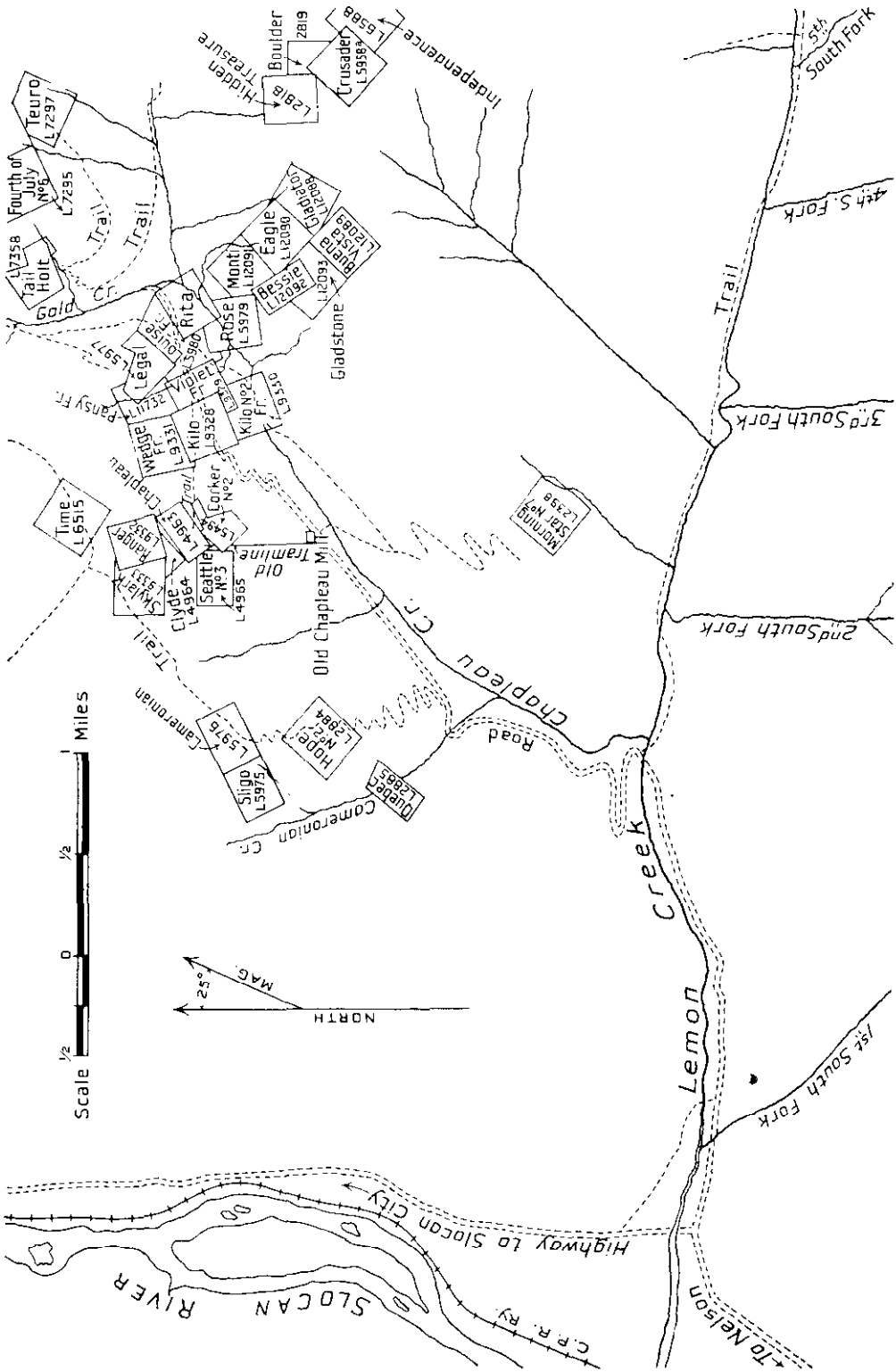
The producers of base metals have been generally inactive owing to the depressed market; the only notable exception being the *Sullivan* mine, which maintained production at its established rate. In the Slocan, leasers have found it possible to mine small segments of ore which may be cheaply developed or which have been developed by previous operators, but the only programme of new development has been on the *Sunshine* group at Sandon, by the Silver Ridge Mining Company, as herein described.

In the following an effort has been made to select a few properties and areas of possible interest which are still in the prospective stage, little emphasis has been laid upon those of proven worth.

LODE-GOLD DEPOSITS.

CHAPLEAU CREEK-LEMON CREEK AREA.

During the past season there has been a considerable revival of interest in the Chapleau Creek-Lemon Creek district, south-east of Slocan City. The principal cause of attention to the area was the reopening of the *Kilo* property, on Chapleau Creek. Because of this



Chapleau Creek-Lemon Creek Area. Map showing locations of surveyed claims.

operation and of the possibility that improved means of access would lead to the discovery and development of other similar deposits by stimulation of prospecting in the area, the road was reconditioned and extended for truck-hauling as far as the *Goldstream* property, half a mile above the *Kilo* property and 9 miles from the highway. The point of junction with the highway is 6 miles south of Slocan City. The road follows up Lemon Creek to the mouth of Chapleau Creek. It is on easy grade for the first 3 miles, but for the remainder of the distance, as it rises above Chapleau Creek on its north-west side, the road is on a steeper gradient. Although satisfactory during summer months, parts of this latter stretch, particularly the last 2 miles to the *Kilo*, would require some relocation to permit continuous winter-hauling by trucks.

In the district, the creeks, Chapleau, Lemon, and other small tributaries, are deeply incised between peaks rising to altitudes of nearly 8,000 feet. The larger streams run swiftly on steep gradients and assure year-round source of power and water-supply for any milling operation which might be warranted by the deposits in the area. Snowfall, although heavy enough to necessitate sturdy construction of buildings, is not sufficient to affect any well-organized mining operation. Timber is plentiful and suitable for all domestic, mining, or construction needs.

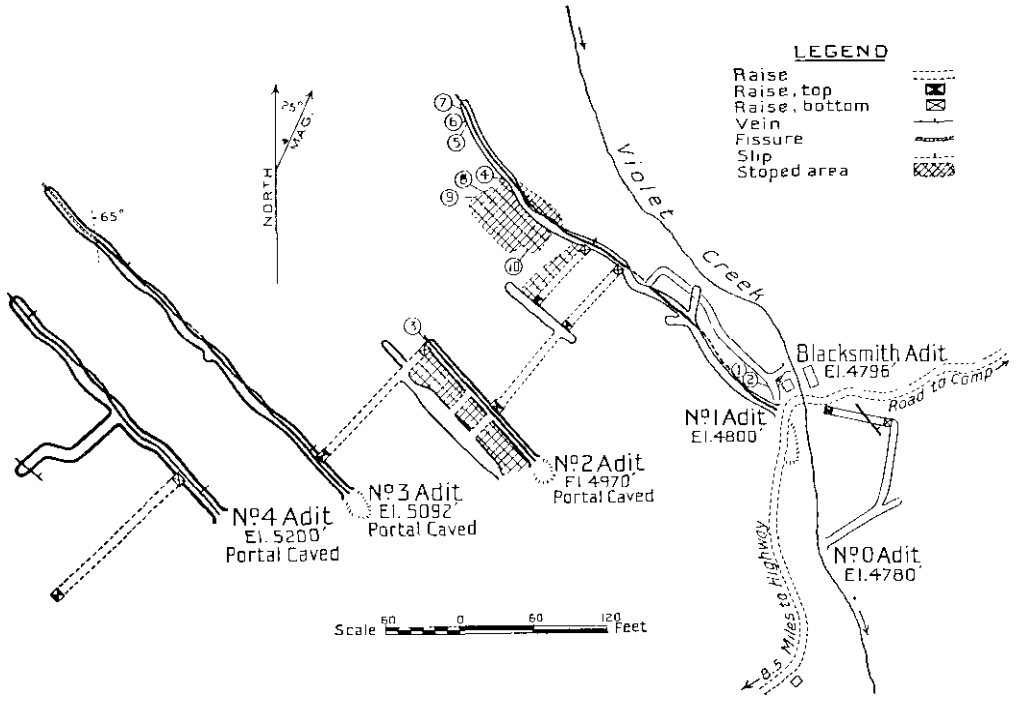
Geological conditions are strikingly similar throughout the area. The underlying rocks are granite and associated rocks of the Nelson batholith. The veins under investigation are usually of gentle dip, seldom exceeding 45 degrees, of average width, seldom over 2 feet, and composed of quartz gangue, sparsely mineralized by pyrite and minor amounts of sphalerite and galena. Values associated with the sulphides are principally in gold, with minor amounts of silver. The occurrence of free gold has been reported. Commonly the quartz is milky-white, characteristically intermediate to low temperature in origin, but where the best values are found there is usually a width of rust-stained and discoloured quartz within the walls, on either the foot- or hanging-wall of the milky quartz. This occurrence strongly indicates the possibility of two periods of mineralization. Although the presence of the rust-stained, rose-coloured quartz does not necessarily indicate gold values, the reverse is usually true—namely, that commercial values are rare other than in or adjacent to this kind of quartz. The entire vein-filling is almost entirely free from, and fractured parallel to, the walls. Vein-fissures are commonly strong and well-defined. No evidences of pre-mineral faulting of sufficient magnitude to create operating difficulties were observed; post-mineral faults are not rare, but generally cause only minor displacement of vein-structure. Good walls are the rule and only a minimum of timbering is required upon removal of the vein.

Comprehensive development has been undertaken only at the *Chapleau* and *Kilo* properties. At the former there has been little work done since 1904, when conditions of faulting and decreased values on the lowest level discouraged the operators, although since that time various leasers have made small shipments. In consideration of typical conditions in this district it must be mentioned that the *Chapleau* property probably presents problems not generally encountered by reason of its proximity to an area on the north-west and north, in which geological conditions are irregular by reason of the inclusion of older rocks within the granite mass. These occurrences may be studied on the *Skylark* and *Ranger* claims immediately adjoining the *Chapleau*.

In the district, the *Kilo* property thus offers the only opportunity for detailed study of what at this time appears to be the most favourable conditions for the development of commercial ore.

Kilo Group. Reference should be made to the Annual Report of the Minister of Mines for 1933. Owned by Mrs. N. F. McNaught, of Silverton, operated intermittently since 1897, the group consists of the *Violet* and *Kilo* Crown-granted mineral claims, and the *Wedge*, *Pansy*, and *Kilo No. 2* Crown-granted fractional mineral claims. During 1938 the property has been held under lease and bond by H. V. Dewis, of Silverton, who built new camp buildings and employed up to eleven men. Assay equipment, compressor, and machine-drills were placed on the ground and active development was carried on for four months. A total of 501 tons was shipped with content of 197 oz. of gold and 282 oz. of silver.

Geological conditions are similar to those previously described as characteristic of the district. The vein averages about 2 feet wide and where values have been found sufficiently high to constitute shipping-ore they are invariably confined to a width of discoloured vein-quartz that accompanies the ordinary white quartz gangue. The granite host-rock is commonly dark-coloured and even-grained, with occasional conspicuous feldspar phenocrysts. The walls are good and stand with little timber, except in the portions of the mine originally opened. There, the granite has decomposed, but such deterioration naturally would not be effective in the life of a continuous operation. Generally, the vein strikes north-west and dips up to 45 degrees north-east. Mineralization by pyrite, galena, and sphalerite is commonly sparse. Near the face of the No. 1 level a 1- to 2-inch width of siliceous gouge lies on both foot- and hanging-wall of the quartz, separating it from the granite. Such occurrence is unusual.



Kilo Group. Plan of underground workings from owner's map. No. 0 adit approximate location only; Blacksmith's adit from survey by the writer.

As detailed in the 1933 Report, development completed prior to this year consisted of the driving of four principal drift-adits; the elevation of the lowest of these, No. 1, the main haulage-level, is 4,800 feet. At 4,780 feet elevation a short prospect adit, No. 0, was started at the level of Violet Creek in an effort to develop the vein below the No. 1 level. At 5,350 feet, ahead of the face of No. 1 level, there is reported to be an inclined shaft, sunk on ore presumed to be an extension of the vein, from which early operators are said to have shipped ore of good grade. At this time, the shaft is difficult to find. Near the portal of No. 1 level earlier operators exposed and exploited a shoot of ore which was worked partly by underhand stoping and partly from a shallow adit driven between the elevations of No. 1 and No. 0; in addition, a second shoot of ore was developed but not completely mined near the face of the level.

Unless the reported ore in the inclined shaft at 5,350 feet elevation proves the exception, development has been productive of little ore other than slightly above and slightly below the No. 1 level. A raise from this level to No. 2 and a further raise to No. 3 level, at elevations 4,970 feet and 5,092 feet respectively, and several hundred feet of drifting at these levels, has displayed vein continuity but shows a general lack of commercial values. No. 4 level, a drift-adit 250 feet long, at 5,200 feet elevation, is not connected with the other

levels and is, at the present time, accessible only through a long inclined shaft. This working has not been examined for several years. From the given elevation and the position shown for this level on the owner's plan, conjecture arises as to whether or not the drifting has been on the principal vein or on another in the hanging-wall. This consideration is emphasized by the presence of a second vein, of similar strike and dip, indicated in a foot-wall crosscut from the drift, 85 feet south-west of the vein, exposed by the drift. On the No. 2 and No. 3 levels, vein-widths probably average less than 2 feet and the quartz is milky-white with little mineralization.

On the No. 3 level, after drifting some 290 feet on the vein, the adit intersected a strong slip striking north 5 degrees west, dipping 65 degrees east. Up to this point in the drift, the vein is narrow, attaining widths greater than 1 foot only in short sections, the best of which shows 15 inches for a length of 36 feet. In many places up to the 290-foot mark, the quartz is heavily fractured and on its foot-wall carries a 2- to 4-inch band of siliceous gouge. At the intersection with the slip the vein-quartz, here having a width of 15 inches, is cut off and does not appear again in the remaining 60 feet to the face of the drift. The gouge seam does continue, however, thus indicating the probability of two periods of fissuring. Correlation may be possible between two such assumed fissurings here in the plane of the vein and two periods of mineralization embodying the discoloured quartz and the white quartz in the productive parts of the vein. On the No. 2 level, where a drift developed the vein for a length of 130 feet, values were apparently high enough to permit shipping of ore, as stopes have been carried to a distance of some 45 feet up the dip of the vein over the full length exposed. In the working-adit, between No. 0 and No. 1, known locally as the Blacksmith tunnel, the earlier operators drifted on the vein for about 150 feet, some 85 feet of which is now accessible. As the difference in elevation between this and the No. 1 level is only about 6 feet, the work constituted little more than underhand stoping. However, of possible interest in the light of future operation, this working provides exposures of several small post-mineral faults striking at right angles to the vein and throwing downward some 3 feet on the south side.

In 1938 Dewis stoped the shoot of ore already developed near the face of the No. 1 level. A length of 50 feet in the drift showed commercial assays when operations commenced, and stoping was carried upward from this length for a slope distance of 50 to 70 feet before losing shipping values. Some ingenuity was displayed in this working by carrying water by pipe-line from a point farther up the hill and sluicing the muck down the 40-degree dip into wing shoots. At this location the iron-stained, rust-coloured quartz band was found to be persistent but variable in width from a mere stringer to 35 inches. No definite information was obtainable, but indications were that the ore raked upward to the north-west.

When values in this section of the vein on No. 1 level decreased to a point at which shipping was no longer profitable, the operation was transferred to the No. 0 level, and an effort made to tap the downward extension of the small shoot originally developed near the portal of No. 1 level and by means of the Blacksmith tunnel. This work was done since the property was examined, but it is understood that extension of the raise, already started from the No. 0 level, found ore and permitted one shipment.

Although development on the upper levels has been disappointing, results from the No. 1 level are sufficiently attractive to make further extension of this level worthy of consideration, especially if proof of continuity between the present face and the inclined shaft is forthcoming by means of surface development. Any operation would of necessity have to be conducted with the utmost economy, because at the present time attractive assays are offset by the generally narrow widths of the high-grade streak and the lack of information as to frequency of ore-shoots.

The following are assays of samples taken from this property:—

No. 1.—Over 10 inches discoloured vein-quartz, containing slight pyrite, no visible sphalerite or galena, on the hanging-wall of the vein, in the Blacksmith tunnel at 12 feet from the south end: Gold, 0.36 oz. per ton; silver, 0.4 oz. per ton.

No. 2.—Over 13 inches of typical milky-white vein-quartz, containing only slight pyrite, below the previous sample: Gold, *nil;* silver, *nil.*

No. 3.—Over 31 inches of white vein-quartz at the face of No. 2 level: Gold, 0.08 oz. per ton; silver, 0.3 oz. per ton.

No. 4.—Over 9 inches discoloured vein-quartz, heavily fractured parallel to the walls, containing no visible mineral, on the No. 1 drift wall, at the north end of the stope under development: Gold, 0.46 oz. per ton; silver, 0.3 oz. per ton.

No. 5.—Over 12 inches white quartz, considerably mineralized by pyrite, on the west wall of the No. 1 drift, 12 feet short of the face: Gold, *nil;* silver, *nil.*

No. 6.—Over 2 inches of siliceous gouge on the foot-wall of the previous sample, containing no visible mineral: Gold, trace; silver, trace.

No. 7.—Over 19 inches white vein-quartz, slightly mineralized by pyrite, at the face of the No. 1 level: Gold, *nil;* silver, *nil.*

The following five samples were taken from the working-face and ends on the No. 1 level stope at the time of examination:—

No. 8.—Over 24 inches of strong brown vein-quartz, mineralized by galena, sphalerite, and pyrite, concentrated in fractures: Gold, 0.74 oz. per ton; silver, 0.5 oz. per ton.

No. 9.—Over 17 inches of similar material: Gold, 0.28 oz. per ton; silver, 0.7 oz. per ton.

No. 10.—Over 35 inches of similar material: Gold, 0.28 oz. per ton; silver, 0.3 oz. per ton.

Select fine-grained sphalerite and pyrite: Gold, 49.20 oz. per ton; silver, 35.4 oz. per ton.

Select brown quartz carrying disseminated medium to coarse-grained galena and pyrite, no visible sphalerite: Gold, 1.20 oz. per ton; silver, 2.4 oz. per ton.

Rose Group. This group, consisting of the *Rose* and *Louise Fraction* Crown-granted mineral claims, is owned by A. S. Johnson, of Montreal, Quebec. These claims, on both sides of Chapleau Creek, adjoin the *Kilo* ground on the east and south-east. Present access is by some 1,500 feet of badly overgrown foot-trail leading from the *Kilo* camp. If necessary, a road could be constructed from the *Kilo* road slightly below the *Kilo* camp or, as an alternative, on excellent grade for a distance of 1 mile from the *Kilo* road at the *Chapleau* mill. No development on this ground is reported since 1899, and although there are evidences of that development none is in condition for purposes of examination or is worthy of rehabilitation. On Chapleau Creek, at an elevation of 4,500 feet, there is a small pile of apparently selected vein material from irregular exposures of vein in granite host-rock, showing in place in the creek bottom. The vein-quartz is milky and massive, heavily fractured with healing of the fractures by later quartz. Sulphide mineralization is chiefly by medium to coarse-grained pyrite and galena with, although not identified, probably some sphalerite. Two grab samples were taken from this ore pile and assayed as follows:—

Selected medium to coarse-grained pyrite and galena: Gold, 0.42 oz. per ton; silver, 0.2 oz. per ton.

Patchy coarse pyrite and galena in quartz: Gold, 20.40 oz. per ton; silver, 10.6 oz. per ton.

The exposure suggests that limited expenditure for surface-stripping is justified.

Of particular interest in connection with this showing is the speculation as to whether it can be correlated as the extension of the *Kilo* vein on its strike and dip.

Goldstream Mineral Claim. The workings on this claim are at the end of the road, half a mile beyond the *Kilo* camp. The *Goldstream, Bearpaw,* and *Gold Knob* are held on location by G. Soucey, of Vallican, who also owns the adjoining *Legal* Crown-granted mineral claim. At this time all four claims are under lease and bond to C. Ritchie, of Rossland, who, with one or two partners, worked on the ground up to the end of the year. The *Legal, Goldstream,* and *Gold Knob* adjoin each other and lie in an easterly line from the *Kilo* ground; the *Bearpaw* adjoins the *Legal* and *Goldstream* claims on the north. A cabin beside the road, only a few hundred feet from the showing, is well constructed and provides accommodation for four men. Water for domestic use is obtained from Gold Creek. This summer there was installed a small air-compressor capable of supplying one drill.

Development during the past season was concentrated on the showing on the *Goldstream* claim on Gold Creek. At an elevation of 5,000 feet, at the end of the road, the creek crosses a typical quartz vein in granite, striking south 85 degrees west, dipping 25 degrees north. At the time of examination the vein had been exposed for 20 feet on the east side of the creek and 35 feet on the west side, and showed widths from 15 to 23 inches. Within the vein

are inclusions of light-green acidic rocks, altered phases of the host-rock. The vein is made up of milky-white quartz and rust-stained, brown or pink quartz on either wall, the latter carries the principal mineralization of pyrite, galena, and sphalerite. In this part of the vein-filling the writer saw some specks of free gold. In one section a total width of 48 inches was made up by 10 inches of discoloured quartz on the foot-wall, 24 inches of white quartz on the hanging-wall, and a centre section of included rock. The width of the stained high-grade quartz commonly ranges in the limited development from 3 to 6 inches. As at the *Kilo*, mineralization, typically medium to coarse grained, is concentrated along fracture-planes paralleling the walls rather than disseminated through the quartz mass.

At the time of examination development had been centred on the exposure on the west side of the creek and consisted of stripping out the vein from the surface. It is understood that, since then, a drift has been driven 32 feet westward from the face of the open-cut. At the face of the drift the operators report the vein to have pinched to 3 inches. It is also understood that 40 feet of prospect-tunnel was driven south of the drift and at a higher elevation. This work was an attempt to develop the vein up its dip, but unfortunately the overburden was so heavy at the location selected that bed-rock was never exposed.

Eighty feet south of the original exposure there is another vein-outcrop, poorly exposed for a few feet on the bank of the creek. As nearly as could be determined, the strike at this outcrop is north 40 degrees west, the dip 35 degrees north-eastward.

Samples taken from the exposure on the west side of the creek assayed as follows:—

Select sample of oxidized gouge occurring irregularly within the vein, no visible mineral: Gold, trace; silver, 0.4 oz. per ton.

Across 12 inches of white vein-quartz, little mineralized: Gold, *nil;* silver, 0.2 oz. per ton.

Across 30 inches, mixed quartz and included rock on hanging-wall of previous sample, slightly mineralized by fine-grained pyrite: Gold, *nil;* silver, *nil.*

Select brown and rose quartz from shipment pile, slightly mineralized by galena, sphalerite, pyrite: Gold, 11.50 oz. per ton; silver, 8.7 oz. per ton.

Legal Mineral Claim.

As given in the foregoing report on the *Goldstream* mineral claim, the *Legal* Crown-granted mineral claim is, at the present time, under lease and bond to C. Ritchie, of Rossland, B.C. It adjoins the *Goldstream* claim to the east and the *Kilo* ground to the west; considerable work has been done on this claim in the past, principally in an effort to prove extension of the *Goldstream* vein westward. The generally light overburden facilitates economical surface-stripping.

Near the south-east corner of the claim, at elevation 5,385 feet, two small cuts expose a quartz vein striking north 55 degrees east, dipping 50 degrees north-west. The exposure is typical of the district, the vein has a width ranging from 13 to 16 inches of white unmineralized quartz with, at one exposure, 6 inches of brownish quartz on the hanging-wall. A sample taken over 22 inches at this location, including both white and discoloured quartz, assayed: Gold, trace; silver, 0.4 oz. per ton. Sixty-five feet away, on a south 60 degree west line, at elevation 5,390 feet, another small cut exposes 13 inches of slightly discoloured quartz containing no visible mineral, which assayed: Gold, trace; silver, trace. Twenty feet still farther south-west another caved cut indicates continuity of the vein. In these exposures there is characteristically 2 to 3 inches of hydrothermal leaching of the ferro-magnesian minerals on both foot- and hanging-wall of the vein.

At 5,355 feet elevation, some 400 feet from the south boundary and near the centre of the claim, an adit has been driven on an east-west quartz vein in granite. The vein exposed by this work differs from the usual type in the area in that it is narrower, tighter, and faulted.

For 57 feet on a north 15 degrees east bearing, a drift exposes widths ranging between 2 and 5 inches of white quartz mineralized by pyrite. The dip of the vein is here 35 degrees west. A sample taken at the centre of this exposure, over 4½ inches, assayed: Gold, 0.02 oz. per ton; silver, 0.4 oz. per ton. In the length of 57 feet, one section of about 10 feet contains no quartz, and fissure continuity is maintained only by a tight fracture. At 57 feet the strike of the vein is changed abruptly to north-east by a complicated system of fractures, the two most prominent of which strike due north and north 70 degrees west, and dip 85 degrees east and 65 degrees south respectively. A drift for 40 feet in this new

direction developed widths of vein up to 10 inches, shows it to dip 20 degrees north. Near the centre of this 40-foot length a raise was driven 30 feet south on the vein. In the raise the vein ranges in width from 4 to 10 inches and is composed of white quartz, little mineralized. A sample taken in the drift at the foot of the raise, over 10 inches of white quartz mineralized by pyrite, assayed: Gold, 0.94 oz. per ton; silver, 0.9 oz. per ton. Just beyond the 40-foot length of north-easterly development the vein is faulted out of the working between two tight fractures 9 feet apart, one strikes north 80 degrees east and dips 60 degrees south, the other strikes due east and dips 60 degrees south. The working was driven on a north-west bearing through this section of granite. At the second fracture, the working is still on a north-west bearing, the vein was again intersected and followed for 5 feet. It strikes north-west and dips flatly south-west. Five feet beyond the second fracture the vein and drift change direction to north 20 degrees east, the vein dipping 30 degrees north-west. The face of the adit is 9 feet from the last change of direction and the vein has a width of 4 inches of white quartz, slightly oxidized and mineralized only by a slight amount of pyrite occurring in irregular bunches.

In a direction south 65 degrees west from the portal another adit was at one time driven at an elevation some 95 feet lower, apparently in an attempt to develop the vein on its dip. The working is now badly caved.

Bearpaw Mineral Claim.

The *Bearpaw* claim, under lease and bond to C. Ritchie, of Rossland, adjoins and lies to the north of the *Goldstream* claim and the *Legal* claim, and is staked to cover the top of the southern slope of the hill between Violet Creek and Gold Creek. Timber is scarcer than on the *Goldstream* and *Legal* claims and little water is available. Overburden is light enough to permit economical surface work. At 5,850 feet elevation, at a point about half a mile above the *Kilo* camp, a small open-cut exposes a vein of pyrolusite in decomposed granitic rock. The strike of this vein appears to be about north 60 degrees east and the dip almost vertical. On both margins of the central 42-inch width of pyrolusite mineralization, the granitic wall-rock has been absorbed irregularly for widths up to 8 inches and contains additional amounts of that mineral. A sample over the central 42-inch width assayed: Gold, *nil;* silver, *nil;* manganese, 7.3 per cent.

There is a further exposure of the vein 50 feet south-west and 20 feet lower, at the portal of a caved adit. There a 36-inch width of vein carries considerable pyrolusite.

Hollinger Group.

This group, consisting of the *Hollinger*, *Hollinger No. 1*, *Hollinger No. 2* mineral claims, and *Hollinger Fractional* mineral claim, is held on location by E. A. Panquist and C. W. Tipping, of Slocan City. This ground lies approximately 1 mile by trail from the *Kilo* camp, on the opposite or south-east side of Chapleau Creek, and adjoins the *Rose* Crown-granted mineral claim. The slope is more precipitous than on the north-west side and is covered by heavy timber at all but the highest altitudes. The trail from the *Kilo* camp at the present time is only a foot-trail and, as in the case of the *Rose* claim, if future development so warranted access would be by a new road on creek grade from the *Chapleau* mill. This year the owners have built a new cabin on the ground to provide accommodation for two men. It is near a small spring which provides domestic water.

The principal exposure consists of a quartz vein striking north 40 degrees west, dipping 10 degrees to the north-east, with a width ranging from 1 to 4 feet. The quartz-filling is typically strong and white, mineralized only slightly by pyrite, and heavily fractured. In places the granite walls of the vein are badly decomposed as a result of the length of time since the work has been done. Development on this showing has been by intermittent surface-stripping over a length of about 550 feet. The vein, as thus exposed down its dip, drops away gently from the contour of the hillside toward the north-east. At the south-west end of this series of open-cuts, at an elevation of 5,325 feet, an adit has been driven on the strike for 29 feet from the face of a 13-foot open-cut in overburden. This adit presents the only opportunity for comprehensive sampling and samples were taken at 5-foot intervals. The vein is strong and shows no displacement. Samples taken in this working are as follows:—

Across 8 inches of hanging-wall granite, silicified, showing some effects of hydrothermal leaching, containing no visible mineral, at portal: Gold, *nil;* silver, *nil.*

Across 22 inches vein-quartz, no visible mineral, below previous sample: Gold, 0.06 oz. per ton; silver, trace.

Across 8 inches foot-wall granite below preceding sample: Gold, *nil;* silver, *nil.*

Across 24 inches vein-quartz, no visible mineral, at portal plus 5 feet: Gold, trace; silver, 1.6 oz. per ton.

Across 23 inches vein-quartz, no visible mineral, portal plus 10 feet: Gold, *nil;* silver, *nil.*

Three samples at portal plus 15 feet over 20 inches of hanging-wall granite, 25 inches of vein and 7 inches of foot-wall granite respectively, each assayed: Gold, *nil;* silver, *nil.*

Across 18 inches vein-quartz, no visible mineral, at portal plus 20 feet: Gold, trace; silver, trace.

Across 21 inches vein-quartz, slight pyrite, at portal plus 25 feet: Gold, 0.16 oz. per ton; silver, 0.2 oz. per ton.

Across 20 inches foot-wall granite decomposed to gougy constituency, below previous sample: Gold, *nil;* silver, *nil.*

Across 14 inches vein-quartz, no visible mineral, at the face: Gold, trace; silver, 0.2 oz. per ton.

These assays are low and it is probable that higher ones could be obtained from the surface showings if the cuts were cleaned and the vein exposures freshened.

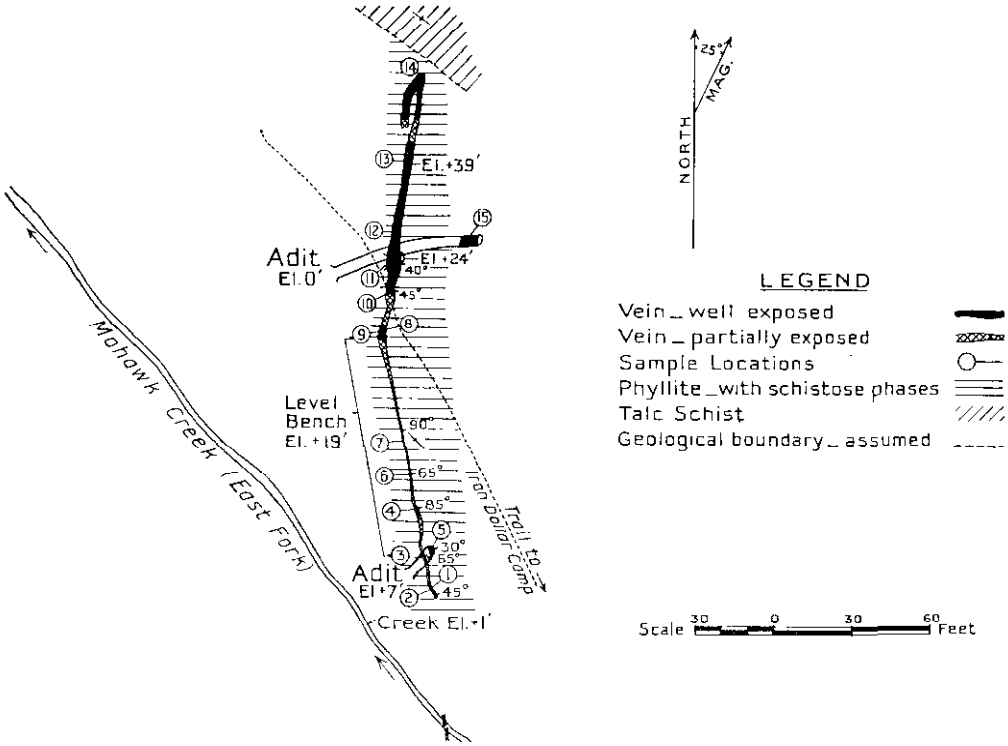
In a south-easterly direction from these workings and near the top of the hill, considerable work was done in the past. This development is scattered and shows several narrow but reportedly high-grade veins in granite. At the present time these workings are not safe owing to the collapse of timber and slacking of the granite walls. Above timber-line at 5,870 feet, some 600 feet south-eastward of the working-adit described in the foregoing, an adit, now in very bad condition, has been driven south-eastward for 30 feet and exposes one of these veins. The vein has a width of 12 inches at the portal, but pinches rapidly to 3 inches within the adit. It is flat-lying and tight, strikes north-eastward, dips 10 degrees to 15 degrees north-westward, and is down-faulted repeatedly for short distances on the south-east side of tight strike-faults. The effect of these small faults has been to permit exposure of the vein for the full length of the working, otherwise it would have been lost in the back within a short distance of the portal. Near the face of the adit a sample was taken across 3 inches of heavily oxidized vein material containing no visible sulphide mineralization, but originally carrying considerable pyrite as shown by the cavities left by the oxidation and removal of the crystals. This sample assayed: Gold, 1.06 oz. per ton; silver, 21.3 oz. per ton.

Two hundred and twenty-five feet east of this adit, at elevation 6,060 feet, another caved working shows a 3- to 4-inch quartz vein in granite. It strikes due north, and dips 10 to 15 degrees east into the hill. Although it was not possible to examine the vein within the working, its width there appears to increase to about 6 inches. A sample taken at the portal over 3 inches of honeycombed quartz from which much of the sulphide mineralization had been leached, assayed: Gold, 0.92 oz. per ton; silver, 11.3 oz. per ton.

Lardeau Area.

Gilman Group. This property, under option to J. S. Rear, of Vancouver, B.C., consisting of the *Gilman, Black Hock,* and *Frisco* Crown-granted mineral claims, has been previously described in the Annual Reports of the Minister of Mines for 1914 and 1933. The ground under development lies on the north-east side of the East Fork of Mohawk Creek, about 1 mile from the head of this branch of the creek. The slope rising to the north-east above the showings is regular and covered by only sparse growth and is subject to snowslides, particularly affecting a short section of the trail to the property lying about one-third of a mile north-west of the developed ground. The local topography is gentle and rounded rather than rugged and precipitous. Access to the holdings is by means of trail from Camborne, by way of the property of the Spider Gold and Silver Mines, Limited. For 2⅓ miles, from Camborne to the *Spider* property, the trail, though steep in parts, permits transportation by caterpillar tractor; of the four succeeding miles of foot-trail from the *Spider* to the *Gilman,* the first 2½ miles, to Mohawk Creek, are on excellent grade, the remainder being slightly steeper though still lending to economical

construction of improved trail or road. At present, the bridge crossing of Mohawk Creek is adequate only for horse-traffic. Close to timber-line, growth is small and sparse, mainly young alder and brush, but timber suitable for all domestic and mining purposes is available readily within a short distance down-stream. The creek is of sufficient flow to permit a small year-round milling operation. At the present time camp buildings on the adjacent *Iron Dollar* property, also under option to J. S. Rear, are being utilized by the crew of four men employed. These accommodations are sufficient for eight men.



Gilman Group, Lardeau Mining Division.

The showing consists of a strong quartz vein, striking north generally, dipping from 30 degrees east to vertical, lying in phyllite and schist of the Lardeau series. Mineralization is chiefly by pyrite, with lesser amounts of galena and sphalerite. By assay results on samples taken, gold values appear to be associated chiefly with pyrite. The vein is well exposed by surface-stripping for a length of 200 feet, and exhibits characteristic minor variations in strike and a major deflection from slightly west of north to slightly east of north near the centre of the exposure. Typically lenticular in habit, the vein reaches a maximum width of 6 feet near the point of deflection. In this length upon which development has been concentrated, the wall-rock is of firm and comparatively competent phyllite, striking north-westward; bands of phyllite are contained within the vein-quartz. Beyond the southern limit of the stripping quartz is exposed irregularly in the bed of the creek for a short distance, but little work has been done to test continuity under the overburden and growth on the south-west bank. Toward the northern limit of the stripping the vein becomes irregular, occurring as two strands, of 3-foot and 1-foot widths respectively, in the distance between samples No. 13 and No. 14. For 175 feet north of sample No. 14 small crosscutting trenches have been dug in an effort to prove additional length in this direction but, although narrow and irregular widths of quartz had been found in three of the four cuts completed at the time of examination, none exposed vein-structure similar to that exposed farther to the south. This prospecting on the north of the showing has been in talc-schist, characteristically light-brown in colour and flecked with darker brown specks, probably limonite resulting from the decomposition of contained iron sulphides. As far as could be

determined by the limited exposures, this formation strikes north 50 degrees west, dips vertically or steeply north-east, and is in contact with the phyllite immediately north of sample No. 14, which probably explains the lack of vein strength beyond that point.

Up to 1938, little work has been done on the property since the original development recorded in the 1914 Annual Report, Minister of Mines, with the exception of certain sampling in 1933.

At the present time surface-stripping is almost continuous for the 200-foot length shown on the accompanying map; at the time of examination certain sections, although stripped, were not freshly broken and the weathered surfaces offered no opportunity for accurate sampling.

Two short crosscuts have been driven to intersections with the vein. One of these, 14 feet long, near the southern limit of the stripping, is only about 12 feet below the surface exposure; the other, 59 feet long, near the centre of the stripping, is 24 feet below. In the southerly crosscut the vein ranges in width from 12 to 23 inches, is composed of almost solid quartz seamed by phyllite and is only very slightly mineralized by pyrite and galena. In the longer crosscut, the vein-width is 72 inches, mineralized by bunches of pyrite. Here the foot-wall is well defined, the hanging-wall less so by reason of inclusions of wall-rock.

Most effective further development would be additional stripping south of the present work and driving of a crosscut from a point on the creek which would permit of a right-angled intersection with the vein, approximately 100 feet below the surface exposure near its present northern limit.

Samples taken, and assays thereon, are as follows:—

Sample No.	Gold.	Silver.	Description.
	Oz. per Ton.	Oz. per Ton.	
1	1.10	1.0	Across 16 inches freshly broken, friable quartz, carrying bunchy pyrite, very slight galena and sphalerite.
2	*Nil*	*Nil*	Across 11 inches on the foot-wall of the previous sample. Rusty gouge, sheared phyllite seamed by quartz stringers.
3	0.44	0.8	Across 24 inches fresh quartz with inclusions of phyllite. Slight mineralization by pyrite.
4	0.06	Trace	Across 11 inches fresh quartz seamed by phyllite. Slightly mineralized by pyrite.
5	Trace	Trace	Grab sample of quartz, containing only very slight pyrite and galena.
6	0.06	5.0	Across 9 inches practically barren quartz.
7	1.34	0.4	Across 5 inches of fresh quartz slightly mineralized by pyrite.
8	0.25	0.9	Across 21 inches fresh quartz, containing bunches of pyrite.
9	0.02	0.4	Across 13 inches of fresh quartz on the foot-wall of Sample No. 8, well mineralized by galena and slight sphalerite.
10	0.36	1.2	Across 34 inches of rusty quartz, containing bunches of pyrite.
11	0.88	1.2	Across 69 inches of fresh quartz carrying considerable pyrite, slight sphalerite and galena.
12	0.14	0.4	Across 40 inches rusty quartz, very slightly mineralized by pyrite.
13	1.20	0.8	Across 36 inches of quartz, well mineralized by fine-grained pyrite and slight coarse galena.
14	1.02	0.4	Grab sample of fresh quartz with inclusions of phyllite, slightly mineralized by pyrite.
15	0.30	0.3	Across 72 inches of fresh quartz mineralized by bunches of pyrite.
	0.84	0.4	Select sample of pyrite.
	0.86	5.6	Select sample of mixed pyrite, galena, and sphalerite.

Alpine Gold Co., Ltd.

Reference should be made to the Annual Report of the Minister of Mines, British Columbia, for 1927, containing a report on this property by B. T. O'Grady. The holdings of the Alpine Gold Company, Limited, consist of the Crown-granted claims *Crown Point No. 6* and *Nelson No. 5*, and the following located claims: *Alpine Fraction, Swiss Fraction, Washington, Oregon, Idaho, Meadow, Basin,* and *Sitkum.* All the foregoing are held in the name of John B. White, of Spokane, who, in addition, has lease and option from E. Harrop and associates, on the following Crown-granted claims: *Kootenay Pass, Rocky Fraction, Berne, Highland Chief,* and *Swiss.*

The workings are well above the timber-line at the head of Sitkum Creek, on the south-eastern slope of the Lemon Creek divide, at an elevation of 7,000 feet. The area has been subjected to intense erosion, relief is marked but not precipitous. The camp has been built to the east and south-east of the principal workings, in the draw followed by one branch of Sitkum Creek from the Lemon Creek divide. The elevation of the camp is 6,750 feet; of the 189-foot adit reported upon in 1927, 7,150 feet; of a new adit driven this year, 6,925 feet. The trail from the camp to the new adit, north-west of the camp, follows up the draw, whereas that to the old adit traverses directly up the bare slope to the west of the camp. The most noticeable feature of this western slope is the abundance of massive blocks of float rock, amongst which there is a considerable amount of vein-quartz.

The property can now be reached by 8 miles of truck-road, following up Sitkum Creek on a 12-per-cent. grade, leading from the main highway along the West Arm of Kootenay Lake at a point some 8 miles north-east of the city of Nelson. This road leads to the lower part of the claims and an additional half mile of steeper tractor-road has been built to the camp-site. Sufficient ground is held at lower elevations beside the road to supply all timber necessary during the life of any operation at the property. Water sufficient for any future milling operations is available from Sitkum Creek. A new bunk-house, cook-house, and combination compressor-house and blacksmith-shop have been built at the property during the past two seasons. Accommodation is adequate for fifteen men.

The state of development of the deposit is essentially as described in 1927, with the addition of the new low level, or No. 10 adit. As exposed, the area is underlain by granite of the Nelson batholith, host to the quartz vein under investigation. The vein strikes approximately south 75 degrees west and dips 20 to 30 degrees to the north. The small amount of development and the flatness of the vein make these figures of strike and dip open to possible later adjustment in the light of further exposure. Apparently lenticular in habit, the vein may be traced for several thousand feet on the surface by means of irregular natural exposures on the barren hillside. Widths of 5 feet were noted in such surface exposures, and one sample underground was over 82 inches without reaching the foot-wall, but such figures must be considered as above the probable average width of vein over its length. The quartz lies commonly between well-defined walls, is rust-stained in many of the exposures and fractured parallel to the walls, and is mineralized by irregular concentrations of pyrite and a slight amount of galena and sphalerite. A narrow width of hydrothermal leaching of the ferro-magnesian minerals from the granite is more pronounced on the foot-wall than on the hanging-wall. Underground development exposes mica-lamprophyre dykes up to 16 feet in width, younger than the vein, which strike across it at from north 10 degrees east to north 50 degrees west and dip steeply east or west.

Surface-stripping has been limited principally to slight additional work at locations where the vein was previously exposed by natural causes.

Principal underground development consists of the drift-adit described in the 1927 Report, upon which no work has been done since, and the drift-adit driven this year at a point 770 feet north-eastward from and 225 feet below the old tunnel.

For 60 feet from the portal of the old tunnel, driven at south 75 degrees west, the vein is strong, extending from back to floor. Three samples, taken at 20-foot intervals along this section, assayed: 0.49 oz. gold per ton over 44 inches, 1.29 oz. gold per ton over 45 inches, and 0.05 oz. gold per ton over 56 inches. Between 60 and 116 feet from the portal, the adit crosscuts three mica lamprophyre dykes all striking between north 10 degrees east and north 50 degrees west, dipping steeply east or west; the width of the first is 13 feet, of the second 2 feet, and of the third, 17 feet. Between the first and second of these dykes the vein is displaced by downward block-faulting for a distance of 3 feet; in this 7-foot section it has been considerably disturbed and calcite is prominent as gangue. Between the second and third dykes the vein regains its normal strike and dip, is but sparsely mineralized, and has an average width of at least 72 inches. A sample taken at the centre of this 17-foot section assayed: Gold, trace; silver, trace. For 35 feet beyond the third dyke to the face of the drift-adit, the working is all in granite. Just short of the face a crosscut was driven due south for 20 feet; the vein was intersected in the floor at 4 feet from the south wall of the drift. It dips 30 degrees to the north, reaches the back at the face of the crosscut, and exposed across a full width of 56 inches. The indicated faulted down-throw on the

west side of the third dyke is some 8 to 10 feet. From the face of the crosscut a drift extends 19 feet south-westward. From the 56-inch width at the face of the crosscut the vein narrows rapidly along the strike to the south-west, and at the face of the drift is evidenced by two bands of quartz separated by granite; the stronger of the two quartz bands has a width of 11 inches. A sample taken 10 feet back from the face, over 26 inches of vein-quartz containing considerable mica and included granite, but practically no sulphide, assayed: Gold, trace; silver, 0.2 oz. per ton.

The lower, new adit was begun at the outcrop farthest north-east, a few feet below the vein exposure. Between the two workings the vein is exposed irregularly. The new adit was driven westward for a distance of 260 feet in granite, generally following a series of strong fractures filled by gouge and crushed granite, on several of which there has been considerable movement. Originally this working nowhere intersected the vein. At 155 feet from the portal the fractures diverge, and two of the strongest swing to the left wall of the adit. They strike south 75 degrees west, and dip 65 and 80 degrees southward respectively. A third, the main fracture, continues due west, dipping at 80 degrees to the south. The main working has followed the west striking fracture to the present face. The two branching fractures have been followed for 15 feet into the left wall. After the completion of the adit to 260 feet, at 150 feet from the portal the back was broken upward to a height of 17 feet above the rail. Vein material exposed there consists of 23 inches of white quartz containing slight coarse pyrite at the top of the backswipe, succeeded below by 15 inches of similar quartz, included in which are fragments of rock darker than the usual granite; below again is exposed 18 inches of strong quartz, well-mineralized by coarse-grained pyrite. A sample over the upper 23 inches and a second from the centre 15 inches assayed: Gold, *nil;* silver, *nil.* From across the lowest 18 inches a sample assayed: Gold, 1.34 oz. per ton; silver, 0.5 oz. per ton. The vein exposure was not very satisfactory at the time of examination, it permitted only an approximation of strike and dip and limited information regarding possible faulting on the fractures. As read, the strike is south 70 degrees west, dip 30 degrees northward. Where the back is taken down, the principal fracturing is confined to one strong width on the right-hand side of the working and the vein appears to be faulted on it; only a few feet farther west the divergence of the fracturing takes place. In an effort to determine which of the branches of the fracturing controls the faulting of the vein, the back of the short tunnel to the left has been broken upward to a height varying from 10 to 15 feet, but no evidence of the vein in place was found as at the first location in the main tunnel. The only possible indication of vein material in this branch working, at the time of examination, were stringers of quartz within the fracture farthest south on its foot- and hanging-walls. As evidenced at this location, this branch fracture is sufficiently strong and wide, with marked signs of movement, to be better termed a fissure; within it, between the quartz stringers, is a 10-inch width of the darker rock noted as included in the quartz in the vein. Examination shows this to be definitely acidic and high in plagioclase, probably one phase of the main granitic intrusion. By evidence of quartz stringers within its mass, embayments of quartz from the two wall concentrations and general silicification, this rock is placed as older than the mineralization. At the face of the branch tunnel the fracture has regained its normal narrower width and contains no such included rock or quartz. Further development at this level must be directed not only to the determination of the vein to the north of the faulting but toward its location to the south of the fracture sysem and west of the present exposure in the back of the main adit.

Cranbrook Area.

Anderson Group.

These holdings, known also as the *Golden Egg* group, consist of the *Golden Egg, Lucky Strike, Gold Brick, Twilight, Sunset,* and *Black Bear* claims, all held on location by J. J. Rollheiser, of Kimberley. At the present time the group is under lease for five years, from 1938, to the Hall Brothers, of Marysville. The property is on the north-west side of Perry Creek, and on the east side of Sawmill Creek, between elevations of 5,000 and 6,000 feet. Access from the main Perry Creek road is by some 2 miles of good road leading directly to the present workings. No camp buildings have been constructed on the property.

The area is underlain by rocks of the Creston formation; green, purple, and white argillaceous quartzites, commonly heavily weathered on exposure. Outcrops are not numerous, for, despite the comparatively high elevations, the topography is regular and overburden generally covers the bed-rock. For this reason the discovery of the showing is a credit to the patience and persistence of the prospectors. They found attractive float, and reasoning that it could not have come far by reason of the gradual slope of the hillside, sunk pits and trenches to bed-rock, more or less blindly, over a considerable area. When a quartz vein was finally discovered it was necessary to drive 135 feet of crosscut trenching to provide a fresh exposure. From the end of this trench 35 feet of additional stripping along the vein exposed it striking north 10 degrees west, dipping 25 to 35 degrees westward. For the first 15 feet of this additional work the quartz filling is heavily shattered and weathered; for the remaining 20 feet to the face of the cut, where the floor is 15 feet below the surface, the effects of surface action are much less marked. In the latter length, vein widths range between 15 and 28 inches. The vein-quartz is characteristically glassy and fractured, and the fractures are healed by hematite. Dendritic structure on fractured faces indicates the presence of manganese. Mineralization by pyrite is sparse and values occur as visible free gold.

The property was under option to the Consolidated Mining and Smelting Company of Canada, Limited, for a short time. During that period, a 16-foot shaft was sunk at the face of the cut and three diamond-drill holes were put down. According to information supplied by that company the holes were located and drilled as follows:—

Number.	Location.	Dip.	Length.
			Feet.
One	100 feet north of shaft	40 degrees, bearing southward	243
Two	At hanging-wall of outcrop	90 degrees	25
Three	At hanging-wall of outcrop in trench 75 feet west of hole No. 2	90 degrees	95

During the past year Rollheiser and associates made shipments totalling 43 tons, with contents of 10 oz. of gold and 21 oz. of silver.

Samples taken by the writer were as follows:—

At 5 feet from face of the cut, over 24 inches firm discoloured quartz containing a very slight amount of pyrite: Gold, 0.34 oz. per ton; silver, trace.

Eleven feet from face of the cut across 28 inches of vein as described above: Gold, 1.33 oz. per ton; silver, 0.9 oz. per ton.

At 11 feet from face of the cut, across 23 inches to the hanging-wall of the vein, soft gouge, decomposed Creston quartzites, no visible sulphide mineralization: Gold, 0.14 oz. per ton; silver, 0.3 oz. per ton.

At 11 feet from face of the cut, across 12 inches to foot-wall of vein, description as previous samples: Gold, 0.28 oz. per ton; silver, trace.

At 17 feet from the face of the cut, across 15 inches, firm discoloured vein quartz, little mineralized: Gold, 1.88 oz. per ton; silver, 0.5 oz. per ton.

Lower Arrow Lake Area.

Big Cayuse Group.

This group, consisting of the *Box Canyon*, *Box Canyon Nos. 1* to *4*, *Big Cayuse*, *Summit*, *Joe*, *Rainy Day*, and *Alley Oop* mineral claims, is held by right of location by Joe Gallo, of Nelson, B.C., and two associates. The property is on the north-west side of Cayuse Creek, which drains into the east side of Lower Arrow Lake near its southern end. Access from the small settlement of Deer Park to the property is by 1½ miles of Government road, 3½ miles of logging-road, and finally 3 miles of poor trail following up the creek. A new trail is at present being built which will be shorter than the old one and better located. The camp, beside the creek, at an altitude of 4,000 feet, consisted at the time of examination of one tent; a new log cabin, providing accommodation for two men, has since been built. The principal showing, a quarter of a mile west of the camp, is on the steep bluffs on the north-west side of the

creek, at an elevation of 4,445 feet. Big Cayuse Creek is of sufficient flow for any milling needs, and falls within 2 miles up-stream from the camp provide excellent sites for the development of power. Timber is plentiful, mainly yellow pine, fir, cedar, and spruce.

The rocks close to the showings consist principally of metamorphosed sediments intruded by granitic members of the Nelson batholith. The showing upon which development is being concentrated at the present time consists of mineralization by pyrite, pyrrhotite, chalcopyrite, and molybdenite carrying gold and silver values. It lies within the altered sediments either along or within a few feet of the contact between those rocks and the igneous members. Fissuring is poorly defined except at the upper limits of the outcrop. At the contact with the igneous rocks the alteration in the sediments has been intense and the product is commonly a quartz-feldspar-hornblende-biotite-gneiss or quartz-feldspar-biotite-gneiss. Within a few feet of the contact the bedding in the sediments is still evident; there, the most typical formation is micaceous quartzite.

Development up to the time of examination on October 18th consisted of a 13-foot drift-adit on the best mineralized exposure at the base of a 20-foot cliff. There, at 4,445 feet, the zone of mineralization strikes north 70 degrees west, dips 65 degrees southward. The igneous rock is in contact with the zone on its south-west side and the alteration in the sediments decreases gradually toward the north-east. On the cliff face above the portal mineralization is irregular and disseminated over a width of 3 to 4 feet. After driving 3 feet in the drift there was little or no mineralization, but such irregularity was expected in view of the surface exposure; an additional few feet of work re-established its presence. At 2 feet from the face a tight slip, striking north 20 degrees east, dipping 60 degrees to the south-east, displaces the zone 18 inches to the south-west, and at the face a 4-inch post-mineral lamprophyre dyke strikes across the drift at north 20 degrees east, dipping vertically. A sample taken across 49 inches in the back at the portal assayed: Gold, 0.16 oz. per ton; silver, 0.05 oz. per ton. At this location the zone is slightly silicified, mineralized by pyrite and pyrrhotite concentrated principally within 18 inches on the hanging-wall side. A sample taken across 17 inches on the left side of the face, mineralized by pyrite and pyrrhotite, assayed: Gold, *nil;* silver, *nil.* A select sample taken from the small dump at the portal, well-mineralized by pyrrhotite, pyrite, and slight chalcopyrite, considerably silicified, assayed: Gold, 0.72 oz. per ton; silver, 0.2 oz. per ton.

Some 700 feet up the 40-degree side-hill above the adit, approximately on the strike of the showing at the adit, a small amount of stripping over a length of 300 feet has exposed what is believed to be the extension of the same mineralization. The exposure is within the gneiss, usually 6 to 10 feet north-east of the igneous contact. It averages about 10 inches in width. The margins are defined by tight fractures, in contrast to the exposure at the adit. Mineralization and silicification are slight. Owing to the greater distance from the igneous contact, the wall-rocks and the gangue rock within the zone are not as highly metamorphosed as at the lower showing. Within as little as 10 feet to the north-east of the zone the bedding of the sediments is pronounced. At a point near the centre of the exposure the strike of the mineralization is north 35 degrees west and the dip appears to be vertical, although the small extent of the stripping does not permit accuracy.

The feature of principal interest in connection with this property is its location in a little-developed district. Favourable results from the present operation would indicate a considerable area worth prospecting.

GOLD-SILVER DEPOSITS.

Rosebud Lake Area.

During the past season Godfrey Birtsch, of Nelson, reported the discovery of gold on the *Lucky Strike* and *Davne* claims in the Rosebud Lake area. This area lies east of the main highway from Salmo to Nelway, south-east of the junction of the Salmo River with its South Fork. Access is by truck-road from the main highway close to South Fork, at a point 10 miles south of Salmo. As far as Rosebud Lake, where there is a short turn-off to the *Lone Silver* property, the road is the old highway; this year, extension has been made so that it is now possible to drive an additional mile east of the lake to within a few hundred feet of the development work on the *Davne* claim. The occurrence of commercial mineralization in this district has been recognized for many years by reason of the operation at the

Lone Silver property, but until 1936 production from this property was principally silver; in 1936 leasers discovered gold mineralization in one section of the workings and made three small high-grade shipments. However, until Birtsch's discovery this year on nearby ground the district generally was not considered as a potential producer of gold.

In this area recent fires have burned off most of the timber, displaying the gentle topography and the higher elevations rising by rounded slopes from small areas of swampy land which occupy the shallow valleys. From Rosebud Lake, at an elevation of 2,650 feet, the road passes eastward through a section of low-lying land at the foot of a gently-rounded slope which rises to the south. On this slope, above Rosebud Lake and slightly east of it, is the *Lone Silver* property. On the same slope, half a mile east of the *Lone Silver* and slightly higher, is the principal working on the *Davne* claim. Below this the road ends and further access to the *Lucky Strike* property is by foot-trail which continues south-eastward up the slope to an altitude of 3,000 feet, down into a second swampy valley and up a second slope to an elevation of 2,900 feet, all within a distance of three-quarters of a mile.

On and near these claims fires have left sufficient timber for domestic purposes and limited mining needs, but there is no large supply. However, either timber or lumber may be purchased locally. Water for domestic purposes is at present taken from wells or springs, and beyond this the South Fork of the Salmo River and Rosebud Lake are the only available sources of supply closer than the Salmo River itself. Records show that the South Fork is of adequate year-round flow for any milling operation which might be required.

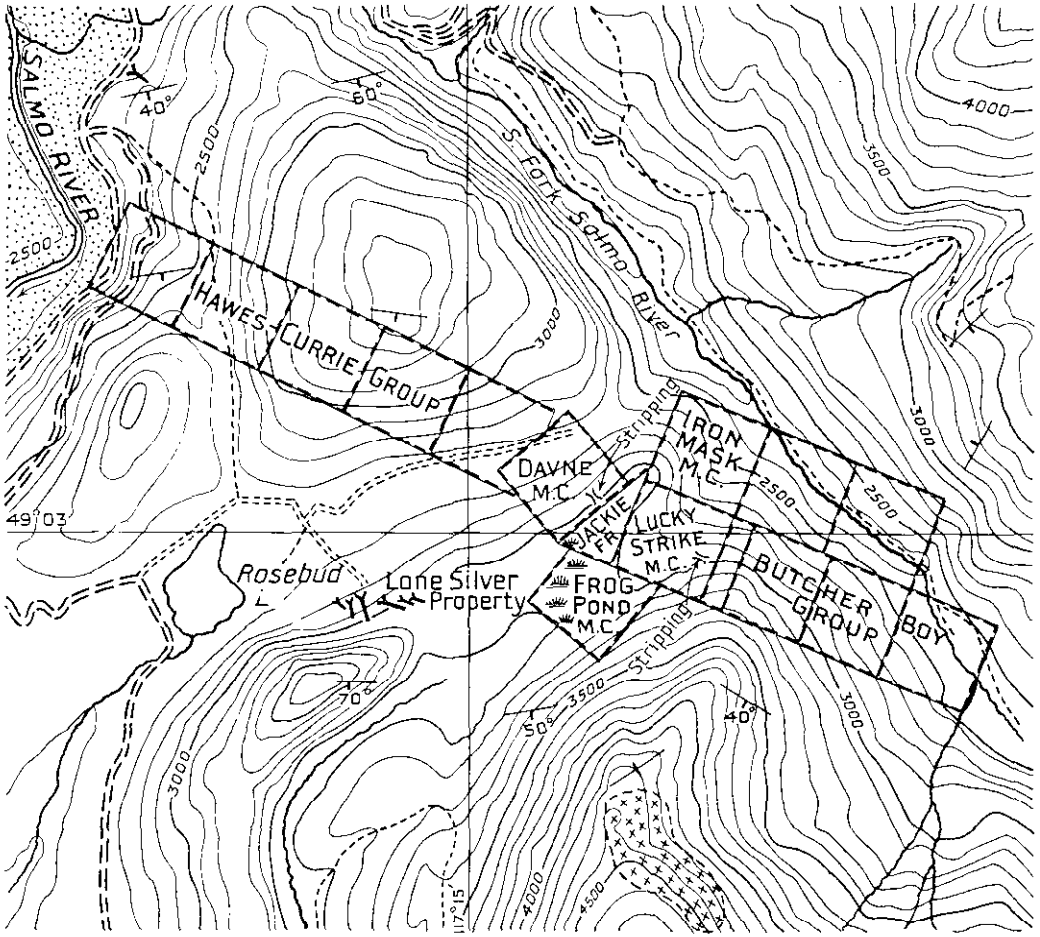
The area is underlain by rocks of the Pend d'Oreille series of phyllite, argillaceous quartzite, and limestone intruded by various members of the Nelson batholith. Only one major exposure of the igneous rock occurs anywhere near the showings and this is a small mass of syenite and monzonite exposed a mile to the south-west. As reported in the Minister of Mines Report for 1936 the rocks at the *Lone Silver* property consist of dolomitic limestone and platy argillite, both dark in colour, striking east and dipping steeply south. On the *Davne* and *Lucky Strike* claims the formation is represented by phyllite and dolomitic limestone. The phyllite is typically light to dark brown in colour, folded and contorted and, where carbonaceous, transitionary to graphitic schist. Schistosity has been developed parallel to the bedding-planes which strike generally east, and dip from 35 to 60 degrees to the south. In the exposures examined the dolomitic lime rocks are predominantly light grey to medium grey in colour, are compact, have a conchoidal fracture, and display only traces of bedding. Locally these limy members give rise to light-green talc-schist.

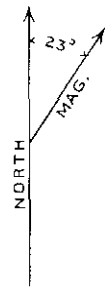
Lucky Strike Group.

Four claims, the *Lucky Strike, Davne, Iron Mask,* and *Frog Pond,* were staked in the spring of 1938 by Godfrey Birtsch, of Nelson. Of these the *Davne* and *Iron Mask* were sold by Birtsch. Since then the *Lucky Strike, Davne,* and *Frog Pond* claims, and several others adjoining, have been optioned to R. C. McCorkell, 703 Royal Trust Building, Vancouver, and his entire holdings will here be treated as a unit under the name of *Lucky Strike* group. Mr. McCorkell's optioned ground includes the *Butcher Boy* group of five claims and one fraction, adjoining the *Lucky Strike* and on the strike of the fissure to the south-east, the *Jackie Fractional* claim, adjoining the *Lucky Strike* and on strike of the fissure to the north-west, and the *Davne* claim and the *Hawes-Currie* group of five claims staked on strike still farther to the north-west.

Two log cabins have been built on the *Davne* claim, providing adequate accommodation for a crew of six men. Water for domestic use is obtained from a shallow well.

The original work on the *Lucky Strike* claim disclosed a fissure striking in a north-westerly direction within phyllite. Characteristically the fissure is tight and narrow, and is represented by several parallel openings now filled by sulphide-bearing quartz gangue. Between the individual strands of vein material the phyllite is fissured across the planes of bedding and schistosity, and lies as short incompetent blocks. The maximum fissured width observed, including enclosed phyllite, is 20 inches; in certain locations vein structure is evidenced by only a single strand of mineralization ranging in width from 1 to 6 inches. Average total width of fissuring is close to 6 inches as exposed by all the present development-work. Sulphide mineralization, with which are associated gold and silver values, consists of galena, tetrahedrite, pyrite, sphalerite, and chalcopyrite; very marked near the surface is the production of secondary mineralization, notably cerussite, chalcocite, covellite,





LEGEND

RECENT & PLEISTOCENE
Recent alluvium and glacial deposits

POST-TRIASSIC
NELSON BATHOLITH
Syenite, monzonite

WINDERMERE
PEND D'OREILLE SERIES
Phyllites; argillaceous quartzites; limestone

Road — well travelled
Branch road
Mine adit
Surface stripping
Contours
Approximate boundaries of staked claims
Swamp

Scale 1/3 1/4 1/6 1/2 0 1/3 2/3 Miles

Map based on Geological Survey of Canada Map Nº 299ª Salmo Sheet

Rosebud Lake Area. Showing approximate locations of some staked claims. After G.S.C. Map No. 299A.

malachite, and azurite. Microscopic examination shows that in places the galena and tetrahedrite are intimately associated, in addition to which a small but important proportion of these minerals occurs finely and irregularly disseminated in gangue minus 200 mesh in size. Detailed microscopic examination failed to reveal native gold or any silver minerals. This leads to the conclusion that gold occurs either in grains too fine to see or in erratic distribution, and that silver values are associated with the tetrahedrite. Where fresh, mineralization is commonly strong, the gangue compact and white in colour. On weathered surfaces sulphide mineralization has been leached, leaving an exposure poor in appearance and composed of vuggy, copper-stained quartz, carrying little primary sulphide.

The original development on the *Lucky Strike* claim consisted of a series of shallow pits on the strike of the vein. Further work was then confined to the location showing the highest values, and there, at the time of examination, at an elevation of just under 3,000 feet, a length of 150 feet on the vein had been opened to a depth of 20 feet below the surface. Overburden at this location is not over 3 feet, but the phyllite is shattered and weathered to a depth of 13 feet. This, with the fact that where the vein is narrow the foot-wall is commonly frozen, creates some slight difficulty in the holding of the walls and presents a problem of sorting or dilution. Working from the surface in this manner, using only a gad or short steel, has made it possible to mine a narrower width than would be feasible in an underground operation.

The strike of the vein is north 70 degrees west, the dip at the west end 65 to 70 degrees northward, and almost vertical at the east end. In this stripping the intersection of an extremely tight fracture, older than and intersected by the main fracture, provided a locus for sulphide mineralization in the main fracture. This cross-fracture, exposed only on the south side of the main fissure, strikes north and dips 65 degrees to the west, and was barren of any mineralization to within 2 inches of the fissure wall. A sample of select ore from the vein at the intersection assayed: Gold, 2.96 oz. per ton; silver, 400.2 oz. per ton. At this point the vein consisted of a single 2-inch strand. The sample location was 15 feet below the surface, below the zone of surface alteration, which here extends to a depth of 11 feet. Forty feet east of this location a sample of select ore was taken from the main 2-inch strand of vein. A sample, taken 15 feet below the surface, where leaching and oxidation are marked by the absence of primary sulphides and the presence of secondary mineralization, assayed: Gold, 2.46 oz. per ton; silver, 3.9 oz. per ton. Another sample over 15 inches of unmineralized phyllite on the hanging-wall of the vein at this location assayed: Gold, *nil;* silver, *nil.*

On the strike of the vein, 300 feet north-west of this open-cut and nearly 100 feet lower, an adit had been faced up at the time of examination. The face showed a very narrow stringer of quartz which was presumed to be the extension of the vein, but the exposure was not adequate to permit any degree of certainty as to this.

The following is a list of assays from samples taken from the *Lucky Strike* cuts on June 20th, 1938. At that time stripping was shallow and limited, and the results are given in order that some comparision may be made between near-surface values and those below the zone of weathering or near its lower limits:—

(1.) From the west end of the stripping over 8 inches of quartz stringers in phyllite, mineralization of quartz by galena, tetrahedrite, malachite and azurite: Gold, 0.60 oz. per ton; silver, 150.0 oz. per ton.

(2.) Five feet east of No. 1, across 4 inches quartz, heavily mineralized by galena, tetrahedrite, azurite, malachite, slight sphalerite: Gold, 2.60 oz. per ton; silver, 212.0 oz. per ton.

(3.) Five feet east of previous sample, across 3 inches quartz, well-mineralized as No. 2: Gold, 2.10 oz. per ton; silver, 316.0 oz. per ton.

(4.) Across 5 inches of phyllite on the hanging-wall of sample No. 3, little mineralization: Gold, 0.02 oz. per ton; silver, 4.0 oz. per ton.

(5.) Across 3 inches phyllite on the foot-wall of sample No. 3, little mineralization: Gold, trace; silver, 2.2 oz. per ton. No stripping for 33 feet south-east of sample No. 3.

(6.) At west end of second stripping across 8 inches, stringers of quartz in phyllite, little mineralization: Gold, 0.40 oz. per ton; silver, 6.0 oz. per ton.

(7.) Five feet east of sample No. 6, across 3½ inches of quartz, slightly mineralized by galena and tetrahedrite: Gold, 1.2 oz. per ton; silver, 4.0 oz. per ton.

(8.) Five feet east of sample No. 7, across 4 inches of quartz, little apparent mineralization: Gold, 2.70 oz. per ton; silver, 0.4 oz. per ton.

(9.) Five feet east of sample No. 8, across 1 inch of discoloured quartz, little apparent mineral: Gold, 1.84 oz. per ton; silver, 1.2 oz. per ton.

(10.) Five feet east of sample No. 9, at east limit of stripping, across 3 inches of quartz, very slight galena, tetrahedrite: Gold, 1.40 oz. per ton; silver, 0.4 oz. per ton.

Total shipments for 1938 from the *Lucky Strike* claim amounted to 37 tons, containing 53 oz. gold and 1,727 oz. silver.

On the *Davne* claim the original stripping, some 1,700 feet north-west of the *Lucky Strike* working and on the strike of the fissuring on that claim, exposed similar vein-structure in fairly compact, dolomitic lime rocks which are sheared and show gradational phases to talc-schists. Mineralization is similar to that on the *Lucky Strike* claim, with the same general intimate association of galena and tetrahedrite. Primary mineralization, with minerals identified in order of relative abundance, is by galena, tetrahedrite, sphalerite, and pyrite. Secondary mineralization is pronounced, the galena is commonly traversed by tiny fractures containing cerussite showing ragged replacement outlines. Many areas of tetrahedrite have been almost entirely replaced by chalcocite and covellite or by malachite and azurite. Covellite and chalcocite have also invaded and replaced galena in certain areas adjacent to original tetrahedrite inclusions. As in the *Lucky Strike* mineralization, no free gold or silver minerals were observed on microscopic examination.

On this claim, at elevation 2,965 feet, one of the original shallow cuts made on the line of strike of the *Lucky Strike* fissure exposed a vein having a width of 2 inches. At the time of examination this cut had been extended 33 feet south-east, partly as an open-cut and partly as an inclined shaft. In this work the vein was found to continue south-eastward for a length of 16 feet with a width seldom over 2 inches. At 16 feet it split into two stringers which, 17 feet farther south-east, at the foot of the shaft, were separated by 4½ feet of dolomitic lime rock. At this point one of these two branches had a width of 2½ inches, the other 2 inches. The strike of the main undivided section is south 45 degrees east, and the dip vertical or nearly so; one of the two branches continues on this strike, the other diverges on a south 65 degrees east strike; both branches have a nearly vertical dip.

A sample taken over the 2½-inch width of the south-west stringer at the face of the shaft assayed: Gold, 5.92 oz. per ton; silver, 193.1 oz. per ton. Another sample over the 2-inch width of the north-east branch at the face of the shaft assayed: Gold, 4.08 oz. per ton; silver, 102.7 oz. per ton. In each of these two stringers the mineralization is principally by galena and tetrahedrite, with that mineralization concentrated in a 1-inch width; the remaining width, on the margins, consists of rusted unoxidized quartz.

Some 75 feet south-east of the face of the shaft a small cut exposes typical phyllite as found in the *Lucky Strike* workings, but does not expose any extension of the vein. Still farther south-east by 60 feet a shallow cut in dolomitic lime shows a 1-foot width of disseminated quartz and quartz stringers. Values lower than those found in the main cut at the shaft are reported there.

On the northern margin of the shallow draw, between the original exposures on the *Lucky Strike* and *Davne* claims, on the strike of the vein, there are exposures of light to medium grey dolomitic lime rocks, generally more compact and fresher than at the *Davne* working. Crossing the strike of the vein, a width of at least 200 feet is indicated for this member of the series. To date there has been no development within this width and it is not possible to say what effect it may have on fissuring or mineralization.

Movement in the plane of the fissure-shearing is well demonstrated by exposures of faulted segments of pre-mineral dyke rock, originally crosscutting the fissure. Only one of these dykes, occurring in the main cut on the *Davne* claim, is sufficiently fresh to permit an approximation of its original composition, which was probably that of a diorite. In this instance the dyke is well exposed on the north-east side of the cut where it strikes south 60 degrees east, dips 35 degrees south-westward, and a small faulted segment on the south-west wall of the cut indicates a throw of only a few feet. The vein fissuring in traversing the dyke appears to be unaffected by it. Two other dykes crosscut by the fissure were noted on the property, but in neither case was any faulted extension observed; these two dykes, severely affected by regional metamorphism, are altered from their original composition and display incipient gneissic structure.

Total shipments for 1938 from the *Davne* claim amounted to 4 tons, containing 11 oz. gold and 170 oz. silver.

The development described above was completed before the ground was optioned to R. C. McCorkell. Further work under his direction consisted principally of surface-stripping by bulldozer on the *Davne* claim and a small amount of supplementary hand-stripping. The bulldozer work was not eminently satisfactory owing to the depth of the overburden and to the decomposed state of certain of the underlying rocks, notably the phyllite. It was of certain help, however, in tracing the fissure extension to the south-east of the inclined shaft and has cleared a road location which may later be utilized from the end of the present road to the *Davne* workings.

SILVER-LEAD-ZINC DEPOSITS.

Lardeau Area.

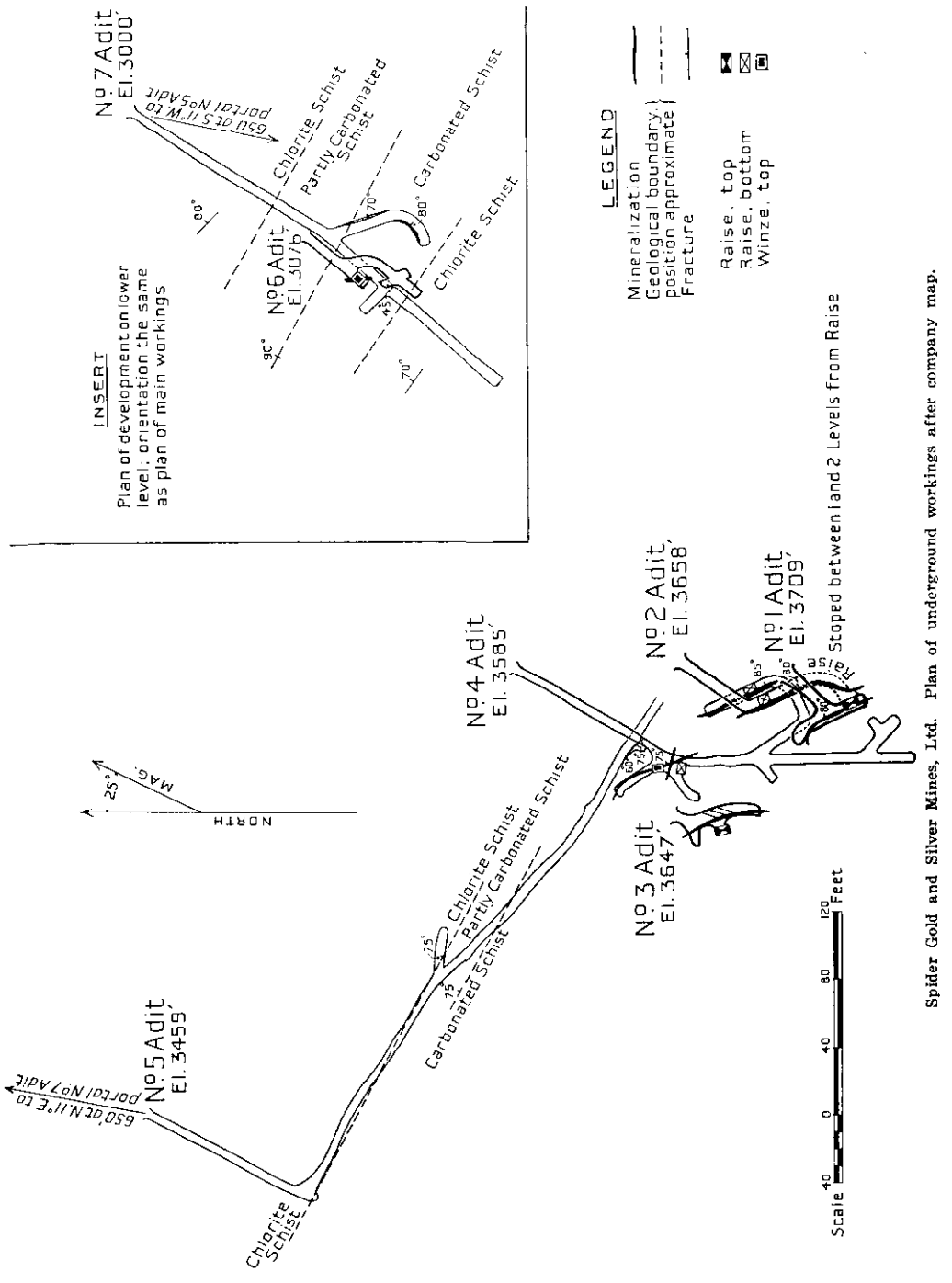
Spider Gold and Silver Mines, Ltd.

This property was formerly owned and operated by the Multiplex Mining, Milling and Power Company, Limited. In December, 1936, a syndicate, headed by I. G. Nelson, of Nelson, reopened the mine and commenced operation. In 1937 control was transferred to the Spider Gold and Silver Mines, Limited; I. G. Nelson, president, and W. S. " Duke " Harris in charge of operations at the mine. The holdings of the company consist of five located claims and one fraction, the *Spider, Multiplex No. 1, Winton, Ready Money* claims, and the *Mabel Fraction.* The camp is at an elevation of 3,500 feet on the south side of Poole Creek. The trail to Camborne, 1½ miles distant, has been improved during the past two years and, although steep, serves excellently for hauling by tractor. An agreement was made with the Meridian Mining Company for the use of their mill-building at Camborne and two ore-bins were constructed, connected by a short jig-back tram, in order to obviate tractor haulage down the last steep third of a mile of trail. Plans to install mill equipment have not yet matured. Two excellent camps, one at the upper workings and one at the lower workings, provide accommodation for twenty men. Up to nineteen men were employed prior to suspension of the operation last June.

The property has been reported upon in the Annual Reports of the Minister of Mines, British Columbia, for 1924, 1926, and 1929, and in Memoir 161 of the Geological Survey, Canada. As described in these reports the rocks exposed by the development consist of massive, dark green chloritic schists which have been partly converted to grey carbonate rock. This alteration was effected by rising mineralizing solutions whose ascension was principally through a set of joints striking slightly west of north and dipping steeply east, and by ensuing lateral passage of the solutions from these joints along the schistosity of the rock and other fractures. Later these same north-westerly joints provided the principal means of entry for solutions bearing the ore minerals, pyrite, sphalerite, galena, some chalcopyrite, arsenopyrite, and tetrahedrite in a quartz-calcite gangue. At the later phase of mineralization intersections between the joints and other minor openings provided suitable loci for the concentration of ore-deposition. Replacement is distinct, both by the early carbonatizing solutions and by the ore-bearing mineralization, with the effects marked most clearly along planes of schistosity and secondary cross-jointing intersecting the north-westerly joints. The production of chlorite is marked and was greatest near the close of each of the two periods of mineralization.

The zone of carbonatization best defined by the underground work has an average width of about 50 feet, with its length in a south-easterly direction along the strike of the schists. The margins of the zone are variable by reason of a transitionary band between the two rock-types. This transition-zone ranges between 20 and 50 feet in width. Commercial mineralization, as so far exposed, is confined within the carbonated rocks. Ore-shoots strike north-westward across the zone, and range in length from 40 to 70 feet, with a maximum width of 4½ feet. Close to the unaltered rock, structure and mineralization weaken and there is an indicated tendency for the strike to swing toward that of the schists. The dip of these shoots is steeply east, the pitch north, as exposed by present development.

Development has been upon seven levels as shown on the accompanying map. Levels Nos. 1 to 5 comprise the principal work and expose the best showings on the property. Levels Nos. 6 and 7, considerably lower, represent effort which would have been better directed toward more thorough exploration of the nature and possibilities of the deposit on the upper levels.



Spider Gold and Silver Mines, Ltd. Plan of underground workings after company map.

Within the zone of carbonatization on levels Nos. 1 and 2 the principal ore-shoot so far developed on the property has been exposed for a length ranging between 50 and 70 feet. Raises and stopes between the levels have proved vertical continuity through a range of 50 feet. At the present time only a small block of ore is left at the north end of the stope. The south end has been broken through to No. 1 level, but little of the broken ore has been drawn. There has been no stoping in the 30-foot height from No. 1 level to the surface. As displayed by this working the average width of mineralization is slightly over 3 feet. Definition of the limits of the vein structure is better than usual on the property, although even here inclusions of wall-rock and dissemination of mineralization beyond its margins are common. Mineralization by sphalerite, galena, pyrite, and lesser amounts of tetrahedrite is heavy, coarse, and typically bunchy. Quartz and calcite as gangue minerals are irregular in distribution. Two shipments made up of ore from this stope and from the raise on this ore body from No. 4 level, in July and September, 1937, totalled 50 tons.

No. 3 level drifts for 40 feet on another similar shoot. A raise had been started previously and this year 12 feet of additional raising broke through to the surface to give a 20-foot vertical section on the vein. Mineralization is heavy in gangue of strong, fresh quartz. At the surface the width of mineralization is 38 inches. A sample taken in the raise, 8 feet below the surface, across full vein-width of 22 inches, mineralized by galena, sphalerite, pyrite, and tetrahedrite, assayed: Gold, 0.10 oz. per ton; silver, 91 oz. per ton; lead, 7.8 per cent.; zinc, 19 per cent.

No. 4 level develops the presumed downward extension of the shoot exposed on No. 3 level, 62 feet above, as well as of the one exposed on No. 2 level, 73 feet above. On the former, a 45-foot length is shown by drifting on No. 4 level. At the centre of this length a winze sunk 46 feet shows the mineralization to average slightly less than 3 feet, composed of bunchy concentrations of coarse galena, sphalerite, pyrite, chalcopyrite, and slight tetrahedrite. Examination was made only to a depth of 36 feet, the water-level at the time. A raise on the mineralization was started slightly south of the winze and had reached a height of 18 feet above the drift-floor when examined. In this work the hanging-wall is not exposed, but the foot-wall is shown to be irregular with mineralization leading off into the wall-rock. The vein exposure is similar to that in the winze. A sample taken 13 feet above the drift-floor, across 32 inches of quartz and rock, mineralized irregularly by galena, sphalerite, and pyrite, assayed: Gold, 0.04 oz. per ton; silver, 11 oz. per ton; lead, 6.2 per cent.; zinc, 5.8 per cent. This sample was taken as typical of the vein exposure in this working. Another sample, taken selectively from a patch of heavy mineralization by galena, sphalerite, pyrite, and some tetrahedrite, only a foot away from the first sample, assayed: Gold, 0.14 oz. per ton; silver, 48 oz. per ton; lead, 27.4 per cent.; zinc, 10 per cent.

On No. 4 level the shoot, developed on Nos. 1 and 2 levels, has a length of 50 feet and is similar in appearance to the exposures on the upper levels. A raise on the mineralization, collared at the centre of this length, originally planned to extend to No. 2 level, was driven upward for a distance of only 23 feet.

No. 5 level has been driven as a main haulage-level. The level was started before it was recognized clearly that the carbonatized rock is definitely preferable to the chlorite-schist as a host-rock, and was driven along the outer margin of the favourable zone for the first 160 feet from the initial crosscut from the portal. If the crosscut had been advanced an additional 25 feet all the further work in the south-easterly direction could have served to prospect the length of the more favourable formation. Under the present company, extension of this south-easterly work to the present face was swung slightly to the south and is within the zone. As it is, this working provides excellent opportunity to study the transition from the incompetent chlorite-schist through the firmer, partly-affected marginal phases to the final hard to brittle carbonated rock in which traces of schistosity are faint or entirely obliterated.

In its purpose, to intersect the downward extension of the two ore-bodies on No. 4 level, No. 5 level has not as yet been markedly successful. At 80 feet from the present face, on the left wall, there is a sparse scattering of pyrite, galena, sphalerite, and chalcopyrite mineralization disseminated in quartz gangue. A sample taken across 24 inches assayed: Gold, trace; silver, trace; lead, *nil;* zinc, 10.1 per cent. A select sample, taken 2 feet below the channel sample, from a small patch of mineralization, mainly galena, assayed:

Gold, 0.12 oz. per ton; silver, 130 oz. per ton; lead, 42.5 per cent.; zinc, 14.9 per cent. Thirty feet beyond this location a slip striking south 60 degrees east, dipping 60 degrees south-westward, is intersected close to the right wall. Eighteen feet farther south-east, at which point the fissure again enters the wall, the strike swings to a bearing of south 25 degrees east and the dip steepens to 75 degrees. Just short of this an 8-foot crosscut driven into the right wall provides a good exposure of the fissure, which has a width of 2 feet and is slightly mineralized by galena, sphalerite, and chalcopyrite in quartz gangue. The face of the crosscut and the face of the main adit 30 feet ahead of the crosscut are both barren of mineralization. At the time of examination, the fissure was making considerable water and the filling was heavily rust-stained.

The principal point of interest in this exposure is, of course, any possible correlation with the exposures in the winze above and on No. 4 level. In favour of such correlation is the location of the exposure on No. 5 level, which is approximately where it might be expected, and the fact that the winze was the most likely source of the water in the fissure. Also, it is interesting that at the north end of the exposure on No. 4 level the strike of the shoot swings to the west, a change comparable to that in the fissure on No. 5 level. Against correlation of the two exposures is the reverse dip of the fissure on No. 5 level, and the necessity of assuming a pitch to the south-east, opposite to that indicated for the shoot assumed between the exposures on Nos 3 and 4 levels. The consideration of the reverse dip on No. 5 level is offset in certain degree by the fact that the fissure there is steepening progressively toward the south-east and may, quite conceivably, show a reverse dip to the north-east within a short additional distance south-east. In the final analysis, further drifting south-east on this fissure is indicated as the next logical step in the course of exploratory development.

Levels No. 6 and No. 7 have been driven some 500 feet below the upper workings in order to explore the presumed downward extension of the zone of carbonated rock.

No. 6 level, at an elevation of 3,076 feet, was started close to the margin of the altered formation and, 35 feet from the portal, intersected mineralization exposed by surface-trenching. At this intersection a winze was sunk for 16 feet on the mineralization, exposing its strike as north 5 degrees west, the dip steeply east. Mineralization is heavy and composed of coarse galena, sphalerite, and pyrite. Little tetrahedrite is seen at this level. Gangue minerals are quartz and calcite. A sample taken over 52 inches, at 6 feet from the bottom of the winze, assayed: Gold, 0.14 oz. per ton; silver, 12 oz. per ton; lead, 12.1 per cent.; zinc, 20 per cent. Additional width on the hanging-wall is indicated beyond the wall of the winze. Later work to locate the southerly extension of this body on this level disclosed fracturing but little mineralization. A shipment of 36 tons was made from the dump of this working in November, 1937, reportedly representing unsorted vein material from the winze.

No. 7 level, at an elevation of 3,000 feet, was driven to intersect any downward extension of the showing on No. 6 level. It was started in chlorite-schist, and not only crosscuts the carbonated zone but extends beyond for 70 feet into the unaltered schist. A branch working, following a fracture off the main crosscut to the south, has exposed an irregular zone of silicification, sparsely mineralized, which strikes north 10 degrees east, and dips 65 to 80 degrees east. Within the development-work on this level this exposure apparently represents the only likelihood of extension downward from the showing on No. 6 level.

Slocan Area.

Sunshine Group.

The *Sunshine* group, controlled by the Silver Ridge Mining Company, of Vancouver, consists of the *Corinth* and *Dozer* mineral claims and the *Katie* and *Peggy* fractional mineral claims. The *Corinth*, *Katie* and *Peggy* are Crown-granted, the *Dozer* is held by right of location. In addition to these claims the company has certain rights to several others adjoining. This ground is 2 miles due west of the town of Sandon, at elevations varying between 5,000 and 6,500 feet, and has been developed during the past three years under the direction of R. A. Grimes. The property is reached from Sandon by 4½ miles of good road on easy grade. Excellent camp buildings, providing accommodation for eleven men, have been constructed at an elevation of 5,700 feet. Late this season a new camp has been built closer to the location of present operations. Timber is plentiful on the property, mainly spruce and balsam, suitable for any immediate

domestic construction or mining needs. Water sufficient for milling purposes is available only from Carpenter Creek, slightly more than a mile east of the property at an elevation of 3,200 feet.

The rocks underlying the holdings are members of the Slocan series. Where exposed these are principally fine-grained, slaty and argillaceous members with limy and quartzitic phases. Colour varies between dark grey, dark green, and black, with slight variations marking bedding. Several veins, striking generally east to north-east, were indicated before operations were started by the present company, but no comprehensive development had been undertaken. The present programme is based simply on the belief that the ground is worthy of prospecting by reason of its favourable location close to several other properties having profitable records of production in silver-lead and zinc. Further encouragement is lent by the acknowledged fact that vein-outcrops are frequently poor in this district.

The first stage of prospecting by the Silver Ridge Company consisted of widespread surface-stripping by bulldozer, principally in a north-south direction across the prevailing strike of the veins. Next, shallow underground work was done with a view of obtaining more precise information as to structure and vein characteristics. Finally, a low-level crosscut is being driven to explore any downward extension of the surface and near-surface exposures. In the first year of operation, before this programme of development was adopted, a 400-foot adit was driven on the *Sunshine* claim. In the light of later knowledge this work proved to have been misdirected.

Some very valuable information was gained relative to the use of bulldozer for surface prospecting. Ideal conditions of steep side-hill, reasonably light overburden and decomposed near-surface rock-formation facilitated the operations and permitted speed and economy. It is claimed that, hiring bulldozer and labour, material was moved at 10 cents a cubic yard. More exact information from the surface exposures necessitated subsequent hand-work, but the bulldozer was found eminently satisfactory in narrowing down the likely field for such more intensive development.

Two adits on the *Cuba* claim give interesting exposures of vein-conditions near the surface. These adits, the *Jan*, at elevation 5,700 feet, and the *Belle*, at 5,603 feet, were driven on vein exposures made by bulldozer stripping. The original exposure of the *Jan* vein was heavily weathered, but contained small pieces of clean galena. The outcrop strikes south 65 degrees east and dips 15 degrees south-westward, and cuts a salic, pre-mineral sill, 2½ feet in width, bedded with the sediments which lie horizontally or have only a slight dip to the north-east. From the outcrop, a shaft was sunk 50 feet on the vein. In this work it is not possible to estimate the original width of the vein as later movements in the plane of the fissuring and marked weathering have created a shattered zone ranging in width from 2 to 3 feet, with the mineralization, principally clean galena, disseminated throughout. Fifty feet down the shaft the vein is cut off on the hanging-wall of a flat fault striking south 65 to 70 degrees east dipping 10 to 20 degrees north-eastward. The adit was then started and driven 95 feet north-westward to a point 10 feet below the foot of the shaft. From this point a crosscut for 45 feet to the south-west found the faulted section of the vein and indicated the heave to be about 40 feet to the south-west. From this intersection a drift was carried on the vein, below the fault, for 110 feet north-westward and 30 feet south-eastward. In this drift the dip of the vein was found to have steepened to 65 to 70 degrees south-westward. The vein is characteristically narrow, 2 to 6 inches, mineralized by silver-bearing galena, and below the fault is oxidized and sufficiently irregular to render tracing difficult. On the north-westerly extension a 25-foot length was underhand-stoped to a depth of 8 feet and showed clean silver-lead ore across a width of 20 inches. The hanging-wall in this stope is well-defined despite characteristic pinching and swelling. At the north-west face of the drift the vein is cut off by a fault. At the end of the 30-foot drift south-eastward from the crosscut a small stope was carried up on the vein to the fault intersection.

The *Belle* adit lies 200 feet north-eastward of the *Jan* portal. This working was driven as a drift for 400 feet on a narrow vein striking west to north-west, dipping 60 to 70 degrees to the south-west. The sediments strike north to north-west, dip gently west to south-west. The vein is seldom over 2 inches in width and is heavily oxidized and mineralized by stringers of clean galena. Continuity is disrupted by a series of small faults parallel to the bedding of the sediments, which made it difficult to follow the vein under-

ground and are thus responsible for the irregular outline of the working. Eighty feet short of the face of the drift a crosscut was driven 45 feet on a bearing slightly east of north. At the face of this crosscut a poorly-defined fault strikes slightly west of north, dips 65 degrees east. This movement is earlier than those that parallel the bedding.

As mentioned previously, the value of this shallow development is primarily as a source of information for the guidance of further work. One shipment was made from the *Jan* tunnel.

Recently a caterpillar Diesel and a 400-foot Gardner-Denver compressor have been purchased and installed near the new camp on the *Oregon* claim where, at 5,303 feet elevation, a crosscut is being driven on a bearing south 24 degrees west. This working within 1,700 feet should intersect any extension of the *Jan* and *Belle* veins on this level as well as crosscut at least one other vein indicated on the surface. A recent report by Mr. Grimes states that the face of this crosscut was in 150 feet at the end of the year.

Golden Area.

Monarch. This property, on Mount Stephen, 3 miles east of Field, is controlled by the Base Metals Mining Corporation, of Toronto. Considerable detail on this operation is given in the Annual Report of the Minister of Mines for 1935 and previous years. The mill has not operated since 1935, and during the past season only a small crew was maintained on development-work in the East Monarch section of the workings.

Since the beginning of 1936, development-work has traced two ore-bodies, delineating one fairly completely and partly exploring the limits of the other. Both are south to south-eastward of the original stopes in the East Monarch. Mineralization by galena and sphalerite is similar to the sections previously mined.

The body, upon which development is considered fairly complete, is small. It is probably 125 feet long, averages 30 feet wide, and 2 to 13 feet thick. The ore-body is developed by east and west crosscuts from what is known as the 200 level, properly an incline, the length of this lens lies in a north-south direction, and dips about 15 degrees to the north. The eastern limits of the ore are marked by the presence of fine to medium grained pyrite, mixed usually with sphalerite but little galena. There is only slight pyritization at the western limits of the ore. On this level mineralization is all within unstratified, light blue-grey limestone, which commonly contains irregular stringers and bunches of calcite.

The northerly end of the larger of the two ore-bodies lies 200 feet east of the south end of the 200 level ore-body. From this point development has been carried some 400 feet south-eastward in the ore-bearing zone which rises gently in that direction. The dip of the ore-body is about 15 degrees to the north-east, which results from its location on the east limb of a broad anticline whose axis strikes north 25 degrees west and pitches gently north, as reported in the Annual Report of the Minister of Mines for 1929. South-eastward the width of mineralization tapers from 80 feet to approximately 40 feet. The thickness ranges from 50 to 10 feet, it being thinner toward the southern end. At the time of examination development was still proceeding south-eastward. Pyritization marks the western limits of galena-sphalerite mineralization along this length.

At the north end of this ore-body, mineralization is partly in unbedded light grey limestone and partly in the underlying dolomitic limestone. The contact between these two formations rises toward the south-east at almost the same inclination as the ore-body, and the decreased thickness at that end of the body is all within the dolomite, just below the grey lime contact. Previously, mineralization has been found only within the grey lime formation.

An interesting feature is the presence of marked fissuring, assumed to be pre-mineral, which strikes eastward across the larger ore-body. Some of these fissures make a considerable amount of water and adjacent mineralization is markedly lower in grade than average. Although it is a considerable distance underground it is reasonable to assume that the loss in values is directly attributable to the leaching action of the water. This assumption is at least partly substantiated by the fact that at these locations zinc values are depleted further below the average than are the lead values.

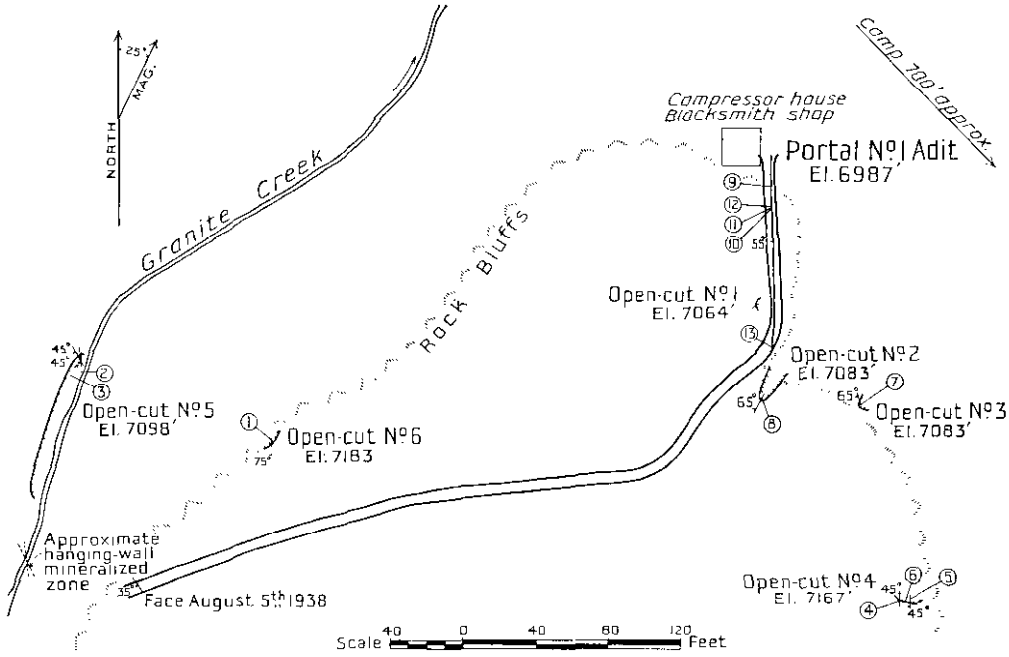
The company reports, tentatively, that 70,000 tons are available from the larger block, which probably averages: Silver, 1.4 oz. to the ton; lead, 10.5 per cent.; zinc, 13.6 per cent. The probable average of the small tonnage indicated on the 200 level is given as: Silver, 1.3 oz. to the ton; lead, 7 per cent.; zinc, 19.5 per cent.

Windermere Area.

Key Group. This group of claims, known either as the *Key* group or *Silver Key* group, was reported upon by the Resident Mining Engineer in 1935: "Leaving the highway 3 miles northerly from Canal Flats, an old logging-road is followed for 12 miles, thence 13 miles of pack-trail leads to the property, at elevation between 8,000 and 9,000 feet above sea-level, which is situated at the head of the East fork of Doctor creek, a tributary of Findlay creek.

"Near the property two tributaries of the East fork of Doctor creek rise separately in a large basin. The west tributary rises in a small lake, flows through a short canyon and is divided from the East branch, which rises in a meadow, by a flat-topped rock ridge. To the east and south the rim of the basin is about 3,000 feet above the meadow and is formed of porphyritic granodiorite with large feldspar phenocrysts, while to the west the rim is quartzite, apparently overlain by greenstone for some distance.

"The canyon marks a fault and along it the beds vary greatly in dip and strike and at places are quite contorted."



Key Group. Plan of surface and underground workings from compass survey.

Since 1935, W. S. Bryant, of Fort Wayne, Indiana, has leased the property from the Blake Brothers, of Skookumchuck. The group consists of the *Silver Key* and *Key Nos. 2* to *8* mineral claims, and the *Mascot* and *Mascot No. 2* and *No. 3* fractional claims, all held on location. Since 1936, the road has been improved at its upper end so that it is now possible to drive for 15 miles from the highway; the succeeding 11 miles of trail from the end of the road to the camp needs considerable further work, including some relocation, before permitting of economical horse-packing in either summer or winter. The trail was kept open at considerable expense and effort during the winter of 1937–38 when a crew of four men was maintained at the property. On the trail and at the camp, the high elevations and rugged topography lend to heavy snowfall with resulting danger and difficulties from slides.

A new bunk-house providing accommodation for eight men has been built at the location of the original cabin. A small gasoline compressor, capable of supplying one light drill, has been installed together with the necessary blacksmith equipment.

As described in the 1935 Report, the two streams tributary to the East Fork of Doctor Creek are separated by a flat-topped rock ridge consisting, on the east, of greenstone, and on the west of a succession of quartzite-beds varying from cherty to argillaceous. Impurities originally contained within the quartzites have produced considerable muscovite and graphite as products of regional metamorphism. Jointing is commonly platy, owing to the presence of the muscovite. The original colour of the rock has been modified to varying degrees, the most noticeable result is the production of an iridescent sheen which coats many of the exposed surfaces. This effect is due probably to the leaching action of descending waters upon iron contained within the rocks as pyrite and as an original constituent, followed by its redeposition as a pigment.

The showings of principal interest occur within the quartzite, on the west flank of the ridge and near its northern end. On the west flank a zone of slight mineralization by galena and pyrite, 60 feet in width, is exposed on both sides of the west tributary creek, known locally as Granite Creek. At Cut No. 5 on the west side of this creek, the zone strikes nearly due north and dips 45 degrees west, with the bedding of the quartzite. The foot-wall is naturally well exposed but the hanging-wall is obscured by overburden. A sample (No. 2) taken over 69 inches of heavily-oxidized quartzite, slightly mineralized by galena and pyrite, on the foot-wall of the zone, assayed: Gold, trace; silver, 2.0 oz. per ton; lead, 3.2 per cent. A grab sample (No. 3) taken from a small pile of select mineralization from this location assayed: Gold, trace; silver, 4 oz. per ton; lead, 7.2 per cent. The extension of this zone on the east side of the creek is displaced 500 feet south by a fault traced by the line of the creek. Near the faulted extension the quartzite is folded and contorted but the prevailing strike of the zone is north 20 to 30 degrees west, with the dip irregular but predominantly south-westward. The width of the zone is close to 50 feet. A sample taken across 48 inches of stained quartzite, at the best exposure of mineralization by pyrite and galena, assayed: Gold, trace; silver, 0.4 oz. per ton; lead, 0.6 per cent. This mineralization is concentrated principally along the bedding-planes.

Above Cut 5, on the west side of the ridge, 3 to 4 inches of heavy mineralization, mainly galena, lies bedded with the quartzite, which strikes north 3 degrees west and dip at 75 degrees to the west. A small Cut, No. 6, has been made and the exposure suggests that the dip is probably greater than usual owing to local pressure from the steeply overhanging ground immediately above. A sample (No. 1) taken across this mineralization assayed: Gold, 0.02 oz. per ton; silver, 27.5 oz. per ton; lead, 38.5 per cent. The wall-rock, of grey quartzite, is barren or only slightly mineralized.

On the top of the ridge, near its northern end, there are several narrow stringers of heavy mineralization, principally galena with some tetrahedrite, carrying attractive values in silver. At Cut No. 2, a 3- to 4-inch vein, bedded, strikes north 30 degrees east, dips at 65 degrees westward. Additional width of shearing up to 8 inches is due to the intersection of the mineralized fissure by a barren post-mineral fracture striking due north, dipping 50 degrees west. A sample (No. 8) taken across 2½ inches of heavy mineralization of galena and some tetrahedrite, assayed: Gold, 0.04 oz. per ton; silver, 278 oz. per ton; lead, 13.9 per cent. At Cut No. 3, 50 feet to the east of Cut No. 2 and at the same elevation, another vein of similar width strikes north 10 degrees west, dips 65 degrees west. There, too, the vein is bedded and consists of strong mineralization by galena and some tetrahedrite with the production of some secondary copper minerals, notably malachite. A sample (No. 7) across 4 inches assayed: Gold, 0.02 oz. per ton; silver, 235 oz. per ton; lead, 6.6 per cent. The wall-rock is, as usual, unmineralized or mineralized only to slight degree. One hundred and ten feet south of Cut No. 3 and on strike sufficiently close to be considered as a probable extension of the vein similar vein-structure has been exposed at Cut No. 4. There, 4 to 6 inches of fair mineralization by galena and tetrahedrite in a quartz gangue is separated from a parallel vein by 6 to 8 feet of barren quartzite. The parallel vein has a width of 3 to 6 inches. Both veins are bedded, strike due north, and dip 45 degrees west. A sample (No. 4) from the west vein, taken across 6 inches, well mineralized by galena and a small amount of tetrahedrite, assayed: Gold, 0.01 oz. per ton; silver, 110 oz. per ton; lead, 1.2 per cent.

A sample (No. 5) from the east stringer, across 6 inches slightly mineralized by galena assayed: Gold, trace; silver, 2 oz. per ton; lead, 0.6 per cent. A chip sample (No. 6) taken across 96 inches of quartzite between the two leads assayed: Gold, *nil;* silver, *nil;* lead, 0.5 per cent.

Underground development has been directed principally toward exploration of the wide zone exposed on Granite Creek as described above. Owing to danger and inconvenience from snowslides from the precipitous walls of the creek, an adit was collared at the northern end of the ridge. The location selected was at the outcrop of one of the narrow, well-mineralized veins, and the adit served the dual purpose of developing this vein while progressing toward the principal intersection. The drift on the vein was carried for slightly over 100 feet from the portal and in this length displayed the vein bedded with the quartzite, striking almost due north, dipping 55 degrees west. Vein-widths range generally between 2 and 4 inches, although in places weakness in the bedding has permitted dissemination of the mineralization, creating increased widths accompanied by a corresponding decrease in concentration and partial loss of true vein characteristics. Mineralization by galena and pyrite is erratic and generally weak; the gangue is composed of silicified quartzite and some free quartz. The wall-rock in this section is typically of grey, unmineralized quartzite. Samples taken from this vein were as follows:—

Sample No.	Gold.	Silver.	Lead.	Description.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	
9	0.02	3.6	0.8	Over 20 inches disseminated mineralization by galena and pyrite in silicified quartzite at portal plus 15 feet south.
10	Trace	1.0	0.4	Over 24 inches on the foot-wall of the lead, silicified quartzite containing very slight pyrite and galena. Portal plus 26 feet south.
11	Trace	8.0	0.4	Over 4 inches vein mineralized by galena. Portal plus 26 feet south.
12	Trace	0.2	0.3	Over 17 inches hanging-wall slightly silicified quartzite, very slightly mineralized by galena and pyrite. Portal plus 26 feet south.
13	Trace	6.4	0.7	Over 14 inches vein mineral, here evidenced by silicification of quartzite bedding and fine seaming by galena. Portal plus 103 feet south.

At 105 feet from the portal the adit was swung to a bearing slightly south of west. For 320 feet from the change in direction the working is in quartzite, unmineralized and exhibiting little irregularity of possible importance. At 320 feet the ground becomes heavily sheared and continues so for the next 50 feet. At 370 feet a well-defined hanging-wall, striking north 25 degrees west, dipping 35 degrees south-westward, marks the limit of the movement. Examination disclosed no distinct foot-wall. After the date at which examination was made the operators extended the adit and reported the intersection of both the narrow vein exposed at Cut No. 6 and the main wide zone of mineralization for which the working had been driven.

South of these principal showings the basin is rimmed by high ground rising to elevations of 9,000 feet. On the north slope of this rim, at an elevation of 7,630 feet, some 1,500 feet south of the camp and above the source of the east branch creek, a shear-zone in porphyritic granite has attracted attention.

The shearing is only about 100 feet east of a contact with typical quartzite. This contact strikes due north. Within the granite, over a width of 50 feet, there occur individual shears ranging in width from 1 foot to 6 feet. These shears, also striking approximately north, dipping to the west, are generally unmineralized except for the presence of muscovite and sericite. A sample taken across the full 6-foot width of the largest shear-zone assayed: Gold, trace; silver, 0.2 oz. per ton; lead, 0.8 per cent. A shear, striking north 15 degrees west, dipping at 75 to 80 degrees westward, is cut off on the cliff face some 25 feet above the floor of the cut by another later shear which strikes north 20 degrees west and dips 55 degrees

westward. These movements are later than the mineralization of the quartzite, and, lacking evidence of any later period of mineralization, it is doubtful if this area within the granite is of commercial interest.

DRY SILVER ORES.

Slocan Lake Area.

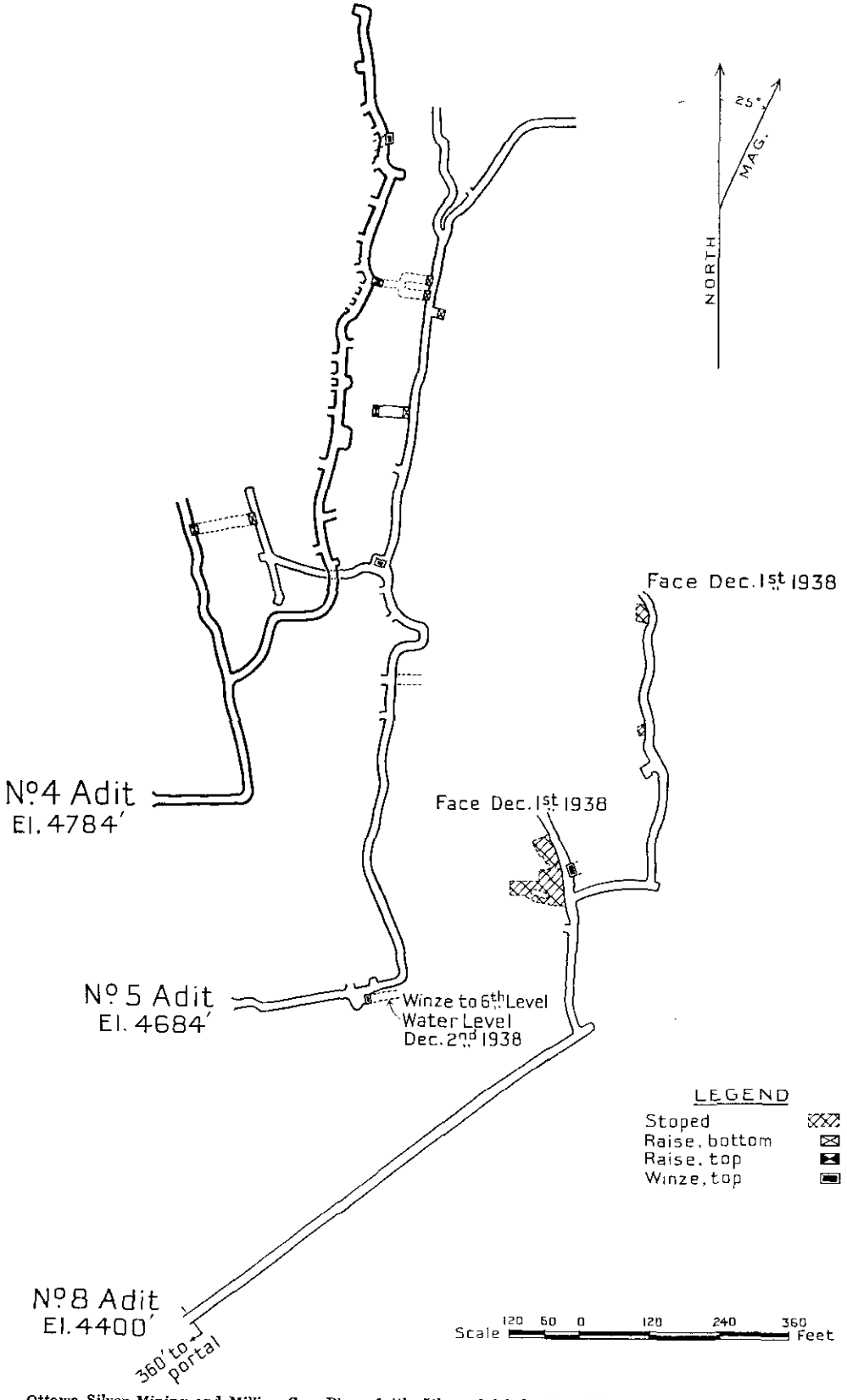
Ottawa Group. This group of thirty-one claims, all Crown-granted except the *Double Cross Fraction*, which is in process of Crown-granting, is held by the Ottawa Silver Mining and Milling Company; head office, 401 Sherwood Building, Spokane, Washington. C. R. Thomas is president of the company, and D. D. Fairbanks is in charge of operations at the mine. A flotation mill, rated at 100 tons a day, powered by a 170-horse-power Diesel electric plant, is close to the highway only a mile from Slocan City. The mine, on Springer Creek, at an elevation of 4,500 feet, is reached from the mill by 5 miles of good road. At the mine, a 150-horse-power Diesel plant supplies power for an L-type 13½-inch and 8- by 8-inch compressor. A combined cook-house and bunk-house provides accommodation for twenty-five men. During the past year an average of eighteen men has been employed at the mill and mine. Ore is hauled by truck from mine to mill. During the past season the mill has been running only part time, either one or two shifts, depending on the output from the mine. Shipments of concentrates at the rate of 20 tons a month have been fairly well maintained. Total production for 1938 was 112 tons of dry ore and 75 tons of concentrates, containing 3 oz. gold and 59,959 oz. silver.

As described in Annual Report of the Minister of Mines for 1935 and previous years, and in Memoir 184, Geological Survey, Canada, original development on six levels explored a wide zone of shearing in coarse-grained porphyritic granite of the Nelson batholith. The movement is represented by two distinct shearings which strike north and dip flatly east almost parallel, known respectively as the east and west veins. Although there is apparently a tendency for the two lodes to approach each other on their southerly extensions, none of the underground development to date has proved any such intersection.

In the references cited above, complete data are given on the upper six levels. In 1937 and the early part of 1938 a few men were engaged in selective mining on No. 5 level, removing pillars and small blocks of ore left by the previous operators. In addition, one narrow hanging-wall strand of mineralization was located and mined. This sniping was abandoned principally because of the small size of the drift, not sufficiently large for a half-ton car, and the distance of the working-place from the portal, 2,600 feet. In the past two years development has been concentrated on the No. 8 level, driven at an elevation of 4,400 feet, 284 feet below No. 5, the next adit above. No. 6, below No. 5, is accessible only from the upper level and is flooded at the present time.

On No. 8 level a 1,200-foot crosscut was required to reach the west vein. Ensuing work in a northerly direction has proved both lodes to be strong and well maintained, with widths up to 20 feet on the west vein and probably 15 feet on the east. The estimated average width of each is 5 feet. Within the shear-zone the original granite has been brecciated, altered by regional metamorphism, finally silicified, and is now light green to grey in colour. Feldspar crystals have been destroyed to a great extent, particularly in the ore-bearing sections of the shear; where observed in the barren sections they are commonly elongated or shattered. Mineralization by native silver, argentite, tetrahedrite, galena, pyrite, sphalerite, and chalcopyrite occurs anywhere within the limits of the shear-zone as irregular concentrations, sometimes in vein-like form, sometimes as small isolated wedges or lenticular masses. Heavy concentrations of mineralization may be seen easily and mined selectively with little difficulty, but frequently milling or even high-grade ore may appear to be only sparsely mineralized, necessitating judicious handling in underground and later sorting. Gouge bands, 2 to 12 inches in width, swing through the shear-zone from one wall to the other. Slickensides are common on the walls.

The evidence indicates that following the primary shearing, secondary movements reopened tight and irregular fissures between the original walls. Later mineralization, responsible for the ore-deposits, was concentrated in the secondary openings. Final small strike-faults, disturbed the original walls and the ore-concentrations still further.



Ottawa Silver Mining and Milling Co. Plan of 4th, 5th, and 8th level workings after company's map.

From the initial crosscut on No. 8 level, on December 1st, 1938, the drift on the west lode had been advanced 375 feet north. The strike of the shear is north 10 to 30 degrees west, the dip 30 to 35 degrees eastward. At 220 feet from the initial crosscut, another crosscut was driven 145 feet from the west lode to the east. A drift northward on the east lode had reached a point 500 feet north of the crosscut on December 1st. The strike of this shear is predominantly north 10 to 20 degrees west, and the dip 30 to 35 degrees eastward, but one short section strikes north 20 degrees east, dips 30 to 40 degrees eastward.

To date the west lode has produced most of the ore from No. 8 level. From the initial crosscut to the crosscut to the east drift the exposure, according to the operators, returns only low assays. From the crosscut to the east lode, for a distance of slightly over 100 feet northward, a stope had been carried to a maximum distance of 90 feet up the dip of the west vein. This stope provides the best exposures of the shear on this level. The southern part, stope No. 1, has been worked most extensively and, at the time of examination, a high-grade concentration was being mined at the south end. A sample across 16 inches assayed: Gold, trace; silver, 301 oz. per ton. Mineralization by argentite, native silver, and tetrahedrite was strong over this width, but a 4-inch width included at the centre of the sample showed particularly heavy concentration. A sample taken selectively from this 4-inch width assayed: Gold, trace; silver, 1,107.2 oz. per ton. A third sample taken across 48 inches, to the hanging-wall of the first sample, composed of silicified shear filling, little mineralized, assayed: Gold, *nil;* silver, 7.8 oz. per ton. Extension of the high-grade mineralization toward the north end of the stope was not well-defined but appeared to be rising toward the hanging-wall of the shear.

No. 2 stope is properly an extension of No. 1 stope northward, but has been developed separately by reason of an abrupt break in the hanging-wall which makes that wall some 4 feet lower in No. 1 than in No. 2. A dragging movement later than the shearing is clearly marked at this point by pronounced slickensides. At the south end of No. 2 stope, 40 feet up the dip of the vein from the drift, a sample across a 5-inch streak of heavy mineralization carrying argentite and tetrahedrite assayed: Gold, trace; silver, 166.8 oz. per ton. Another sample across 45 inches, little mineralized, on the foot-wall of the preceding sample assayed: Gold, *nil;* silver, 1 oz. per ton. Shallow underhand-stoping has been carried for a length of 50 feet on the east side of the drift, opposite No. 1 and No. 2 stopes. At the face of the west drift, beyond any stopes, the shear is practically barren of mineralization. A sample taken here across 60 inches assayed: Gold, *nil;* silver, 0.6 oz. per ton.

The crosscut from the west drift to the east drift followed a fracture striking north 60 to 75 degrees east, dipping 40 degrees southward. Twenty-five feet short of the east drift the strike changes to north 25 degrees east, the dip becomes almost vertical. The crosscut was continued eastward to the east lode. A drift run north on the lode intersected the cross-fracturing on the west wall of the drift.

The east lode, as so far exposed on No. 8 level, is more irregular in strike and dip than the west lode. A sample taken at the intersection of the crosscut and the east lode, across 30 inches of gouge and heavily-sheared rock, little mineralized, representative of the shear filling at this location, assayed: Gold, *nil;* silver, *nil.* For the first 250 feet of drift on the east lode, ore-lenses are irregular and not large. Beyond that point, to the face at 303 feet from the crosscut at the time of examination, the concentrations of mineralization are stronger and give promise of better continuity. At 220 feet a short crosscut was driven west to reach the foot-wall of the shear. There a sample taken across 25 inches of shear filling, little mineralized, assayed: Gold, 0.04 oz. per ton; silver, 5.4 oz. per ton. At 50 feet from the face a sample across a 5-inch width of strong mineralization assayed: Gold, trace; silver, 429.8 oz. per ton. This stringer could be traced along the wall for several feet. It is marked by a well-defined gouge band on its hanging-wall. Both the gouge band and the mineralization lie toward the centre of the shearing, and display no tendency toward concentration on either wall.

The drive northward on these two drifts has not yet reached the projected downward extension of the best mineralization within the shear-zone on the upper levels. One difficulty that the operators have encountered in their calculations is inadequate knowledge of the pitch of the ore-shoots. Estimation of outcome of the property is rendered extremely difficult without comprehensive bulk-sampling and close estimation of mining costs. Bulk-

sampling, or careful compilation of assays of channel samples from both the high-grade concentrations and the remainder of the shear filling, would give an assay for mill-heads which might be mined at a reasonable cost. In the event that this assay proved too low to permit operation, the returns from the sampling of the high-grade concentrations might indicate the feasibility of selective mining, possibly by hand-steel, and a system of back-filling the waste. However, whether the property is considered on a milling or on a shipping basis, any contemplated system of underground work must allow for handling of the entire shear filling, as nowhere may any part of it be considered competent to remain in-place during the course of selective mining.

PLACER-GOLD DEPOSITS.

River Placers Syndicate.

The operation by this syndicate during the past season on the Pend d'Oreille River, 6 miles by road west of Nelway, merits brief description. Under the direction of A. H. W. Crossley, of Nelson, experimental equipment has been used to apply the principle of the air-lift to the problem of raising placer gravel from the bottom of the river. The lift, a small gas-engine, a compressor, receiver, and a short sluice-box are mounted on a raft. The raft is attached by movable blocks to an overhead cable slung across the river, and permits the working of a narrow strip of gravel from bank to bank. A hand-winch on the raft, with one end of the cable attached on shore, provides the motive power.

The lift-pipe is supported over one end of the raft, raised and lowered by block and tackle. The most efficient pipe size has not yet been definitely ascertained; at the time of examination the upper 8 feet were of 9-inch pipe, the lower 6 feet and a 2-foot nozzle on the bottom of 8-inch, but since then the advisability of using one diameter throughout has been given serious consideration. The advantage of having slightly greater diameter on the top section is that it may be slid over the lower section, to provide an easy adjustment for different depths of water. When the nozzle is on the river-floor a lip at the top of the 9-inch section must be above the upper end of the sluice-box. Air at about 20 lb. pressure is let into the pipe from two jets, one at the bottom, the other a few feet higher up, the air from the upper one acting as a booster. The rising column of air and water within the pipe carries sand, gravel, and boulders with it from the river-bottom. Any gold brought up with this material is saved in the sluice-box.

There is no doubt that the lift will function as planned; when examined it was bringing up boulders weighing up to 15 lb. A little fine gold showed on cleaning up the sluice-box, but the weakness of the operation appeared to be the lack of gold in the gravel rather than imperfection of the equipment.

Nelson Placers, Ltd.

Two placer operations have been conducted on Forty-nine Creek during the past season. Nelson Placers, Limited, represented by H. W. Robertson, of Nelson, holds two adjoining leases, the *Pot Hole* and the *Old Channel*, accessible from the Blewett road by a quarter of a mile of side road. The end of this branch road is 8½ miles from Nelson. H. A. McKen represents the owners of, and applicants for, ten claims and four leases staked above and two leases staked below the *Pot Hole* and *Old Channel* leases.

The ground of the Nelson Placers, Limited, includes much of the area that was hand-worked and hydraulicked between the years 1890 to 1900. During the past season, the operation has been directed principally toward hydraulicking marginal gravel considered too low-grade to be worked by the earlier operators. To this end a high flume was built along the north-east bank of the creek, with intake at a considerable distance up-stream; 8-inch pipe-lines carry the water from penstocks to 4-inch and 2-inch monitors.

At the time of examination low water prevented operation of the larger monitor, which had already stripped a section from the north-east bank, 25 feet wide and 175 feet long. The face of the bank exposed over this length was made up of 20 feet of reworked boulder-clay at the top, underlain by 1 foot to 2 feet of brownish, angular fragments of granite in a medium fine matrix. Below this a 3- to 4-inch layer of gravel, loosely cemented by bluish clay, lying on bed-rock of Nelson granite, appeared to be the most favourable bed for gold occurrence. The 2-inch monitor was being used to prospect the same bank farther down-stream.

During the season an average of four men was employed for seventy-three days, the greater part of this time being spent on construction-work. A total of 11 oz. of gold was produced.

McKen's operation is concentrated on the seventh claim up-stream from Robertson's ground, the *Ebby* claim. Two gas-engines, are used, one for the drag-line and one for a small centrifugal pump. The operation consists of sinking a shaft on the north-east side of the creek. At the time of examination a depth of 28 feet had been attained. No details were forthcoming from the operators concerning the success of this work.

J. D. Mining and Prospecting Co., Ltd.

The operations of this company were conducted on Hall Creek, just below Keno Creek, 1 mile from the Nelson-Nelway highway at Hall Siding, a station of the Great Northern Railroad. The company, directed by J. D. King, financed by Spokane interests, was organized on the assumption that commercial gold and platinum values are associated with the black sands found on the creek. In addition, a small concentrating plant, consisting of a jig and a 1-ton combination amalgam-barrel ball-mill, was installed in Nelson with the idea of handling not only the black sand product from Hall Creek but any that might be supplied from other placer operations in the district. Several camp buildings were constructed on Hall Creek and up to eighteen men were employed during the season. After many minor difficulties, culminating in the disappearance of King, operations ceased early in September. At the present time, Sidney Sloane, of Spokane, the largest individual shareholder in the company, is attempting to make arrangements with various creditors and other shareholders in order that the programme of development at the property and custom concentration of sands in Nelson may be continued next season.

It is unfortunate that no comprehensive data were obtained either from the workings or from the concentrating plant. The former was not in operation sufficiently long to permit any conclusive estimate of the amount of black sand carried by the ground and the concentrating plant was never used. The only apparent worth of the efforts to date lies in a slight amount of additional geological information obtainable from the pit excavated in the course of testing the equipment, and in data relative to the system used to save the black sand.

The excavation exposed a section comprised of 10 to 15 feet of reworked boulder-clay overlying some 8 feet of bluish boulder-clay and gravel which is succeeded below by 3 feet of hard-pan. Bed-rock, exposed irregularly below the hard-pan, is of the Hall series of conglomerate, sandstone, and carbonaceous shales intruded by later dykes. In the course of the operation it was found that the top section of drift carried only small amounts of fine gold, that the blue clay and the hard-pan below were productive of the black sand. Some coarse gold was reported in the hard-pan on and near bed-rock. No information is available concerning the presence of minerals of the platinum group. The operation was hampered considerably by the large boulders in the two upper strata.

At first, the operators believed that Keno Creek was the source of the black sand and the gold. Toward the end of the season further prospecting suggested that a dry wash on the north side of Hall Creek, nearly opposite Keno Creek, is a more likely possibility.

The equipment used for the recovery of the black sand and the gold is of interest. Water for a 4-inch and a 6-inch monitor is taken from Keno Creek by pipe-line and from Hall Creek by flume. In the sluice-box, 3½ feet wide, the gravel passes first over 75 feet of ordinary pole and rail riffles; next, over an 8-foot length of plank which is succeeded by 6 feet of screen of ¼-inch opening. Tailings are carried on past the screen and return to the creek. The screened product passes to a sluice-box 2 feet wide in which four successive undercurrents are set; the first two are spaced 15 feet apart; the second and third, and third and fourth, 10 feet apart. Beyond the fourth undercurrent the tailings pass over 50 feet of wooden riffles before being rejected as waste. The four undercurrents are worthy of particular attention, in that they provide the principal means of separating grey sand from the black sand. A 2-foot length of 25-mesh screen is set in over the full width of the bottom of the sluice-box above each of four undercurrents, with wooden cross riffles in the intervals between the screens. The box below the screen is 14 inches deep, tapered from 2 feet square at the top to 1 foot square at the bottom. On two opposite sides of the box are cut two horizontal lines of three holes, 1 inch in diameter, 2-inch centres. On each side,

there is one line of holes near the top of the box, and one near the bottom. Four small slides fitting on the outside of the box are each bored with three corresponding holes, so that by moving the slides it is possible to regulate the flow from the capacity of the holes to zero. The closing of the lower three holes and the opening of the upper permits a concentration of black sand in the bottom of the box and the removal of the lighter mixture of grey and black sand from the top. When the feed is heavy in black sand, the openings are reversed and the concentrate is carried through the lower pair of holes. At the bottom of the box there is a drain-hole and plug.

The sand passes from the four undercurrent boxes and is carried by a flume for a few feet and then passes over a 6-foot length of 225-mesh screen. Grey sand is carried over the screen as waste and the finer black sand is collected in bin No. 1 below. When the bin is full a baffle is placed in the flume, ahead of the screen, and the flow of water is diverted from the tailing flume to another, in the floor of which is placed a second 6-foot length of 225-mesh screen over bin No. 2. The product in bin No. 1 is then shovelled into the flume, ahead of the baffle, and the final concentrate is caught in bin No. 2. When handling clean black sand bin No. 1 is not used, a single screening at bin No. 2 provides sufficient concentration.

At the time of examination No. 2 bin contained several tons of sand that was predominantly grey although supposedly ready for shipment to smelter or concentrating plant.

SPECIAL REPORTS.

Typewritten copies at 25 cents each are available to those who specially request reports on the following properties:—

Cranbrook Area: Campsall Group, Golden Dream Group.
Sheep Creek Area: Mountaineer Group.

PROGRESS NOTES.

BY

H. C. HUGHES.

LODE-GOLD DEPOSITS.

VICINITY OF NELSON.

Athabasca.—Situated on Morning Mountain. Owned and operated by the Noble Five Mines, Limited; Paul Lincoln, manager; P. Hansen, mine foreman. The property was reopened in September and an 100-horse-power electric motor was installed in October to run the compressor. A crew of six men with four working underground was employed. Development-work consisted of approximately 60 feet of sinking and 60 feet of drifting, 100 feet of raising and 30 feet of crosscutting. The total production amounted to 91 tons which was shipped to Trail. This yielded 97 oz. of gold, 323 oz. of silver, 3,087 lb. of lead, and 5,867 lb. of zinc.

Alma N.—Situated on Morning Mountain above the *Granite Poorman.* Owned and operated by the Alman Star Syndicate; W. R. C. Beadon, manager, who purchased the property outright from the owners. During the summer and fall the old workings were resampled and 5,000 feet of diamond-drilling done.

California.—Situated on Toad Mountain, near Nelson. Owned by Mrs. Mary Wilson, of Nelson, B.C. This property was operated desultorily by several sets of leasers during the early part of the year. It was then taken over by R. H. Kline and Alex Poelzer, of Nelson, B.C., who installed a small gasoline-driven compressor. A total of 128 tons of ore was shipped to Trail, which yielded 180 oz. gold, 269 oz. silver, 2,585 lb. lead, and 4,560 lb. zinc. The level being worked required considerable repair-work and retimbering near the portal.

Daylight and Victoria-Jessie.—Situated on Toad Mountain, adjoining the *Silver King* mine. Operated by the Daylight Gold Mines, Limited, a public company capitalized for

3,000,000 shares, with Mr. W. G. Norrie-Loewenthal as managing director. The mine foreman is Andy McIntyre. An extensive programme was undertaken at this property this year. A new camp, consisting of cook-house, bunk-house, and dry-room of sufficient capacity to accommodate sixteen men, was built near the site of the old Victoria tunnel. The *Silver King* power-line was put in repair by the West Kootenay Power and Light Company. A new compressor-house was built and a 75-horse-power electric motor belt-connected to a 450-cubic-foot Gardner-Denver compressor was installed. Development-work done during the year consisted of 370 feet of surface-trenching on the *Daylight* and *Victoria-Jessie*, 33 feet of drifting and 34 feet of crosscutting by hand-steel on the *Daylight* claim, and 355 feet of drifting and 77 feet of crosscutting on the *Victoria-Jessie* group. In the early part of the year 12 tons of ore was shipped by the Rolick Brothers, which yielded 13 oz. gold and 8 oz. silver.

Euphrates.—Situated 8 miles south of Nelson, on the Nelson–Salmo highway. Owned by the General Lee Mining and Milling Company, with Sarkis Terzian as manager. Development-work done during the year consisted of 2,000 feet of underground diamond-drilling. Eight men were employed for this work with four underground.

Granite-Poorman.—Situated on Eagle Creek, near Blewett, B.C., about 5 miles west of Nelson. The property is owned by the Livingstone Mining Company, Incorporated; H. R. Smith, manager; and was operated by them until the end of July. A crew of nineteen men with thirteen working underground was employed during that time. An option was then taken by W. R. Green, but little or nothing was done under this agreement. Toward the end of the year a lease was taken on the property by Mr. H. D. Forman, of Nelson, B.C. The tonnage treated yielded 184 oz. of gold and 196 oz. of silver.

Venango.—This property adjoins the *Granite-Poorman* on the west. It is owned and operated by D. H. Norcross and associates. During the year 1,500 feet of truck-road was built from the *Granite-Poorman* road, a geophysical survey made, 400 lineal feet of ground-sluicing was done, and 60 feet of sinking. A camp was built and a complete small mining plant was installed.

Gold Crown.—Situated at the head of Sitkum Creek, adjoining the *Alpine* group. Owned by Mrs. Anna Belle Radcliffe, of Nelson, and operated for a short time during the summer under lease by S. Reese, A. Mona, Rudolph Nelson, and Russell Decaire. Hand-steel only was used and the ore mined was taken from surface cuts and trenches. A total of 39 tons was mined and shipped to Trail. This yielded 36 oz. gold and 28 oz. silver.

Venus-Juno.—Situated on Morning Mountain, near Nelson, B.C., owned by R. Heddle, of Nelson. It was operated by leasers during the year, and 392 tons shipped to Trail yielded 407 oz. of gold and 760 oz. of silver.

Golden Eagle Group.—Situated on Hall Creek, about 4 miles above the Nelson–Salmo Highway. Owned and operated by the Nelson Gold Mining Syndicate; W. Rozan, manager. Three men were employed during the year and did surface trenching and tunnelling.

Ymir Camp.

Goodenough.—Situated on Elise Mountain. Operated by the Ymir Consolidated Gold Mines, Limited; G. G. Sullivan, manager. The mine and mill were operated continuously during the year, an average of thirty-six men being employed with twenty-four underground. The mill was run only one shift per day. Development-work consisted of 667 feet of drifting, 135 feet of crosscutting, 564 feet of raising, and 3,000 feet of diamond-drilling.

Ymir.—Situated on the north fork of Wildhorse Creek. This property is owned and operated by the Ymir Consolidated Gold Mines, Limited; G. G. Sullivan, manager. The mine was operated continuously during the first five months of the year, all ore mined being treated in the mill. An average of ten men was employed with seven working underground. During the latter part of the season leasers removed some ore from the surface at the old glory-hole. Development-work consisted of 350 feet of drifting, 48 feet of crosscutting, and 100 feet of raising. From the combined Ymir Consolidated operation a total of 13,978 tons was milled, yielding 5,481 oz. gold, 34,938 oz. silver, 410,274 lb. lead, and 225,710 lb. of zinc.

Colorado.—Situated on the North Fork of Wildhorse Creek. Owned and operated by a local syndicate, composed of J. Ferguson, S. Curwin, R. Griffiths, and A. Holstrom, with J. Ferguson as manager. Three men were employed underground. Work was confined to

development, which totalled 125 feet of drifting and 50 feet of raising. A portable gasoline-driven compressor was used.

Ymir-Wilcox.—Located on Wildhorse Creek. Owned by the Wilcox Mines, Limited, and operated under lease by the Ymir-Wilcox Development Company; D. H. Norcross, manager. The lease expired this year and was not renewed. This mine was operated only during the open season. Eleven men were employed with six working underground. The ore was treated in a 10-stamp mill on the property and the concentrates shipped to Trail. Development-work consisted of 20 feet of raising and 160 feet of diamond-drilling. A total of 1,395 tons of ore was mined, yielding 112 oz. of gold, 443 oz. of silver, 7,580 lb. of lead, and 4,984 lb. of zinc. In addition amalgam yielded 237 oz. of gold and 256 oz. of silver.

Ymir-Yankee Girl.—Situated on Bear Creek, 3 miles from Ymir, B.C. Operated by the Ymir-Yankee Girl Gold Mines, Limited; L. G. Morrell, manager, and E. McQuaid, mine foreman. The mine and mill operated continuously throughout the year. The average number of men employed was 110 with an underground crew of eighty. The problem of recovering ore left in pillars and in stopes in the less accessible parts of the mine has been met by giving this to leasers; an average of sixteen men being engaged in this work for the last seven months of the year. This work was all done by hand-steel. The development-work done included 1,740 feet of drifting, 377 feet of crosscutting, 1,194 feet of raising, 148 feet of sinking, and 1,939 feet of diamond-drilling; 50,930 tons of ore were broken and, of this, 42,717 tons were milled. This last yielded 10,818 oz. of gold, 43,342 oz. of silver, 794,498 lb. of lead, and 556,856 lb. of zinc. The contract miners produced 4,132 tons of ore, which was purchased by the company.

Ymir Centre Star.—Situated on Jubilee Mountain, near Ymir. Operated by the Wesko Mines, Ltd.; Harold Lakes, manager; Harry Stevens, mine superintendent; John Sandberg, mill superintendent. The mine and mill were operated continuously until August 21st. During this time an average of forty-three men was employed with twenty-two underground. From this date until October 1st an underground development crew of six men was employed. then the mine closed down and a watchman was left in charge. Development-work included 223 feet of drifting, 325 feet of crosscutting, 53 feet of raising, and 2,432 feet of diamond-drilling. A total of 15,096 tons of ore was mined, yielding 2,930 oz. of gold, 19,555 oz. of silver, 389,465 lb. of lead, and 186,069 lb. of zinc.

Tamarac.—Situated on Elise mountain. Operated by the Balsam Gold Mines, Limited; F. O. Orr, manager, Vancouver, B.C. An average of eight men with six underground was employed for a short time in the early summer. Work was confined to development, which included 40 feet of crosscutting, 107 feet of raising, and 200 feet of diamond-drilling.

Ymir Commodore.—Situated on Wildhorse Creek. Operated by the Ymir Commodore Mines Company; J. D. Ferguson, manager. Work was commenced on this property in April and confined to development. Five men were employed with three working underground. A complete mining plant, consisting of 75-horse-power electric motor belt-connected to a 12- by 12-inch single-stage compressor, steel sharpener, and oil furnace, were installed in a new power-house near the portal of the low-level tunnel. Development-work included 200 feet of surface-trenching, 400 feet of drifting, and 300 feet of diamond-drilling.

Vicinity of Salmo.

Queen.—Situated on Wulf Creek. Operated by the Sheep Creek Gold Mines, Limited. H. E. Doelle, manager; F. R. Thompson, mine superintendent; Louis Vogel, mill superintendent. The mine and mill operated continuously throughout the year. The average number of men employed was 105, with sixty-three of these underground. An extensive development programme, with the ultimate object of exploring all the favourable belt of quartzites on the Sheep Creek ground, has been successful in showing up three promising veins, in addition to the *Queen, Hideaway,* and *Bruhn.* These in order of their occurrence from the shaft are called the "76," "81," and "85" veins. Of these, the "81" to date has been the most promising. The 5 and 7 levels from the *Queen* shaft have been connected by raises to the 2-level adit on the *Hideaway* vein. Some development was also done on the *Midnight* vein across Wulf Creek. All development waste is being back-filled into old stopes. Development-work included 9,612 feet of drifting and crosscutting, 779 feet of raising, and 608 feet of diamond-drilling. The tonnage mined and milled was 53,728 tons, from which bullion yielding 25,862 oz. of gold and 9,822 oz. of silver was obtained.

Kootenay Belle.—Situated on Sheep Creek. Operated by the Kootenay Belle Gold Mines, Limited; Vere McDowall, manager; J. Tonkin, mine foreman; and Neil Munro, mill superintendent. The mine and mill operated continuously throughout the year, with an average crew of 120 men, eighty of which were employed underground. Development on the No. 4 level adit-crosscut was pushed during the year. A raise on the "A" vein to the 3 level has greatly improved ventilation in the lower parts of the mine. Preparations are being made to sink from the 4 level not far from the intersection of the crosscut and the "A" vein. Surface-trenching on the *Dixie* claim, across Sheep Creek, disclosed the presence of commercial widths and values in a vein thought to be the extension of one of those found on the *Gold Belt*. A certain amount of preliminary sinking and drifting with hand-steel on the surface showing gave sufficiently encouraging results to warrant the commencing of a crosscut to intersect this vein at depth. This was commenced at the same elevation as the No. 4 adit-level. Development-work on the *Dixie* claim included 200 feet of surface-trenching, 51 feet of sinking, and 26 feet of drifting. Development-work in the main part of the mine included 2,375 feet of drifting, 381 feet of crosscutting, 519 feet of raising, and 1,405 feet of diamond-drilling. The tonnage mined and milled was 48,238 tons, from which bullion yielding 19,421 oz. of gold and 6,307 oz. of silver was obtained.

Gold Belt.—Situated on Sheep Creek and operated by the Gold Belt Mining Company, Limited, with H. E. Doelle as manager, Mike O'Donnell as mine superintendent, and O. Bellavance as mill superintendent. Development-work with a crew of forty men, twenty-one of which were employed underground, was in progress until June, when the construction of an 150-ton mill was commenced. This necessitated increasing the surface crew to about sixty men. The mill was put in operation near the end of October, after which a total of ninety men was employed with about forty-five working underground. Development-work included a raise from the 2,100 to the 1,580 level, the completion of which established good natural ventilation in the mine. The total development footage was as follows: Drifting, 4,200 feet; crosscutting, 782 feet; and raising, 475 feet. A total of 9,844 tons of ore was mined and milled and the precipitate treated at the *Queen* mine. The bullion yielded 4,437 oz. of gold and 1,724 oz. of silver.

Reno.—Situated on Fawn Creek, and operated by the Reno Gold Mines, Limited. W. S. Ellis, manager; A. K. Olsen, mine foreman; and Albert Norcross, mill superintendent. The mine and mill were operated continuously throughout the year. An average crew of 120 men was employed with eighty working underground. Owing to the fact that development at depth on the *Reno* vein and on parallel veins to the north has not produced commercial ore the mill will be closed down when the available reserves are exhausted, possibly about the middle of February. An aggressive development campaign, commenced last summer, will be carried on after the conclusion of milling operations. A geological and geophysical survey, surface-trenching, and diamond-drilling programme was carried out last summer. Present development consists of underground work on the *Bluestone* vein in the Fawn Basin and the driving of the 4,900 crosscut. The portal of the 4,900 crosscut is just above the mill. It has as its objective the downward extension of the *Motherlode* and *Nugget* veins about 600 feet below the No. 5 level on the *Motherlode*. The possibility of exploring the entire favourable belt of quartzites on the *Reno* ground for parallel veins, from this tunnel, is being kept in mind. Development-work for the year included 574 feet of drifting on the *Bluestone* vein; 1,014 feet of crosscutting in the 4,900 crosscut; 13,390 feet of diamond-drilling as well as 2,385 feet of drifting; 300 feet of crosscutting, 505 feet of raising, and 38 feet of stations cut, and 218 feet of sinking, in the *Reno* mine proper. In addition, 1,700 feet of surface-trenching was completed. A total of 49,158 tons of ore was mined and milled, and bullion produced which yielded 19,897 oz. of gold and 6,987 oz. of silver.

Clubine-Comstock.—Situated on Boulder Creek, about 4 miles north of Salmo. Operated by the Clubine-Comstock Gold Mines, Limited. L. R. Clubine, manager. The mine was operated continuously throughout the year, twelve to fifteen men being employed with ten underground. Both compressed air and hand-steel were used. A total of 851 tons of ore was mined and shipped to the Trail smelter, yielding 649 oz. of gold and 80 oz. of silver.

Kootenay Ore Hill.—Located on Mount Vernon, about 3 miles from the *Queen* mine. This property is owned by the Kootenay Ore Hill Gold Mines, Limited. It was operated under lease by H. D. Forman, in conjunction with the adjoining *Summit* group, from

February until May. The ore mined was treated in the small 10-ton mill on the property and concentrates shipped to Trail. No development-work was done. An average of twelve men was employed with five underground. The tonnage mined yielded 1,019 oz. of gold, 1,026 oz. of silver, 45,848 lb. of lead, and 45,168 lb. of zinc.

Nugget.—This property, which adjoins the *Motherlode*, is controlled by the Reno Gold Mines, Limited. It was operated for several months of the year by two leasers, who mined 350 tons of ore which yielded 232 oz. of gold and 126 oz. of silver. The ore was shipped crude to Trail.

Erie Creek Area.

Arlington.—Situated on Keystone Mountain. Owned by the Relief-Arlington Mines, Limited, and operated under lease by Roger Oscarson, of Spokane, Wash. Nine men were employed continuously throughout the year, six working underground. All work was done by hand-steel and the ore shipped crude to Trail. Development-work included 693 feet of drifting and crosscutting, and reopening of an old working for a distance of 90 feet. In addition, there was a total of 10,375 feet of new road built. A total of 972 tons of ore was mined, which yielded 1,345 oz. of gold, 2,940 oz. of silver, 51,394 lb. of lead, and 49,471 lb. of zinc.

Harriet.—Situated on the East Fork of Erie Creek, about 3 miles from the road to the *Second Relief* mine. Owned by E. Ballanger, of Salmo. Four men were employed underground for the greater part of the year. All work was done by hand and the ore shipped to Trail. A total of 40 tons yielded 145 oz. of gold and 18 oz. silver.

Second Relief.—Situated on Erie Creek, about 13 miles by road from Erie, B.C. Operated by the Relief-Arlington Mines, Limited. S. M. Manning, manager; Walter Tattrie, mine foreman; and Gus Kvist, mill superintendent. The mine and mill operated continuously throughout the year, an average of 100 men being employed with fifty underground. During the year the main shaft was sunk another level and considerable work done on the showings on the west side of Erie Creek. Development-work on the main vein included 245 feet of surface-trenching, 1,743 feet of drifting, 655 feet of crosscutting, 477 feet of raising, 189 feet of sinking, and 353 feet of diamond-drilling. On the showings to the west of the creek 1,406 feet of trenching was done by hand and 4,290 feet of stripping was done by bulldozer, as well as 1,689 feet of drifting, 176 feet of crosscutting, and 766 feet of diamond-drilling. A private townsite, on which about twenty dwellings were built last year, is located about a mile below the mine. The total ore mined and milled amounted to 45,918 tons, which yielded bullion carrying 12,229 oz. of gold and 2,651 oz. of silver. In addition refinery slag and amalgam yielded 115 oz. of gold and 1,082 oz. of silver.

Nelway Area.

Bunker Hill.—Situated on 16-Mile Creek, about 7 miles east of Nelway. Operated under lease by the Westmont Mines, Incorporated; H. R. Stayton, of Trail, B.C., manager. Operations employing nine men with six underground were commenced in October. A total of 74 tons of ore was mined and shipped to Trail, which yielded 5 oz. of gold and 76 oz. of silver.

Rosebud Lake Area.*

Lone Silver.—Operated during the past season by the Lone Silver Gold Mines, Limited, of Vancouver, haphazard development added little information of apparent value to that already published in the Minister of Mines Report for 1936.

Arrow Lakes Area.

Paladora (Meadowview).—Situated 30 miles east of Edgewood, on the Vernon–Edgewood Road. Operated under lease by S. P. Pond, of Nelson, B.C. Four men were employed underground from July to October. Development-work consisted of 20 feet of crosscutting. A total of 50 tons of ore was mined and shipped to Trail, which yielded 19 oz. of gold and 93 oz. of silver.

Big Cayuse.—Situated on Cayuse Creek, about 9 miles from Deer Park. Owned and operated by Joe Gallo and partners. Two men were employed on surface and underground work. This included the building of 2¾ miles of foot-trail, a cabin, and 30 feet of drifting underground.

* By R. J. Maconachie.

Vicinity of Retallack.

Highland Surprise.—Situated on Lyle Creek, about 3 miles from Retallack. Operated by Joe Gallo, of Nelson, who undertook an active development campaign. A good raw-hide trail was built from the end of the road to the camp, a distance of about three-quarters of a mile, the bunk-house was reconstructed to accommodate twelve to fifteen men, and a cook-house and dry-house built. A crew ranging from seven men with three underground in August to fifteen men with six underground in November was employed; supplies were hauled in the late fall and preparations made for continuing the operation all winter. Development-work included 200 feet of surface-trenching, 220 feet of drifting, and 80 feet of crosscutting. A total of 295 tons of ore was mined and shipped to Trail, which yielded 278 oz. of gold and 191 oz. of silver.

Eureka.—Situated about 3 miles east of the *Highland Surprise* and operated for a short time by Roy Wallace, of Walla Walla, Wash. About 3 miles of a truck-road, connecting this property with the *Highland Surprise* road, was built last summer. A total of 15 tons of ore was mined, yielding 10 oz. of gold and 4 oz. of silver.

Rossland-Trail Area.

Properties of the Consolidated Mining and Smelting Co. of Canada, Ltd.—The *War Eagle, Le Roi, Josie, Centre Star,* and *Columbia* and *Kootenay* were operated by lessees under arrangements made by the Company in 1933. In all there were twenty-four separate leases in which a total of sixty-four men were engaged in mining ore in surface and underground operations. The work was carried on under the supervision of J. K. Cram. The total tonnage shipped to the Trail smelter was 9,633 tons; this yielded 6,807 oz. of gold and 7,994 oz. of silver.

Velvet.—Situated on Sophie Mountain, on the Cascade Highway, 13 miles east of Rossland. Operated by the Velgo Mining, Incorporated, of Spokane; H. W. Seamon, manager. A development programme which entailed raising from the No. 8 level adit-crosscut to the old No. 6 level and thereby dewatering the workings from the shaft for examination and sampling was completed. Late in the year a lease was taken on the property by R. Bielli and associates of Rossland, who shipped a small tonnage to Trail.

I.X.L.—Situated on Mount Roberts. Operated by the I.X.L. lessors, of Rossland, B.C., K. Jorgensen, manager. Six men with two working underground were employed throughout the year. A total of 150 tons shipped to the Trail smelter yielded 393 oz. of gold and 92 oz. of silver.

Midnight.—Situated on Mount Roberts. Owned by Mrs. Laura Gilmour, of Rossland, B.C., and operated under lease by D. A. Lins. From three to five men, with two to four underground, were engaged in this work throughout the year. A total of 265 tons of ore was mined and shipped to the Trail smelter, which yielded 991 oz. of gold and 254 oz. of silver.

O.K.—Located on Mount Roberts. Operated under lease by L. and C. Penny for a short time early in the year. A total of 39 tons of ore was mined and shipped to the Trail smelter, which yielded 18 oz. of gold and 22 oz. of silver.

Gold Drip.—Located on Mount Roberts. Owned by Mrs. M. D. McKinnon, of Beverley Hills, California, and operated under lease by C. A. Ritchie and partner for the first half of the year. A total of 19 tons was mined and shipped to the Trail smelter, which yielded 3 oz. of gold and 6 oz. of silver.

Georgia Group and Mascot.—Situated on Monte Cristo, near Rossland. Operated by the Gold Cup Mining Company, under the direction of R. W. Haggen, of Rossland. Nine men, three underground, were employed throughout the year in a development programme which included 800 feet of surface-trenching, 180 feet of drifting, 180 feet of crosscutting, and 1,700 feet of diamond-drilling. In addition a geophysical survey was made of the property.

Bayonne Area.

Bayonne.—Situated on Summit Creek, 23 miles by road from Tye Siding. Operated by the Bayonne Consolidated Mines, Limited; head office, Vancouver, B.C.; P. N. Pitcher, mine

manager; Jack Ratledge, mine foreman; and O. Bellavance, mill superintendent. The mine and mill operated continuously throughout the year with an average crew of eighty-one men, forty-three of whom were employed underground. According to the company officials, development-work has failed to disclose commercial ore and in their opinion, no further work is justified. Present ore reserves will be exhausted about the end of the year when the mine and mill will be closed. Development-work included 1,719 feet of drifting and crosscutting, 642 feet of raising, and 2,847 feet of diamond-drilling. A total of 19,298 tons of ore was mined and milled, from which bullion yielding 10,289 oz. of gold and 35,638 oz. of silver was recovered.

Spokane Group.—Situated on Wall Mountain, about 18 miles from Tye. Owned and operated by R. M. and K. K. Laib, of Bayonne, B.C. A small amount of work was done this year by the owners. A total of 79 tons of ore shipped to the Trail smelter yielded 61 oz. of gold, 1,051 oz. of silver, and 28,299 lb. of lead.

Virginia.—Situated on the Bayonne Road, near Arkansas Lake. Owned by J. Mulholland and operated under lease by D. Masciangelo and three partners. Development-work included 200 feet of drifting. A total of 20 tons of ore was mined by hand-steel and shipped to Trail. This yielded 10 oz. of gold and 16 oz. of silver.

Springer Creek (near Slocan City).

Lakeview.—Situated on the Springer Creek road, about 2 miles from Slocan City. Owned by P. Johnson and operated under lease by Mike Negovan and R. Bassic. Ninety-six and a quarter tons of ore was mined by hand-steel and shipped to the Trail smelter. This yielded 26 oz. of gold and 517 oz. of silver.

SILVER-GOLD DEPOSITS.

Slocan Lake Area.

Molly Hughes.—Situated on the shore of Slocan Lake, about 1 mile above New Denver. Operated by the Slocan Idaho Mines Corporation, Spokane, Washington, under the direction of O. C. Born. A total of eleven men with six underground was employed for the greater part of the year. Development included 142 feet of drifting and 40 feet of crosscutting, all on the No. 4 level. A total of 137 tons of ore was mined and shipped to Trail, which yielded 57 oz. of gold, 14,165 oz. of silver, 5,236 lb. of lead, and 5,753 lb. of zinc.

McAllister.—Situated on London Mountain, about 3 miles from Three Forks. Owned by the Slocan Silver Mines, Limited, and operated under lease by George Allen. Ten men, with six underground, were employed during the greater part of the year. Compressed air developed from water-power was used to mine ore. A total of 1,534 tons was shipped to Trail, which yielded 13 oz. of gold and 38,743 oz. of silver.

GOLD-SILVER-LEAD-ZINC DEPOSITS.

Ymir Camp.

Howard.—Situated on the South Fork of Porcupine Creek. Operated by the Durango Mines, Limited, Vancouver. Major A. W. Davis, who resigned as manager, was succeeded by A. M. Richmond; A. McIntyre was mine foreman, and Wm. B. Donohue mill superintendent. An average of sixty-five men, with thirty-two underground and seven in the mill, was employed from the beginning of the year until November 5th, when the property was closed down. According to the management the development-work undertaken was not successful in finding commercial ore and the mine reverted to the original vendor, Mr. J. F. Duthie, of Seattle. The mill and greater part of the 5-mile tram remain the property of the Durango Mines, Limited. Development-work included 115 feet of drifting, 266 feet of crosscutting, 599 feet of raising, and 2,621 feet of diamond-drilling. In addition a geophysical survey was made on the property.

Porcupine Group.—Situated on Porcupine Creek, about 3 miles from Ymir. Owned by E. Haukedahl and associates, of Ymir, B.C., and optioned to Ernest H. Carlson, Spokane, Washington. A small blacksmith-shop and 275 feet of drifting was done during the year.

Vicinity of Salmo.

Emerald.—Situated on Iron Mountain, about 4 miles from Sheep Creek. Operated by the Iron Mountain, Limited; head office, San Francisco, California; Harold Lakes, of Nelson, manager. A programme of surface-stripping by bulldozer in which 6,234 lineal feet of work was done was followed by underground work with hand-steel. About 35 feet of tunnel was driven; three men were employed.

SILVER-LEAD DEPOSITS.

Ainsworth Camp.

Revenue.—Situated near the head of Sturgis Creek, a tributary of Keen Creek. Owned by the Sturgis Creek Mines, Limited, of Calgary, Alta., and operated under lease by H. E. Singel and one man. The old workings are badly caved and require considerable repair-work and retimbering before underground work can be done. A total of 38 tons of ore was shipped, chiefly from an old dump, which yielded 1,796 oz. of silver, 10,092 lb. of lead, and 3,956 lb. of zinc.

Utica.—Located on Paddy's Peak. Owned by the Utica Mines, Limited, and operated for about six weeks on a contract basis by R. Rowe, of Nelson, B.C. Five men, three underground, were employed during that time. The stoping-ground is some 2,400 feet from the portal of the low-level adit and a fairly efficient mechanical ventilation system has been installed. Hydro and Diesel power are used.

Caledonia.—George McCready operated this property for thirteen days during the year.

Sandon-Three Forks Area.

Monitor.—Situated on Carpenter Creek, about 3 miles from Three Forks. Operated by the Slocan Monitor Silver Mines, Limited; Harold Lakes, manager; W. Postelwaite, mine foreman. A bunk-house and cook-house, to accommodate ten men, and an office were built, and a portable gasoline-driven compressor installed. During the first half of the year fifteen men were employed, ten of these working underground. The ground is very soft and requires close timbering. Development-work included 816 feet of drifting and crosscutting, 133 feet of raising, and 336 feet of diamond-drilling. A total of 46 tons of ore was mined and shipped to Trail, which yielded 4,646 oz. of silver and 29,041 lb. of lead.

Silver Ridge.—Situated on the Silver Ridge road, near Sandon. Operated under lease by Clarence Cunningham, who employed two men underground. A total of 21 tons of ore was mined by hand-steel, which yielded 1,850 oz. of silver and 21,373 lb. of lead.

Victor.—Situated about 3 miles from Sandon. Owned by Mrs. D. Petty, of Nelson, and operated by E. Doney and son. A total of 78 tons of ore, mined and shipped to Trail, yielded 17,472 oz. of silver, 57,261 lb. of lead, and 27,207 lb. of zinc.

Slocan Lake Area.

Bosun.—Situated on Slocan Lake, near New Denver. Owned by C. J. Campbell and operated under lease by Louis Vigna and Mike Zatoni, with Thomas Avison, of New Denver, in charge. A total of 92 tons of ore was mined and shipped to Trail from the Lake level tunnel.

Standard.—Situated on Emily Creek, about 2 miles from Silverton. Controlled and operated by the Western Exploration Company, Limited; A. M. Ham, manager; and Charles Hanna, mine foreman. An active development campaign was carried on until August, when the mine was closed down, awaiting a period of better metal prices. According to the management a substantial tonnage of new ore was blocked out between the No. 7-C and No. 7-B levels. The number of men employed varied between thirty-two, with fifteen underground in the early part of the year, to fifteen, with eight underground, during the latter part of the development programme. This programme included the cleaning-out and retimbering, where necessary to make safe and accessible, some 4,520 feet of old workings, as well as new work consisting of 687 feet of drifting, 96 feet of crosscutting, 202 feet of raising, and 2,200 feet of diamond-drilling. Included in the repair-work was the retimbering of the main raise from the No. 6 to the No. 5 level and reconditioning 2,600 feet of the No. 5 level to provide ventilation and a second exit from the mine. The remainder of the work, old and new,

was done on Nos. 6, 7-C, and 7-B levels. Mechanical ventilation was found to be necessary and was installed on No. 6 level. In addition a new truck-road was built to connect the bins at the No. 7-C portal to the main *Standard* road.

Hewitt.—Situated on Red Mountain, near Silverton, B.C. Owned by the Galena Farm Consolidated Mines, Limited, and operated under lease by George Mathews, Jack Harding, and George Hegberg, all of Silverton, B.C. A total of 147 tons of ore was mined and shipped to Trail, which yielded 13,587 oz. of silver, 50,636 lb. of lead, and 34,446 lb. of zinc.

Capella.—Situated on Goat Mountain, near New Denver. Owned by the Wells estate and operated under lease by Emile Bettle and Charles Stedile. A raw-hide trail was built from the mine to the road near New Denver, a distance of about 1 mile. A total of 9 tons of ore was mined and shipped to Trail, which yielded 2,401 oz. of silver, 305 lb. of lead, and 100 lb. of zinc.

Lardeau Area.

True Fissure.—Situated on Great Northern Mountain, about 3⅓ miles by road from Ferguson. Operated by the New True Fissure Mining and Milling Company, Limited; head office, Canada Trust Building, Windsor, Ontario. K. G. Gillie, manager. Operations were suspended until November, when a contract to do 1,500 feet of drifting with additional crosscutting on the No. 3 level was let to the Interior Construction Company, of Penticton, B.C.

Vicinity of Albert Canyon.

Regal Silver.—Situated on Clabon Creek, about 11 miles from Albert Canyon. Operated by A. S. McCullough, Vancouver, B.C., and associates. E. C. Lansing, manager. The mine operated during June, July, and August, during which time twenty men were employed with eleven underground. Some experimental work toward making a marketable tungsten concentrate was done in the small underground mill of about 25 tons daily capacity.

Nelway Area.

Reeves-McDonald.—Situated on the Pend d'Oreille River, about 5 miles from Nelway. Operated by the Reeves-McDonald Mines, Limited. B. N. Murphy, mine manager. During the first four months of the year development-work employing fourteen men, six of whom worked underground, was carried on in the River tunnel, and 270 feet of drifting and 62 feet of crosscutting accomplished. During the next three months, 1,297 feet of diamond-drilling was done from various points near the face of this tunnel. The River tunnel is now over 1 mile long without a second opening to the surface and the present ventilation equipment is taxed to capacity.

SILVER-LEAD-ZINC DEPOSITS.

BY

H. E. Miard.

Cranbrook Area.

Sullivan Mine.—Owned and operated by the Consolidated Mining and Smelting Company of Canada, Limited. General superintendent, William Lindsay; assistant mine superintendents, Jos. R. Giegerich and L. D. Thompson; mill superintendent, H. R. Banks. The enviable record established by this gigantic operation, in several respects, was maintained during the year. The output averaged 7,600 tons per working day and the development-work done comprised 3,718 feet of drifting, 721 feet of crosscutting, 5,047 feet of raising, and 58 feet of sinking. Filling operations were resumed in the spring and were carried on as long as the weather remained favourable, 436,420 cubic yards of gravel being placed in stopes in that time. It is intended to start this work again early in the current year, possibly with some improvements on the present method based on the experience gained.

Exploration of the ground surrounding the present workings continued and an aggregate length of 10,615 feet of diamond-drilling was done in the course of the year.

The number of men on the pay-roll varied within limits in the course of the year, the average being 552 underground and 555 on the surface (264 of the latter representing those employed at the concentrator), or a total of 1,107.

Ventilation and dust-control have very rightly been considered of sufficient importance to be placed under the administration of a special department, in charge of an engineer who devotes all his time to the study of these vital matters. Generally, the ventilation is ample and well managed. In the 3,901 shaft the circulation still depends upon auxiliary fans and sheet-metal pipes, an installation which it has been found advisable to reinforce lately, but the intended immediate driving of a raise, from the 3,350 at the 3,900 level will place this section, at least in part, into the main ventilating circuit.

St. Eugene Extension.—Owned by the St. Eugene Extension Mines, Limited. Little was done on this property, situated on Moyie Lake, beyond a thorough mineralogical and geological examination after the dewatering of the workings was completed early in the year. All activities were suspended at the beginning of March, but it is understood that exploratory and development work is to be resumed there again shortly.

PLACER-GOLD DEPOSITS.

Pend d'Oreille River.

Several small operations conducted by one or two men were active along the river throughout the season.

Big Bend Area, North of Revelstoke.

Hail Columbia Placer.—Situated on the Big Bend highway, 62 miles north of Revelstoke. Owned and operated by Alex McCrae and sons, of Revelstoke. Ground-sluicing by booming methods is practised, as the supply of water is limited. An ingenious winch, operated by a water-wheel, is used for removing large boulders.

Camp Creek Placers.—Situated on the Big Bend highway, 59 miles north of Revelstoke. Operated by the Camp Creek Placers, Limited. K. G. McKenzie, manager. A crew of six men was employed during the placer season. Gravel was moved through the sluices by two 3½-inch monitors for which there was ample water available. A new type of rubber riffle was used in the sluices and claimed by the management to be very satisfactory.

Lemon Creek Area.

Lemon Creek Lease.—Situated on Lemon Creek, about half a mile above the Slocan highway. Five partners—Clarence Bond, C. Strike, J. Ingram, George Boder, and Ole Gullickson—operated this lease for a short time during the summer. The many large boulders encountered made the work very difficult and unprofitable. A total of 10 oz. of gold was produced.

Cranbrook Area.

Inca Placers.—On the Moyie River. Operated by the Consolidated Mining and Smelting Company of Canada, Limited. An average crew of eleven men was employed from April 15th to November 9th under the direction of W. F. Marleau. A total of 60,000 cubic yards of gravel was handled in sluices with the help of a power-shovel, and 474 oz. of gold was recovered.

NON-METALLIC DEPOSITS.

Vicinity of Nelson.

Kootenay Lake Limestone Quarry.—This property, owned and operated by the Consolidated Mining and Smelting Company of Canada, Limited, was closed down in April following a fire which destroyed the blacksmith-shop and compressor-house.

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VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

2,825-339-8593

The Annual Report of the Minister of Mines is now issued in parts as follows:—

Part A.—The Mining Industry (Statistical Review). John P. Walker.

Part B.—North-western District. Joseph T. Mandy.

Part C.—North-eastern District. Douglas Lay.

Part D.—South Central District. M. S. Hedley.

Part E.—South-eastern District. R. J. Maconachie.

Part F.—South-western District. H. Sargent.

Part G.—Inspection of Mines. James Dickson.

PART F

ANNUAL REPORT

OF THE

MINISTER OF MINES

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDED 31ST DECEMBER

1938

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

BRITISH COLUMBIA DEPARTMENT OF MINES.

VICTORIA, B.C.

Hon. W. J. ASSELSTINE, *Minister.*

JOHN F. WALKER, *Deputy Minister.*

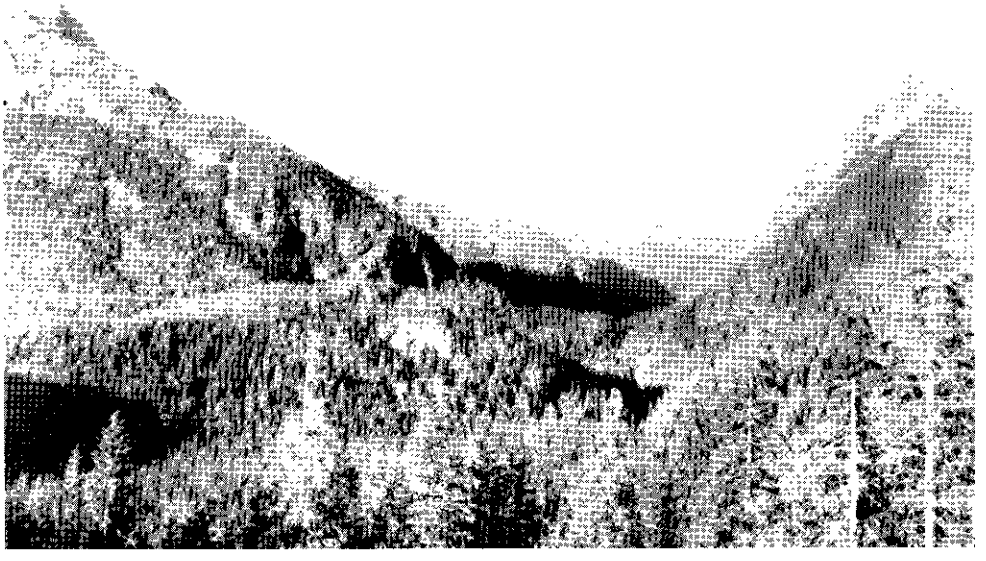
JAMES DICKSON, *Chief Inspector of Mines.*

D. E. WHITTAKER, *Chief Analyst and Assayer.*

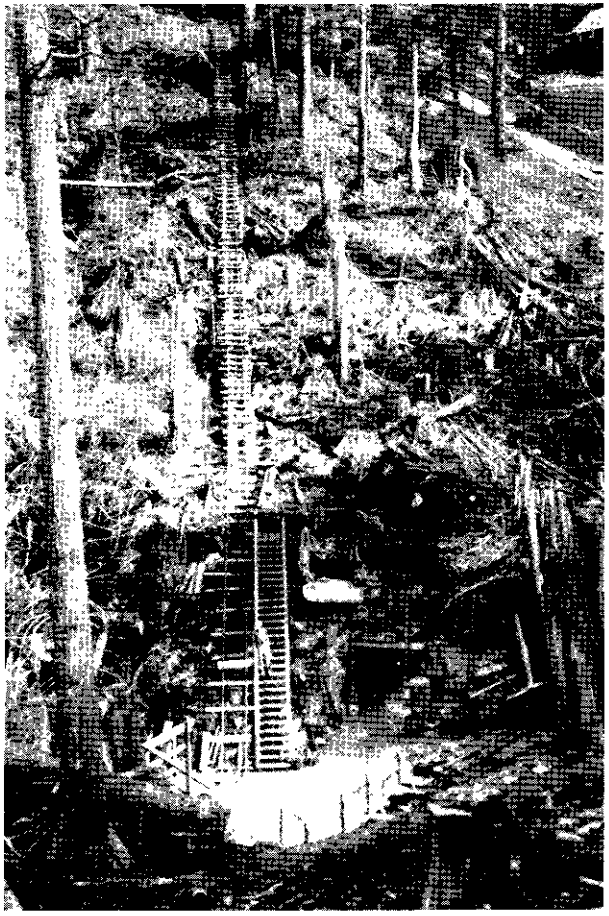
P. B. FREELAND, *Chief Mining Engineer.*

R. J. STEENSON, *Chief Gold Commissioner.*

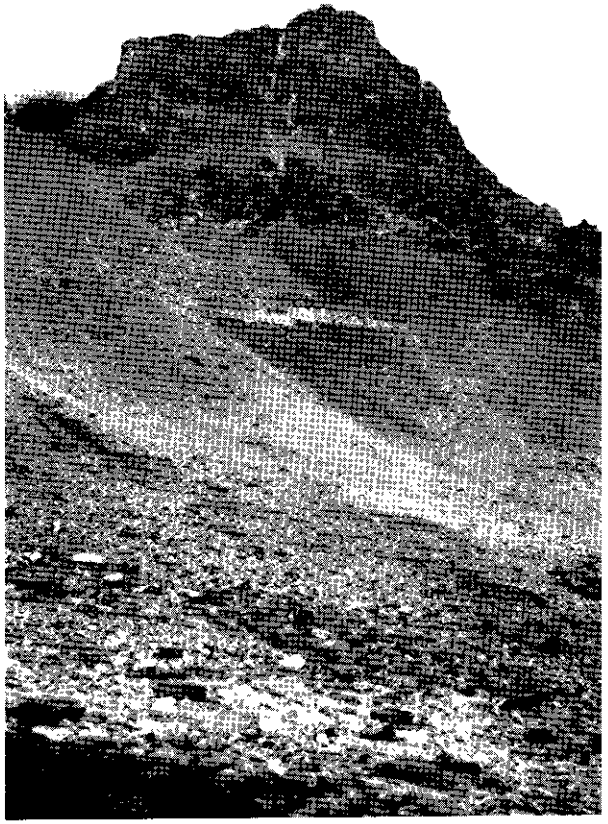
Blackhorn Mountain and glacier at head of Razor (Wolverine) Creek.



View north-east up Blind River, towards Zeballos Lake, from Central Zeballos property.



Surface incline from portal of 1,100-foot adit at Privateer Mine.



Dykes in bluff north-west of Homathko Gold Mines camp.

PART F.

SOUTH-WESTERN DISTRICT.

BY

H. SARGENT.

SUMMARY.

During 1938 prospectors and mining companies have paid a great deal of attention to gold-bearing veins on Vancouver Island, particularly in the Zeballos section and in some other localities tributary to the west coast. Production, which had been limited to shipping crude ore, was extended to milling when mills were provided during the latter part of the year for the *Privateer*, *Goldfield*, and *Rey Oro* properties. There was also activity elsewhere on Vancouver Island and at some points on the Mainland coast and adjacent islands. On the Mainland, producing mines were the *Ashloo*, *Britannia*, *Bralorne*, and *Pioneer* properties, with a new producer in the Empire Mercury Company. A small retorting plant was erected on the property of Empire Mercury Mines, Limited, and some mercury produced before the end of the year. Mercury production is a new departure in the Province. The scale of operations at the *Britannia* mine established a new record, and gold produced at the *Bralorne* mine exceeded the output of any previous year. Although the spectacular developments in the Zeballos area have attracted attention to that locality, prospectors were active in various other sections of the South-western District.

During the major part of the field season the writer was ably assisted by Edwin P. Williams. The co-operation of prospectors and mine officials and their numerous courtesies are gratefully acknowledged.

LODE DEPOSITS.

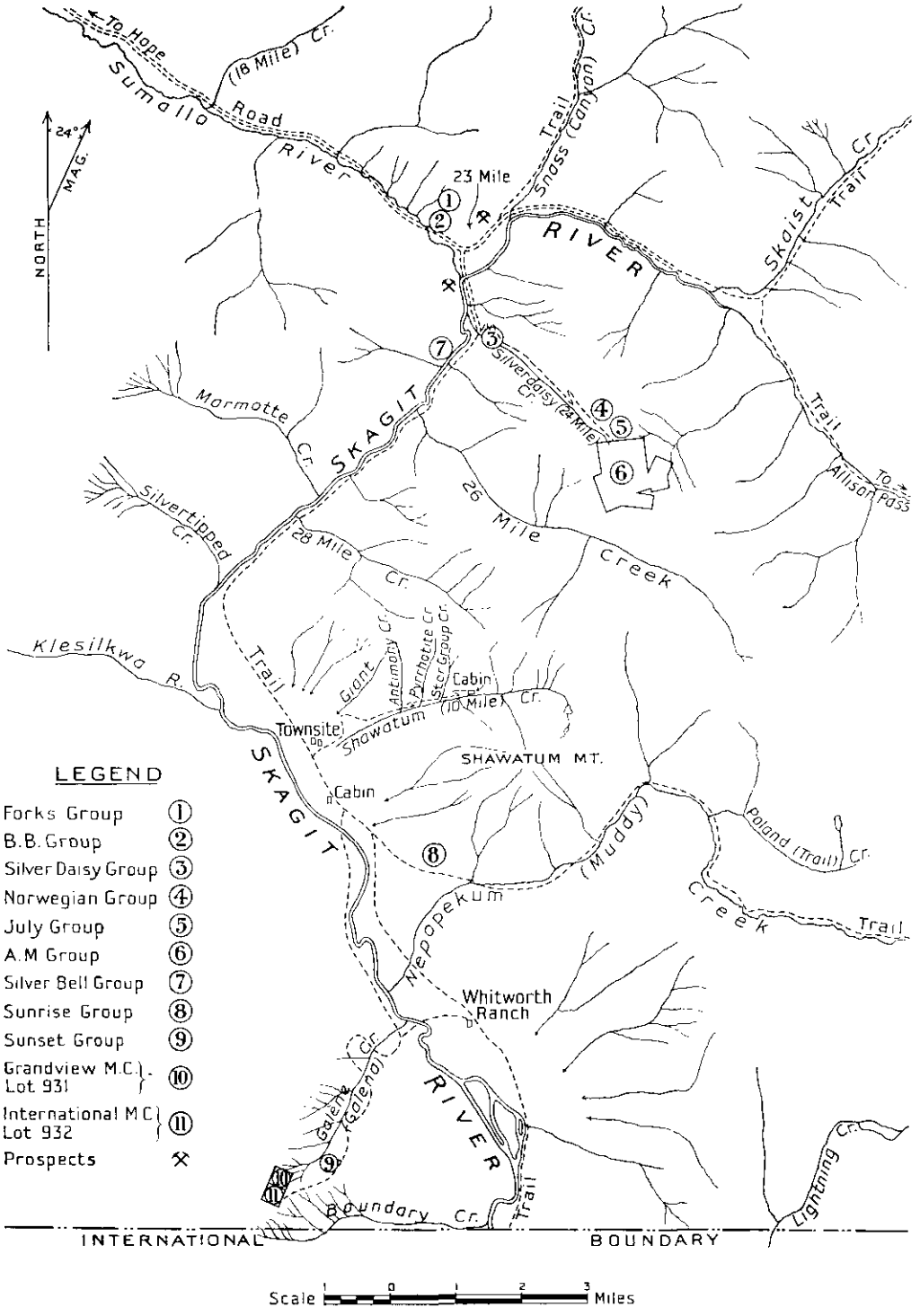
SKAGIT RIVER AREA.

Veins carrying values principally in silver and lead, and in some cases in gold and copper, and replacement deposits carrying values in one or more of the metals gold, silver, copper, lead, and zinc, occur within the Skagit River drainage basin in British Columbia. This report includes descriptions of various occurrences and general references to the area in which they occur, and is accordingly entitled " Skagit River Area," although a considerable part of the Skagit drainage basin in British Columbia lies outside the area covered by this report. The approximate positions of several occurrences have been indicated on the accompanying map of the area.

The Skagit River in British Columbia lies within the Cascade Mountain system. The main stream and the tributaries occupy deeply cut valleys in what has been described as an uplifted plateau, which stream erosion and glaciation have carved into rugged mountains. The valley of the upper Skagit is rather narrow with steep sides. The Sumallo River enters the Skagit from the west in the northern part of the area. The walls of the Sumallo Valley and the western wall of the Skagit Valley south of the junction are precipitous. The valley of the eastward-flowing Klesilkwa River is broader, and southward from the junction of the Klesilkwa with the Skagit the main valley is of fair width. In this section also the valley walls rise steeply.

Total relief in the area, measured between the main valley at the International Boundary, 1,650 feet in elevation, and the highest peaks which are between 7,200 and 7,300 feet elevation, is about 5,600 feet. The elevation of the floor of the main valley at the junction of the Sumallo and Skagit Rivers is between 2,000 and 2,100 feet. A number of the tributaries which enter the valley, south of the junction of the Klesilkwa with the Skagit, are streams of considerable volume up to the points where the tributary valleys enter the main valley. At these points the streams disappear, the water probably finds its way to the main channel through loose sub-surface material with which the main valley is presumed to be filled.

The climate of the area is drier than that of the western slopes of the Cascade Mountains. Tree-growth is heavy; pines are more prevalent than on the western slopes, but



Skagit River Area.

a good deal of cedar grows in the main valley. So far as the writer knows no lumbering operations have been carried on in the area, though there appear to be considerable stands of timber. Fire and snowslides in parts of the area have destroyed a good deal of timber, some of which has found its way into the river and its tributaries and has accumulated as large jams.

South of the junction with the Klesilkwa the main valley, ranging from 1,650 to 1,900 feet in elevation, averages more than a mile in width. This includes low benches on which considerable areas are overgrown with rhododendrons; elsewhere the growth is principally of small pines. The benches are in part of gravel but seem to have a fair cover of light soil in other sections. Doubtless the valley-bottom and the low benches contain land which would be suitable for cultivation, though irrigation might be necessary. There have been several attempts at ranching which have been discontinued, probably largely owing to the lack of transportation, there being no local market. In the past few years part of the valley has been tested for placer by Keystone-drilling, the results of which are not known to the writer. Present activity in the area is related to prospecting and development of prospects, and to trapping.

Access is most convenient by way of the road from Hope, which follows up the valley of the Nicolum, over a divide and down the Sumallo River to a point 23 miles by road from Hope, near the junction of the Sumallo and Skagit Rivers. A number of prospects are in this vicinity, which has been called the 23-Mile Camp. From 23-Mile, the road continues about 4 miles to Skagit Bluffs. This has been designated as the western end of the Hope–Princeton Highway, of which the projected route continues to Allison Pass at the head of the Skagit River. It is understood that there remains about 12 miles of the projected highway, including Allison Pass and the approach from both sides, on which no work has been done. From 23-Mile a rough road, passable for trucks in dry weather, continues southward down the eastern side to Silver Daisy (24-Mile) Creek, about 1¼ miles from 23-Mile. From this point a trail continues down the east side to the International Boundary. From a crossing about 13 miles southward of Silver Daisy Creek there is also a trail (in poor repair) that runs southward along the west side to Galena Creek. Access to the area is also possible by several trails in use in former years. From the trunk road and trails, branch trails serve various mining properties. Limited accommodation is available for travellers at W. H. Robinson's cabin on the road, 22 miles from Hope. The camps at various mining properties and cabins in the main valley afford shelter at convenient points. C. J. Howlett has a cabin about at the site of the old Steamboat townsite, south of 10-Mile Creek, or 12½ miles by trail from the end of the road at Silver Daisy Creek.

It is perhaps well at this point to attempt to clear up confusion regarding certain stream names. The confusion is principally confined to a part of the area lying north-east and east of 23-Mile, and is due to differences between local and official names and to the fact that there have been some differences in the names which appear on various official maps. On the map accompanying this report the river flowing north-westward to the mouth of its tributary, the Snass, and thence south-westward, is called Skagit River, in accordance with Department of Lands Maps Nos. 6-C and 86.

Locally, the Skagit above the Skaist has been called Cedar Creek, and the Skaist, with the main stream as far as the junction with the Sumallo, has been called the Skaist; this usage reserved the name Skagit for the main stream below the mouth of the Sumallo. Unfortunately this confusion has found its way into some of the published reports.

The area covered by the accompanying map includes parts of two sections, mapped geologically by Cairnes in 1922 and 1923. An intervening north-westward-trending belt, averaging between 3 and 4 miles in width, was not mapped by Cairnes. This belt extends from one side of the area to the other, and crosses the Skagit River between points somewhat south of 24-Mile Creek and somewhat south of 28-Mile Creek. The geology of most of the area was mapped by Camsell, whose report and map appear in the Summary Report of the Geological Survey, Canada, for 1911. Cairnes' maps and reports appear in the Summary Reports of the Geological Survey, Canada, 1922, Part A, and 1923, Part A. Though on a smaller scale, the mapping by Cairnes was done in greater detail than that by Camsell. In the season of 1937 mapping was again undertaken in the area.

This work, by W. E. Snow, included the more detailed mapping of the belt not mapped by Cairnes. The results of Snow's work have not yet been published. Geological mapping of a narrow strip along the International Boundary is covered by sheets 14 and 15, respectively "Hozameen Range" and "Skagit Range," published in Memoir 38 of the Geological Survey, Canada, in 1912.

Based on Cairnes' mapping, supplemented by the mapping by Camsell, it may be said that the area included in the map accompanying this report is principally underlain by two series of rocks into which there are some later intrusives. These series are the Hozameen of Palæozoic age and the Dewdney of Jurassic and possibly Lower Cretaceous age. The north-east corner of the area is underlain by Cretaceous sediments, younger than and lying east of the Dewdney series. The contact which strikes somewhat west of north was stated by Cairnes to be probably a faulted one. In the south-west corner of the area the geological maps indicate Skagit volcanics of Oligocene age.

The boundary between the Hozameen series to the west and the Dewdney series to the east is shown in the northern and southern sections mapped by Cairnes in 1922 and 1923 respectively. In the northern section the boundary trends about south 30 degrees east to the point where it crosses the Skagit not far below the mouth of the Snass, from which point it continues roughly due south to the southern limit of mapping about 1½ miles south of 24-Mile Creek. In the area covered by the map herewith the northern limit of Cairnes' 1923 mapping crosses the Skagit about a mile below the mouth of 28-Mile Creek, from which point it runs roughly south 65 degrees east but does not follow a straight line. In this section the contact between the Hozameen and Dewdney series is shown extending about due south from the northern to the southern limit of mapping; that is, from a point roughly 6 miles east of the Skagit River, just east of a marked bend in Nepopekum Creek, to a point approximately 1½ miles from the International Boundary. It appears that the belt not mapped by Cairnes must be underlain principally by rocks of the Hozameen and Dewdney series.

The Hozameen series, referred to the Pennsylvanian subdivision of the Carboniferous period, is the oldest series mapped in this area. Including the part assumed to be underlain by Hozameen series in the belt not mapped by Cairnes, the Hozameen series must underlie considerably more than half the area and contains the host-rock of a great many mineral deposits.

The following passages, descriptive of this series, are quoted from the 1922 Summary Report, Part A, Geological Survey, Canada: "The Carboniferous rocks occur chiefly in the basin of Sumallo River. They are continuous into Coquihalla area where they were referred to the Pennsylvanian period and correlated both with the Cache Creek rocks of Thompson Valley and with the Hozameen series at the International Boundary. They are composed of volcanic and sedimentary rocks. The volcanic members are chiefly dark green andesitic rocks referred to in a general way as greenstones. They consist dominantly of flow types, but include some pyroclastic beds. In part these rocks are massive and of those some, probably, represent later intrusions. A large proportion, however, of these greenstones exhibit some degree of schistosity and, in part, have a very slaty structure. The more deformed members show much alteration to chlorite and, in some cases, to sericite. The sediments include chert, slate, and limestone. The limestone occurs in small proportion compared with either the chert or slate, but is of economic importance in that the ore-deposits of the section are commonly associated with it. The siliceous material composing the chert was, probably, derived from a magmatic source associated with the volcanic extrusions, but the slates are composed of normal sedimentary detritus.

"Near igneous intrusions these older rocks are all metamorphosed in varying degrees. The limestone suffers the most complete change, and its identity may be completely obscured in the process. The cherty and slaty rocks may also be greatly altered in composition and appearance. Near the junction of Sumallo and Skagit Rivers, and alongside the Dewdney trail, outcrops of a peculiar mottled rock may be seen. This rock was originally a chert interbedded with thin layers of slate or argillite. It has been irregularly bleached by the near-by intrusion of quartz diorite, and recrystallized to form a much coarser-grained rock than that from which it was derived.

"These Carboniferous (Cache Creek) rocks have a general trend of north 30 to 40 degrees west; and, north of Sumallo River, dip at an average angle of 50 to 60 degrees to

the south-west. South of the river several dips in the reverse direction were observed. The structure, however, includes probably more than one major fold and is complicated by faulting, thrusting, and overturning to the north-east."

It is worthy of note that in 1922 Cairnes attributed the deposits of mineralized, metamorphosed limestone in this series to intrusive members of the series. This hypothesis was set forth as follows: ". . . the more massive hornblende andesite and diorite porphyrite rocks included with the greenstones of the Carboniferous rocks are, in part, intrusive and have effected the metamorphism and mineralization . . ."

The following quotation from Summary Report, 1923, Part A, Geological Survey, Canada, gives further information concerning the Hozameen rocks in the southern part of the area: "Little information of value could be obtained relative to the thickness of the series, owing to its excessive deformation and to the faulted or intrusive character of its contacts with later formations. In the present area the series, as a whole, has a general trend of north 35 degrees west and dips at an average angle of 73 degrees to the north-east. This structure, however, is complicated by faulting and thrusting and by the development of slaty and schistose structures."

The Dewdney series is next to the Hozameen in areal extent and lies east or north-east of the Hozameen series, the contact being a faulted one. Cairnes referred the series tentatively to the Upper Jurassic but possibly Lower Cretaceous and stated that it might prove to include members belonging to both periods. The following descriptive material quoted from Summary Report, 1922, Part A, Geological Survey, Canada, refers to this series in the northern part of the area: "The rocks included with the Dewdney series . . . form a belt about 5 miles wide extending across Skagit and Skaist Rivers in a general north 15 degrees west direction above the mouth of Canon Creek. This trend corresponds closely with the average strike of the series. The structure is, apparently, synclinal, complicated by minor folding and by much faulting. A large part of the series is thinly bedded in shades of brown and black and some distinctly slaty strata are included. Massive beds are also abundant and from these in particular and at a number of localities poorly preserved fossils were discovered. . . . In a general way the members of the Dewdney series . . . are notable under the microscope for their tuffaceous appearance, a characteristic obtaining even in those members which in the outcrop and hand specimen strongly resemble normal sediments. The coarser rocks are all highly feldspathic. Their constituents under the microscope include plagioclase of intermediate composition, a minor proportion of quartz grains, and abundant fragments of lava, the whole in an almost isotropic ashy ground-mass. The proportion of crystal to lithic fragments varies greatly and the ground-mass usually constitutes a large proportion of the slide, differing in this respect from the feldspathic greywackes and arkoses of the Lower Cretaceous. Occasional sills of hornblende lamprophyre were observed in this section."

In the southern section Cairnes mapped the largest intrusive, a tongue from the Chilliwack batholith, consisting chiefly of granodiorite, assigned to the Miocene period. The tongue averages a mile or more in width and, from a mile or so east of Galena Creek, trends about north 70 degrees west beyond the western margin of the accompanying map. The northern boundary of the intrusive is indicated near the mouth of Galena Creek, and within the area covered by the accompanying map the intrusive is bordered by rocks of the Hozameen series. In the northern section Cairnes mapped two bodies of quartz diorite of Cretaceous age. One extends about 3 miles northward from the junction of the Skagit and Sumallo Rivers and crosses the contact from the Hozameen into the Dewdney series. The width is indicated as a little more than half a mile at the south end, diminishing to perhaps a tenth of a mile at the north end. The other body is about 2 miles in length and reaches a maximum width of about 1 mile near the northern end. This body is almost entirely north of Silver Daisy Creek, with its centre line about 1¾ miles east of the Skagit River at the mouth of Silver Daisy Creek, and is entirely surrounded by rocks of the Dewdney series. Smaller bodies of granitic intrusives, which do not show on Cairnes' maps, occur at various points in the area; for example, on the slope north of 10-Mile Creek and near the *Sunset* group on Galena Creek.

At three points in the area dark green or almost black rocks, usually containing conspicuous silvery white scales, are known to occur. Several specimens were submitted for

laboratory study. The white scales were found to consist of closely packed clusters of secondary sericite. The specimens were found to consist almost entirely of olivine, or of olivine with serpentine, presumed to be derived from the olivine, and occasional grains of pyroxene. The rocks are accordingly much altered, ultra-basic ones, probably representing peridotite with segregations of dunite. At one point similar rock, lacking the white scales, appeared as dykes in the rock with the white scales. It was found to be a completely reconstituted rock, containing patchy aggregates of pyroxene and lime feldspar, the pyroxene replaces the feldspar. Fine grains of sulphides, consisting principally of pyrrhotite, are disseminated through the rocks. Several samples of typical material were assayed and found to contain from 0.2 to 0.4 per cent. nickel. These were from exposures north of 23-Mile on the *Forks* group and on a prospect lying to the east, indicated on the map, but not named.

The third point at which the altered peridotite was found is on the south slope of the ridge between 10-Mile and 28-Mile Creeks, more precisely in the basin at the head of the small creek marked as Star Group Creek. This material was not sampled. The two exposures north of 23-Mile are close to the indicated position of the faulted contact between the Hozameen and Dewdney series, but lie to the east and west respectively of the intrusive quartz diorite previously mentioned, which crosses the contact in this vicinity. It may be significant that the occurrence north of 10-Mile Creek would be at no great distance from the assumed position of the contact in the unmapped belt. The writer did not attempt to outline the extent of the altered peridotite in either locality. It was reported locally that this rock occurs over a large area north of 23-Mile Creek.

At numerous points in the Skagit River area there are occurrences of sulphide minerals, as vein and as replacement deposits, with the latter quantitatively much the greater. More detailed discussion of the types of occurrence and descriptions of particular deposits will be found later in this report under the two headings, "Replacement Deposits" and "Vein Deposits."

It is reported that placer gold in small quantity was found in the Skagit River in 1858. No serious attempts have been made to mine placer gold, though, as mentioned previously, some ground has been tested by Keystone-drilling in the past few years. In 1860 the Dewdney trail was constructed by the Royal Engineers; it follows the route of the present road from Hope as far as Snass Creek. This trail and the branch trail from 23-Mile down the Skagit River furnished the most convenient route to Ruby Creek, a tributary of the Skagit, in the State of Washington, on which some fairly rich placer-ground was discovered in 1879.

Known discoveries in the area covered by this report are of a considerably later period. The oldest known is covered by the *International* and *Grandview* claims, which were staked in 1906 and are now Crown grants in good standing. In the fall of 1910 two prospectors reported that they had discovered rich gold ore on Steamboat Mountain south of 10-Mile Creek. In the following winter a good deal of interest was promoted in the alleged discovery and money was raised to carry on exploration. Attention was thereby attracted to the district, and when the season opened in 1911 a great deal of prospecting was undertaken. This resulted in a number of discoveries, notably in the 23-Mile Camp and on the north side of 10-Mile Creek.

The reported discovery of rich gold ore on Steamboat Mountain proved to be fraudulent and the boom collapsed, leaving three townsites which are now marked by a little weathered lumber remaining at the sites.

From time to time there has been a fair amount of activity in the area. In the past few years activity has been largely centred at two recent discoveries in the north-eastern part of the area. The *A.M.* copper property, discovered in 1930, has had a great deal of exploratory work done on it by the Consolidated Mining and Smelting Company of Canada, Limited. The *Norwegian* group, discovered in 1933, with adjoining claims, has been the site of a good deal of development-work by the Invermay Annex Mining Company. Small shipments to smelters have been made from the *Rainbow*, the *Silver Daisy*, and the *Invermay Annex* property. The shipments from the latter two consisted of silver-lead ore from narrow veins

The Annual Reports of the Minister of Mines, British Columbia, and the reports of the Geological Survey, Canada, previously mentioned, contain reports and progress notes con-

cerning various properties in the area. Specific references to some of these will be found in the descriptions of certain properties later in this report.

Many of the properties in the area have been restaked several times, and as a result are referred to in the previous reports under several different names.

Claims in the area in good standing, held by location, number 130 or more. The stakings date from 1921 onward, and more than 100 date from 1930 or later. Though discoveries were made in 1930 and in more recent years, many of the recent recordings cover discoveries of considerably earlier date.

The writer spent from July 9th to 17th in the northern part of the area, returned for a brief visit to the *Invermay Annex* property in October, and spent from September 25th to October 4th in the southern part of the area. Visits were paid to most of the known occurrences and detailed examinations were made where warranted. These, supplemented by information from reports which have been mentioned, form the basis of the two following sections of the report. Only properties visited by the writer are described in the following notes.

For information concerning properties not described in this report the reader is referred to Annual Reports of the Minister of Mines, British Columbia, and to Geological Survey, Canada, Summary Reports, 1911, Part A; 1920, Part A; 1922, Part A; 1923, Part A.

Replacement Deposits.

Deposits of this type, in rocks of the Dewdney and the Hozameen series, are the most important occurrences known in the area. On the *A.M.* property in the Dewdney series, pyrite and chalcopyrite with quartz and calcite replace the matrix in a breccia bed. The mineralogy is comparatively simple; values are in copper, gold, and silver. In the Hozameen series sulphide mineralization occurs with quartz and calcite in metamorphosed limestone, and to some extent in siliceous sediments and in volcanic rocks. A considerable number of lime silicates are developed in the metamorphic rocks and with the sulphide replacement deposits; the occurrence of scheelite at the *Mammoth* deposit in the 23-Mile camp is worthy of note. A variety of sulphide minerals occurs in the replacement deposits and in related veins. The sulphides include pyrrhotite, sphalerite, pyrite, chalcopyrite, arsenopyrite, galena, stibnite, jamesonite or boulangerite, and probably grey copper.

The deposits in the Hozameen series may be divided into two types. One, with sulphide mineralization, consisting principally of pyrite, chalcopyrite, and sphalerite, with some arsenopyrite and galena, carries values in copper and silver. This type is represented by the *Silver Bell* and *Sunset* properties described in the following notes. In the other division sulphide mineralization consists of pyrrhotite with more or less sphalerite, chalcopyrite, arsenopyrite, and pyrite, and occasional galena. This mineralization is represented by deposits occurring north of 10-Mile Creek and described under "10-Mile Creek Section"; the silver content is very small; percentages of copper are lower, and gold values, though small, occur more consistently than in the first type.

In this area the average grade is low in all the replacement deposits on which work has been done. In the case of the *A.M.* group and of the first type of deposits in metamorphic limestone the grade is probably high enough to be attractive, provided sufficient tonnages can be proven to warrant large-scale operations. In the 23-Mile Camp, in addition to the *Silver Bell* group, which is described in the following notes, there are two other known occurrences, described in reports of the Minister of Mines, British Columbia, and in publications of the Geological Survey, Canada, under the names *Mammoth* and *Defiance.*

In the 10-Mile Creek section there are a great many known sulphide-replacement deposits carrying some values in gold in addition to copper and zinc. The close spacing of many exposures indicates that if some large replacement-bodies do not occur there must be a great many small bodies close together. These facts may be sufficient to warrant detailed geological mapping, and if the results were encouraging carefully directed exploration might be in order.

The limestone which is so important in connection with the replacement-bodies in the Hozameen series is very often so metamorphosed as to be difficult to recognize. The series has been greatly deformed and the limestone, probably originally present as more regular lenses, has been affected by the regional deformation, producing some very irregular bodies.

Daly refers to this feature of limestone in the Hozameen series observed near the boundary (Geological Survey, Canada, Memoir No. 38), as follows: ". . . Wherever seen, the beds are never continuous for more than a few hundred feet, but occur as pods or lenses from 30 to 40 feet thick in the middle and tapering off to nothing at each end. This form of limestone body is that often assumed when the rock-series in which it occurs has been subjected to powerful squeezing and rolling-out. The carbonate acted as if it were plastic, thinning here, thickening there, according as the lines of force were directed. The material pinched out at one point became accumulated in pods elsewhere . . ." This feature is obviously of importance in assessing the value of deposits in limestone in the Hozameen series, and in prospecting for such deposits.

A.M.

The claims *A.M. Nos. 1, 2, 3, 4, 5, 12,* and *13, August Fraction, August Nos. 2, 3, 4, 6,* and *7,* located in 1932; *Rex,* located in 1936; *Fall Nos. 1* and *2, M.L.A. Fraction,* and *Snow Fraction,* located in 1937, are recorded in the name of the Consolidated Mining and Smelting Company of Canada, Limited. Five additional claims, recorded in the names of individuals, are understood to be controlled by the company. The claims are in and adjoining the basin at the head of a northward-flowing tributary which enters the Skagit River about 2 miles eastward from the mouth of the Skaist. The basin, which lies east of the head of Silver Daisy Creek, has an open and grassy floor with occasional patches of trees. The sides rise in steep rock bluffs. The camp is at about 5,425 feet elevation and the workings, which include open-cuts and six adits, lie south and south-east of the camp. The adits are at elevations from about 5,400 to 5,825 feet.

Supplies and equipment for the property are understood to have been brought up principally on a pack-trail which leaves the road at a point east of 23-Mile. The property is also readily accessible via the trail up Silver Daisy Creek, the divide at the head of the creek is crossed at about 5,850 feet elevation and the distance to 23-Mile by this route is approximately 7 miles.

The underlying rocks are mapped as Dewdney series by Cairnes, who states that the series forms a belt about 5 miles wide trending west of north, apparently in the form of a syncline complicated by minor folding and by much faulting. Cairnes also pointed out that the rocks are notable under the microscope for their tuffaceous appearance and that the coarser rocks are highly feldspathic. The workings are about 1½ miles from the western margin of the belt, and there the rocks strike west of north and the dips are from moderate to steep, north-eastward.

The mineralization occurs principally in a bed of breccia believed to be from 50 to 80 feet thick. The breccia is composed of fragments of other rocks in the series—namely, arkosic, tuffaceous, and argillaceous types—in a matrix composed almost entirely of introduced material. The matrix, composed of quartz, calcite, and sulphides, contains some corroded ferro-magnesian minerals, and has apparently replaced the original matrix of the breccia and to some extent has corroded the edges of the fragments. The sulphides, which make up a considerable proportion of the matrix, are principally pyrite and chalcopyrite, with some pyrrhotite. This mineralization carries some gold and silver values in addition to copper. Shears cut the wall-rock near the mineralized breccia, and on No. 6 level pyrite-chalcopyrite mineralization seems to be definitely related to a shear which strikes west of north and dips steeply to the west.

There are some narrow veins in which pyrite, chalcopyrite, sphalerite, and arsenopyrite are found. Selected arsenopyrite, from a shear cut in No. 5 adit, assayed: Gold, 1.86 oz. per ton; silver, 12.3 oz. per ton; copper, *nil.* Chalcopyrite and pyrite are developed with tourmaline in and along a 4-foot shear exposed on the surface north-west of the principal workings. This is similar to mineralization exposed in shallow workings on the *Invermay Annex* property, situated some distance to the north-west and described in another section of this report.

The No. 5 adit crosscuts a dyke similar to the quartz diorite or granodiorite on the properties at the head of Silver Daisy Creek. This dyke has been highly altered and contains a good deal of carbonate. It also contains some pyrrhotite and chalcopyrite.

The discovery was made in 1930 and the property was bonded to the Consolidated Mining and Smelting Company of Canada, Limited, in the same year. Underground development done by the company on six adit-levels consists of 2,478 feet of horizontal workings, all

driven by hand. When the property was visited in July, 1938, work had been suspended, and had not been resumed at the end of the year.

In the zone of mineralization the rocks have been very much altered, and it appeared probable that very close study and familiarity would be required before one could differentiate safely between various members of the series. The time devoted to the examination of this property did not permit detailed mapping of the workings. Brief references to the property appear in Annual Reports, Minister of Mines, British Columbia, 1930, 1931, and 1933. The writer is indebted to G. H. Kilburn, engineer for the company, who kindly supplied information concerning the extent of the workings.

The adits are all driven westward and, except No. 6, are all straight crosscuts. No. 6 level, driven 823 feet as a crosscut, encountered the mineralized zone at 723 feet from the portal. A drift was driven 85 feet northward from the adit-crosscut, and another 400 feet in length was driven southward. Crosscuts 130 and 80 feet in length respectively were driven westward from the drift at points 200 and 400 feet southward from the adit-crosscut. The sulphide mineralization appears to lie almost entirely to the west of a shear which is followed in the south drift. The crosscuts indicate that the mineralization is variable, and it appears to be richest close to the shear.

At 325 feet southward from the adit-crosscut, the writer took a sample across a width of 4 feet, measured westward from the shear. It assayed: Gold, 0.02 oz. per ton; silver, 2.4 oz. per ton: copper, 2 per cent. The average value on No. 6 level is understood to be lower than on the other levels and to consist chiefly in copper. The zone of disseminated sulphide mineralization was crosscut on Nos. 1, 4, 5, and 6 levels, on which the width exposed ranges from 65 to 80 feet. The range in elevation covered is approximately 380 feet. It is understood that although the average grade is low it would be attractive if sufficient tonnage could be blocked out to warrant a large-scale operation.

Silver Bell.

The four claims, *Silver Bell* and *Silver Bell Nos. 3, 4,* and *5*, are recorded in the names of H. Thomson, T. Martin, F. Fritz, and H. L. Woods, all of Hope. The group composed of these claims is about 1 mile south of the junction of the Skagit and Sumallo Rivers, covering ground on the steep western side of the Skagit River Valley. Frank Fritz, who has long been connected with the property, has a cabin on the eastern side of the Skagit about three-eighths of a mile southward from the end of the road at Silver Daisy Creek. The river is crossed near the cabin by means of a boat and cable, and a trail climbs to the principal workings, situated on a narrow bench at the tops of bluffs. An adit, driven north-westward from the face of the bluff, is at approximately 2,300 feet elevation, about 360 feet above the river.

The *Silver Bell* group was known for some time as the *Diamond* group and reported upon in Annual Reports of the Minister of Mines, British Columbia, from 1913 to 1923, and by Camsell, Geological Survey, Canada, Summary Report, 1911, and Cairnes, Geological Survey, Canada, Summary Report, 1920, Part A. More recently the property was reported upon under the name *Bell* group in Annual Reports of the Minister of Mines, British Columbia, 1925 and 1927, and in Geological Survey, Canada, Summary Report, 1922, Part A.

The claim *Silver Bell No. 3* of the present group was recorded in 1921, the other claims were recorded in 1935 and 1938. However, ground covered by these claims had been staked before and allowed to lapse.

The geological mapping shows the property to be underlain by rocks of the Hozameen series, which include limestone of varying purity interbedded with massive cherty rock, and volcanic rocks, some of which are intrusive. Contact metamorphic effects, including the development of sulphide mineralization, have been attributed to the intrusive greenstones included in the Hozameen series. At the principal showing the enclosing rock has been brecciated in part and in part disturbed by squeezing. The original minerals, apparently, have been selectively replaced by silicates. The result is a complex, composed largely of lime silicates, bearing little resemblance to the limestone from which it is presumed to have been derived. Locally it has been aptly called "curly rock"; some of this, however, may have been produced by the squeezing of rock originally composed of laminæ of siliceous, argillaceous, and possibly calcareous material. Pyrrhotite, arsenopyrite, and chalcopyrite form the bulk of the material in certain bands, and occur as grains or small masses disseminated through the metamorphic rock, which also contains garnets, epidote, and actinolite. Arseno-

pyrite also occurs in some narrow, vein-like masses. Cairnes reported some sphalerite and galena in narrow stringers on the borders of the main showing. The writer was shown a specimen containing grey copper, said to have come from such a vein. An 8-inch vein of almost solid chalcopyrite in a cut 1,100 feet above the river has been mentioned in earlier reports, but was not visited by the writer. Values are principally in copper, with some silver; a little gold has been reported from some samples; in general the grade is low.

The writer visited the principal and lowest showing, also an adit and a group of open-cuts, lying west of the principal showing. Previous reports refer to some surface cuts situated at considerably higher elevations. It is understood that recent work has been concentrated on the principal showing. This has been explored by stripping a considerable area, and making a crosscutting trench in rock on a narrow bench just above a steep bluff, and by driving a short adit from the face of the bluff a few feet below the bench. A short distance farther north a surface cut has been made on the bench.

Recent work at the south end of the showing has exposed disseminated sulphide mineralization in metamorphic rock cut by joints which strike east of north and dip from 35 to 45 degrees westward. The jointed rock contains disseminated mineralization for a thickness of 5 feet normal to the jointing, below which the rock is more siliceous and the sulphides are less abundant. A sample across 3 feet of the better mineralized material assayed: Gold, *nil;* silver, 2 oz. per ton; copper, 2.3 per cent.

Old stripping continues northward, and at about 60 feet from the most southerly stripping a trench has been driven in rock due west for about 25 feet from the face of the bluff, and thence for 26 feet at south 65 degrees west. The inner 28 feet of the trench crosscuts sulphide mineralization which is massive in two bands and in the remainder of the section is disseminated and variable.

The most easterly mineralization is along a fracture striking north 10 degrees west and dipping 75 degrees to the east; along it heavy sulphide mineralization, about 18 inches wide, is developed. This can be traced southward for about 35 feet as a very rusty band up to 4 feet wide. About 5 feet to the west another rusty band on the surface contains a good deal of sulphides and quartz. To the west again the rock is less well-mineralized, but the section sampled at the most southerly stripping lies west of the southerly projection of this second well-mineralized band. At the face of the trench the rock is sparingly mineralized with sulphides, but for the few feet east of the face on the north side of the cut the rock is very rusty and shows more evidence of sulphides.

From a point about 20 feet north-west of the bend in this trench stripping trends north-eastward for 28 feet. It exposed what are doubtless the northerly continuations of the fractures along which the most massive sulphide mineralization is developed south of the trench. Here the more easterly fracture seems to stand almost vertically, and the rock on the sides of the fracture is heavily impregnated with sulphides for a total width of 2 or 3 feet.

Disseminated sulphides, extending outward from the more massive mineralization, give a total width of 7 or 8 feet which is well-mineralized. Farther away the sulphides fade out and the rock becomes noticeably impregnated with epidote. To the west, beyond 5 feet of barren or very low-grade material, the second well-mineralized band is 18 inches in width. The mineralization does not terminate at the north-western boundary of the stripping, but the distance to which it extends northward along the projected strike of the fractures has not been indicated.

A cut has been made at a point near the edge of the bluff, 50 feet east of north from the end of the stripping just described, and about 80 feet due north from the outer end of the long crosscutting trench. In this open-cut shearing striking north 35 degrees west and dipping 45 to 65 degrees south-westward is exposed for a length of 12 feet. Toward the outer end of the cut there is moderate sulphide mineralization for a width of 18 inches.

In the workings which have been described the sulphides have been in part affected by weathering, and possibly some of the copper has been leached. Dense, hard seams or lenses of limonite have been formed at some points where sulphide mineralization was presumably concentrated; elsewhere, unless freshly broken, the rock has a rusty coating which obscures any unaltered sulphides.

An adit has been driven 80 feet north-westward from the face of the bluff at a point about due east of the most southerly stripping, and about 30 feet below the highest rock

exposed in the surface workings. The adit slopes downward for the inner 25 feet, that is from the point where it is vertically below the long trench. There is probably 10 or 12 feet of rock between the floor of the trench and the roof of the adit. For 15 feet toward the portal from this point a steeply-dipping fracture is exposed in the adit and along it there is a good deal of copper carbonate, but the wall-rock, which is siliceous, contains little sulphide mineralization. From this point north-westward to the end of the adit the wall-rock is cut by parallel joints which strike about north 70 degrees east and stand about vertically; though siliceous, the rock contains a moderate proportion of disseminated sulphides.

The more easterly and wider of the two well-mineralized bands exposed in the stripping above the adit would fall at or outside the portal if projected to that point, and must have been weathered off if it continued that far. The western band was not recognized in the adit and may not continue that far south or to that depth. It seems probable that the siliceous rock in which the adit was driven represents material less favourable for sulphide mineralization than the more limy rock exposed on the surface. Joints or sheeting of moderate westerly or north-westerly dip, exposed at the south end of the stripping, suggest the possibility that only the inner end of the adit is in the favourable zone; the disseminated mineralization there lends support to this supposition.

From a point in a draw about 250 feet westward from the stripping, and at approximately 2,425 feet elevation, an adit has been driven about 100 feet at north 80 degrees west, following a slip which dips 75 degrees to the north. Just outside the portal a fault is exposed, striking north 30 degrees west and dipping steeply to the north-east. Thin-bedded limestone is bent at the fault in such a manner as to indicate that the north-east side had moved downward relative to the south-west side. Chert at the north-east side is faulted against limestone on the south-west side.

From a point 8 feet inside the portal a short drift runs north 30 degrees west for a few feet. The floor is 2 or 3 feet below that of the adit, and the drift was filled with water to the level of the adit floor. The south wall of the adit is siliceous, but the roof and north wall are of bedded limestone which strikes east and dips 40 degrees north. At 80 feet from the portal the adit is timbered where it cut through fracturing which strikes north. A little disseminated sulphide mineralization is exposed in the siliceous south wall at the portal, and some rusty arsenopyrite is exposed at the portal of the short drift. On the dump there is some silicified limestone containing pyrite and chalcopyrite.

About 25 feet higher than the adit there is an outcrop of fine-grained andesitic greenstone. Farther up the hill, at approximately 2,550 feet elevation, silicified limestone has been exposed in an open-cut, and followed up the slope to about 40 feet higher elevation in a series of cuts or benches. The limestone strikes northward and dips about 65 degrees eastward, but at the highest working it is practically vertical and to the west the rock is very siliceous. On the east side of the lowest face the limestone contains garnets of moderate size.

The cut exposes evidence of mineralization over 7 feet from east to west. Limestone east of the cut shows little evidence of mineralization. Most of the mineralized section is rusty and leached. From 15 to 33 inches from the eastern side a fair quantity of sulphide mineralization, chiefly pyrrhotite and chalcopyrite, is to be seen. A sample across this section, 18 inches wide, assayed: Gold, *nil;* silver, 0.4 oz. per ton; copper, 0.3 per cent. Lime is exposed for 10 feet north-east of the lowest bench, and at 40 feet there is an exposure of fine-grained greenstone. Rusty rock, 5 to 7 feet wide, is exposed in the benches above.

Sunrise.

A claim known as the *Sunrise*, near the bottom of the south-westerly slope of Shawatum (Steamboat) Mountain, was recorded in 1933 in the name of C. J. Howlett, of Hope. In 1937 the *Dorothy* claim was recorded in the name of J. S. Day, who is associated with Howlett, and in 1938 the claims *Sunrise Nos. 2, 3,* and *4*, said to extend in a line southward to Nepopekum (Muddy) Creek, were recorded in the names of Howlett, Day, and W. Jamieson. The *Good Luck* claim, recorded in the name of H. C. Cooke, and the *Red Cross* claim, recorded in the name of H. H. Stevens, staked in 1937, are understood to be contiguous to those held by Howlett, Day, and Jamieson. It is reported that there was some further staking in 1938.

The workings, consisting of four open-cuts, at elevations from 2,400 to 2,500 feet, are understood to be on the *Sunrise* claim. They are situated on a moderately steep, wooded slope overlooking and about 400 feet above a fairly level area, which extends south-eastward

from the main Skagit Valley, between Steamboat and Little Steamboat Mountains. The workings are reached by a trail which leaves the main Skagit trail about three-quarters of a mile south of Howlett's cabin, which is south of 10-Mile Creek. The branch trail, at easy grade, is followed somewhat south of east for approximately a mile, and from this point a new trail is followed north and east to the workings about half a mile distant.

Overburden is generally not heavy on the steep slope but, with the tree-cover, is sufficient to mask the bed-rock in most places. The section is mapped as underlain by the Hozameen series. In 1911 Camsell mentioned that the Hozameen series some 3,000 feet higher on the mountain was "folded, fractured, and metamorphosed, and . . . traversed by dykes of diorite porphyry, diabase, and lamprophyre."

A fine-grained diorite dyke was observed at the most westerly cut. The other exposures are of white, soft, decomposed rock, cut by irregular quartz lenses and stringers, and, at the second cut, apparently overlain by a fine-grained siliceous layer. The dyke, siliceous layer, and white, decomposed rock contain disseminated sulphides, principally pyrite. Stains suggest the presence of some copper sulphide, and some galena and sphalerite were observed. Microscopic study indicated that the siliceous layer was a dense breccia with small angular quartz fragments, and that the white decomposed rock was probably a silicified limestone.

The first cut is at approximately 2,400 feet elevation; the second, about 150 feet south 80 degrees east from the first, is at approximately 2,430 feet elevation; the third, about 100 feet from the second, at north 80 degrees east, is roughly at 2,490 feet elevation; and the fourth, 235 feet south 45 degrees east from the second, is at approximately 2,500 feet elevation. Pyrite is exposed in the dyke at the first cut, in the silicified limestone and the breccia at the second, and in the silicified limestone at the third and fourth cuts. At the fourth, a considerable amount of chlorite was noticed and a little sphalerite and galena were to be seen, particularly in the north-west corner of the cut at the floor. Samples of the pyrite-bearing breccia, and the silicified limestone impregnated with pyrite from the second and third cuts, assayed *nil* in gold and silver. In the fourth cut a vertical channel, representing 5 feet, assayed: Gold, 0.02 oz. per ton; silver, 0.4 oz. per ton. A sample across 15 inches in the north-west corner at the floor assayed: Gold, 0.02 oz. per ton; silver, 0.2 oz. per ton; lead, *nil;* zinc, 3.8 per cent.

Sunset.

Four claims recorded in 1936 in the names of J. S. Day and C. J. Howlett, and four claims recorded in 1938 in the names of W. A. Jamieson, J. D. Mowat, H. Castillou, and M. M. Castillou, are included in this group. The claims are near the head of Galena Creek in the south-west corner of the area and are served by a branch trail up Galena Creek, which also serves the *International* and *Grandview* Crown-granted claims lying a short distance to the south. The branch trail leaves the main Skagit trail on the east side of the river at the Whitworth Ranch, crosses the river on a foot-log and, on the west side of the river, crosses ground which is flooded during high water. The crossing is about 5 miles from Howlett's cabin south of 10-Mile Creek, which makes the distance, to the end of the road at Silver Daisy Creek, roughly 17 miles. There is also a route down the west side of the Skagit from a crossing not far from Howlett's cabin. This trail has several stream crossings where the bridges would need to be rebuilt or repaired. From the junction of these two routes, about a quarter of a mile west of the Skagit River, at about 1,700 feet elevation, the trail up Galena Creek climbs steadily by a series of switchbacks for approximately 4½ miles to a junction at approximately 4,800 feet elevation.

From this point the trail to the *International* and *Grandview* claims continues southwestward, and the trail to the *Sunset* camp runs westward about 1,500 feet to the camp at 4,700 feet elevation. The trail traverses a considerable section, sloping toward the Skagit, in which the timber has been killed by fire.

The property was known formerly as the *Silent Friend* group, which was reported upon in Annual Reports of the Minister of Mines, British Columbia, for 1929 and 1930. At that time surface work was done on contact metamorphic-type mineralization, and an adit 320 feet long was driven below the outcrop. Work by the present operators has consisted in cleaning out and extending the surface cuts and driving a short branch drift following shearing on the adit-level.

The camp and workings are in a northward-facing basin tributary to Galena Creek. A log cabin, built by the former operators, was without a roof last September, but was serving

temporarily as a shelter in which a tent was erected. The adit-portal, at approximately 4,860 feet elevation, is about 950 feet westward from the camp on the north-easterly side of a small spur extending northward into the basin. A dry gulch, trending about north 30 degrees east, runs into the basin on the other side of the spur. The surface workings and exposures are principally on the western side of the spur, which slopes steeply in a north-westerly direction, and toward the foot the slope is heavily covered with debris. These workings are from 80 to 130 feet higher than the adit. The slopes in the basin are steep, as are those in the country traversed by the trail up Galena Creek. Overburden is heavy and, within a short distance of the camp and workings, there is a moderately heavy stand of timber, consisting of hemlock and balsam fir from 10 to 18 inches in diameter.

This section was mapped by Cairnes as underlain by the Hozameen series intruded by an elongated mass of granodiorite, referred to the Chilliwack batholith of Miocene age, which crosses Galena Creek trending somewhat north of west. Just north of the camp and about 1,100 feet north-eastward from the workings there are outcrops of similar rock in a small area, assumed to be a smaller intrusive related to the larger one. The surface showings consist of limestone more or less altered by contact metamorphism. The limestone is squeezed and contorted but appears to strike about north 30 degrees east and to dip 35 degrees westward, and has an indicated thickness of 60 or 70 feet. It is cut by joints and some shears which are roughly parallel to the bedding. The limestone is overlain by greenstone and underlain by black, cherty rock and green, siliceous breccia. The adit driven south-westward by former operators, from a point 60 feet below the foot-wall of the limestone, is in chert and breccia for its length of 320 feet.

From the dip of the limestone-beds exposed in the surface it might have been expected that the adit would have intersected limestone about 250 feet from the portal. Since the adit did not enter limestone it is apparent that the dip of the contact must be flatter than the dip of the bedding observed on the surface, or that the contact must be either a faulted or an unconformable one.

Metamorphism of the limestone varies from recrystallization to complete replacement by sulphides, or almost complete replacement by lime silicates and magnetite or specular hematite. Actinolite, garnet, calcite, quartz, some epidote, magnetite, specular hematite, pyrite, sphalerite, chalcopyrite, and a minor amount of galena are the principal minerals developed in the metamorphosed rock. At some points these contact minerals, lacking the sulphides, make up the rock which then appears in dyke relationship to the rest of the mass. It is possible that such occurrences represent silicification of basic dykes which previously had been almost completely altered to carbonate, though they may represent complete reorganization of the limestone, with the introduction of basic elements along fracturing or other favourable structural features. The alteration of the limestone is by no means uniform, some sections have escaped with inconspicuous recrystallization, whereas the near-by rock is composed of contact silicates or of sulphides. Except for jointing and minor shearing along the bedding, the structural features which have controlled the alteration are not marked.

Limestone is exposed on the rocky spur 60 feet higher than and about 75 feet south-westward from the adit-portal. To that point the rock exposed on the spur is chert or cherty breccia. Typical contact minerals are observed in breccia at approximately the elevation of the adit, 30 to 50 feet westward from the portal. On the easterly side of the spur, 95 feet above the level and 110 feet south-west of the portal, a shear is exposed striking north 35 degrees east and dipping 30 degrees north-westward, following the bedding in the limestone. It is marked by a rusty streak, 6 to 12 inches wide, containing garnets, specular hematite, and some pyrite, and is traceable for 40 feet south-westward. The overlying rock is green and fine-grained and appears to be composed of lime silicates and carbonate. Contorted limestone, 7 or 8 feet below the shear, contains some copper carbonate. The rocks exposed to the south and south-east are fine-grained greenstones. To the west overburden conceals the rock for 25 to 40 feet, beyond which mineralized showings are exposed on the westerly slope. The exposures are in an area of irregular shape, which has a maximum length from north-east to south-west of about 80 feet and a maximum width of about 60 feet, measured north-westward down the slope.

Near the bottom fresh stripping extends horizontally for about 70 feet from a cut in rock at the south-west end to the north-east end of the exposure. There is another cut at the south-west end about 15 feet lower than the first. The cuts expose sulphide mineralization, including a lens of dark brown sphalerite containing small masses of chalcopyrite. There is a good deal of quartz, and apparently calcite has been leached. Pyrite, chalcopyrite, and a little galena were also observed. The sulphides are considerably more abundant in the upper than in the lower cut. In the upper cut sphalerite, as free as possible from inclusions of chalcopyrite, was selected. Quartz with pyrite and chalcopyrite was also selected. Samples of these materials gave the following assays:—

Description.	Gold.	Silver.	Copper.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Selected sphalerite	Trace	0.2	*Nil*	60.6
Selected quartz with pyrite and chalcopyrite	0.02	4.2	5.2	7.4

Twenty-two feet north-eastward across the exposure from the south-west side of the upper cut a band of contact silicates, 2 to 4 feet wide, is exposed. This band trends south-eastward and dips steeply. Beyond it, flat-lying gossan is exposed just below the stripping and extends north-eastward for about 25 feet, then turns downward and is covered by debris.

Just above the gossan the stripping exposes disseminated sulphides, of which a chip sample, taken from 15 feet along the stripping, assayed: Gold, 0.01 oz. per ton; silver, 2.6 oz. per ton; copper, 1.1 per cent.; zinc, 13.1 per cent. The disseminated sulphides extend to about 2 feet above the bottom of the stripping, then give way to limestone which is probably recrystallized, but otherwise shows little evidence of metamorphism. This extends for about 15 feet up the slope to a second irregular seam of gossan, up to 5 feet thick, exposed for a horizontal distance of about 25 feet. A third similar seam of gossan is exposed 20 feet or so above the second. Between 50 and 52 feet from the south-west end the stripping crosses another band, composed of contact silicates, containing pyrite and magnetite. This stands steeply and trends south-eastward up the slope. The three flat-lying seams of gossan thus extend between two steep bands of contact minerals containing little sulphide, and are separated by horizontal layers of limestone not markedly affected by metamorphism. North of the second steep band of contact silicates recrystallized limestone extends for 20 feet horizontally, which contains garnets, magnetite, and other contact minerals, but very little sulphide mineralization. Beyond this the rock contains specular hematite to the end of the exposure.

The adit was driven 146 feet at south 27 degrees west; thence 61 feet at south 71 degrees west; thence 112 feet at north 66 degrees west to the face. In this distance it passed from east to west under the principal showing. Shearing, crosscut from 52 to 58 feet on the last course, had been followed 10 feet south-westward by a drift. The shearing dips steeply to the south-east. Some calcite and hematite, filling narrow cracks, are exposed in the drift. The adit is in chert or cherty breccia, cut by several joints and fractures, but containing little mineralization. If the adit were continued on its last course it would probably pass the bottom of the dry gulch under shallow cover. Whether it would encounter limestone or not is uncertain, and the extension in this direction could probably be determined more cheaply by surface work, even in the heavy overburden below the surface workings. An alternative method of locating the base of the limestone would be to raise from the adit, and it might be in order to raise on the shearing exposed in the drift. This would probably be more expensive than stripping on the surface but should leave a more permanent working.

The extent of the body containing ore-minerals has not been delimited by the existing workings, and extensive sampling would be necessary in order to determine the grade of the deposit. It is likely that further stripping would expose more sulphide mineralization and, as the mineralization is irregular, changes would probably be observed if cuts were extended into the deposit.

10-Mile Creek Section.

A great many occurrences of sulphide mineralization have been prospected by surface workings in a section of country lying north of 10-Mile (Shawatum) Creek, which enters the Skagit Valley from the east just south of the old townsite. The mineralized section extends

from the tributary, shown on the map as Giant Creek, eastward for about 1¾ miles as far as bluffs above the cabin, and northward to the summit of the ridge between 10-Mile and 28-Mile Creeks. Some thirty mineral claims are understood to be in good standing in this section. All are held by location and are unsurveyed. These claims were recorded in various years from 1924 to 1938. A number of them cover discoveries made prior to 1924, which formerly were known by other names. A prospect named *Clear* group is shown on the map accompanying Camsell's report (Geological Survey, Canada, Summary Report, 1911), though the group was not described in the report, and the *Billican*, *North Star*, and *Skagit Giant* groups were described by Cairnes (Geological Survey, Canada, Summary Report, 1923, Part A). Of these names, *Skagit Giant* alone is now in use and applies to a claim staked recently. References to this section were made in the Annual Reports, Minister of Mines, British Columbia, for 1923 and 1929.

The old townsite is approximately 11 miles southward by pack-trail from the end of the road at Silver Daisy Creek. The trail up 10-Mile Creek leaves the Skagit River trail at the townsite and, after making its way across the flat, climbs to the north side of 10-Mile Creek Valley and continues on that side to a cabin at about 3,750 feet elevation, just north of the creek, about 2½ miles eastward from the townsite. In its length of about 3½ miles the trail climbs approximately 2,000 feet; for most of the distance the grade is fair, but in two sections the trail climbs steeply. The north side of the valley rises to a ridge of which the summit ranges in elevation from 5,900 to 6,600 feet. In the section with which this report is concerned there are four tributaries which head in fair-sized basins, and in their lower courses occupy deep draws cutting through the steep lower slopes of the 10-Mile Creek Valley. Moderate-sized timber extends to elevations of 5,000 to 5,500 feet, above which the slopes are more open. Overburden is deep in the basins and of moderate depth on the steep lower slopes. Rock-exposures are numerous as much of the country is steep and bluffy.

The four tributaries are shown on the map, named from west to east Giant, Antimony, Pyrrhotite, and Star Group Creeks; of these, the first and last are called Dry Gulch and Mineral Creek respectively in the report by Cairnes.

The writer spent four days in the fall of 1938 examining occurrences in the 10-Mile Creek section. C. J. Howlett, who has been familiar with the section since shortly after the first discoveries were made, and who owns a considerable number of the claims, very generously acted as guide. It is believed that the most promising occurrences were examined in this period, but a number were not visited, including some of the higher showings described by Cairnes. Those visited range in elevation from 2,750 feet west of Giant Creek to 5,600 feet in the basin at the head of Star Group Creek. As the claims are unsurveyed and many of the location-posts are old, it is impossible for the writer to be entirely certain on which claims some important showings are situated. Accordingly where particular occurrences are described in the following notes they will be located with reference to the cabin or the tributary creeks. So many showings have been discovered and have been prospected in shallow workings, that to describe even the more important ones in detail would require more space than it seems desirable to devote to this report, which, accordingly, has been generalized as much as possible.

Geological mapping by Cairnes shows this section to be underlain by rocks of the Hozameen series. These include andesitic greenstone, chert, cherty argillaceous sediments, and limestone. The series has been subjected to regional deformation, and in this locality a strong system of jointing, striking about north 31 degrees west and dipping steeply to the south-east, is characteristic. There has also been more local deformation resulting in fracturing and shearing of rather diverse attitudes. Small intrusives of quartz diorite and hornblende diorite were observed by the writer, and Cairnes mentions other diorite intrusives.

Although irregular replacement deposits containing massive and disseminated sulphides are numerous, and have been incompletely explored by many surface workings, their structural relationships and certain other important features have not been clearly indicated. This is due to a number of factors—the margins of these bodies tend to be gradational and are rarely completely exposed by the workings; the rocks have been very much deformed and have been greatly metamorphosed; the rugged terrain, timber, overburden, and rusty coating on much of the weathered rock surface combine to obscure the rocks and make it difficult to trace their relationships. However, certain features are apparent—a consider-

able number of the deposits are developed in a metamorphic rock which apparently is derived from an original limestone; the regional jointing with shears, which have variable attitudes, appears to have furnished channels through which the mineralizing solutions gained access to the rocks in which the deposits are developed. It is also worthy of mention that intrusive dioritic rocks have been found or indicated close to most of the important centres of mineralization.

The most promising replacement mineralization seen by the writer lies in the small area extending from the east side of Pyrrhotite Creek to just east of Star Group Creek, between about 4,500 and 5,000 feet elevation, and not far east of Antimony Creek, at about 3,400 to 3,450 feet elevation. At these showings massive and disseminated sulphide mineralization is developed, generally in a fine-grained mottled rock from buff to pale purple colour and of cherty appearance.

Some of it is siliceous but much of it contains carbonate. At some points the rock has obviously been brecciated. It probably represents irregular masses or pods of impure limestone, which generally has been completely metamorphosed. Some cherty beds may be included and there may have been nodular cherty inclusions in some of the limestone. The extent of the bodies of the metamorphic rock has not been indicated. It is found in contact with or close to andesitic greenstone, which forms an important part of the series. Some of the limestone adjoining diorite intrusives is now represented by a highly epidotized rock from which practically all the carbonate has been eliminated. At other points rock, composed almost entirely of moderately fine-grained carbonate, is to be seen.

Quartz diorite outcrops on the ridge between two branches of Star Group Creek and just east of the east fork of the creek. Hornblende diorite outcrops on the ridge less than a quarter of a mile eastward from Pyrrhotite Creek at approximately 4,575 feet elevation. Float, or a doubtful outcrop, just above the main trail, a short distance east of Antimony Creek, indicates the probability that diorite intrudes that locality also.

Sulphide mineralization varies from networks of narrow joints or fractures filled with sphalerite and pyrrhotite to disseminated sulphides and massive fine-grained sulphides composed principally of pyrrhotite. Pyrrhotite is present in the greatest quantity, and sphalerite second quantitatively, but at some points is almost entirely absent. Chalcopyrite is very commonly present and almost always in small quantity. Pyrite and arsenopyrite are present locally and galena was observed at one or two points. Calcite or ankeritic carbonate is often present, and may be coarsely crystalline. At some points carbonate crystals are intergrown with well-crystallized quartz. Quartz, usually heavily mineralized with sulphides, occurs in lenses or vein-like masses in some of the larger, irregular sulphide deposits. This quartz is often the focus for the development of pyrite and arsenopyrite.

The ridge between the two forks of Star Group Creek has been called Gold Pan Point. It is composed largely of quartz diorite for some distance north of the junction of the two forks of the creek. A good deal of mineralization has been exposed east of the east branch and west of the west branch for some distance north of the junction.

Vein-filling in east-west fracturing in the diorite, and some disseminated mineralization in greenstone, have been prospected by extensive workings on Gold Pan Point. East of the east fork on the steep south-westerly slope between 4,650 and 4,720 feet elevation, there are four cuts and a 25-foot adit, exposing mineralization varying from massive to sparsely disseminated sulphides. Massive sulphides, occurring over widths of 5 or 6 feet, grade into sparsely disseminated mineralization. At two of the cuts lenses of quartz, heavily mineralized with sulphides, are exposed; they strike north-westward and dip from 30 to 45 degrees to the south-west and are underlain by disseminated mineralization. These workings constitute what has been called the " glory-hole," and a great deal of work has been done in an area roughly 125 feet from north to south and a maximum of 50 feet from east to west. However, the variable nature of the mineralization and the depth of overburden leave room for doubt concerning the size and grade of the deposit. A sample across 5 feet of massive sulphides assayed: Gold, 0.10 oz. per ton; silver, 0.3 oz. per ton; copper, 0.1 per cent.; lead, *nil;* zinc, 10.8 per cent.

Possibly 600 feet farther north, also east of the creek, at about 4,750 feet elevation, a recent cut exposes massive and disseminated mineralization, adjoining and just south of a

small outcrop of quartz diorite. Due west on Gold Pan Point there is disseminated mineralization in greenstone very close to quartz diorite and the cuts exploring the veins lie to the south. In the west fork, about 150 feet west of the mineralized greenstone, sulphide mineralization of a disseminated character is exposed in the bed of the creek. A sample across 45 inches assayed: Gold, 0.02 oz. per ton; silver, 0.8 oz. per ton; copper, *nil;* zinc, 2.2 per cent. Just west of the creek, at elevations from 4,875 to 4,850 feet, there are three cuts or strippings in a distance of about 275 feet from north to south. A sample of selected fracture-filling, largely sphalerite, from the most northerly, assayed: Gold, 0.20 oz. per ton; silver, 1.2 oz. per ton; copper, 0.2 per cent.; lead, *nil;* zinc, 22.9 per cent.

Several cuts expose sulphide mineralization at various points between Star Group Creek and Pyrrhotite Creek. The draw occupied by Pyrrhotite Creek trends about south 10 degrees west and a long surface cut is on the eastern side at approximately 4,500 feet elevation. The cut is about 110 feet in length and runs at about north 20 degrees west to a point approximately 60 feet from the creek. From 8 to 28 feet and 33 to 54 feet from the south end the cut exposes massive sulphides, consisting principally of pyrrhotite with some chalcopyrite. The mineralization seems to trend about north 30 degrees east and to dip 40 to 55 degrees south-eastward. There is disseminated mineralization with occasional bands of massive sulphides to the north end of the cut. A chip sample, taken carefully between 37 and 49 feet from the south end, excluding decomposed material from 41 to 42 feet, assayed: Gold, 0.02 oz. per ton; silver, trace; copper, 0.5 per cent.; zinc, *nil.* At the cut, overburden is 5 to 8 feet thick. For 800 or 900 feet up the hill, north-eastward from the long cut, variable mineralization is exposed at intervals in several cuts and outcrops. Rock, well-exposed for some distance above the creek on the west side, appears to consist largely of siliceous breccia and to contain little mineralization.

Two cuts, about 100 feet apart, on the steep slope east of Antimony Creek, at approximately 3,400 and 3,450 feet elevation, expose sulphide mineralization of good width. These cuts are understood to be on the *Ruby* and *Vancouver* claims. In the more northerly cut massive mineralization is developed under shearing striking east and dipping 25 degrees to the south; the mineralization also cuts through the hanging-wall of the shearing in small chimney-like masses. A sample representing 8 feet normal to, and lying immediately below, the shearing, assayed: Gold, 0.10 oz. per ton; silver, trace; copper, 0.35 per cent.; zinc, *nil.*

Massive mixed sulphide mineralization apparently occupies most of a vertical section of about 25 feet, exposed in two cuts in the basin at the head of Star Group Creek at about 5,600 feet elevation. Typical material, selected from the dump of the lower cut, assayed: Gold, 0.02 oz. per ton; silver, 0.3 oz. per ton; copper, *nil;* zinc, 0.4 per cent.

Mineralization, consisting largely of pyrite, is developed in epidotized greenstone exposed in cuts at about 2,700 feet elevation on the trail a short distance east of Giant Creek and on the ridge just west of Giant Creek between 2,750 and 3,200 feet elevation. Some magnetite occurs at the latter location. Selected heavily mineralized material returned assays of a trace in gold and silver. One sample assayed 0.3 per cent. copper. Showings of massive pyrrhotite mineralization are understood to occur east of the creek at higher elevations.

Vein-mineralization does not appear to be apt to yield commercial ore-bodies, but it doubtless has a relationship to the replacement deposit and gives some indication of the association of values. Typical occurrences are described in the remainder of this report on the 10-Mile Creek section.

Numerous parallel veins are exposed in bluffs just north of the cabin, and these have been prospected between elevations of 4,175 and 4,500 feet by strippings, surface cuts, and two or three short adits. The bluffs are predominantly of fine-grained andesitic greenstone cut by a great many parallel joints striking about north 35 degrees west and dipping 75 to 80 degrees eastward. There are also flatter-lying shears. Many of the joints are filled with mixed sulphides, in which the writer recognized sphalerite, arsenopyrite, chalcopyrite, galena, and a fine-grained grey sulph-antimonide of lead which is probably jamesonite, and Cairnes reported the presence of stibnite. Pyrrhotite is the most abundant and is followed by sphalerite. Galena appears to occur locally. Most of these veins are less than an inch wide, though some are 2 or 3 inches in width. The vein-fillings consist almost entirely of sulphides,

of which many crystals appear to have grown inward from the walls. Samples taken by the writer gave the following assays:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
2- to 3-inch vein in 10-foot adit	0.10	6.6	*Nil*	2.7	4.4
½- to ¾-inch vein	0.06	0.4	*Nil*	....	7.9

Some assays quoted in the Annual Report, Minister of Mines, British Columbia, 1929, from the *Gold Coin* group, doubtless from this same series of veins, gave materially higher assays in silver. Although these veins are numerous they do not appear to be sufficiently closely spaced, and are too narrow individually to be of commercial importance. Irregular lenses of similar sulphides are developed in flat-lying shears from 2 to 15 inches thick and were observed intersecting the joints. Disseminated sulphides were observed in the walls of the steep fractures and the flatter-lying lenses.

Quartz or quartz and carbonate, usually abundantly mineralized with sulphides, occurs as veins or lenses within or on the margins of several of the irregular replacement-bodies. This mineralization is apparently developed along shearing and is usually of low or moderate dip.

The ridge, called Gold Pan Point, is composed largely of quartz diorite for some distance northward from the junction of the two forks of Star Group Creek. Several fractures of east strike and steep north dip cut the quartz diorite. These fractures are generally from 6 inches to 1 foot wide, and contain crushed wall-rock, some quartz, and mixed sulphides, including notable proportions of arsenopyrite. From one of these, at approximately 4,650 feet elevation, the writer took two samples, which returned the following assays:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Principally sulphides, representing about 6-inch width of vein	0.08	0.3	0.6	*Nil*	9.8
Selected arsenopyrite from vein	0.40	0.6	....	....	23.6

Veins striking about south 70 degrees east and dipping 45 degrees or less steeply to the south were observed on the ridge just east of Pyrrhotite Creek, in workings at elevations from 4,350 to 4,400 feet. The rock is the fine-grained metamorphic rock, probably originally limestone. Most of the veins, which are from 2 to 10 inches wide, contain mixed sulphides which are also disseminated in the wall-rocks. Arsenopyrite is an important constituent of the veins and occurs intergrown with large well-formed quartz crystals. Selected arsenopyrite assayed: Gold, 0.36 oz. per ton; silver, 0.8 oz. per ton; arsenic, 27.0 per cent. About 500 feet a little east of north from these workings an open-cut, at about 4,650 feet elevation, exposes an irregular vein from 1 foot to 2½ feet wide, striking north-westward and dipping steeply to the south-west. This vein is filled largely with sulphides but also contains some quartz; the sulphides consist of solid, well-crystallized pyrite, with some pyrrhotite and arsenopyrite. A sample of selected pyrite assayed: Gold, 0.14 oz. per ton; silver, 0.1 oz. per ton; copper, *nil*.

A quartz vein outcrops in Pyrrhotite Creek at approximately 4,500 feet elevation. The vein is not well exposed, but appears to strike about north 30 degrees east and to dip steeply to the south-east. It is 4 to 5 feet in width and is composed largely of quartz, but contains pyrite, chalcopyrite, and some stibnite.

Vein Deposits.

Vein deposits in the Skagit River area, described in the following notes, occur in andesitic and cherty rocks of the Hozameen series, in the Skagit volcanic series, and in granitic rocks. Most of the veins on which work has been done average less than 2 feet in width. The veins contain a variety of sulphide minerals, and quite commonly sulphides form the greater part of the mineralization. Values are principally in silver and lead, copper and gold contained in the veins or in parts of the veins depend usually on the presence of chalcopyrite or arsenopyrite and pyrite. Work on the veins has been done principally in the 23-Mile Camp and in the granitic intrusive just east of that camp. Small shipments of ore carrying good values in silver have been made from the *Invermay Annex* and *Silver Daisy* properties in this part

of the area. On the *International* and *Grandview* claims, in the Skagit volcanics, the vein contains segregations of almost pure galena carrying moderate values in silver and comparatively little gold. Pyrite-chalcopyrite mineralization in the same vein carries moderate values in gold, silver, and copper, and is essentially free from lead. Veins are found in and at the margins of sulphide replacement deposits and are referred to in the part of the report dealing with replacement deposits.

B.B.

The claims *Big Ben* and *Big Ben No. 2*, which form this group, are recorded in the names of W. H. Robinson and V. Lunde, and cover ground north of the Sumallo River just east of the 23-Mile junction. The workings are on bluffs north of the road and lie east of a rock-slide which is half a mile or so westward from the junction. Several of the workings were made years ago, but the claims now covering them were staked recently. The country-rock is fine-grained andesite and granular quartzite, some of which has been brecciated. A quartz diorite intrusive, mapped by Cairnes, is near-by, and dykes, probably related to the larger intrusive, are found close to the workings. A short adit and several rock-cuts on the bluffs explore quartz-sulphide mineralization in joints or fractures, which strike north-eastward and are vertical or dip very steeply, and in shattered wall-rock adjoining these fractures. The sulphides observed include pyrrhotite, chalcopyrite, arsenopyrite, pyrite, galena, and needle-like crystals of a lead sulph-antimonide which, after microscopic study, were reported to be boulangerite or jamesonite.

Numerous fractures of the same general attitude are to be seen in the bluffs south of the Sumallo, in the same vicinity, and some of these show as conspicuously rusty streaks. The more easterly and higher workings were made some years ago and are reached by a switchback trail which crosses the rock-slide.

The highest working is a cut at about 2,475 feet elevation and, about 12 feet lower, there is an adit from which a short raise connects with the middle of the cut. The face of the cut is about 15 feet high and is divided midway by a flat-lying, rusty band a few inches thick. Above this, a fracture containing 1 inch to 1½ inches of sulphides is separated from a parallel fracture containing 2 to 4 inches of sulphides by 18 inches of light quartzite. Mineralized material 3½ feet wide, immediately below the flat-lying band, narrows going down. It includes 9 inches of massive sulphides, consisting chiefly of pyrrhotite and chalcopyrite, with some galena, pyrite, and arsenopyrite. A sample across the solid sulphides, 8 inches wide at the floor, assayed: Gold, 0.20 oz. per ton; silver, 24.0 oz. per ton; copper, 0.4 per cent.; lead, 3.5 per cent.; zinc, *nil.*

The adit is driven north-eastward from a 15-foot rock-cut which starts at the edge of the bluff. The connection with the cut above is 18 feet from the portal, and from this point the adit turns to a course of north 70 degrees east and continues 21 feet to the face. A fracture, containing sulphides, usually a few inches wide, is followed for the length of the adit. At the turn the sulphides form an irregular mass 15 inches wide which narrows ahead, the width in the face is about 2 inches. About 10 feet back from the face a fracture striking north 20 degrees west and dipping 50 degrees westward crosses the adit. It is 3 inches wide and contains sulphides; several narrow parallel joints also contain sulphides. South-westward from this adit and 125 to 150 feet lower there are two rock-cuts exposing narrow fractures or joints, of north-easterly strike and steep north-westerly dip, which contain some small lenses of sulphides.

A recent working on the property, consisting of stripping on a bluff, is possibly 150 feet above the road and is reached by climbing the steep slope from the road east of the rock-slide. A little sulphide mineralization is developed in irregular fracturing over a width of 5 or 6 feet, but the sulphides are concentrated principally in one or two narrow fractures. Radiating aggregates of fine needles of the antimony-bearing sulphide are conspicuous along with arsenopyrite. The sulphides from a fracture 2 to 4 inches wide, and the adjoining material to the slides, were sampled, giving the following assays:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Sulphides from fracture 2 to 4 inches wide	0.02	19.8	*Nil*	1.8	Trace
Twenty-one inches west of fracture, containing a good deal of sulphide	0.02	3.4	*Nil*	1.1	Trace
Twenty-one inches east of fracture, containing little sulphide	Trace	0.8	*Nil*	Trace	Trace

Talus obscures the downward continuation, but the mineralization can be traced for 20 feet upward, in which distance it pinches to a narrow width, and above is obscured by overburden.

International and Grandview.

The Crown-granted claims *International*, Lot 932, owned by R. E. Hemphill, of Glendale, California, and *Grandview*, Lot 931, owned by Joseph Gibson, Sardis, B.C., are at the head of Galena Creek, in the position indicated on the map. They are the oldest locations in the area, having been staked in 1906 and brought to Crown grant in 1915. They were described by Camsell (Geological Survey, Canada, Summary Report, 1911), and by W. M. Brewer, Annual Report, Minister of Mines, British Columbia, 1915, under the name *International* group, and were referred to in the Annual Report, Minister of Mines, British Columbia, 1929, under the name *Grandview*. It is understood that the claims were bonded to interests, represented by Alex. Robinson, operating under the name of Morning Star Mines, Limited (N.P.L.), which company, now defunct, was registered in August, 1927, and was removed from the register in November, 1932. At the same time Robinson was responsible for work on the *Silent Friend* group, which is now known as the *Sunset* group, and is described in this report under the latter name. When the writer visited the property in September, 1938, he was not accompanied by a guide well acquainted with the property. Evidence of a tent-camp was found, but no recent working was observed in the part of the property visited.

From the junction, about 1,500 feet eastward from the camp on the *Sunset* group, the Galena Creek trail continues south-westward on the ridge east of Galena Creek. For half a mile it climbs by a series of switchbacks, then follows the crest of a rather sharp ridge which forms the divide between Boundary Creek to the south-east and Galena Creek to the north-west. At a point a little less than 1½ miles by trail from the junction the route turns north-westward for about 200 yards, reaching a small lake, at the eastern end of which a temporary camp was evidently set up some years ago. The lake is roughly 350 yards long and is the highest of several in the upper basin of Galena Creek. From the western end of the lake workings in a dry gully are reached by climbing north-westward up a talus-slope for about 200 yards. The workings extend into a gully or draw which runs about 25 degrees east of north from steep bluffs which form the rim of the basin. The bluffs are of andesitic tuff and andesitic breccia. The area was mapped as underlain by Skagit volcanics of Oligocene age. The north-easterly boundary of the formation would be no very great distance from these workings.

The lowest workings, at approximately 5,850 feet elevation, are almost completely filled with talus. About 150 feet southward from this point the draw is reduced to a narrow steep gutter cut through bluffs which rise for 50 or 60 feet. The principal showing lies on the eastern side of the draw, at the foot of bluffs 100 feet south 20 degrees west from the talus-filled cut first visited. Mineralization is well exposed there and for perhaps 30 feet to the north. The volcanics are cut by a series of joints which strike from 5 to 30 degrees west of south and stand vertically or dip steeply to the east. Such a joint forms the eastern wall of the draw and of the mineralization, and cuts through the flat-lying contact between underlying andesitic tuff and overlying andesitic breccia. The joint can be distinguished for 40 or 50 feet above the contact in the face of the bluff, but the mineralization, which is 4 to 5 feet wide in the underlying andesitic tuff, dies out abruptly at a flat-lying irregular surface of low dip to the north, about 4 feet above the contact. This surface is not noticeable in the bluff to the east, but can be followed as an irregular break for 10 feet west of the mineralization and is then obscured by talus.

The contact, at approximately 5,900 feet elevation, is marked by a fairly strong joint in the bluff to the east. The western wall apparently dies out a few feet above the top of the mineralization; it is a joint less regular than the eastern wall. The mineralized exposure consists of rusty decomposed material, white earthy matter, some quartz, and lumps of sulphides, and one considerable mass of sulphides from 18 inches to 2 feet wide and 2 feet in vertical extent. Except for a shell around the outside this consists of coarse, cubic galena, containing a little pyrite and chalcopyrite. The shell, and a seam immediately below it, consists of quartz, pyrite, and chalcopyrite. Lumps of fine-grained calcite are also to be seen

and this mineral accounts for the white earthy material in the outcrop. Two samples of selected material returned the following assays:—

Description.	Gold.	Silver.	Copper.	Lead.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.
Cubic galena	0.06	23.0	....	76.8
Selected quartz and pyrite	0.30	5.2	1.2	0.1

It would probably be feasible to test the continuity of this occurrence by surface workings for 100 feet or so to the north, beyond which the debris is probably too deep for such work. It could be followed southward into the bluffs by a drift.

Invermay Annex Mining Company, Ltd. (N.P.L.).

The *Norwegian* group of eight claims, with twenty-one other claims, situated near the head of Silver Daisy Creek, and the *Home* claim, situated east of the Skagit River about opposite the mouth of the Sumallo, were recorded in 1933 and subsequent years. The claims are now in the name of the Invermay Annex Mining Company, Limited, which was incorporated in 1934.

The discovery was made in 1933 on claims of the *Norwegian* group, on which the principal workings are situated. The accompanying plan shows the five adits and a number of open-cuts, as at October 21st, 1938. An aerial tramway was built from a point below the workings to a lower terminal on the *Home* claim, near the Skagit River, in 1935. This lower terminal was constructed in 1938 after having been destroyed by a snowslide. In 1936 a shipment of ore was made to the smelter at Trail. Work on No. 3 level was commenced in 1937, and after a considerable shut-down was resumed early in the fall of 1938 near the inner end of the level.

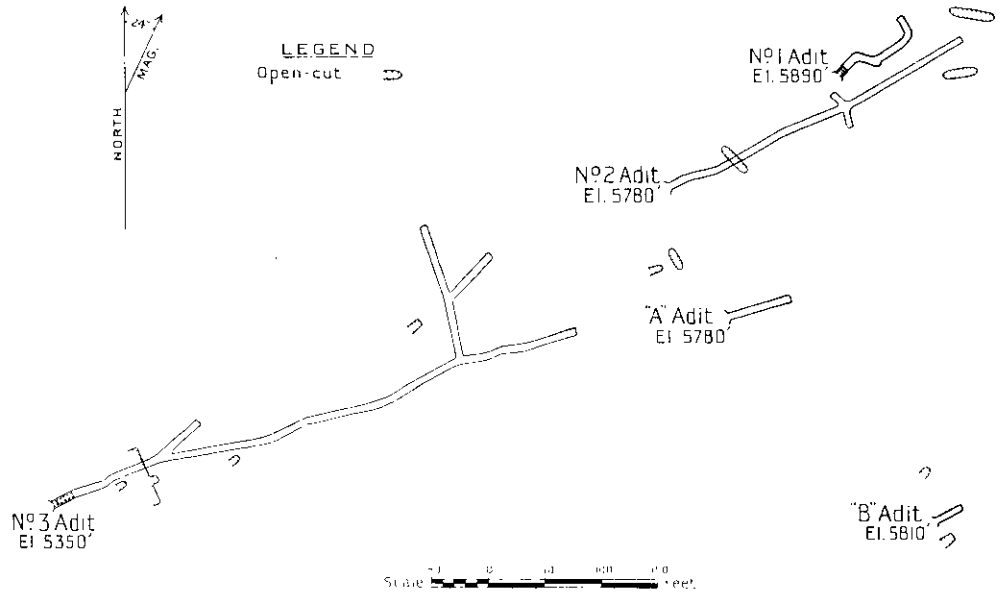
A crosscut and branch drift were driven and the main drift was extended. It is reported that in November the main drift had been advanced to a total distance of 615 feet from the portal and that work was then stopped on that level and a new level, 125 feet lower, was started.

A short aerial tramway, which was built from No. 2 level to the upper terminal of the longer tramway, is now largely dismantled. The longer tramway is of the single continuous-wire type and is equipped with a 10-horse-power Diesel engine. It was used for taking down the ore shipped to the smelter, and has been used for taking supplies to the mine. The lower terminal is connected by a short branch road with the road which runs southward from 23-Mile to Silver Daisy Creek. The property is also served by the trail which leaves the road at a point nearer Silver Daisy Creek and makes its way on the north side to the head of the creek. The lower section of the trail climbs steep bluffy slopes and crosses rock-slides in a series of switchbacks. The upper section is at an easier grade on more gentle, timbered slopes, but traverses considerable stretches of boggy ground. The camp, with accommodation for about fifteen men, and the upper terminal of the tramway near the camp are at approximately 5,100 feet elevation, about 3,100 feet higher than the road and 3¾ miles by trail from it. They are on a moderate south-westerly slope not far north of the creek and just below the steep slope on which the workings are situated. This slope is timbered to about the elevation of No. 2 level, 5,780 feet elevation, above which it is more open and grassy. Overburden is generally several feet deep.

Geological mapping by Cairnes shows the area in which the property is situated to be underlain by rocks of the Dewdney series, intruded by a considerable mass of quartz diorite. The rocks exposed in the surface and underground workings on this property, and on the *July* group, are granitic, as is an outcrop farther south-east on the divide at the head of the creek. Specimens submitted for microscopic study were reported to be hydrothermally altered, apparently most of them were originally granodiorite or quartz diorite. However, some of the specimens are of altered biotite granite, and at the *Invermay Annex* property some very much altered material of more basic composition appears as dykes in the more acid rocks. The altered rocks contain sericite, calcite, and more or less chlorite, actinolite, diopside, and touramaline, and disseminated sulphides. There is commonly enough carbonate present to cause specimens to react noticeably with acid.

Surface cuts and underground workings on the property have indicated and partly explored a shear-zone for a length of approximately 1,000 feet. Shearing between walls

which are usually from 1 foot to 2½ feet apart has been followed for the lengths of No. 2 and No. 3 levels. The general strike is north of east, but considerable changes in strike occur. The dips are generally steep to the south, though northerly dips are also observed. Shear-strands, generally from 1 inch to 1 foot in width and striking north-east, join the wider shearing on both sides. Some gouge seams of similar strike cross the wider shearing. The crosscut near the inner end of No. 3 level cuts seven or eight shears in 100 feet lying north of the main drift. Various surface cuts expose shear-strands occurring in widths of 30 or 40 feet. Thus branching and sub-parallel shear-strands cut a zone which, at least locally, is of considerable width; the actual width has not been indicated. No. 1 level, which follows an irregular course, is doubtless in part on the shearing followed on No. 2 level; and probably the shearing followed in No. 2 and No. 3 levels is the same, and is the principal shear of the zone. However, this is not proven, the levels are not connected, and the attitude of the shearing varies considerably at different points.



Invermay Annex property. Plan of workings from compass survey; elevations are approximate.

The material between the walls of the shearing is crushed and altered wall-rock with which there may be one or more lenses of quartz and sulphides paralleling the walls. The lenses are usually less than 8 inches thick and commonly are from 1 inch to 6 inches thick. The combined width of such lenses in any section of the wider shearing rarely amounts to 1 foot. The vein-mineralization was apparently largely concentrated in the wider shearing, though narrow lenses of quartz and sulphides are also found in branching or parallel shear-strands and, at some points, the walls of such strands have been impregnated with sulphides. Much of the better mineralized material is frozen to the walls, though some more sparingly mineralized lenses are comparatively free from the walls. It seems probable that the banded nature common to much of the vein-filling is in part inherited from gouge which it has replaced and in part is due to successive movement along the shear between periods of mineralization. At some points, as for example the inner end of No. 2 level, there has been a good deal of movement since the vein-minerals were introduced.

A varied suite of sulphide minerals is to be found on the *Invermay Annex* property and there is a good deal of difference in the modes of occurrence of some of these minerals. Galena and sphalerite are important constituents of vein-filling. Lumps of coarse cube galena were found on the surface, and some parts of the vein are composed largely of sphalerite. Some of the vein-matter has a dark, banded appearance, and is composed chiefly of finely crystalline quartz, galena, and sphalerite, with the sulphides tending to be segregated in separate bands. A fine-grained grey mineral, identified as jamesonite, was observed in

banded ore in which pyrite, arsenopyrite, and chalcopyrite, may also be found. It is possible that grey copper also occurs in ore of this type, though the mineral has not been identified. Some vein material of this type is banded with white quartz which is moderately coarsely crystalline and contains disseminated crystals of arsenopyrite and chalcopyrite, and more rarely of pyrite. Similar moderately coarsely crystalline quartz with an open, vuggy structure is also found, forming narrow lenses, and this material, though having a little sphalerite along the walls, appears to be mineralized principally with arsenopyrite in thin, elongated prisms. Locally, the wall-rocks along fractures contain disseminated sulphides; they consist principally of pyrite and arsenopyrite, but also include chalcopyrite and sphalerite, and carry non-commercial values in gold. There is still another type of mineralization on the property—namely, the occurrence of small and variable amounts of pyrite and chalcopyrite in a heavily tourmalinized gneissic rock which weathers to a very rusty colour. This material has been incompletely explored in "A" and "B" adits and in surface cuts lying southward from No. 2 adit-portal. A sample taken in the cut 45 feet north from "B" adit-portal, across 18 inches normal to the foliation, assayed: Gold, 0.02 oz. per ton; silver, 1 oz. per ton; copper, 0.25 per cent.

The vein-mineralization so far exposed has been valuable principally for its silver and lead content. The ore shipped to the smelter in 1936 had a dry weight of 21.227 tons and the smelter assay was: Gold, 0.01 oz. per ton; silver, 175.3 oz. per ton; lead, 13.6 per cent.; zinc, 19.8 per cent. Vein material, sampled by the writer, assayed from a trace to 0.14 oz. per ton in gold. The gold appears to be associated with pyrite and arsenopyrite, and as these are sparingly developed or absent in the more heavily mineralized parts of the vein the gold values are apt to be negligible in material carrying good values in silver and lead.

The following table of assays of samples taken by the writer will give some notion of the range in values. The shipment is evidence that material of higher grade has been obtained on the property:—

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
No. 2 level—	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
6 inches at west side of vein, approximately 270 feet from portal	Trace	92.4	Trace	15.6	14.9
4 inches at east side of vein, approximately 270 feet from portal	Trace	31.6	*Nil*	2.6	16.1
No. 3 level—					
6 inches across sulphide lens, main drift, approximately 330 feet from portal	0.04	22.0	*Nil*	.....	17.8
2 inches quartz and sulphides, main drift, approximately 485 feet from portal	0.14	22.0	*Nil*	*Nil*	6.6
3-inch zincky vein in north crosscut, 30 feet from main drift, inner end No. 3 level	0.08	8.0	0.4	.....	24.0
7 inches altered wall-rock with sulphides at tight shear in north crosscut, 100 feet from main drift	0.08	1.2	0.2	.....	0.5
20 inches altered wall-rock with disseminated sulphides from face of branch drift from north crosscut	0.04	1.4	Trace	.....	0.8

There are caved cuts in the direction of the main shearing for 200 feet east of north, up the slope from No. 1 adit-portal. No. 1 adit, following an irregular course, crosses several rusty shears. Down the slope 125 feet towards No. 2 portal a cut exposes shearing across a width of about 4 feet. The portal is approximately 110 feet vertically below No. 1 level and 185 feet west of south from No. 1 portal. In its length of 290 feet, No. 2 level followed shearing between walls generally from 2 to 2½ feet apart. The roof is lagged from the portal to 22 feet, from 75 to 110 feet, and from 154 to 248 feet from the portal, obscuring the nature of the vein-filling. In the lagged sections there are two small stopes, from which it is understood that the ore shipped from the property was mined. From the portal there is little vein material to be seen in the roof until just before the lagged section at 75 feet is reached, where there is 1 foot of vein-matter. The centre line of the manway serving the first stope is approximately 95 feet from the portal. The roof of the stope, 28 feet above the floor

of the drift, extended 8 feet westward and 20 feet eastward from the centre line of the manway. Shearing, 6 to 10 inches wide in the roof, contained streaks of zincky vein material. Eastward from the end of this lagged section there is little but gouge until a point a few feet from the next lagged section is reached; there, vein-mineralization, about 7 inches wide, is developed and continues to the lagging. The second stope is in this lagged section, the manway approximately 210 feet from the portal was inaccessible. From the end of the lagging to the face, a distance of 42 feet, the shear is loose and apparently there has been post-mineral movement. Streaks or lenses of vein-matter occur in the shear, and about 25 feet from the face two such lenses, with a combined width of 10 inches, are separated by about 18 inches of altered wall-rock. The results of sampling these lenses appear in the table earlier in the report.

In the distance of about 620 feet from No. 2 portal to No. 3 portal there are several caved cuts and pits. About 90 feet from the lower portal, a wide crosscutting surface working exposes shearing and some vein-mineralization, and 25 feet nearer the portal a smaller cut exposes 7 or 8 inches of banded vein in which arsenopyrite, chalcopyrite, and pyrite occur in crystalline quartz with galena and sphalerite and some jamesonite in bands on the walls of the quartz.

In No. 3 adit, which is approximately 430 feet lower than No. 2, there is fairly continuous vein-mineralization from the end of the timbering at 40 to 70 feet from the portal. The shearing, which is from 1½ to 2½ feet wide, contains 10 to 12 inches of vein-matter, consisting of quartz heavily mineralized with sphalerite but containing some galena, notably between 50 and 60 feet from the portal. Between 80 and 100 feet from the portal there is mineralization, irregular in width and in proportion of sulphides. In this section, branch shears diverge north-eastward and one, containing gouge only, is followed in a drift for 48 feet from a point 100 feet from the portal. From the branch drift onward the main drift contains less sulphide mineralization. Irregular lenses carrying a good deal of sulphides over widths from 2 to 12 inches, and lengths up to 15 feet, are found to about 350 feet from the portal. These lenses appear to be controlled in part by branch or cross-shears which strike east of north and dip generally steeply to the north-west. From this point to the face of the main drift (at October 21st) vein material is usually less than 2 inches in width. This material is light in colour, moderately coarsely crystalline, and is vuggy and sparingly mineralized with sulphides.

A branch crosscut, driven northward from a point about 385 feet from the portal, crosscut several shear-strands; one of these about 30 feet from the main drift contains a zincky lens 3 inches wide. The others contain little or no quartz, but the brecciated material in some of the shears and the material along the walls contain disseminated sulphides, largely pyrite, with some chalcopyrite, arsenopyrite, and sphalerite; this material gave low assays in gold. In this section a good deal of the rock is basic, very much altered, and cut by numerous shears. At the west side of the drift running north-east from this crosscut, there is an irregular lens of quartz cut by stringers filled with chlorite. Tourmaline, and some ankeritic carbonate, a small quantity of feldspar, and some pyrite and chalcopyrite, are contained in the quartz. Similar material, 1 foot wide, was also observed at the wall of the vein near the face of the main drift.

July.

The claims *July* and *July No. 1*, located in 1935, are recorded in the names of G. M. Allison, T. Smitheram, and V. Lunde, of Hope. Situated near the head of Silver Daisy Creek the claims lie east of the *Invermay Annex* property. The workings on the *July* group consist of two short adits and some surface cuts, on ground which slopes steeply to the creek to the south, about half a mile by trail from the *Invermay Annex* camp and approximately 4½ miles by trail from the end of the road near the mouth of Silver Daisy Creek. Both adits start about at the edge of a talus-slope on which some of the surface cuts have been made.

The rock exposed in the workings is quartz diorite, similar to that at the adjoining *Invermay Annex* property, and the geological setting is essentially the same at both properties. Sulphide mineralization occurs with fine-grained quartz in narrow widths, generally following the walls of a zone of shearing or fracturing, of which the average strike in the workings is east of north and the dip is usually steep to the east. However, the fracturing is not simple, a number of splits run off into the walls and there are changes of strike at short intervals. There are also some changes in dip.

The two adits, which are both drifts, expose walls from 3 to 4 feet apart, along which there are lenses of quartz and sulphides or gouge seams, from 1 inch to 1 foot thick. The central part of the vein is occupied by altered wall-rock which usually represents two-thirds or more of the volume between the walls. The sulphide minerals are principally sphalerite, arsenopyrite, and chalcopyrite. The assays of samples listed below give an indication of the grade of the mineralization.

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Mixed sulphides selected from upper adit dump	0.15	30.2	2.1	*Nil*	13.8
4 to 5 inches rusty quartz at face, upper adit	0.02	2.4	0.5	*Nil*	1.0
6 inches zincky material at hanging-wall lower adit, 80 feet inside portal	0.06	4.7	0.6	*Nil*	18.1
3 inches fine-grained quartz with arsenopyrite at hanging-wall, about 65 feet from portal	0.04	11.6	1.4	*Nil*	4.9
2½ inches oxidized vein-matter at foot-wall, about 65 feet from portal	0.04	5.4	0.7	*Nil*	4.8

The upper adit is at approximately 5,675 feet elevation and is 32 feet long, driven at north 15 degrees east. The walls are 3½ to 4 feet apart and dip 75 degrees eastward. In the face there are several narrow, rusty streaks, of which the best is 4 to 5 inches wide.

The lower adit, at approximately 5,660 feet elevation, starts from a point about 175 feet south 18 degrees west from the upper portal. The first 80 feet of this adit is on a bearing of about north 25 degrees east. The working is timbered for 12 feet and from the timber to 80 feet from the portal there is vein-matter, 2 to 7 inches wide, along the east wall. At the end of the course the vein-matter, which is 7 inches wide and zincky, appears to be cut off by a gouge band which follows the east wall of the next course. For most of the distance from 35 to 80 feet from the portal there is from 1 inch to 3 inches of oxidized vein-matter along the west wall. The roof is lagged in this section. In the next course, 21 feet at north 8 degrees east, there is principally gouge along both walls. This is followed by 41 feet at north 25 degrees east with a scantily-mineralized quartz-lens, up to 12 inches wide, along the east wall for the first 15 feet or so, followed by gouge which continues along the next course 19 feet at north 45 degrees east. The working then turns to a bearing of north 8 degrees west for 8 feet to the face, though the gouge band along the east wall of the previous course appears to continue its north-easterly strike. The gouge band along the west wall in the course, 41 feet at north 25 degrees east, appears to continue on that bearing and was therefore left in the wall when the drift turned to the bearing of north 45 degrees east. The last course of the working, following a shear crossing the general strike, was probably started with a view to crosscutting to the fracture wall marked by the gouge band, left behind 19 feet to the south-west. The projection of the gouge band on its observed bearing would be 8 or 10 feet ahead of the end of the working.

Silver Daisy.

The claims—*Silver Daisy*, *Silver Stem*, *Silver Leaf*, and *Black Jack*—which form this group are held by location in the name of Mae Matheson, of Vancouver. The group is on the east side of the Skagit River near the mouth of Silver Daisy Creek, 1¼ miles by road southward from 23-Mile. The claims were recorded in the years 1925, 1937, and 1938, but cover a discovery made some years earlier. The property has been mentioned in various Annual Reports of the Minister of Mines, British Columbia, from 1913 to 1929, and in Geological Survey, Canada, Summary Report, 1920, Part A. Small shipments of ore, understood to amount to about 30 tons in all, were made to the smelters at Trail and Tacoma in various years from 1916 to 1929. No work was being done when the writer examined the property in July, 1938.

There are 4 adits which, for convenience, will be referred to as "A," "B," "C," and "D" adits. "A," "B," and "C" are close together, and are driven on the vein from the steep walls of the gorge through which Silver Daisy Creek flows. "A" and "B" adits are on the north side and "C" is on the south side of the creek about at the same elevation as "B." "D" adit is a long crosscut, driven from a point on the north side of the creek about where the gorge joins the Skagit Valley. The portal is approximately 285 feet down-stream from "B" and "C" portals and 175 feet lower. It is about 250 feet east of the road.

The rock is a massive, black, cherty member of the Hozameen series. The vein, usually marked by shearing from 8 inches to 2 feet wide, contains lenses of quartz and sulphides from 2 to 8 inches, and usually between 2 and 4 inches, in width. Splits leave the main shearing at several points. The strike of the shearing changes from north 65 degrees east at the south-west end of "C" adit to north 20 degrees east at the north end of "B" adit. The dips of the shearing and the flat-lying splits range from 80 degrees to about 30 degrees north-westward. One flat-lying split, containing about 2 inches of quartz, is to be seen in the bluff between "A" and "B" adits. The sulphides, which include pyrrhotite, sphalerite, chalcopyrite, and galena, and probably tetrahedrite, are largely confined to the quartz-sulphide lenses. The following table of samples and assays will give an idea of the range in values in the better mineralized material now exposed.

Description.	Gold.	Silver.	Copper.	Lead.	Zinc.
	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	Per Cent.
Quartz and sulphides, average width 3 inches at hanging-wall "A" adit, 20 feet from north face	0.04	23.8	Trace	1.7	5.6
Quartz and sulphides, average width 3 inches at hanging-wall, south end of drift, "A" adit	0.10	170.7	0.7	15.7	2.0
"C" adit; quartz and sulphides, average width 6 inches; inner 20 feet	0.04	41.6	Trace	2.5	10.2

"A" adit is driven north-westward from the foot-wall, reaching the vein in a few feet. The vein has been drifted upon south-westward for 12 feet and north-eastward for about 48 feet. In the south face, which is just a few feet from the wall of the gorge, there is shearing 6 to 12 inches wide which, at the hanging-wall, contains quartz and sulphides from 2 to 4 inches wide. For just over 30 feet north-eastward from this face the floor has been stoped and the roof is high. Beyond that point to the north-east face the shearing is from 10 inches to 2 feet wide and contains sulphide-bearing quartz which reaches a maximum width of about 4 inches.

"B" adit, about 15 feet lower than "A," had the floor flooded by water from the creek when the property was examined. It is driven 64 feet at north 37 degrees east, thence 50 feet at north 22 degrees east to the face. From 20 to 64 feet from the portal the ground is stoped above the level, excepting for a 5-foot pillar in the middle of the stope. At the inner end of the stope quartz, containing some sulphides, is 3 to 6 inches thick; the dip there is 35 degrees westward. The dip steepens progressively to 80 degrees westward at the end of the drift beyond the stope, and the vein-filling gives way to rusty gouge.

"C" adit is driven south-westward for 60 feet. Quartz, 3 to 6 inches wide, containing some sulphides, is followed for 27 feet at about south 40 degrees west until it comes to a strong slip striking south 65 degrees west and dipping 60 degrees north-westward. This slip forms the foot-wall from the junction south-westward to the face. Though the slip continues north-eastward toward the wall of the gorge there is little mineralization along it. For the inner 20 feet of the adit there is quartz, fairly well mineralized with sulphides, from 6 to 8 inches wide. Pyrrhotite is the predominant sulphide; there is a less quantity of sphalerite and some chalcopyrite and galena.

In its length of 503 feet "D" adit curves from an easterly to a south-easterly course, crosses beneath the creek, and, near the inner end, curves to the east again. At 362 feet from the portal it cut a 1½- to 3-inch fracture containing gouge and quartz with sulphides and abundant sphalerite. The fracture strikes north 65 degrees east and dips 75 degrees north-westward. There is a second fracture containing iron sulphides 8 inches in the foot-wall of the first, and some thin veins of quartz farther in the foot-wall. This mineralization has been followed 6 feet westward in a drift. At this point the working is about 70 feet westward from the inner end of "C" adit and the strike of the fracturing is parallel with that in "C" adit. However, the dip observed in "C" adit is 60 degrees, and the position of this fracture on "D" level is such that an average dip slightly steeper than 80 degrees would be required to connect with "C" adit. For 28 feet beyond the short drift on "D" level a fracture striking north and dipping 25 degrees to the west is exposed in the western

wall of the working. This fracture, ½ inch to 2 inches thick, containing gouge and quartz, does not intersect the previously mentioned fracture in the working.

Tatla Lake Area.

In the past three or four seasons there has been a good deal of prospecting in certain sections of the area tributary to Tatla Lake Post-office. Situated about 2 miles west of the south-west end of Tatla Lake, Tatla Lake Post-office is approximately 215 miles due north of Vancouver and is about 105 miles westward from Williams Lake, on the Pacific Great Eastern Railway. This report deals with lode-gold prospects in the Blackhorn Mountain section, approximately 24 miles south 20 degrees west, and in the Perkins Peak section, approximately 21 miles south 75 degrees west from Tatla Lake Post-office. Prospects on Tatlayoko Lake, also tributary to Tatla Lake Post-office, have been described in recent reports.

Blackhorn Mountain, in the Clinton Mining Division, and Perkins Peak, in the Quesnel Mining Division, lie within the "Tatla-Bella Coola Area," mapped geologically by Dolmage (Geological Survey, Canada, Summary Report, 1925, Part A). A hematite deposit and a prospect carrying low values in gold, both on Perkins Peak, were described by Dolmage. Of these, the hematite deposit has been described in several Annual Reports of the Minister of Mines of British Columbia. So far as the present writer knows, O'Grady's description of the property of the Homathko Gold Mines, Limited, on Blackhorn Mountain, published in the Annual Report of the Minister of Mines, British Columbia, 1937, Part F, is the only publication dealing with prospects in that section, where the activity dates from discoveries made in 1936. Current interest in the Blackhorn Mountain and the Perkins Peak sections is in gold-bearing quartz. Both sections lie comparatively short distances east of the eastern contact of the Coast Range batholith, which is composed essentially of granodiorite and quartz diorite. The general trend of the contact is west of north but the actual outline of the batholith is very irregular. Dykes, doubtless related to the batholith, are conspicuous in both sections and are very numerous in the Blackhorn Mountain section.

The settlement of Tatla Lake is near the western margin of the Interior Plateaux system. A few miles to the west the rolling plateau gives way to more rugged topography, merging, in turn, into the Coast Mountains, which cut off direct access to the sea and necessitate a trip of about 150 miles by road eastward to Williams Lake; thence 315 miles by railway and steamer, or about 365 miles by highway, in order to reach Vancouver.

The area tributary to Tatla Lake has a moderate precipitation, has generally a dry summer and a rather cold winter. Settlers have lived in this area for many years, driving their cash product—beef cattle—to the railway at Ashcroft in the early days and now to Williams Lake. A motor-truck makes the return trip between Williams Lake and Tatla Lake weekly, carrying mail, passengers, and freight. Accommodation for travellers is available at various points along the route, also at the ranch of Robert Graham, site of the Tatla Lake Post-office and store, and of a very comfortable dwelling, where excellent accommodation is afforded travellers. At Kleena Kleene, 15 miles westward on the route to Perkins Peak, James Mackill maintains a lodge offering good accommodation.

Blackhorn Mountain Section.

Following a discovery of gold-bearing quartz in 1936, there has been a good deal of prospecting activity at the head of Razor (Wolverine) Creek, a northward-flowing tributary of Mosley Creek (West Branch of the Homathko River). The work has been done principally on Blackhorn Mountain, which is on the western side of Razor (Wolverine) Creek, though some quartz discoveries have been reported on the eastern side.

A truck-road, 15 miles in length, runs southward from Tatla Lake to the north end of Bluff Lake. From this point a pack-trail about 2 miles in length, along the eastern side, leads to the south end of the lake. Near the north end the trail crosses precipitous bluffs for about 450 yards. It is more convenient to travel the length of the lake by boat. From the southern end of Bluff Lake the pack-trail continues to the head of Razor (Wolverine) Creek, a distance of about 15 miles. It runs through sections in which the trees have been killed by fire in the past few seasons. The grade of the trail is easy for most of its length. The trail up the main valley of Razor (Wolverine) Creek leads to temporary camps situated on the eastern side of a lake near the head of the creek. A branch trail climbs steeply up the

western side to a temporary camp, at 6,300 feet elevation, on the property of the Homathko Gold Mines, Limited. From the head of the lake a trail crosses to the west side and climbs to a temporary camp at approximately 6,950 feet elevation on the *Homestake* group of A. F. Rafferty.

The only topographical map of this section shows the peak known as Blackhorn as reaching an elevation of approximately 10,000 feet, and Razorback Mountain, east of the valley, is shown as reaching a height of 10,667 feet above sea-level. The lake near the head of the valley has been named Blackhorn Lake, is a little less than a mile in length and reaches a width of about a quarter of a mile. Its elevation is approximately 5,450 feet. The head of the lake is immediately at the toe of a glacier which occupies the valley-bottom from this point upward, rising rather steeply in a south-westerly direction. The eastern or south-eastern side of the valley near the head of Blackhorn Lake is precipitous and several hanging glaciers are to be seen above the level of the ice-tongue in the main valley. The western valley-wall is also precipitous in part. It is cut by several narrow chutes or draws and contains several small glaciers. Except on the steeper slopes the bed-rock is covered with talus or glacial debris of varying thickness.

The elevations of the workings and principal exposures, as determined by altimeter readings, range from about 6,775 to 7,575 feet above sea-level. The workings and the two temporary camps near them are above timber-line, a considerable handicap as it necessitates packing fuel and such timber as may be required for prospecting. There is some small balsam timber near the lake, and a more abundant supply of suitable timber farther down the valley.

Some forty-nine claims were reported to be in good standing in the fall of 1938. None of the claims has been surveyed and the writer saw comparatively few of the location posts or cairns. The following explanation of the positions of the various holdings is based on information supplied by the owners. It is understood that the ten *Homestake* claims, owned by A. F. Rafferty and associates, cross the valley above Blackhorn Lake and include, therefore, bluffy country south and south-east of the lake, the glacier-filled valley-bottom and ground on the western side of the main valley. Of the thirty claims held by Homathko Gold Mines, Limited, it is understood that two lie just east of the lake and the others lie on the west side of the valley extending northward from the *Homestake* claims for about 3 miles. However, it is understood that the *Black Horn* claim, owned by Mrs. R. Nicholson, of Tatla Lake, and the *Victor No. 2* claim, owned by J. Hamm, also of Tatla Lake, divide the company's claims into two blocks. Further, it is understood that the *Hunting Lodge* claim, owned by J. Mackill, of Kleena Kleene, is surrounded by claims in the company's south block, that the *Victor No. 1*, owned by G. V. Braid, of Tatla Lake, adjoins the *Victor No. 2* to the north-west, and that Rafferty's *Bonanza* group of six claims adjoins the company's northern block of claims to the north-west.

The writer visited this section early in September, and in addition to the time required travelling between Tatla Lake and the camp on the Homathko Gold property, spent four days examining workings and surface exposures. During this period some snow fell, accumulating on occasion to a depth of perhaps 1 inch; there were also heavy rains. These reduced the visibility and did not facilitate getting over the rugged terrain. Because of weather conditions it was not possible to visit all reported discoveries, though places where substantial work has been done were visited, as were also many showings where little work had been done. No showings lying east of Razor (Wolverine) Creek were visited by the writer. A surface cut and near-by outcrop on the *Golden Lode* claim were the only points examined in the northern block of the Homathko Gold Mines holdings. The adjoining *Bonanza* group and the *Victor No. 1* and *Victor No. 2* were not visited.

The report on this Blackhorn Mountain section is based on the writer's observations in September, 1938, and on the reports by O'Grady and Dolmage, previously mentioned. Available maps of the section are of small scale and are incomplete. For the purposes of this report the relative positions of the various workings and exposures were determined roughly by a combination of pace and compass surveys with triangulation, based on differences of elevations from altimeter readings, and on bearings and vertical angles, measured with a Brunton compass. These methods are necessarily subject to considerable errors.

The head of Razor (Wolverine) Creek lies approximately at the southern limit of the geological and topographical mappings by Dolmage (Geological Survey, Canada, Summary Report,

1925, Part A), which shows the section as underlain by rocks of Triassic age, with intrusive rocks of the Coast Range batholith lying not far to the west and south-west. The Triassic rocks are described as a "thick series of volcanic rocks—interbedded with some thin beds of argillite and lenses of limestone containing fossils of Triassic age." The Coast Range batholith is composed of quartz diorite and granodiorite.

The examination made in September, 1938, was confined to a belt about 3 miles in length on the west side of Razor (Wolverine) Creek. The belt examined generally lies between elevations of 6,800 and 7,500 feet. The highest rocks observed are greenstones, though in the steep slopes and crags which tower above the highest points visited there are probably beds or lenses of sedimentary rocks. The rocks exposed consist of greenstone, conglomerate, generally green in colour, dark, thin, platy argillaceous rocks, some bands of grey sericitic schist, and numerous light-coloured dykes and sills which cut the other rocks. The greenstones probably represent altered andesite. The pebbles and matrix of the conglomerate are so permeated with chlorite that from a distance of a few feet it is not readily distinguishable from the greenstone. The conglomerate is schistose at some points, but some green chlorite schist, which grades into massive greenstone, may represent highly chloritic sediments or the greenstone rendered schistose near its margin.

Owing to the difficulty in travelling along the steep easterly-sloping side of the valley, to interruptions of continuity by numerous dykes which extend high above the belt examined, and to the fact that the attitudes of the rocks show considerable variation, coupled with the fact that accumulations of ice or rock debris mask certain sections, the relationships of various rock-masses were not traced with certainty. Therefore, the interpretations which enter into the following description of relationships are subject to revision.

The belt examined extends in a general north-south direction for approximately 3 miles. The upper camp and the adit on the Homathko Gold Mines property are approximately 1 mile from the north end, and Rafferty's upper camp on the *Homestake* group is about half a mile from the south end. These camps furnish points of reference used in the following notes. For much of the southerly 2 miles, black, platy argillites were the lowest rocks observed. The top of this member of the formation ranges from about 6,800 feet elevation half a mile south of the adit to 7,200 feet elevation a little south of Rafferty's camp. The base of this member was not observed, but near Rafferty's camp a thickness of 300 feet is exposed. Green conglomerate overlies the platy argillites. A thickness of 300 feet of conglomerate was measured at one point. This may include some bands of argillaceous rock. Grey sericitic schist, probably varying in thickness and 50 to 60 feet thick at some points, tops the conglomerate. Green schist, grading upward into massive greenstone, immediately overlies the grey sericitic schist. North of the Homathko Gold Mines camp the underlying argillites may also be almost continuous, but of this the writer is less certain. However, the green conglomerate, topped by grey schist, in turn overlain by massive greenstone, was observed 1 mile north of the camp. Not far south of the camp massive greenstone outcrops in a spur projecting eastward into the valley. The greenstone appears to have a width of at least 1,000 feet from north to south and to extend westward right below the adit. The lowest point at which the greenstone was observed was at approximately 6,400 feet elevation, below which it continues for some distance at least and above which it appears to continue to just below the adit. The greenstone thus breaks the continuity of the platy argillites which, however, were seen at the proper elevations to the north and to the south, though their contacts with this greenstone are covered with debris. The presence of this greenstone is of considerable importance, as it is undoubtedly more favourable structurally for fissure-vein formation than the platy argillite and probably more than the green conglomerate.

Light-coloured granitic dykes and sills are prevalent and conspicuous. Many of the dykes have an east-west trend and stand almost vertically. They also vary in attitude. Between 1 mile and 1¼ miles south of the camp, dykes and masses of this rock form the greater part of the exposures. In the vicinity of Rafferty's camp and for some distance south dykes and sills are numerous and are particularly conspicuous in the black argillite which, curiously enough, appears generally to lie almost horizontally, though so cut by intersecting dykes that it appears as comparatively small masses of black, platy rock, separated by almost equal widths of dyke-rock. The compositions of the dykes vary considerably, but they are generally of the granodiorite to quartz diorite order and are commonly porphyritic. At a number of points these dykes cut the quartz veins without important displacement. South of

Rafferty's camp there are several cuts exposing quartz on either side of a diabase dyke and close to a granitic dyke. The nature of the exposure was not such that the relationships could be definitely determined.

Where bedding-planes could be recognized their strikes range from northward to 30 degrees west of north with low to moderate westerly dips. Schistosity, however, ranges from north-west with south-westerly dips to north-east with north-westerly dips. The dips are generally between 15 and 30 degrees, but occasionally reach 45 degrees.

There are numerous quartz exposures. In general, these are in the schistose rocks. Commonly quartz, as stringers or as narrow veins, follows the schistosity or bedding. At other points quartz occupies fractures which definitely cut across the host-rock. The occurrences observed are generally less than 2 feet wide and most of them range from 1 inch to 15 inches wide. Some of them are traceable for considerable distances, but quite a few are comparatively short lenses which are related to more persistent structural breaks. Commonly the quartz is present as numerous irregular stringers over widths of several feet. Usually there is some silicification of wall-rock, and in some cases, adjacent to veins and stringer-zones, the wall-rock has been largely replaced by quartz and carbonate for widths up to 9 or 10 feet. Some steeply dipping quartz veins were observed cutting across the strike of the schist, and of these some were observed to pass abruptly, in a roll, from this cross-cutting relationship to an attitude essentially conforming with that of the schist.

The quartz at various points contains sulphides, and commonly fine sulphides are disseminated in the silicified wall-rock. Generally the sulphides have been introduced after the quartz has been fractured, and occasionally they have replaced carbonate in fractures or small masses in it. Visible sulphides include arsenopyrite and pyrite, and some chalcopyrite, sphalerite, and galena occur locally, and pyrrhotite has been reported in a section examined microscopically. Free gold in fine grains is to be seen in some of the ore and has also been reported from microscopic studies. Some of the free gold found in material from the outcrops may represent surface concentrations, but visible free gold has been recognized in specimens from the adit away from any significant oxidation. In the notes on microscopic study of material from the Homathko Gold property, published in the 1937 Report of the Minister of Mines, it is suggested that the gold belongs to a period in the mineralization later than the deposition of the sulphides.

This is perhaps borne out by the fact that some vein material carrying fair sulphide mineralization does not assay very well in gold, and wall-rock, even though impregnated with sulphides, in most cases is practically barren. However, the sections carrying best values in gold are usually well-mineralized with sulphides, of which arsenopyrite is commonly the most abundant. Lacking sulphides or visible free gold, quartz sampled by the writer was essentially barren.

Numerous quartz-outcrops are to be seen at intervals in a length of 3 miles, and at several points interesting values in gold are found. In general, these exposures are in schist and the mineralization would be regarded as weak. Though there is a rough alignment for considerable distances there is also a good deal of variation in the attitudes of the various quartz veins and lenses. Though no one vein can be said to have been traced continuously for any great distance, the occurrence of numerous quartz-outcrops in the weaker rocks over a distance of 3 miles, with occasional sections yielding attractive values, is encouraging and with the results of a small amount of underground work suggest to the writer that there are fair chances of finding commercial ore-bodies in fractures in the more competent rocks near the quartz-outcrops. This statement must be modified to exclude the granitic dykes which cut the quartz veins and are therefore probably later than the gold mineralization.

Black Horn Claim.

This claim was recorded in 1936 in the name of Mrs. R. P. Nicholson, of Tatla Lake. It is understood to adjoin the *Golden Lode No. 2* claim to the south-east and, accordingly, lies between the northern and southern blocks of claims owned by Homathko Gold Mines, Limited. The writer was guided to the showings on the claims by J. Hamm, of Tatla Lake, owner of the *Victor No. 2*, recorded in August, 1938, which is said to lie just west of the *Black Horn*. The *Golden Lode No. 2*, on which a cut at 7,000 feet elevation is described under Homathko Gold Mines, Limited, and the *Black Horn* claim were reached by climbing north-westward up the slide from a point on the trail about three-quarters of a mile northward from the Homathko Gold Mines camp. The

showings are from one-half to three-quarters of a mile from the trail and 950 to 1,175 feet higher, at elevations from 6,775 to 7,000 feet.

The most northerly showing on the *Black Horn* claim is about 200 yards, somewhat east of south, from the *Golden Lode No. 2* cut at approximately 7,000 feet elevation. The showing consists of quartz exposed from north to south for about 100 feet. It is cut by a porphyritic dyke 30 feet from the north end. The quartz is from 1 inch to 4 or 5 inches wide for most of its length, but is about 1 foot wide at the north end where it contains a moderate proportion of sulphides. For most of the length the quartz follows the foliation of the grey schist host-rock. It strikes north 30 degrees west and dips 20 to 30 degrees westward. At the south end the quartz turns sharply downward to occupy a narrow fracture, striking east and standing almost vertically, which is exposed for 4 feet below the flat-lying vein. The flat-lying vein does not appear to continue southward, but from 35 to 50 feet southward at approximately the projection of the flat vein quartz about 3 inches wide is exposed, conforming with the schist. It, too, turns down in a steeply-dipping fracture, on the sides of which the schist is altered and impregnated with sulphides for a total width of about 18 inches. A short distance to the south, at approximately the same elevation, a vein is exposed cutting the schist at a small angle. The fracture strikes north-west and dips 45 degrees south-westward. Northward the outcrop rises along the face of a bluff, slowly cutting through the grey sericitic schist to green schist underlying massive greenstone, and gradually assumes the attitude of the schist, which strikes north 30 degrees west and dips 20 degrees south-westward. Quartz is traceable for about 120 feet, beyond which irregular lenses appear for another 75 feet. Near the lower and southerly end there is up to 18 inches of quartz along the sides of the narrow fracture. The wall-rock is altered and impregnated with sulphides so that a maximum width of about 4 feet shows evidence of mineralization. A porphyritic dyke 10 feet wide, striking north-eastward, cuts the mineralized band from 40 to 50 feet from the south end. Beyond the dyke the mineralized width narrows from 3 feet to from 6 to 18 inches with irregular lenses lying below the main vein at some points. The southerly 40 feet is the widest and best mineralized section. It contains galena and pyrite and some chalcopyrite occurring in small masses, though much of the mineralized material contains little sulphide.

The following two samples were taken 15 feet from the south end, they give a section across a mineralized width of 42 inches.

Description.	Gold.	Silver.
	Oz. per Ton.	Oz. per Ton.
20 inches quartz with sulphides	0.18	Trace
22 inches mineralized schist underlying the quartz	Trace	Trace

A cut has been made in this wide quartz-lens which, for convenience, will be referred to as "cut X," from which distances south-eastward were estimated roughly. There are several exposures lying to the south-east on which some stripping has been done. From about 350 to 480 feet south-eastward a reddish-weathered band is exposed. It consists of 3 to 6 feet of altered schist cut by many quartz stringers and impregnated with disseminated sulphide grains. A selected sample of the best mineralized material assayed a trace in gold and 0.2 oz. silver per ton.

Between 570 and 675 feet south-eastward a similar rusty lens about 5 feet in width is exposed with a cut about midway along the lens at about 6,760 feet elevation. Beyond this, the bluffs are precipitous and inaccessible for some distance, but about 1,300 feet south-eastward from cut X there is a cut at approximately 6,725 feet elevation. It is in shearing which strikes about north 30 degrees west and dips 20 degrees north-westward, and follows the foliation of the green schistose conglomerate in which it lies. Quartz is irregularly distributed along the shearing which is exposed for 60 feet northward and 80 feet southward from the cut. The quartz, usually 1 to 2 inches wide, swells at points to 8 inches and occasionally to 12 inches wide. Some of the quartz contains a moderate amount of sulphide minerals.

Homathko Gold Mines, Ltd.

This company, incorporated in May, 1937, acquired claims on Blackhorn Mountain which had been owned by L. Butler, N. Pohlman, C. Mackill, and associates. The thirty claims held include twenty-nine staked in 1936 and one staked in 1937. William Pohlman is president of the company. Prospecting and development-work have been carried on during the past three years. In the fall of 1938, L. H. Timmins, acting for the N. A. Timmins Corporation, of Montreal, acquired an option on the property. The property was described by O'Grady in the 1937 Annual Report of the British Columbia Minister of Mines, Part F, and as noted there a small quantity of ore milled by amalgamation on the property is reported to have yielded gold to the value of about $275.

The claims cover ground to the west of Razor (Wolverine) Creek, with the exception of two claims lying just east of Blackhorn Lake. According to information supplied by the various claim-owners, the company's holdings are divided into a north and a south block, separated by the *Black Horn* and *Victor No. 2* claims, owned respectively by Nicholson and Hamm. The south block, including fifteen claims on the west side of the valley, extends for the length of five claims from north to south. The camp is in the northern half of this block, at approximately 6,300 feet elevation, on a bench overlooking the lake. The most important workings on the property, an adit at approximately 7,100 feet elevation and a surface cut 85 feet above it, are in this block, about half a mile due west of the camp. The cut is at the top of a bluff overlooking a small cirque and the adit is about at the base of the bluff. Both lie just south of a narrow chute or draw which discharges into the cirque. As mentioned earlier in this report it is probable that massive greenstone extends downward from approximately the elevation of the adit to about the elevation of the camp and possibly lower.

The cut was driven 28 feet south 50 degrees west from the edge of the draw; thence 6 feet due west, crosscutting a roll in the hanging-wall. A rusty fracture, 2 to 8 inches wide, striking north-east and dipping 55 degrees north-west, is exposed along the south-eastern side of the cut. At the end of the 28-foot leg of the cut, quartz with included greenstone widens from a few inches near the first fracture, 6 or 7 feet above the floor, to 6 feet near the floor on the south wall of the 6-foot westerly extension of the cut. The hanging-wall appears to roll from a northerly strike to a north-easterly one and the dip, which is 30 degrees westward and north-westward higher up, appears to become steeper near the floor. On the north wall of the 6-foot westerly extension the width becomes less near the floor. Loose rock fragments on the floor of the cut and outside the cut obscured the extent of the showing. The wide showing was sampled where crosscut by the westerly extension of the cut. The 2 feet measured from the hanging-wall, normal to the dip, sampled on both walls of the cut, assayed a trace in gold and in silver. This material consisted of quartz with included schist and contained comparatively little sulphide. The adjoining 2 feet to the foot-wall assayed: Gold, 0.98 oz. per ton; silver, trace. The sample consisted of quartz with a good deal of sulphides and was taken from the south wall. As the wall of the working presented an unfractured, hard, fairly smooth surface, the sample was difficult to cut. O'Grady described this occurrence as it appeared in July, 1937, as a lens 21 feet long, up to 6 feet wide in the central part, and quoted the assays of three samples as follows:—

Description.	Gold.	Silver.
	Oz. per Ton.	Oz. per Ton.
Width, 8 inches at south end of lens	0.56	0.12
Width, 6 feet in centre	0.235	Trace
Width, 8 inches at northern end	0.06	Trace

Above the cut for 30 or 40 feet the schist is rusty and contains stringers and small, irregular lenses of quartz. The schistosity strikes about 10 degrees west of north and dips about 15 degrees westward. Fairly prominent joints striking 30 degrees west of north and dipping about 80 degrees north-eastward cut the schist. Southward from the principal cut, at about the same elevation, there are several shallow cuts in the first 150 feet and another at about 260 feet, beyond which there are exposures in bluffs which become inaccessible farther south. O'Grady described the showing to a point about 500 feet south, beyond which a rusty streak is seen for some distance. The cuts expose rusty schist or quartz, and in the bluffs

there is a fairly continuous quartz vein generally 2 to 4 inches thick, but occasionally swelling to a thickness of 10 or 12 inches. It appears to dip flatly to the west conforming to the attitude of the schistosity. The following information regarding sampling along these surface showings is taken from O'Grady's report:—

Distance.	Width.	Gold.	Silver.
Southward from principal cut—	Inches.	Oz. per Ton.	Oz. per Ton.
258 feet	8	0.14	Trace
343 feet	7	0.17	Trace
394 feet	12	0.82	0.1
About 500 feet	8	0.06	Trace

The adit, at 7,100 feet elevation, 85 feet below the principal cut, is driven through greenstone in which there are two prominent sets of joints which strike from 30 to 50 degrees west of north, the one set dips steeply to the north-east and the other low to the south-west. Near the inner end of the adit the greenstone is schistose. The adit which is driven approximately 100 feet north 65 degrees west crosscut a vein in the last 2½ feet and ended in schist. The position of the vein is about 18 feet north-west of the vertical projection from the narrow fracture in the cut above, and 10 or 12 feet north-west of the vertical projection from the wide lens. Assuming that this vein connects directly with the showings in the cut, the indicated dip would be about 80 degrees north-westward. The walls of the vein are irregular, but the average strike is north-eastward and the dip appears to be almost vertical.

The vein is composed of quartz with some carbonate, sulphides, and chlorite. The chlorite doubtless represents altered inclusions of wall-rock. The sulphides, present in greater abundance than in most exposures on the property, include pyrite, sphalerite, a little galena, some chalcopyrite, and fine-grained arsenopyrite. A little free gold was seen in some selected material stored at the portal. The vein, from 18 to 30 inches wide, was widest in the roof and in the south-west wall of the working, but becomes narrower toward the floor and in the north-east wall. A sample was taken across the vein on each wall about 2½ feet above the floor. The averages of widths and assays were: 25 inches; gold, 1.6 oz. per ton; silver, 1 oz. per ton. The adit crosscut a dyke of porphyritic granodiorite between 83 feet and 89 feet from the portal. The walls of the dyke are irregular, but the strike appeared to be about north 25 degrees east and the dip about 45 degrees north-westward.

It was reported that when work was suspended early in December drifting on the vein had been done both ways from the crosscut, the total amounting to 67 feet. In the drift to the north-east it is reported that the dyke was encountered and that the vein was picked up on the north-east side without much displacement. It was also reported that the drift to the south-west encountered a fault beyond which the vein was found displaced a short distance to the east. It was further reported that sampling of the vein in the drifts yielded values which are regarded as commercial.

Between points 500 feet southward and about 1,500 feet south 15 degrees east from the cut above the adit, the showings in the bluffs are inaccessible. For part of the distance debris or ice masks the bluffs above the elevation at which the outcrop might be expected. From the point, approximately 1,500 feet south 15 degrees east from the principal cut, there are shallow cuts or exposures on the surface, at considerable intervals, for 2,100 feet, on a general course of 15 to 20 degrees east of south. These showings range from 7,575 to 7,200 feet in elevation and over a considerable distance from east to west. It is apparent that they do not represent one vein, but they may be taken as indicating that there is a considerable zone in which veins occur. In these showings the quartz generally follows the foliation of the schist host-rock.

Near the north end of this series of exposures, at 7,575 feet elevation, and by calculation 1,700 feet south 13 degrees west from the adit, a thin granitic sill outcrops. The wall-rock is green schist striking north 15 degrees west and dipping 20 to 25 degrees westward. Irregular lenses of quartz and carbonate occur above and below the sill in a total thickness of 6 feet. Some of the lenses are fairly well-mineralized with galena, sphalerite, and pyrite. They also contain chlorite. The sphalerite is in small, almost black, resinous grains. A sample of selected well-mineralized material assayed: Gold, 0.20 oz. per ton; silver, trace.

Outcrops of the granitic rock are to be found for some distance to the north, and quartz-carbonate lenses to a maximum thickness of 1 foot are exposed at intervals to a point 300 feet northward in the bluffs overlooking the cirque. There, flat-lying quartz, 16 inches wide, turns to follow a joint and cuts sharply across the schist, but a few feet below turns back again to an attitude approaching that of the schist. At 7,325 feet elevation, east of the line of outcrops just described, there is a flat-lying outcrop of quartz 4 to 6 inches thick, which contains a little arsenopyrite and some free gold. The schist, adjoining the quartz, is altered and impregnated with sulphides. A sample across 7 inches of sulphide-bearing schist assayed *nil* in gold and silver. Southward the showings are at lower elevations and pass downward from green schist into the grey, sericitic schist. The most southerly showing in this series, at about 7,200 feet elevation, is on a bluff near a tongue of a small glacier.

Three groups of showings, the most southerly on the property, will be described next in this report. The writer did not go directly from the showing just described to these most southerly showings and conditions were not favourable for locating them closely. However, the nearest of the three is estimated to be about 1,700 feet south-westward from the showing near the tongue of the small glacier, and is, therefore, considerably west of the course on which the showings just described lie.

The most southerly part of the south block of claims is very rugged and granitic dykes are numerous. The three groups of showings are from 7,450 to 7,500 feet in elevation, each is near a draw or slide course. The middle one at 7,450 feet elevation, and some 6,000 feet southward from the camp, yielded encouraging assays. There, quartz 32 inches thick, is exposed for a short distance along the strike which is north-eastward, the dip is about 25 degrees north-westward. The quartz contains pyrite, galena, and sphalerite. Between 7 and 12 inches from the hanging-wall sulphides were plentiful, and this 5-inch section, sampled separately, assayed: Gold, 0.84 oz. per ton; silver, 1 oz. per ton. The 7 inches above and 20 inches below, in which the sulphides are less plentiful, assayed: Gold, 0.16 oz. per ton; silver, trace. The combined average is 0.26 oz. in gold across the full width of 32 inches. About 25 feet lower on the same slide course, two cuts about 25 feet apart expose 12 to 18 inches of schist impregnated with quartz and fine sulphides. This material was not sampled. A porphyritic dyke outcrops just north of the slide on which the cut is situated, and dyke-rocks occupy most of the section for 250 feet to the south. At the other two points, respectively 500 feet north and 500 feet south, quartz exposures strike between north-east and north-north-east and dip about 25 degrees westward. Sulphide mineralization is less than in the middle showing.

Northward from the cut above the adit the surface consists of glacial debris and talus, but at a few points a little rusty quartz is exposed. At approximately 1,300 feet north-east there is a cut exposing some quartz in schist, and about 200 feet farther north-east at 7,265 feet elevation a cut, known as the "galena showing," exposed a lens of quartz, 12 feet long. It strikes north-east and dips 45 degrees north-west, and conforms with the green schist in which it lies. The lens pinches out rapidly at the north-east end. It was not well-exposed in September, 1938. O'Grady described it as 20 inches wide at the south-west end and 24 inches wide at the north end. He took a grab sample from about 1 ton of mineralized quartz, which assayed: Gold, 0.80 oz. per ton; silver, 1.2 oz. per ton; lead, trace; zinc, 2 per cent. Flat-lying quartz is exposed at intervals to a point 400 feet to the north-east where the hillside becomes precipitous. The rock is schistose greenstone, striking north-eastward and dipping from 45 to 70 degrees westward.

The remaining surface showing on this property visited by the writer is on the *Golden Lode* claim, near the southern boundary of the northern block of claims. The showing is at 7,000 feet elevation at a point about 1 mile northward from the adit, and is just below bluffs a short distance north-west of a tongue of a glacier, to be seen from the trail, three-quarters of a mile north of the camp.

The exposure is in grey sericitic schist immediately overlying green conglomerate, and consists of a lenticular mass composed of quartz, carbonate, and incompletely replaced schist. The lens is exposed for a length of 50 feet, is 1 foot wide at the south end, 9 feet wide at a shallow cut 20 feet to the north, and 3 to 4 feet wide 30 feet farther to the north, where it is buried beneath talus. At the south end an east-west fissure, dipping steeply to the south, rolls to the north to conform with the north-striking schist which dips west at a moderate angle. The schist above is cut by many narrow, irregular quartz stringers, and is partly

replaced by vein material including some pyrite. There is a considerable quantity of fine, flaky, white mica in the resulting lenticular mass of replacement material.

At the cut 10 to 12 inches of quartz, occupying a steep southward-dipping fracture of east strike, rolls north to form the bottom of the lens. The quartz vein containing pyrite was sampled, and across 10 inches assayed: Gold, 0.14 oz. per ton; silver, 0.3 oz. per ton. A chip sample across 5 feet of the overlying replacement material yielded *nil* assays in gold and in silver.

Homestake.

The *Homestake* claims, ten in number, owned by A. F. Rafferty, of Vancouver, and his associates, cross the valley of Razor (Wolverine) Creek above the lake. South-westward from the lake the bottom of the valley is occupied by a glacier. A sheltered position for a tent-camp has been found in a tiny cirque in the bluffs on the west side of the valley at about 6,950 feet elevation. The workings and principal showings on the property lie south-westward from the camp between 7,200 and 7,425 feet elevation. The workings examined are within 1,800 feet of the camp, on narrow benches along bluffs or on a talus-slope north of the bluffs. It was reported that there are other showings of importance farther to the south and west, and that some showings have been found in the bluffy ground across the valley to the north-east. The claims have been prospected each season since they were located in 1936.

The N. A. Timmins Corporation, of Montreal, had an option on the property for a short period but relinquished it in the fall of 1938. From the east side of Blackhorn Lake a pack-trail crosses the valley and climbs by a series of switchbacks to the camp in the little cirque. This camp can also be reached readily enough on foot from the upper camp on the Homathko Gold property, 1½ miles to the north; there is no trail for most of the distance, but the route across suitable points on the bluffs is not difficult.

In the vicinity of Rafferty's camp the black, platy sediments lie flat, but a short distance to the south they strike about north 30 degrees west and dip 15 degrees south-westward. Due west of the camp they are in contact with overlying green conglomerate at about 7,200 feet elevation. The dip of the contact brings it lower down, south of the camp, where it disappears beneath debris and ice. Light-coloured dykes which are conspicuous near the camp, are also numerous at several points to the south; they have an east strike and stand almost vertically or dip steeply. Most of the showings are in the green conglomerate or in green schist.

The most southerly cut visited is about 1,700 feet south of the camp at about 7,400 feet elevation. From a point 100 feet farther south, quartz and a zone of alteration are seen extending southward in the bluffs. Quartz is exposed on the surface or in cuts for much of the 500 feet northward from this cut. Two lenses of quartz, each about 1 foot thick, separated by about 4 feet of green schist, are exposed for a length of 5 feet, 35 feet south of the cut. The quartz is rusty and honeycombed. At the cut 2 feet of quartz containing some schist strikes north 20 degrees east and dips 65 degrees westward. The wall-rock is green, schistose conglomerate, of which the foliation strikes about north 30 degrees east and dips 30 to 35 degrees westward. The schist is rusty for 2 feet in the foot-wall and 6 feet in the hanging-wall of the quartz. Stripping, at several points in the 90 feet to the north, exposed quartz-lenses and irregular stringers over a width of about 15 feet. The quartz in the cut is traceable for 60 feet northward where, 10 feet to the east, there is a rusty honeycombed quartz-lens 1 foot thick. At 100 feet north of the first cut quartz, 12 inches wide, is exposed, from which 6 inches of quartz splits off to cut the formation vertically, then turns to follow the formation with moderate westerly dip, and is traceable for 35 feet to the north as far as a small creek. Unconsolidated material obscures the main quartz-bearing zone for this distance.

A second cut, about 165 feet north 15 degrees east from the first, has been driven 23 feet westward in the rock. This crosscuts several quartz-lenses which, with greenstone in which they occur, contain pyrite. Sampling of this material gave negligible values in gold and silver. The lenses strike about north-east and dip about 50 degrees north-westward. They probably are on cross-fracturing between a fracture, striking north 15 degrees east, about 6 feet west of the outer end of the cut, and another fracture, occupied by a greenstone dyke, about at the face of the cut, which can be traced for 75 feet due north. The fracturing or shearing near the outer end of the cut, striking north 15 degrees east, can be traced for 60 feet or so to a third cut, near which it is joined by a narrow, quartz-filled, cross-fracture

striking north-east, extending from the other fracture 20 feet to the west. In the north 15 degrees east fracture at the face of the cut there is 2 feet of quartz and sheared greenstone with some sulphides, and just west of this a sulphide-lens, 15 feet long and 27 inches wide, is exposed. The sulphide-lens consists largely of pyrite, but chalcopyrite and sphalerite were also recognized. Adjoining this to the west the greenstone contains disseminated sulphides. Three samples taken from west to east gave the following results:—

Description.	Width.	Gold.	Silver.
	Inches.	Oz. per Ton.	Oz. per Ton.
Greenstone, with quartz and some sulphides	29	0.02	0.2
Quartz and greenstone, with much sulphide	27	0.78	0.2
Quartz and greenstone, some sulphides	24	*Nil*	*Nil*

From this cut to the next the distance is 175 feet north 20 degrees east. Between 80 and 145 feet on this course there are several light-coloured dykes striking westward, a draw is crossed in the same interval. The cut on the north side of the draw exposed quartz 3 to 10 inches thick, striking north-eastward and dipping irregularly to the north-west, for 6 feet along the strike; 4 feet in the foot-wall it exposed a quartz-lens 10 inches thick. The wall-rock is green schist apparently not derived from the green conglomerate. From this point northward, talus below bluffs occupies the projection of the zone followed this far.

About 550 feet north-east, at approximately 7,200 feet elevation, a cut has been made in the face of the bluff just above the talus where a fault cuts the green conglomerate. The fault strikes north 15 degrees west and dips 50 degrees westward. Limy material on the footwall-side has been brought against the conglomerate hanging-wall of the fault. At the floor of the cut green dyke-rock occupies the fault, but higher up it does not appear. The rusty fault-gouge containing some quartz and pyrite was sampled and yielded *nil* assays in gold and in silver. In the 350 feet northward from this cut there are several light-coloured dykes.

From 400 feet north of the cut at 7,200 feet elevation a diabase dyke, 3 to 4 feet wide, is traceable northward, diagonally up the hill, for some distance. An altered, light-coloured porphyritic dyke lies a short distance to the east. Shearing, generally parallel with the dykes, was observed between the dykes and west of the diabase dyke. Quartz of varying thickness is developed in the shears. The shearing and the dykes strike north 10 degrees west and dip about 55 degrees westward. At three points, in about 200 feet along the outcrop, strippings or closely-spaced cuts over a distance of 30 feet from east to west crosscut the dykes and the shearing. The quartz is lenticular and up to 3 feet thick. Sulphide minerals are wanting or present in small quantity. A sample across the widest quartz exposure assayed *nil* in gold and silver. These cuts are about due west of the camp.

About 300 feet south-westward from the highest of these cuts, another cut exposes 8 inches of quartz with several quartz stringers in 4 feet of sheared greenstone striking north-eastward and dipping steeply to the north-west. The shearing is traceable to the south, but in general contains little quartz or sulphide. At 170 feet southward, quartz 8 inches wide is exposed, and at 200 feet quartz 30 inches wide is exposed. These showings strike about north 20 degrees east and dip steeply to the west. They are in fractures which run to the north-eastward-striking shear traceable north to the cut.

Perkins Peak Section.

Beginning with the 1935 season there has been a revival of interest in prospecting for gold-bearing quartz on Perkins Peak. Most of the activity has centred on the north-westerly slope of the mountain, where the *Mountain Boss* group was staked covering ground containing some old surface workings. The owners of the *Mountain Boss* group have prospected this ground in the past three seasons and have staked some additional claims. Workings on these claims were examined by the writer late in August, 1938. In 1938 some claims were staked in the same section for other interests. As little or no work had been done on these claims they were not examined.

The *Mountain Boss* group of eight claims was staked in 1935 and is held in the names of **F. Crosby, J. Peacock, and J. N. Killas, all of Prince Rupert.** Six claims constituting the

Mountain City group, staked in 1937, and the two *Mountain Chief* claims, staked in 1938, are held by the same owners.

Pack-trails leading to Perkins Peak leave the road which runs north-westward from Tatla Lake, near One Eye Lake, and go via Miner Lake. Two routes have been used recently in reaching a point near the south-west end of Miner Lake, from which point a pack-trail about 7 miles long climbs 2,100 feet to a temporary camp near the claims. Miner Lake lies in a south-westward-trending valley separated by a ridge, exceeding 5,000 feet in elevation, from the valley in which One Eye Lake lies. The writer travelled to the point south-west of Miner Lake by a route approximately 13 miles in length running south-westward from Kleena Kleene, which is at the south-east end of One Eye Lake, and is about 15 miles by road from Tatla Lake. This trip with saddle- and pack-horses took 4½ hours; the remaining 7 miles from Miner Lake to the camp required about 3 hours. The country traversed has been timbered with trees of moderate size. Considerable sections of the route from Kleena Kleene to Miner Lake have been burnt over and the trees have been killed. The other route is presumably that shown on maps of the area as leaving the road about 5 miles westward from Kleena Kleene and following a southerly course to the flat south-west of Miner Lake.

Perkins Peak, on the eastern flank of the Coast Mountains, rises to a height of 9,380 feet. The camp is in a small basin on the north-westerly slope at approximately 6,200 feet elevation. Above the basin talus-slopes rise to steep cliffs. A smooth talus-slope extends from a point about 2,000 feet westward to bluffs about three-quarters of a mile westward from the camp. On this slope, about half a mile from the camp, there are three surface cuts at elevations from 6,900 to 7,000 feet. The principal group of workings, consisting of eight open-cuts and an adit, is about 1 mile from the camp, beyond the bluffs, on a steep north or north-westerly slope which is cut by several gullies. These workings are at elevations ranging from 6,925 to 7,050 feet.

The geological mapping indicates that this section is underlain by rocks of Lower Cretaceous age intruded by a small diorite stock. The Lower Cretaceous rocks are described by Dolmage (Geological Survey, Canada, Summary Report, 1925, Part A) as "composed largely of thinly-bedded sandstone, black argillite, and, particularly in the vicinity of Perkins Peak, a considerable amount of volcanic breccia." The rocks exposed at the workings are chiefly light-coloured quartzite or sandstone, and black or dark grey argillaceous sediments, some of which are limy. These rocks in general strike somewhat north of east and dip southward at about 45 degrees. Basic, much-altered dykes were observed at some points in the workings, and there are exposures in the cliffs indicating light-coloured intrusives in sill and dyke relationship. In the vicinity of the principal group of workings there has been a good deal of disturbance of the beds, possibly owing in part to slumping down the almost precipitous slope. Quartz-lenses, of considerable width, occur along shearing which in general has the same attitude as the bedding, striking roughly east and dipping about 45 degrees south. There are also narrow quartz veins of irregular attitude, and at two points wider quartz veins are exposed cutting the bedding. Very considerable widths of sediments have been silicified. In the quartz and silicified wall-rock calcite is widely distributed. Sulphides, principally arsenopyrite, with some pyrite, occur as small lenses and aggregates disseminated through the silicified material and along some of the quartz-filled fractures. Gold values in unoxidized material are probably associated with the sulphides, though in general these values are low, and some samples containing moderate amounts of sulphides yielded *nil* or "trace" assays. The best values obtained by the writer were from a cut near the western end of the principal workings, where two quartz-filled fractures cut the bedding. A sample across 6 feet, including the veins and 2 feet of quartzite lying between them, assayed 0.24 oz. gold per ton; selected sulphides assayed 0.74 oz. gold per ton and 1 oz. silver per ton. Samples taken across the wide quartz lenses in the shearing yielded *nil* or "trace" assays in gold and silver. A specimen of sulphides taken from the floor of a drift on the adit-level, assayed: Gold, 0.12 oz. per ton; silver, trace. It is reliably reported that samples at a weak, rusty fracture, cut near the portal of this adit, yielded high assays in gold.

Some work was done on the property years ago. In the present activity, dating from 1936, old cuts have been cleaned out and extended. In 1938 some 230 feet of horizontal workings and an 18-foot raise were driven on an adit-level.

The three cuts about half a mile westward from the camp are driven into the northward-sloping, talus-covered mountain-side. Two of the cuts are close together, the lower exposes some quartz with indefinite boundaries. A few feet higher and to the south the second cut exposed a good deal of quartz and some sulphides developed in white quartzite in the 6 feet north of the face. The third cut is about 140 feet to the south-west and 90 feet higher. In a width of 8 feet there are several narrow quartz veins which strike south-east and dip to the north-east. The veins and the quartzite lying between them contain some sulphides. A curious feature was observed at this point—fine-grained sulphides, chiefly arsenopyrite, are found distributed along the margins of elongated, dark crystals in the quartzite. The crystals probably represent hornblende which has been largely altered to chlorite.

The principal group of workings, situated about 1 mile westward from the camp on the *Mountain Boss No. 3* claim, consists of eight surface cuts and an adit-level, all driven southward. The cuts are distributed over a distance of about 300 feet from east to west. An old cut, now almost completely filled with debris, lies about 250 feet farther to the west. The adit was driven from a point below the first two cuts.

The first cut, at approximately 7,045 feet elevation (the elevation of the adit is taken as 7,000 feet) crosscuts 16 feet of quartz containing pockets or lenses of sulphides, principally arsenopyrite. The foot-wall is irregular, but has a general strike of north 80 degrees west and dips 45 degrees southward. Two samples taken across an aggregate width of 14 feet returned *nil* assays in gold and in silver. Crushed and decomposed material extending 2 feet from the foot-wall was not sampled.

The second cut, which was largely filled with debris, appeared to be north of the projection of the quartz-lens. The third cut, about 100 feet west of the first, exposed 4 feet of quartz with scattered arsenopyrite, approximately in the position of the projection of the quartz from the first cut. The fourth cut exposes silicified material near its outer end and terminates at a much-altered basic dyke. In the fifth cut altered quartzite contains a good deal of quartz and some arsenopyrite over a width of 3 feet. In the sixth cut 1 foot of shearing contains quartz and arsenopyrite; the strike is north 70 degrees west and the dip 65 degrees southward.

The seventh cut is approximately 100 feet lower than the first and is just at the eastern side of a small draw. This cut exposes quartz, in fracturing, striking north across the bedding and dipping 30 degrees east. An upper vein, 3 feet wide, is separated by 2 feet of altered quartzite impregnated with quartz and sulphides from the lower vein 1 foot wide. The quartz veins and the intervening quartzite contain arsenopyrite, pyrite, and a little chalcopyrite. A sample across 6 feet, normal to the dip, including the quartz veins and the intervening quartzite, assayed: Gold, 0.24 oz. per ton; silver, trace. Selected sulphides, consisting of pyrite and well-crystallized arsenopyrite from the same place, assayed: Gold, 0.74 oz. per ton; silver, 0.1 oz. per ton.

The eighth cut, on the west side of the draw and somewhat north of the seventh, exposes quartz over a horizontal width of at least 16 feet. The quartz underlies 6 feet of sheared rock, the shearing strikes north 80 degrees west and dips 60 degrees southward. Toward the foot-wall the quartz is very much crushed, the foot-wall is not exposed. Two samples across an aggregate width of 14 feet, measured from the hanging-wall, yielded *nil* assays in gold and silver. This cut is 125 feet lower than the first.

The adit crosscuts the formation for 187 feet, it is driven south 25 degrees east from a point north-west of and 45 feet lower than the first cut. Between 70 and 90 feet from the portal the adit is just west of the vertical projection of the first cut. To about 105 feet from the portal the wall-rock is light-coloured, quartzitic material, much of which has been silicified and impregnated with disseminated grains of sulphide minerals. It is cut by a great many quartz veinlets and contains a good deal of carbonate. In the remainder of the working the wall-rock is dark in colour and may be described as argillaceous quartzite, though some of it is limy.

The siliceous rock near the portal is cut by joints which strike north and dip 45 degrees to the west. About 38 feet from the portal a small fracture, striking north 60 degrees west and dipping steeply north-eastward, was crossed. The fracture contains rust, and for a few inches south of it there is quartz with sulphides. A chip sample, taken along both walls of the working from 40 to 80 feet from the portal, representing quartzite with narrow quartz stringers and sparsely disseminated sulphides, assayed *nil* in gold and silver. At 87 and

90 feet from the portal, fractures which strike north 60 degrees west and dip almost vertically cross the adit; beyond them to 98 feet there is shearing and a good deal of quartz. There is also a considerable amount of sulphide, which is most abundant on the eastern side of the adit from 94 feet to 96 feet from the portal.

Between 106 feet and 112 feet from the portal there is a well-marked shear, striking north 50 degrees west and dipping 65 degrees southward, which has been followed by a drift for 25 feet eastward. It is about in the position where the continuation of the quartz-lens in the first cut would be expected. However, the quartz in this shear is confined to narrow stringers, and the strike is north 70 degrees west as against north 80 degrees east in the cut. Toward the face of the drift the amount of quartz at the floor increased materially over that in the roof. The floor was taken up for a depth of 4 or 5 feet for 14 feet west of the face, and exposed 3 to 5 feet of shearing containing a good deal of quartz and some sulphides. Two samples were taken 5 feet from the face. The first, 7 inches wide, taken at the foot-wall, assayed *nil* in gold and silver. This sample was found to contain about 7 per cent. sulphides. The adjoining 3 feet, containing about 2 per cent. sulphides, assayed a trace in gold.

At 138 feet from the portal a narrow, much-altered basic dyke was encountered. It was followed for 20 feet south 75 degrees east. The dyke is cut off in the roof by a flat, irregular slip. Vein-mineralization was not observed in this shearing.

To test the supposition that the quartz encountered in the surface cuts might have a low dip to the south, a raise approximately normal to the beds, which dip about 45 degrees southward, was put up from the end of the adit-crosscut. In its length of 18 feet the raise encountered only rock.

It is noteworthy that the strike of the shearing and fracturing on this level differs by about 30 degrees from that observed in near-by surface cuts. It is also noteworthy that the fracturing in the light quartzite dips vertically or steeply to the north, whereas shearing in the argillaceous rocks dips approximately with the bedding; that is, from 30 degrees to 65 degrees southward.

The writer did not sample the narrow fractures in quartzite in the adit but, according to reliable information, high values in gold were obtained in sampling the oxidized material in the small fracture crosscut 38 feet from the adit-portal. This was doubtless due largely to surface enrichment, but indicates the possibility that better values might be found in or along the fractures in the quartzite than in the wide quartz-lenses occurring in shearing in the argillaceous rocks, or along the contact between the quartzite and argillaceous rocks. As mentioned earlier in this report, the best values obtained by the writer were from samples taken at the seventh cut from quartz-filled fractures in quartzite, and this would seem to be the point most worthy of immediate exploration. The surface indications and the experience in the adit suggest that the wide quartz showings are lenticular, lack continuity along strike and dip, and have not yielded encouraging values.

Zeballos Area.

BY

John S. Stevenson and R. J. Maconachie.

Answer Group.* The *Answer* group, consisting of six claims, the *Answer Nos 1* to *6*, is held by H. A. Heywood and associates. The camp, consisting of two small buildings, is on the main road up the Zeballos River Valley, slightly over a mile from the beach. The main working, consisting of one adit, lies some 350 feet westward from the camp, at an elevation of 175 feet.

The adit is at the base of a small rock bluff, and had (April 18th, 1938) been driven 13.5 feet in greenstone in which there are small and irregular patches of basic, igneous rock, gabbroic or dioritic in composition. The fracture strikes south 65 degrees west and dips steeply to the north-west. The owners claim to have followed it to the south-west above the bluff, but any such tracing to the north-east is rendered impossible by the low-lying, swamp ground in that direction.

In the adit the fracture ranges in width from a hair-line to 8 inches, with an average width of 2 inches; the filling is essentially of quartz and calcite, with considerable rusty

* By R. J. Maconachie.

gouge. Mineralization is mainly by pyrite. Where the fracture attains its maximum width there is a dissemination of the gangue minerals and sulphides into the walls; where narrow, the filling is commonly frozen to the foot-wall and tight to the hanging-wall. There is no leaching of the wall-rock and no mineralization beyond the limits of the fracture.

Samples taken on April 10th and April 18th, 1938, were as follows:—

At portal plus 7 feet, across 3 inches of quartz with slight pyrite, in the face (April 10th, 1938): *Gold, 1.20 oz. per ton; silver, 0.5 oz. per ton.*

From portal plus 7.2 feet to portal plus 10.8 feet, over full width of fracture filling, ranging from 1 inch to 2 inches, and consisting of gougy, rusty calcite, a little quartz, one or two small patches of fine-grained, dark sulphides and a slight amount of coarser sulphides, mainly pyrite (April 18th, 1938): Gold, 1.04 oz. per ton; silver, 0.6 oz. per ton.

From portal plus 10.8 feet to face at portal plus 13.5 feet, over full width of fracture filling, ranging from 1 inch to 2 inches and mineralized as the preceding sample: Gold, 0.30 oz. per ton; silver, 0.3 oz. per ton.

At portal plus 13.5 feet, over 2½ inches of calcite, a little quartz and slight visible pyrite, in the face (April 18th, 1938): Gold, 0.04 oz. per ton; silver, trace.

At portal plus 13.5 feet, over 18 inches on the foot-wall of the preceding sample, mostly barren greenstone with some calcite veinlets: Gold, *nil;* silver, *nil.*

Beano Group.* The *Beano* group, reported to consist of twelve claims, the *Beano Nos. 1* to *4*, the *Lima Nos. 1* to *4*, and the *Pat Nos. 1* to *4*, staked by A. Stuart and associates, adjoins the *Friend* group on the west. Access at present is by the trail to the *Friend* group, and a branch trail leading off to the north to the camp-site which lies at an elevation of 1,480 feet. By this route the camp is 3 miles from the town of Zeballos. If developments warrant, a new route by way of the main Zeballos River Road and *Golden Gate* ground will probably prove to be the most practical.

Lying approximately 1,000 feet north of the camp, at an elevation of 2,600 feet, the showings have, as yet, had little development. The location of the outcrop on a 40-degree slope at the edge of a sheer canyon 150 feet deep does not lend itself to easy exploration.

The original outcrop was of decomposed basic rock, probably originally gabbro, surrounded by greenstone; no apparent structural relation between the gabbro and the greenstone was visible. Mineralization in the gabbro was irregular, chiefly by massive pyrrhotite.

Recent stripping has exposed two lenses of gabbro. From this stripping, which is insufficient to base comprehensive judgment of the occurrence, the lower lens, at an elevation of 2,593 feet, appears to strike north, dip 40 degrees east toward the lip of the canyon, and have a width of a little better than 4 feet. The hanging-wall has been exposed over an irregular area approximately 8 by 10 feet; the width has been exposed in the face of a crosscutting bench 19 feet long. Samples taken from the face of this cut across the full width exposed were as follows:—

No. 1.—At 3 feet from west end of the bench, across 50 inches of decomposed gabbro, little visible mineral: Gold, 0.80 oz. per ton; silver, *nil;* nickel, *nil;* platinum, *nil.*

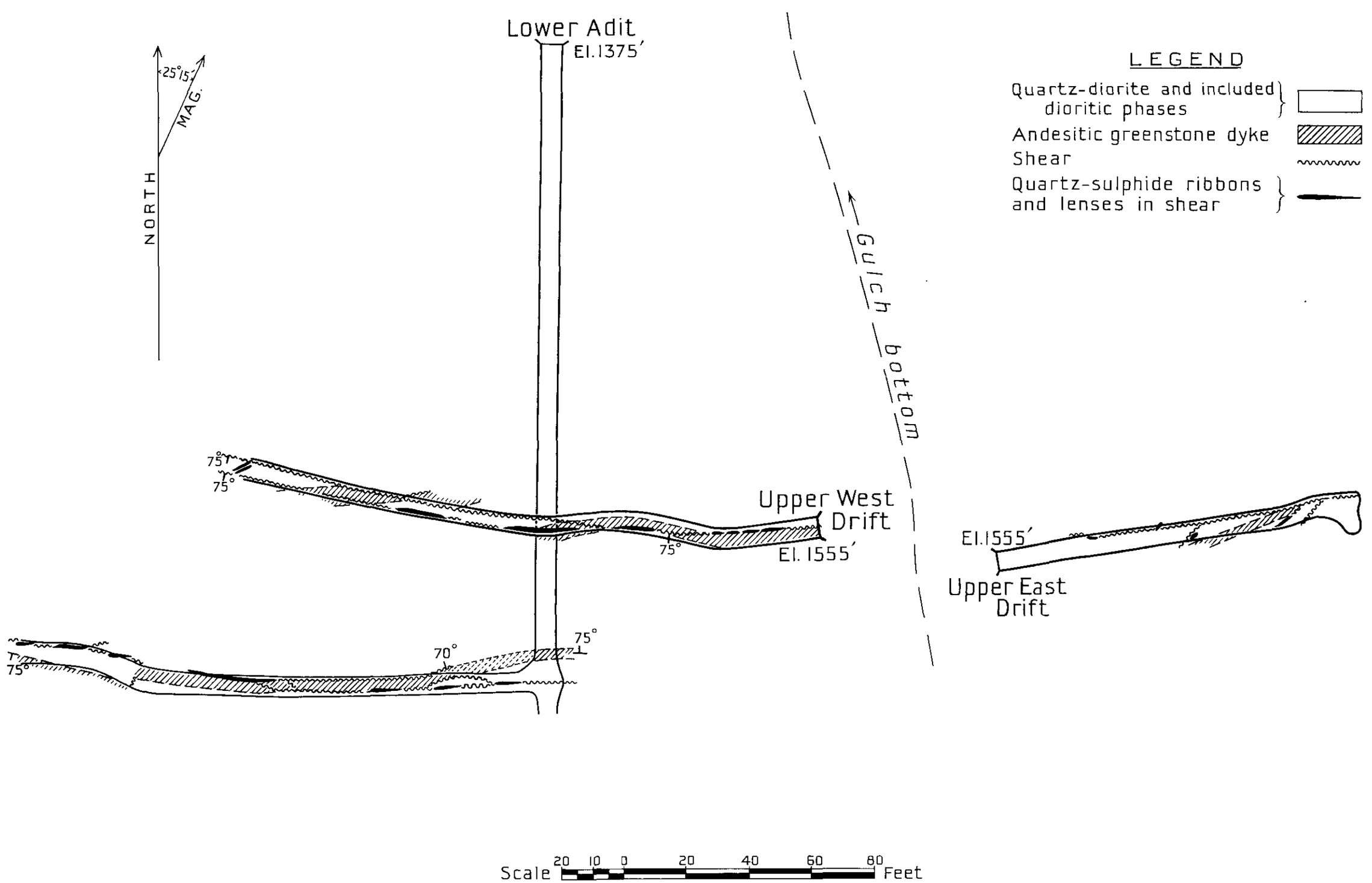
No. 2.—At 9 feet from west end of bench, across 28 inches of decomposed gabbro, containing one section of abundant pyrrhotite: Gold, 1.60 oz. per ton; silver, 0.2 oz. per ton; nickel, *nil;* platinum, *nil.*

No. 3.—At 15 feet from west end of bench, across 10 inches of decomposed gabbro, including 5 inches of almost solid pyrrhotite: Gold, 3.50 oz. per ton; silver, 0.1 oz. per ton; nickel, *nil;* platinum, *nil.*

No. 4.—A sample of massive pyrrhotite assayed: Gold, 9.38 oz. per ton; silver, 0.2 oz. per ton.

The upper stripping, at an elevation of 2,610 feet, had not exposed the formation as clearly and had only been blasted into at one location at the west end of the outcrop. From the available evidence it appeared that this may be a separate mass of gabbro separated from the lower one by greenstone. The total area stripped at this upper location was about 15 by 25 feet. One sample, No. 5, taken at the west end over 33 inches of very badly decomposed gabbro, carrying a little pyrrhotite, assayed: Gold, 2.76 oz. per ton; silver, trace; nickel, *nil;* platinum, *nil.*

* By R. J. Maconachie.



Central Zeballos Gold Mines, Limited (N.P.L.), underground workings. Modified from Company's plan; drift detail and geology by the writer.

Near the snow-covered floor of the ravine, some 200 feet south of these outcrops, there are exposures of similar material on the west wall of the canyon. At the time of examination (April, 1938) there had been no work done at that location and the significance of the occurrence had not been determined.

Central Zeballos Gold Mines, Ltd. (N.P.L.).†

The Central Zeballos Gold Mines, Limited (N.P.L.), owns the following mineral claims: *Extension Nos. 5* to *8*, staked in 1936 by N. H. McClary, *Extension Nos. 9* and *10*, staked in 1937 by Einar Ellingrud, and *A.B.*, *A.C.*, *A.D.*, and *A.E.*, staked in 1937 by Victor M. Davis. The original workings on the ground covered by the above claims were described by the writer in "Lode-gold Deposits of the Zeballos Area," British Columbia Department of Mines, 1938, pp. 21–22, under the name of *Extension* group. Since then three adits have been driven, the total underground work comprises approximately 690 feet as of September 10th, 1938, and the camp has been moved from Goldvalley over to Bibb Creek.

The camp may be reached by following a go-devil trail that leaves the main Zeballos Road at the *Privateer* mine and follows up the Zeballos Valley for 2 miles to the main camp near the mouth of Bibb Creek, at an elevation of 660 feet. The workings are up Bibb Creek Canyon, the lower adit being at an elevation of 1,375 feet and the upper two adits both at an elevation of 1,555 feet.

The rock-walls of the canyon rise precipitously from the adit-portals to the steep ridges above. However, a steep foot-trail goes from the upper adit westward up the mountain-side, one branch leading to the westerly showings and the other branch leading to the copper showings and to the original camp on the Goldvalley side of the ridge lying between Goldvalley and Spud Creeks.

The underground workings comprise three adits; a lower crosscut adit and drift at an elevation of 1,375 feet, and two upper drifts both at the same elevation of 1,555 feet. The lowest adit is reached by a good horse-trail up Bibb Creek Canyon and the upper two by a steep trail and guide-rope leading still farther up the same canyon. Tram-lines connect the upper adits with the lower, and the lower adit with a loading-platform at the camp.

The deposit consists of disconnected ribbons and broken lenses of quartz and sulphides that occur within a narrow complex shear-zone. The shear, in part follows, and badly faults, a greenstone dyke. The dyke has been highly leached and altered by mineralizing solutions and appears to have been of andesitic composition. Other than the dyke, the main rock formations in the adit comprise dioritic phases of the Zeballos batholith. The detailed relationship of the greenstone dyke, shear and quartz-sulphide lenses, are shown on the accompanying plan.

Sampling.—A number of samples were taken in the drifts to ascertain the manner of distribution of the gold. The detailed results of this sampling are given below:—

	Distance from Portal.	Width.	Gold.	Silver.	Lead.	Zinc.	Remarks.
	Feet.	Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	
Upper adit, west drift	21	14	0.20	Trace	*Nil*	Trace	Fourteen inches, width of crushed dyke in shear zone.
	30	1	2.60	1.8	*Nil*	1.1	Across 1-inch width of quartz-sulphide ribbon.
	48	30	Trace	Trace	*Nil*	*Nil*	Across full 2.5-foot width of crush zone in dyke, including gouge on both walls.
	60	2	4.74	2.8	*Nil*	0.9	Across 2-inch quartz-sulphide ribbon.
	60	6	0.04	Trace	*Nil*	0.1	Across full width of gouge and crushed rock accompanying last sample.
	84	18	0.72	0.8	*Nil*	1.1	Across 18-inch crush zone, including one 3-inch quartz-sulphide ribbon.

† By John S. Stevenson.

Detailed Results of Sampling—Continued.

	Distance from Portal.	Width.	Gold.	Silver.	Lead.	Zinc.	Remarks.
	Feet.	Inches.	Oz. per Ton.	Oz. per Ton.	Per Cent.	Per Cent.	
Upper adit, west drift	100	14	0.86	1.0	*Nil*	0.3	Across 10-inch crush zone, plus 4 inches of quartz and sulphides.
	120	8	0.08	Trace	Trace	Trace	Across 4 inches of crush zone and 4 inches of quartz and sulphides.
	134	30	Trace	Trace	*Nil*	*Nil*	Across full width of fractured and leached greenstone dyke.
	180	....	Trace	Trace	*Nil*	*Nil*	White gouge from fault on south wall.
	180	2	4.6	5.6	5.1	7.5	Across full width of diagonal quartz-sulphide stringer in face.
Upper adit, east drift	30	8	0.06	Trace	*Nil*	*Nil*	Across full width of crush zone, including 1-inch quartz-sulphide ribbon.
	114	3	0.02	Trace	*Nil*	*Nil*	Across full width of crush zone, including bordering gouge.
Lower adit, westward from crosscut	22	18	Trace	Trace	*Nil*	*Nil*	Across 18-inch zone of crushed and leached diorite, containing 1 inch of lean quartz.
	40	8	Trace	Trace	*Nil*	*Nil*	Across 8-inch zone of crushed dyke and gouge.
	40	....	Trace	Trace	*Nil*	*Nil*	Thin hard films of black gouge on either side of above zone.
	70	32	0.06	Trace	Trace	*Nil*	Across full width of white leached dyke between bordering fault surfaces, including black gouge on either wall.
	77	36	Trace	Trace	*Nil*	Trace	Ditto, but without gouge.
	94	1	7.60	5.4	0.3	1.1	Along fairly continuous 1-inch ribbon of quartz and heavy sulphides.
	100	8	0.04	Trace	*Nil*	*Nil*	Sample across typical crush-zone with only a little crushed quartz, no sulphides.
	116	3	6.70	1.2	Trace	1.5	Across maximum or 3-inch width of a lenticular quartz-sulphide ribbon, 30 feet long.
	152	8	0.10	0.5	*Nil*	Trace	Across an 8-inch width of lean crushed and sugary quartz.
	160	¾	3.80	3.0	0.8	2.3	The ½- to ¾-inch band of quartz and heavy sulphides bordering a 6-inch width of lean quartz at this point.
	160	6	0.01	Trace	*Nil*	*Nil*	Across full 6-inch width of lean quartz.
	160	....	Trace	Trace	*Nil*	*Nil*	Seam of white gouge in footwall of last sample.
	170	5	8.10	3.5	*Nil*	0.6	Across full width of quartz sulphide vein in face, best width and vein-section seen.

The results of the sampling, as given in the above table, indicate that: (1) The gold occurs only in the quartz-sulphide ribbons or lenses; (2) only very little gold occurs in the badly crushed and leached rock and gouge of the main shear-zone (more gold, of course, would be expected in crushed sulphides); (3) the greenstone dyke itself contains very little gold, neither where badly leached and fractured nor where lying between well-defined shears.

Surface Workings.—The surface workings consist of several open-cuts and trenches that, with the exception of the first, trace out the continuation of the greenstone dyke for approximately 2,150 feet westward over the crest of the hill. The strippings and two open-cuts immediately above the portal of the upper west drift expose sheared rock and vein-matter

similar to that found in the underlying section in the drift; the surface showings adjacent to the upper drifts were described in 1938 in "Lode-gold Deposits of the Zeballos Area," pp. 21–22.

The many open-cuts that lie westward beyond these immediate showings will be described serially from east to west.

In a north-eastward-trending gulch, at a point approximately 145 feet above and 250 feet westward from the portal of the upper west drift, a small cut exposes two intersecting, vertical shears, a 4-inch shear striking east and a narrow 1- to 3-inch shear striking north-eastward down the gulch. Two quartz-sulphide lenses branch from the main or east-west shear into the south-westerly angle between the two shears. These lenses range from 1 inch to 3 inches in thickness. The rock formation consists of leached phases of the quartz diorite.

Fifteen feet above and approximately 100 feet westward from the last showing, a trench or open-cut has been driven south 70 degrees east for 12 feet into the hillside. No well-defined shear or quartz-sulphide veins were seen in either the trench or in the 15 feet of stripping extending southward from the face; however, the trench exposes a leached section of the greenstone dyke in diorite.

Seventy-five feet above and 350 feet westward from the last trench a combined stripping and small open-cut in the bed of a north-eastward-trending gulch exposes a 30-foot length of shear, striking north 73 degrees west and containing 12 to 14 inches of shattered diorite and 2 to 8 inches of gouge, but no quartz-sulphide vein-matter. This shear lies 1 foot to 2 feet northward from a westward-trending section of the greenstone dyke, here 3 feet wide.

Twenty-five feet above and 300 feet westward from the last cut and on the westerly side of the summit, the greenstone dyke is exposed for 20 feet vertically in the face of a westward-facing bluff. The dyke is conspicuously fractured by joints which strike parallel to it, but are opposed in dip—i.e., dip 75 degrees northward. There is neither any well-defined shear-zone nor any quartz and sulphides in this showing.

In a flat 150 feet below and at a place approximately 100 feet westward from the last or bluff exposure, a shallow stripping and a pit 5 by 3 feet deep, 50 feet beyond the stripping, expose the greenstone dyke, here 2 feet wide, but there is neither any accompanying shearing nor vein-matter.

One hundred and ninety feet below and 150 feet westward from the bluff showing, a low bluff exposes a 2-foot width of greenstone dyke; shear and vein-matter are absent.

Forty feet below and 30 feet westward from the last showing, the greenstone dyke was seen in a long rock chimney; it was possible to get to only 15 feet of the exposure, but the dyke appeared to be similar in all respects to the last.

Copper Showing.—A showing of chalcopyrite occurs in the bed of and up the sides of a rocky canyon at a point 500 feet above and approximately 800 feet southward from the upper adits.

Chalcopyrite and pyrrhotite occur disseminated throughout a dense, siliceous green rock that consists mostly of diopside; the mineralization responsible for the formation of these sulphides, and of the lime silicate, diopside, represents high temperature replacement of limy sediments. The zone of maximum sulphide deposition is 20 feet wide, strikes east, and appears to dip 75 degrees north.

The same zone of disseminated chalcopyrite and pyrrhotite is reported to extend westward and eastward over the mountain.

During 1938, high-grade ore was mined from the drifts and shipped to Tacoma, production for the year being 152 oz. of gold and 91 oz. of silver from 31 tons of ore.

Friend Group.* This group of eight claims, the *Friend Nos. 1* to *8*, and the adjacent *Pioneer* group of seventeen full claims, the *P. Nos. 1* to *11*, *P. Nos. 13* to *18*, and six fractional claims, the *P. Fr.*, the *P. Nos. 1* to *3 Fr.*, and the *P. Nos. 5* to *6 Fr.*, are being prospected and developed by the Pioneer Gold Mines of B.C., Limited. The *Friend* group was staked by A. Stuart, A. MacDonald, and C. Smith in September, 1937.

The area covered by these claims lies on the west side of the Little Zeballos River and is drained by Friend and Beano Creeks. The present camp, on the *Friend No. 1* claim, is reached either by 2½ miles of trail from the beach at the mouth of the Little Zeballos River or by 3½ miles of trail from the town of Zeballos. The latter route is the one in common use

* By R. J. Maconachie.

in back-packing supplies at the present time. This trail from the town attains an elevation of 483 feet within a horizontal distance of a quarter of a mile from the beach in climbing the steep bluffs on the coast-line. Although the trail is on comparatively easy grade above the bluffs, this sharp rise renders this route impractical for anything but back-packing. If developments in the Little Zeballos area warrant an improved trail it should be made either from the mouth of the Little Zeballos River or, utilizing part of the Zeballos River Road, over *Golden Gate* ground and into the area from the north-west.

As is common in the district, the area over which the claims are staked is rugged, deeply incised, and difficult for travel.

The camp for the present operations, accommodating ten men, on the *Friend No. 1* claim, at an elevation of 1,163 feet, is close to a small stream of insufficient flow for any but small domestic use. Any permanent camp would have to be on *Friend No. 3* claim to the west, where there is considerable level ground. Beano Creek, Friend Creek, or the Little Zeballos River provide enough water for small, year-round milling operation. There is a good stand of hemlock, cedar, and balsam on the property.

Development (April 6th, 1938) has been concentrated on two exposures, one close to the camp on the south-west side of Friend Creek and the other, at an elevation of 1,743 feet, on the same side of the creek, 2,000 feet distant from the camp in a north-east direction. The area being prospected is underlain by varying phases of greenstone lying on the south-west of a mass of basic intrusives.

At the lower workings, near the camp, the original showing consisted of a narrow, high-grade quartz vein exposed below a small waterfall on Friend Creek. On this vein, striking south 50 degrees west and dipping almost vertically in greenstone, an adit was driven into the south-west wall of the creek. Within narrow limits the vein weaves and pinches; the maximum width where it swells is 6 inches. Mineralization is by pyrite, arsenopyrite, and slight amounts of galena, sphalerite, and chalcopyrite. Free gold is visible.

At 27 feet from the portal of the drift the vein is cut off by a fault striking north and dipping 75 degrees east, which is clearly seen on the left wall but is obscured on the right wall by a series of fractures striking south 30 to 60 degrees east and dipping 60 to 90 degrees north-eastward. The adit has been driven on line for a distance of 49 feet from the portal, although past the fault there was nothing to follow but a very narrow, barren stringer which does not appear to be the continuation of the main fissure. At 49 feet a crosscut was driven 47 feet in a direction south 38 degrees east in heavily fractured greenstone in an effort to pick up the faulted continuation of the vein. In this work, at 15 feet from the intersection of drift and crosscut, on the south-west wall there was exposed a 1-inch quartz stringer, slightly mineralized by pyrite and arsenopyrite, striking north 18 degrees east and dipping 84 degrees eastward. This stringer pinches out in the back before reaching the north-east wall of the crosscut.

Four feet from the face of the crosscut a stringer of quartz and calcite was intersected; the width is commonly less than 1 inch; the strike is south 40 degrees west and dip 87 degrees north-westward. At the time of examination (April 6th, 1938) a drift on this vein had just been collared in the right wall of the crosscut. As there are indications at the fault in the drift that movement has been to the south-east, and as, by reason of the topography, the face of the crosscut is very close to the surface, this stringer offers the only hope for a continuation of the main fissure in these workings. A sample taken from this stringer, mineralized by pyrite, assayed: Gold, trace; silver, trace.

Other sampling included one across the main vein from the surface exposure at the creek. This sample, across 3 inches of quartz, probably containing free gold, assayed: Gold, 6.10 oz. per ton; silver, 1 oz. per ton. Another across the vein, 2 inches, just north-east of the fault, assayed: Gold, 4.60 oz. per ton; silver, 0.5 oz. per ton.

At the upper location a cut was being faced up on a narrow quartz-filled fracture striking south 80 degrees west and dipping 55 degrees northward. The exposure is on the steep wall of Friend Creek; on the east wall of the creek the fracture is displaced some 35 feet to the south indicating that the present course of water follows a line of faulting.

At the cut the fracturing is within a dioritic dyke striking in the same general direction as the fracturing, and apparently considerably more competent than the surrounding greenstone. On the foot-wall of the fracture the dyke has a width of 3 feet, unsilicified; on the

hanging-wall of the fracture a width of probably 6 to 7 feet, silicified and mineralized by pyrite and arsenopyrite.

A sample across the vein at this point, 9 inches, mineralized by pyrite, arsenopyrite, and sphalerite, assayed: Gold, 0.06 oz. per ton; silver, 0.1 oz. per ton.

A sample across 3 feet of dyke on the hanging-wall of the fracture assayed: Gold, 0.01 oz. per ton; silver, trace.

Golden Gate Group.†

The *Golden Gate* group comprises the following mineral claims: *Golden Gate*, *Golden Gate No. 2*, the *Nabob*, and the *Tagore*, staked in 1936 and 1937, and owned by D. Lutes, of Ceepeecee; Alex. MacDonald, Alfred Bird, and Chas. W. Smith, of Zeballos. This group extends from the old *Tagore* workings eastward across the Zeballos River and up the moderately steep, heavily-wooded hillside of the easterly side of the main valley.

The workings include the old *Tagore* workings and recently made open-cuts and an adit on the *Golden Gate* claim. The *Tagore* workings include an adit, a shallow shaft, and surface cuts on the westerly bank of the Zeballos River. The *Tagore* has been described by Gunning; no work had been done since then to the time of the writer's first visit to the area in 1937. The following description is taken from the report by Gunning, Geological Survey, Canada, Summary Report, 1932, Part A II., p. 37 A II.:—

" The *Tagore* group of claims straddles Zeballos River about 1½ miles above its mouth. The vein is on the west bank of the river and was discovered in 1924 by J. West and A. Ostman. Known as the Eldorado at this time, it was systematically prospected and abandoned by an English syndicate in 1925. In 1929 it was optioned as the Tagore, by A. B. Trites, from Messrs. Malmberg and Nordstrom, of Quatsino. About 2 tons of ore, unofficially reported to have assayed about 20 oz. in gold to the ton, was shipped, but apparently results were not satisfactory, for the property lay idle until 1932, when Malmberg, Nordstrom, and four associates commenced mining on a small scale, under an agreement with A. B. Trites. By September a shipment of 4,500 lb. had been made and the smelter returns indicated an assay value of 2.63 oz. of gold and 2.52 oz. of silver a ton; a gross value at that time of $50.50 a ton. The property is on the main Zeballos River trail and accomodation consists of two small cabins and a blacksmith shed.

" The vein consists of quartz or quartz and calcite with a small to very large proportion of pyrrhotite, zinc blende, chalcopyrite, galena, pyrite, and native gold. Pyrrhotite and zinc blende are the most abundant, and pyrite and galena are very minor constituents. Native gold was seen only during microscopic examination of polished surfaces of the ores and then as small, scattered grains in sulphide or gangue. A very small amount of an unidentified grey mineral was also noted. The quartz is white and finely crystalline to coarse and vuggy. It is much more abundant than calcite which is quite locally, but in some places abundantly, developed. The vein has been followed for a total distance of about 50 feet and varies from a barren, tight fissure to an exceptional maximum width of about 15 inches. It trends north-east, along a well-defined fissure, and the dip is vertical. The rocks in the vicinity are Triassic flows, tuffs, limestone, and other sediments of the Bonanza group cut by a multitude of dykes and irregular bodies which vary from a very dark quartz gabbro containing abundant magnetite to light grey and white micropegmatite. These Coast Range intrusives are very abundant for about 1 mile south of the property, but do not continue far to the north. The Triassic rocks are much contorted and somewhat faulted and generally have very steep dips.

" The vein fissure cuts fine-grained, green, banded tuffs and crystalline limestone which strike 10 degrees north of east and dip very steeply north. Towards the north-east end of the vein these rocks are cut by a northerly-trending diorite dyke, about 7 feet wide, which, on the west side, is partly replaced by white to light grey quartz-augite-albitite. Within the limits of this dyke there is practically no ore in the fissure. The whole productive part of the vein is in the dense, brittle tuffs which have been extensively altered, in large part before the vein was formed, to garnet, epidote, and chlorite. Immediately north-east of the dyke the vein has been developed by a shaft to a depth of 15 feet. Just north of the dyke the vein was found to split into two parts; one continued north-east but died out within 8 feet, the other turned to 10 degrees north of east, approximately along the bedding, and had been followed for 14 feet at the time of examination. The vein pinched and swelled along this

† By John S. Stevenson and R. J. Maconachie.

part, sometimes forming a narrow network of small veins in the volcanics, but, at the junction of the two parts, widths up to about 15 inches of good ore were encountered for a few feet. The vein continued 15 feet south-west of the dyke, in an open-cut, and then encountered altered crystalline limestone in which the ore soon ceased although the fissure continued. The limestone member is probably about 6 feet thick and dips steeply north; it was extensively altered to a mixture of garnet, diopside, quartz, calcite, and zinc blende, with some albite and apatite, before the vein was introduced, and, in heavily weathered portions, exhibits casts of fossils. No search has been made for the vein immediately south of the limestone, this part of the surface being drift-covered, but the writer understands that some ore was encountered in the limestone immediately beneath a narrow lamprophyre dyke that strikes 13 degrees north of east and dips 36 degrees south, above the south end of the vein. Unfortunately, the collar of the shaft is at the edge of the high water-level of Zeballos River, so that further development to the east would have to be well underground in order to avoid excessive inflow of water.

"For several hundred feet to the south-east of this vein the ground was prospected by pits and open-cuts in 1925. Some low-grade, contact metamorphic mineralization, including considerable zinc blende, was found in the same types of rocks that are exposed near the vein, but no similar vein was encountered. It is noteworthy that the vein cuts and is definitely later than the contact metamorphic zinc mineralization in the adjoining rocks."

The work on the *Golden Gate* claim consists of some open-cutting on a vein at an elevation of 800 feet on the east side of the river, and an adit 90 feet below the vein outcrop. The *Golden Gate* workings are reached by a trail approximately half a mile in length from the Zeballos River Road. In 1937 the work consisted of a combined stripping and open-cut some 50 feet in length, along which a little blasting had been done.

The vein is a quartz-filled fissure that weaves, pinches, and swells from 1 to 5 inches in the irregularly-sheared rock. The vein-filling is quartz with small amounts of chalcopyrite and pyrite; inasmuch as the vein has been opened for only a short distance below the surface, considerable rust occurs in the quartz. The rock-formation is a variable greenstone, consisting of phases that range from gabbroic through dioritic to andesitic; the areas of the different phases being quite irregular and the transitions gradual.

The following samples taken in the original open-cut in 1937 indicate the values and nature of associated mineralization:—

Location from North End of Stripping.	Description.	Assay.		
		Gold.	Silver.	Copper.
		Oz. per Ton.	Oz. per Ton.	Per Cent.
5 feet	Across 4 inches and along 2 feet of quartz veinlet with considerable chalcopyrite, some rust	4.0	0.4	1.5
12 feet	Across 4 feet and along 1 inch of quartz, with less *chalcopyrite and much rust*	*0.2*	*0.2*	*0.5*
16 feet	Across 5 inches and along 1 inch showing considerable pyrite, some chalcopyrite	0.12	Trace	Trace
46 feet	Across 5 inches and along 1 inch showing considerable pyrite, some chalcopyrite	1.30	0.3	Trace

Development-work since 1937 consists of a series of surface cuts and strippings and the driving of a crosscut to intersect the vein approximately 90 feet below the outcrop.

The new work exposes more extensively the tight quartz-filled fissure in sheared and variable greenstone displaying phases ranging from andesite to gabbro.

The stripping, along the side-hill to the south from the original open-cut, suggests continuity for an additional distance of some 300 feet in that direction. Two small cuts have been made on strike to the north of the original exposure.

The work to the south exposes the vein having widths ranging from a crack to a maximum, at one location, of 12 inches. Where the fracturing is filled and has normal vein characteristics average widths are less than 3 inches.

At the most southerly point of the open-cut the vein is exposed as 2 inches of rusty quartz, carrying slightly visible pyrite; the strike is due north and the dip 65 degrees east-

ward. The walls are andesite, slightly mineralized with pyrite. A sample across 2 inches of vein material assayed: Gold, 3.80 oz. per ton; silver, 1 oz. per ton.

Thirty feet to the north of this sample, at the centre of 20 feet of stripping, the mineralization appears to have followed a more flatly-lying fracture leading off the main fissuring which is a narrow band continuing on its general northerly strike.

The branch fracture strikes north 55 degrees east and dips at 50 degrees to the south-east; the walls are poorly defined and the occurrence really comprises a dissemination of quartz and a slight amount of pyrite along a line of minor weakness rather than a defined fissure-vein structure.

For the next 190 feet to the north a little irregular stripping exposes only very narrow fissure widths. From 232 feet north of the previous sample the vein has been stripped northward for a distance of 35 feet. At the south end of this cut it has a width of 4 inches; 5 feet to the north of this southern limit a sample across 3 inches of rusty quartz containing very little visible mineral assayed: Gold, 0.92 oz. per ton; silver, 0.1 oz. per ton. For the remaining 30 feet of this stripping the fissure ranges in width from a crack to 1 inch. The strike is north 10 degrees east and the dip indefinite.

Fifty feet north of the previous sample a small cut exposes 12 inches of quartz breccia, well mineralized with pyrrhotite, chalcopyrite, and pyrite, from across which a sample assayed: Gold, 0.16 oz. per ton; silver, 0.4 oz. per ton.

From this sample to the north end of the cut, a distance of 11 feet, the vein ranges from 4 to 7 inches in width, generally sparingly mineralized. The strike in this section is north 15 degrees east and the dip 65 degrees to the east.

Six feet north from the end of this cut is the southern end of the original stripping, and it is approximately below this location that the crosscut intersects what is apparently the downward extension of the vein.

The adit is driven in a direction north 80 degrees east, from a point some 90 feet below the outcrop, and at 125 feet it crosscut vein material striking north and dipping at 65 degrees to the east. At the time of examination (April 11th, 1938) drifting to the north had just commenced.

The vein material in the face of the crosscut is comprised of quartz mineralized by pyrrhotite, pyrite, and some chalcopyrite. At the north side of the face the quartz occurs as narrow stringers; at the south side it is stronger and confined to a single width. The vein-walls are of greenstone with dioritic phases on the foot-wall side. Mineralization appeared to be confined to the quartz although the operators report some on the foot-wall of the vein where first intersected.

A sample from the face across 3 inches of quartz, well mineralized, assayed: Gold, 0.74 oz. per ton; silver, 0.05 oz. per ton.

Golden Peak Group.†

The Zeballos Gold Peak Mines, Limited (N.P.L.), a public company with registered offices at 540 Columbia Street, New Westminster, is stated to have bonded from the owners six full claims and a fraction, contiguous to the *Goldfield* group on the south-east and extending north-eastward from the valley of Spud Creek over the ridge between that and Goldvalley Creek. The property is reported to include the following mineral claims: *Red Star, Green Star, Blue Star, Golden Peak, Bloom Fraction, Golden Peak No. 2, Golden Peak No. 3*, staked by Alfred Bloom (deceased) and Albert Bird in 1933.

The camp, at an elevation of approximately 1,250 feet, is reached by a trail, half a mile long, that leads south-eastward up the hillside from the Spud Creek Bridge of the new road up the valley. Most of the workings are some 200 feet higher up the hillside and are reached by trail leading northward and westward from the buildings; however, one working, the adit on No. 4 vein, is some 760 feet northward along the hillside from and at approximately the same elevation as the camp, and is reached by trail therefrom.

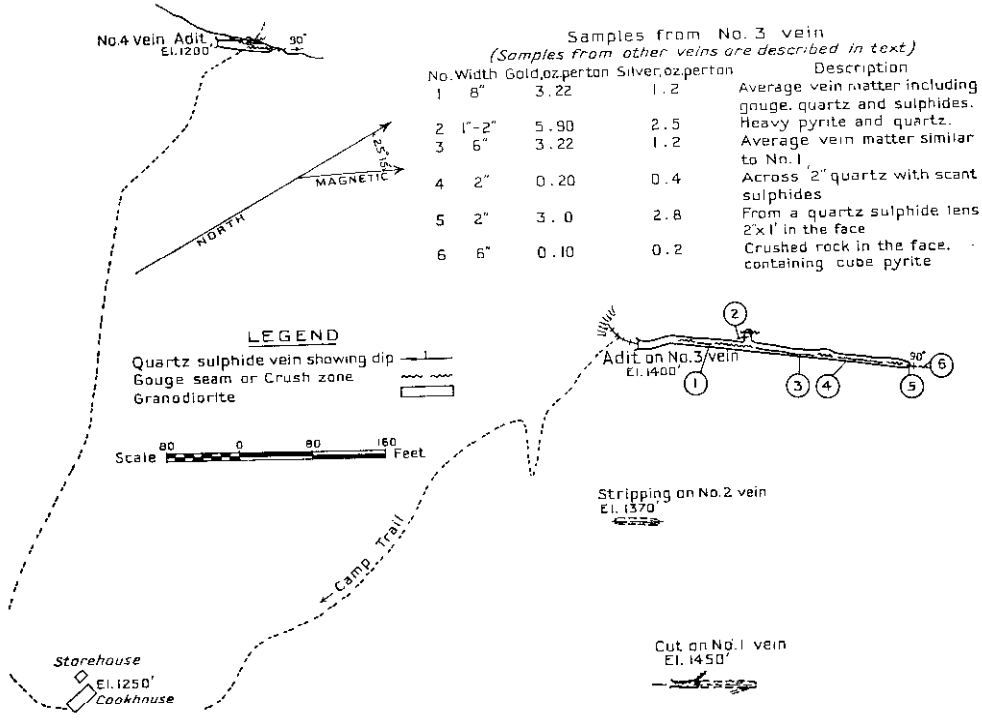
The hillside in the vicinity of all the workings is the typical steep, heavily-wooded type common to the area.

The various adits and surface workings have been driven on four different shear and crush zones that vary in width and in quantity of quartz-sulphide vein-matter. These shears all possess approximately the same strike, north 32 degrees east, and are approximately

† By John S. Stevenson and R. J. Maconachie.

vertical. The minerals found in the veins, include, in addition to quartz, pyrite as perfectly-developed cubes scattered in clusters in the crush-zone, and apparently not accompanied by gold, and pyrite associated with a small amount of galena and sphalerite in the quartz-bands, and apparently accompanied by gold values. The rock is the typical quartz diorite that is rather thoroughly bleached in the crush-zone.

In addition to the four veins previously known it is reported that two additional ones have since been found, having apparently the same general characteristics as to width, mineralization, and strike as the earlier discoveries. On these two veins no development has, as yet, been attempted.



Samples from No. 3 vein
(Samples from other veins are described in text)

No.	Width	Gold, oz. per ton	Silver, oz. per ton	Description
1	8"	3.22	1.2	Average vein matter including gouge, quartz and sulphides.
2	1"-2"	5.90	2.5	Heavy pyrite and quartz.
3	6"	3.22	1.2	Average vein matter similar to No. 1
4	2"	0.20	0.4	Across 2" quartz with scant sulphides
5	2"	3.0	2.8	From a quartz sulphide lens 2"x 1' in the face
6	6"	0.10	0.2	Crushed rock in the face, containing cube pyrite

Golden Peak. Plan showing locations of four principal veins and workings (as of September, 1937), modified after company's plan.

On No. 1 vein there is a cut at an elevation of 1,450 feet. This cut has been driven in a direction north 32 degrees east along a strong vertical break that forms the south-easterly wall. This break is 2 inches in width, and is filled by gouge and a lenticular, discontinuous stringer of quartz and heavy sulphides ranging from 1 to 2 inches in width. A sample taken along a 1-foot length of this discontinuous 1- to 2-inch veinlet assayed: Gold, 14.4 oz. per ton; silver, 5 oz. per ton. The face of this cut, which is 25 feet high, 7 feet wide at the base, and 10 feet wide at the top, shows the above-mentioned gouge-seam and veinlet on the south-east; then a 6-inch aplite dyke striking with the break but dipping 70 degrees north-westward; then in the north-westerly wall a strong shear-zone, striking north 17 degrees east, approximately vertical, and consisting of gouge and thoroughly crushed, leached quartz diorite; the width of such crushed material ranging from 2 to 10 inches. Clusters of unbroken pyrite cubes and an occasional discontinuous, narrow quartz stringer occur in the crushed zone; a sample taken across 6 inches of this material assayed: Gold, 0.20 oz. per ton; silver, trace.

Above this cut the steep hillside has been stripped for some 85 feet, thereby exposing the continuation of the main or south-easterly break of the cut. At the upper end of the stripping the fracturing is manifested by a sheeted zone 3 to 4 feet wide, consisting of closely-spaced, tight joints accompanied by the usual 1-inch border of leaching. At this place the zone is joined from the east by a strongly-sheared zone, 8 inches wide, and by a 2-inch

gouge-seam, both striking north 18 degrees east and vertical; this is the system that seems to carry the structure north-eastward up the hillside.

An adit was driven on the No. 1 vein, from a point 40 feet below the open-cut, the drift face was, on April 13th, 1938, 62 feet from the portal. It is timbered for the first 22 feet, but the remaining 40 feet displays on the north-west wall a 1-inch stringer, widening in one place to 5 inches and narrowing to a seam at the face. The strike of this fissuring is north 35 degrees east and dip vertical to steeply north-westward. From the timber to the face there is also a fissure seam exposed on the south-east wall which strikes north 25 degrees east and dips vertically or steeply north-westward. Both these fissures are filled with quartz and gouge mineralized by slight pyrite; both show bleaching of the quartz diorite walls for 1 inch on either side. Less intense effects of hydrothermal alteration are evidenced for 1 foot on the north-west walls of both fissures and, in the case of the left-hand one, this width is slightly pyritized.

A sample taken across 42 inches at the face was made up as follows from north-west to south-east across the face; 3 inches of fresh quartz diorite, 12 inches decomposed, pyritized quartz diorite, ½ inch gouge representing the north-west seam; 14 inches fresh quartz diorite, 12 inches decomposed and rusty quartz diorite, ½ inch gouge and quartz representing the south-east seam. This sample assayed: Gold, 0.01 oz. per ton; silver, trace.

The work on No. 2 vein consists of a small cut and short stripping. The face of the cut exposes, in the south-easterly side, a narrow vertical, sheeted zone striking north 32 degrees east. This zone is 13 inches wide and consists of badly-leached, pyritized quartz diorite with three quartz-sulphide stringers one-quarter to 8½ inches in thickness. A sample taken across this sheeted zone assayed: Gold, 0.80 oz. per ton; silver, 0.6 oz. per ton.

No. 3 vein has been followed by an adit some 540 feet long. The shear-zone, nearly vertical and striking north 32 degrees east, consists of highly-crushed rock and gouge, the aggregate width of which ranges from 6 to 26 inches. The vein-matter is a discontinuous band from 1 to 3 inches wide of quartz and heavy sulphides, which consist of pyrite and some arsenopyrite.

The lengths of vein-matter are from 2 to 70 feet in individual sections. The short crosscut in this working crosses a veinlet, strike north 10 degrees east, dip vertical, that consists of 1 to 2 inches of heavy pyrite and quartz; a sample across this 1- to 2-inch veinlet assayed: Gold, 5.90 oz. per ton; silver, 2.5 oz. per ton. The face of the crosscut shows a 2- to 4-inch gouge-seam that contains slickensided rounded fragments of barren quartz, and this break contains no continuous vein or veinlet of quartz, and probably therefore represents one of the few truly post quartz-vein shears in the area. The various samples taken along the main break indicate that the best values are with the narrow and discontinuous quartz-sulphide stringers, and that gouge, uncontaminated by quartz stringers, contains but little gold.

The No. 3 adit has been advanced on the vein to the present face at 540 feet from the portal. At 325 feet the vein swells to 12 inches from the 2- to 3-inch width prevailing for the preceding 25 feet, having on this swell gougy seams on either wall and a centre filling of decomposed, slightly pyritized quartz diorite. After this it narrows again to the 350-foot mark. From 350 feet to 450 feet the vein is strong between walls which are vertical or dip steeply to the south-east; in this section widths range from 3 to 12 inches, with an average of probably 7 inches. The filling is principally of quartz, slightly mineralized by pyrite and sheeted parallel to the walls by narrow bands of discoloured quartz, gouge, and fine-grained sulphides. From 300 to 450 feet the strike is north 35 degrees east with practically no variation. At 311 feet a tight fracture was intersected by the north-west wall of the drift and is carried on that wall to 344 feet, from which point it swings to the east to a junction with the main vein at 360 feet. As it approaches the main fissure the width of altered quartz diorite between the two is well mineralized by pyrite.

At 450 feet there is gouge mixed with the quartz and at 455 feet the walls, particularly the north-west one, become weakened by a series of fractures slightly divergent to the north. One of these fractures, well defined and attaining a maximum width of 4 inches, filled with quartz, gouge, and a little pyrite, is, by a changing in its strike to the north-east and a slight northerly change in the direction of the drift, traceable to the face of the drift. The main fissure, on the south-east wall of the drift, well maintained, with a gouge, crushed quartz diorite and quartz filling to 503 feet, pinches to a gouge-seam at 526 feet. At the face of the drift

the two fissures are evidenced by two seams 6 inches apart. Short of the face, in the back of the drift between the two fractures, there is a series of joints in the quartz diorite. These parallel the walls of the main fissures; some are gouge-filled. Sampling in this adit was as follows:—

At 484 feet, across 3 inches and along 6 inches on the left hand branch fracture, solid, fresh quartz dark in colour by ribboning, with moderate pyrite mineralization: Gold, 0.01 oz. per ton; silver, trace.

At 484 feet, across 21 inches between the two fractures, of decomposed quartz diorite carrying two narrow gouge seams and one quartz stringer slightly pyritized: Gold, trace; silver, trace.

At 484 feet, on the main vein, across 4 inches of fresh ribboned quartz well mineralized by pyrite: Gold, trace; silver, trace.

At 447 feet, on the main vein, across 4 inches mainly solid quartz, slight pyrite, well-defined ribboning: Gold, 0.10 oz. per ton; silver, trace.

At 390 feet, on the main vein, across 8 inches fresh quartz well ribboned, moderate pyrite mineralization: Gold, 0.02 oz. per ton; silver, trace.

At 353 feet, across 26 inches, including ½-inch seam of gouge and fine pyrite on the north-west side of the back, and 2 inches of pyritized quartz and 3 inches of gouge forming the main vein on the south-east side; the remainder of the width was made up of decomposed quartz diorite, carrying slight pyrite, lying between the two fractures. This sample assayed: Gold, trace; silver, trace.

The adit on No. 4 vein has not delineated any definite vein as yet, although it breaks into the wall of a heavy crushed zone 6 to 18 inches in width that contains scattered pyrite cubes; a sample taken across 18 inches of this material assayed: Gold, 0.10 oz. per ton; silver, trace. A branch slip from this zone extends north-eastward across the back; this contains some heavy sulphide, but a sample along it assayed only: Gold, 0.12 oz. per ton; silver, 0.1 oz. per ton. This slip joins a 5-inch crush-zone that continues along the south-easterly wall of the drift to the face. A sample taken of this material assayed only traces in gold and silver.

Homeward Mines Syndicate, Ltd.*

The Homeward Mines Syndicate, Limited, of 703 Royal Bank Building, Vancouver, B.C., owns the following mineral claims: The *H. and J. Nos. 1* to *9*, staked in 1937 by H. E. Smith, and the *Pat Fractional*, staked in 1938 by R. Dudley Smith. These claims constitute the property formerly known as the *Golden Horn*. The property is in the Nomash Valley, approximately 2½ miles up-stream from the junction of the Nomash River with the main Zeballos. The claims are on the south-west side of the valley and extend north-eastward from the vicinity of Mount Lukwa toward the valley-bottom.

At present the showings are reached by a pack-horse trail that leads from Ryan's warehouse at the *Privateer* mine up the Zeballos and Nomash Valleys. A foot-trail branches from the main pack-horse trail at a point 4 miles from Ryan's warehouse and side-hills southward up the mountain-side for a distance of 1½ miles from the valley-bottom at an elevation of 530 feet to the camp at an elevation of 1,580 feet.

The camp and workings above are on a steep mountain-side that slopes approximately 30 degrees north-eastward down from Mount Lukwa. The slope is covered with a dense growth of 4- to 10-inch timber and, excepting in the watercourses, by only a small amount of underbrush.

The prospected showings consist of five east-west shears in quartz diorite. The shears range from 1 inch to 10 inches in width, and with the exception of one each contains a narrow 1-inch quartz-sulphide ribbon. The sulphides are not abundant and consist of pyrite, fine-grained arsenopyrite, and small amounts of sphalerite and galena. At the time of examination (September 11th, 1938) the workings consisted of only a few strippings and open-cuts.

The first three workings, at elevations of 1,885 feet, 1,895 feet, and 1,965 feet, extend south-westward up the hillside from the camp. These are pits that were still mostly in slide-rock; the bed-rock was not sufficiently well exposed for examination.

At an elevation of 2,115 feet and south-westward from the last, a cut has been driven in a direction south 80 degrees west for 25 feet to a 12-foot face. The cut follows a narrow shear that ranges from 1 inch to 6 inches in width and contains a lenticular quartz-sulphide

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ribbon ranging from 1 inch to 2 inches in thickness; pyrite and arsenopyrite constitute the sulphides.

At a place approximately 100 feet northward from the last cut, a showing outcrops in the bed of a north-eastward-flowing creek. The showing comprises two east-west shears, a southerly one consisting of 1 inch of gouge, with no quartz or sulphides, but conspicuously bordered by 8 inches of leached quartz diorite, and the other, a northerly one, 6 feet from the southerly, consisting of small quartz-sulphide lenses in crushed rock and gouge that ranges from 6 to 10 inches in width. A sample of the vein-matter assayed: Gold, 0.50 oz. per ton; silver, 0.1 oz. per ton.

The first cut on what is called "the main vein," is at an elevation of approximately 2,150 feet. It is a small cut exposing a steep, east-west shear that ranges from 2 to 5 inches in width, and contains, in addition to gouge and crushed rock, a one-half inch ribbon of quartz and fine-grained pyrite and arsenopyrite with fine-grained sulphides.

The largest cut seen on the property is one on the same vein as the last cut, but 100 feet farther westward up the hillside. The shear in this cut is similar to that in the last except that the quartz-sulphide ribbon increases to 1½ inches in thickness. A few specks of sphalerite and galena were seen amongst the pyrite and arsenopyrite.

At the same elevation as, but a short distance north from, the last cut is what is known as the "high-grade cut." This is a small cut that exposes a steep, east-west shear, ranging from 3 to 9 inches in width and containing a quartz-sulphide ribbon ranging from 1 inch to 3 inches in thickness. A sample of the vein-matter assayed: Gold, 0.50 oz. per ton; silver, 0.1 oz. per ton; arsenic, 3.5 per cent.

King Midas Mining Co.*

The King Midas Mining Company, c/o J. L. Peterson, 509 Vancouver Block, Vancouver, B.C., owns the following mineral claims: *Yauco Fraction, Yauco No. 12, Big Ben Fraction, Goldrock Fraction,* staked in 1935 by A. O. Noakes, and the following Crown-granted claims: *Goldrock Nos. 1* and *3, Yauco Nos. 2, 4, 5, 6,* and *7,* and *Big Ben Nos. 1* to *4.*

The claims extend two abreast up both sides of the North Fork of the Zeballos River for a distance of 9,000 feet from its junction with the Nomash River. The camp and workings, about 1 mile up-stream from the junction, are reached by following the pack-horse trail up the east side of the North Fork of the Zeballos River.

Near the workings the banks of the river are steep and rock bluffs are common. With the exception of a narrow bench on the east side of the river, the valley-walls rise steeply from the river-bottom to the tops of the adjoining ridges. The slopes are heavily wooded, but near the ridge tops, the wooded areas are interspersed with numerous bare rock bluffs.

The recent work has been done on two types of narrow fissure-zones within andesitic greenstone. One type of fissure-zone is relatively open and ranges from 1 inch to 9 inches in width; the shear contains narrow discontinuous lenses of quartz with small amounts of pyrite, arsenopyrite, and in one showing, the "Lynch vein," it contains abundant sphalerite. The other type of fissure-zone is relatively tight, ranges from 1 inch to 8 inches in width and is more or less completely filled by a pinching and swelling ribbon of quartz that contains considerable pyrrhotite, pyrite, and chalcopyrite.

The older, now inoperative, workings on this property are described as the *Marks* property by Gunning in Summary Report of the Geological Survey, Canada, 1932, Part A II., pp. 39 A II. to 42 A II., and also in the Annual Report of the British Columbia Minister of Mines, 1932, p. 205.

The following excerpt from Gunning's report, pp. 39 A II. to 42 A II., describes these older workings; no work was being done on these at the time of the writer's examination (September 12th, 1938):—

"Several small gold veins on the property had not received a great deal of development at the time of examination, but the most promising, on the west side of the north fork a short distance below Fault Creek, had been opened up on the surface by several cuts, and an adit had been started towards it from the bank of the river. The vein occupies a fissure in dense, green, volcanic rocks and strikes 5 degrees east of south, dipping steeply east or vertical. It maintains its southerly trend for about 100 feet, being exposed throughout most of this distance by open-cuts. At the south end it makes an abrupt swing, along an intersecting fissure,

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to a south 30 degrees west course and is exposed in this direction for about 10 feet past the turn. In two small cuts 75 and 125 feet horizontally to the south-west narrow widths of similar vein material have been found and these may represent a continuation of the vein. If so, the vein may be said to have been found on the surface at intervals for a total distance of about 235 feet. Where exposed it varies in width from a maximum of about 6 inches to ½ inch or less and consists of fairly coarsely crystalline, and in places crustified or banded, quartz with zinc blende, arsenopyrite, pyrrhotite, chalcopyrite, and pyrite. The sulphides constitute from less than half to the bulk of the vein. In addition, arsenopyrite is sometimes disseminated abundantly through the wall-rock, particularly in the west wall, for an inch or more from the edge of the vein. Ninety feet below and 80 feet east of the central part of the best exposed part of the vein an adit has been started from the edge of the north fork of Zeballos River. It had been driven 50 feet in September, 1932, encountering andesitic flows and some dykes. Since then it is reported that at about 75 feet from the portal, almost vertically below the outcrop, a vein system nearly 6 feet wide was encountered, and that the vein system consisted of five, nearly parallel, small veins, varying from 2 to 5 inches in width, mineralized with sulphides similar to those in the surface exposures. Also, that the country rock in the vein system was mineralized with small veinlets and disseminated sulphides. Gold values across the 6 feet were sufficiently good to encourage further development along the vein and this work, the report indicates, is being proceeded with.

" The vein does not outcrop in the bed of Fault Creek some 200 or 300 feet north of the surface exposures and, indeed, apparently dies out on the surface, within 40 or 50 feet north of the point under which the adit has been driven. Irregular replacements of low-grade copper mineralization appear immediately north of the end of the vein, but exposures were not sufficiently good to disclose the relation of this material to the gold-bearing vein.

" A small sample of a complete section of the vein from the surface was collected by the writer and submitted for assay.[1] It consisted of about 50 per cent. quartz, with zinc blende, arsenopyrite, pyrite, and a little chalcopyrite and pyrrhotite, and assayed 2.84 oz. of gold and 0.82 oz. of silver a ton. Much higher values have been reported from the vein and undoubtedly could still be obtained, but it was thought that the small sample might represent something near an average of the material in the vein.

" Polished specimens were examined under the microscope and tiny, scattered specks of free gold were noted in most of them, generally closely associated with zinc blende and (or) chalcopyrite, but occasionally isolated in quartz. No free gold was noted in arsenopyrite, either in the vein or in the wall-rock, although that mineral is somewhat crushed and in part veined by chalcopyrite. A small amount of a very soft and sectile bronze-coloured mineral was noted in two surfaces but could not be identified. Also a little galena was observed.

" Several hundred feet farther north, half-way up some bad bluffs about 150 feet east of the river, a similar vein is exposed for a few feet along the same limestone-volcanic contact. It is about 2 inches wide and is fairly heavily mineralized with pyrrhotite, chalcopyrite, and a little zinc blende. Mr Marks reports good gold values from this place and also informs the writer that he has succeeded in finding the " Glory Hole " vein about 250 feet south of the main showing (in the falls). It is questionable whether gold values warrant further work on the vein, but if they do prospecting for it along the strike should be fairly simple. It may be reasonably expected to continue to follow the limestone-volcanic contact as long as mineralization persists and this contact is a pronounced structural feature trending east of south and swinging farther to the east of the north fork as it goes south. It crosses a large sink-hole over half a mile south of the " Glory Hole " and could be found easily at several places in the intervening distance by moderately shallow trenches.

" A few hundred feet below the adit, in the bed of the north fork, there is an area of possibly 7,500 square feet on the west side of the stream, over which very rough pyritic, green to brownish, volcanic breccia is cut by dark-grey to greenish feldspar-porphyry dykes and is mineralized sparsely with a number of small, lenticular veins carrying quartz, pyrrhotite, pyrite, chalcopyrite, and zinc blende. The largest of these veins exposed is only 2½ inches wide and about 12 feet long and the veins are not very abundant. Previous samples taken across the stream-bed for a width of nearly 100 feet were reported to have averaged close to $9 in gold a ton. The writer collected samples of the pyritic, altered volcanic, being careful

(1) All new assays reported were made by A. Sadler, Mines Branch, Department of Mines, Ottawa.

to avoid all mineralized quartz stringers. They assayed: Gold, none, and silver, 0.18 oz. a ton. A specimen of the largest and most heavily mineralized quartz stringer was polished and examined under the microscope; in about 1 square inch of surface there were seven, visible, tiny specks of free gold, either alone in quartz or with zinc blende and (or) chalcopyrite in veinlets in the quartz. Also, a little arsenopyrite was identified.

" On the opposite bank of the stream a small area is underlain by contorted grey to white, crystalline limestone with interbedded, fine-grained brown tuff. The brown material is very pyritic and near or in it are one or two, small, discontinuous stringers of quartz and calcite carrying sulphides. The pyritic material was again sampled and it assayed no gold and 0.1 oz. of silver a ton. A specimen of one of the richer stringers containing considerable arsenopyrite and some zinc blende assayed: Gold, 0.41 oz., and silver, 0.19 oz. a ton. Judging by these results it would seem that the pyritic, altered rocks of this area contain very little or no gold, whereas the small quartz veinlets contain fair values in that metal. No individual stringer is sufficiently large or continuous to encourage development and it seemed unlikely that there is sufficient high-grade material of this sort scattered through the rock to produce any important quantity of commercial ore. As the few samples obtained can hardly be taken to definitely prove this point, however, it might be advisable to channel-sample more promising sections across definite minable widths.

" There are several other places on the Marks property where small quartz stringers carrying gold values have been found, but none has showed sufficient promise to encourage development.

" The copper mineralization on the property is on the west side of the north fork and north of Fault Creek. For about 2,500 feet north of this creek andesitic flows and fragmentals are intruded by many grey to green, feldspar porphyry dykes and are considerably fractured and locally sheared. They have been extensively chloritized and mineralized, either very irregularly or along bedding or shear planes, by mixtures of quartz, epidote, pyrite, chalcopyrite, and pyrrhotite. Development has been concentrated in an area about 200 feet long, north and south, and from 100 to 125 feet wide, west of the river-bed, some 800 feet north of Fault Creek. Here several open-cuts have been made on the steep hillside and they reveal some fine copper ore. Exposures between the scattered cuts are poor, however, so that it is difficult to form an accurate picture of the occurrence. But it seemed to the writer that the principal mineralization trends about parallel to the north fork and that well-mineralized material forms from 15 to 20 per cent. of the total width of about 125 feet partly developed by cuts, the remainder being altered and pyritic volcanic. The volcanic rocks near the upper showings appear to strike about north 15 degrees west (nearly parallel to the river) and dip at 45 degrees or less to the west. Both north and south of this principal section the mineralization is less promising. To the north, large bodies of quartz are exposed along the bank of the stream, but they generally contain only a meagre amount of chalcopyrite and pyrite. To the south there is much less quartz and what little copper there is occurs in chloritic volcanics with pyrite. In the Quatsino limestone on the east side of the river there are many pockets and small, irregular bodies of pyrrhotite with some chalcopyrite, but nothing sufficiently persistent to encourage development. One or two of the porphyry dykes along the creek-bed are themselves mineralized along joints and cracks with narrow seams of quartz, pyrrhotite, and chalcopyrite.

" South of Fault Creek there are one or two showings of similar, irregular copper mineralization in the volcanics, but none has as yet received any extensive development.

" On the whole, it seems that there is an extensive low-grade copper mineralization on the claims which, under favourable market conditions, would merit some further development. At present, with copper around 6 cents a pound and no appreciable precious metal content reported from the deposits, they are naturally receiving no attention."

In the westerly group, a showing, referred to as the " new showing " crops out on the south, rocky wall of Fault Creek, approximately 200 feet west of its junction with the north fork. The exposure is a shear 3 to 6 inches in width, striking south 20 degrees west and dipping 45 degrees south-eastward. It consists of sheared greenstone and a narrow ribbon of quartz containing bands of abundant arsenopyrite and smaller amounts of chalcopyrite, pyrrhotite, and sphalerite. A sample of this vein-matter assayed: Gold, 0.60 oz. per ton; silver, 0.1 oz. per ton; copper, trace; arsenic, 3.1 per cent.

Seventy-five feet up-stream from the east showing a tight, irregular quartz stringer crops out for 20 feet in the south wall of the canyon; it strikes south 80 degrees east and dips 55 degrees southward. The quartz contains a little pyrite and chalcopyrite; a sample of the vein-matter assaying: Gold, trace; silver, trace; copper, 1.2 per cent.; arsenic, *nil.*

The third main exposure in this westerly group is that known as the "Lynch vein." This is exposed in an open, side-hill cut dug into overburden and decomposed shear material; the cut is 30 feet long in a north-south direction and has an 8-foot face. The showing is a vertical shear-zone striking north. It is 9 inches wide and consists chiefly of shattered, decomposed greenstone that encloses a discontinuous quartz vein from 1 inch to 3 inches in thickness. The quartz vein contains greenstone inclusions of pyrite, chalcopyrite, and abundant sphalerite, all the minerals being badly oxidized. A sample of this oxidized vein-matter assayed: Gold, 1.84 oz. per ton; silver, 0.2 oz. per ton; copper, 0.5 per cent.; zinc, 2.8 per cent.; arsenic, *nil.*

Inasmuch as both veins on the west side of the north fork a short distance below Fault Creek, and the copper ore exposed in open-cuts 800 feet north of Fault Creek, have been described by Gunning, and since it is reported no subsequent work has been done on them, they were not examined by the writer.

The second group of showings includes the "Trail vein" and "Glory-hole vein."

The first showing on the Trail vein is approximately 2,300 feet northward from the camp-cabin along the trail that follows the east side of the north fork. The showing consists of a tight, vertical shear 8 inches wide that strikes north 10 degrees east. This shear contains a more or less frozen quartz vein ranging from 5 to 8 inches in thickness and containing pyrite, chalcopyrite, and pyrrhotite. The vein, as such, is exposed by one trench 50 feet long, and 50 feet farther north by another shorter combined stripping and trench. Apparently the same vein is exposed at a point about 250 feet farther northward along the trail and on the south side of a westward-flowing creek. The creek-bed and a small stripping on its south bank expose a 15-foot length of vein. The vein strikes north 12 degrees east, dips 65 degrees east, and consists of two tight lenses of quartz along the strike that range up to 7 inches in greatest thickness. However, the quartz vein-matter dies out northward along the strike of the shear. The quartz contains pyrite, chalcopyrite, and abundant pyrrhotite. A sample of the vein-matter assayed: Gold, trace; silver, trace; copper, 0.8 per cent.; zinc, *nil.*

The Glory-hole vein crosses a creek-bed along the rim of a waterfall. The creek flows westward into the north fork at a point about 1,200 feet up-stream from Fault Creek. The rim of the waterfall is about 100 feet eastward from the river and 80 feet above it; it is also about 150 feet westward below a point in the trail half a mile northward from the camp-cabin. The vein strikes north 50 degrees west and dips 75 degrees north-eastward. It is a quartz-filled fissure-vein ranging from 1 inch to 5 inches in thickness; the accompanying fissure ranging from 5 to 10 inches in width. The quartz contains pyrite, chalcopyrite, and abundant pyrrhotite. A sample of typical vein-matter assayed: Gold, 0.20 oz. per ton; silver, trace. The rock-formations consist of white, crystalline limestone on the foot-wall side and of andesitic greenstone on the hanging-wall side.

Mount Zeballos Gold Mines, Ltd.*

The Mount Zeballos, formerly Farris Zeballos Gold Mines, Limited, of 1508 Standard Bank Building, Vancouver, B.C., owns the following mineral claims: *A.X.*, *B.X.*, *J.*, *S.B.*, *4X*, *B.G.*, staked in 1936 and 1937 by H. E. Smith and P. M. Monckton, and the *Twinco*, *St. George*, *Flobald*, *Hans*, *Big Apple* fractions, staked in 1938 by S. H. Davis, and the *Hank* fraction, staked in 1938 by H. Kinvig.

These claims lie westward from and immediately adjacent to those comprising the *Goldfield* property of the Spud Valley Gold Mines, Limited.

The camp is on Spud Creek, approximately 800 feet down or northward from the camp of the Spud Valley Gold Mines, Limited, or is 5½ miles by truck-road from Zeballos Post-office.

The main workings, comprising two adits at points 875 and 650 feet respectively above the camp on Spud Creek, are on the steep west side of Spud Creek Valley, with which they are connected by a good pack-horse trail.

* By John S. Stevenson.

Close to the workings, the hillside, sloping steeply eastward into Spud Creek, is well covered with heavy timber and the slope is uninterrupted by rocky bluffs at the elevations of the adits.

Geologically the property comprises a conformable series of metamorphosed porphyritic rocks in the upper adit and a uniform mass of andesitic greenstone in the lower adit. Both groups of rocks have been cut by a north-eastward-trending break that constitutes the vein-fissure. The fissure ranges in width from 2 inches to 2 feet and contains discontinuous ribbons and lenses of quartz and sulphides, the ribbons ranging from 2 inches to 10 inches in thickness, and the lenses from 2 inches to 2 feet in maximum thickness.

The workings consist of two adits, a lower at an elevation of 1,600 feet and an upper at 1,825 feet, both driven south-westward as drifts on the vein-shear. The prospect-cuts that had been dug previous to the underground work were not examined by the writer.

The lower adit has been driven south 50 degrees west along the vein to the face at a point 445 feet from the portal. Unfortunately the drift is lagged from the portal for a distance of 215 feet. From the end of the lagging to the face, a distance of 230 feet, the vein-shear continues in the back and in this length occasional patches of barren shear alternate with quartz-sulphide ribbons.

Although consisting for the most of a single crush-zone ranging from 2 to 6 inches in width, the shearing often becomes compound and the several fracture surfaces will enclose lenticular areas or horses of wall-rock. The quartz and sulphides commonly form a single ribbon, usually approximating 2 inches in width, but a few lenticular sections swell to greater thicknesses.

The rock-formation in this lower adit is massive, andesitic greenstone.

The upper adit has been driven south 50 degrees west along the vein to the face for a distance of 424 feet from the portal (September 14th, 1938). As in the lower adit, lengths of barren shear alternate with lengths of quartz-sulphide ribbons. The shear ranges from 2 to 12 inches in thickness and occasionally to short bulges 2 feet in thickness; the quartz-sulphide ribbons range from 2 to 10 inches, but an occasional lens may reach 2 feet in its thickest section. The sulphides frequently constitute a large proportion of the vein-matter and comprise abundant pyrite, with smaller amounts of sphalerite, chalcopyrite, and galena. The texture is definitely banded by the alternation of quartz-sulphide bands within the main ribbon.

Porphyritic rocks prevail in the upper adit. These rocks constitute a conformable series, the gradational members of which strike approximately north 40 degrees west and dip 50 degrees south-westward. They vary considerably in colour, from white to mottled green and white to greyish brown. With the exception of the whitest phase they are all porphyritic in the hand specimen, the brilliantly reflecting feldspars are conspicuous. Under the microscope most of these rocks are seen to consist of clear albite-plagioclase set in a fine-grained ground-mass frequently consisting of albite and quartz. In one section taken from the porphyritic rock at the face (424 feet from the portal), a few unreplaced angular fragments consisting of feldspar laths arranged in a coarsely diabasic texture, were seen; these fragments suggest the unreplaced fragments of an original andesitic greenstone.

A dominantly white, quartzitic-looking phase occurs in the upper adit between points 100 feet and 120 feet from the portal. This rock is in sharp contact with the definitely porphyritic rocks on either side. In a few places it is definitely banded, the banding strikes and dips with the contact—namely, north 50 degrees west and 50 degrees south-westward.

Operations on the property at the time of examination consisted of the driving of both drifts on the vein.

Rey Oro Gold Mining Co., Ltd.*

The Rey Oro Gold Mining Company, Limited, a private company, of 811 Hall Building, Vancouver, B.C., owns the following mineral claims: *Lone Star*, staked in 1934 by Alec McDonald, the *J. and E.*, staked in 1936 by Edward G. Brown, and the *K.* and *Axe* fractions, staked in 1937 by H. E. Smith. The workings are on the north-easterly side of Goldvalley Creek between elevations at camp of 1,300 feet, and at the highest working of 1,600 feet.

The main showing consists of a strong shear-zone striking north-eastward and approximately vertical. This shear-zone contains a lenticular quartz-sulphide ribbon which ranges

* By John S. Stevenson.

from a knife-edge to 5 inches in thickness. Recent work has been concentrated on driving a drift, raises, and intermediate levels on this vein, and of mining high-grade ore from it.

The other workings consist chiefly of open-cuts and strippings which have been driven on individual joints, usually filled with a quartz-sulphide stringer ¼ to ½ inch in thickness; these also strike north-eastward up the hillside from the creek-bottom.

The rock formation in all the workings is quartz diorite.

The following excerpt from "Lode-gold Deposits of the Zeballos Area," British Columbia Department of Mines, 1938, pp. 20–21, describes those surface workings on which very little work has been done since the examination for that report:—

"The showings, all on the north-easterly side of the creek, will be described consecutively up the creek from the one nearest the office.

"No. 1 is a stripping at an elevation of 1,315 feet and 220 feet in a direction south 55 degrees east from the office; it is 60 feet south-east from the foot-log across the creek. It is a stripping 10 feet long, exposing the junction of two joints, one of which strikes north 45 degrees east and dips 80 degrees south-east, the other north 33 degrees east and nearly vertical, in the quartz diorite; where they join the rock is fractured for a width of 1 foot; there is very little mineral in these joints.

"No. 2, 20 feet south-easterly from No. 1, is a stripping that exposes two or three veinlets, striking easterly, that range from ¼ to ½ inch in width and contain scattered grains of pyrite, arsenopyrite, and galena.

"No. 3, at an elevation of 1,325 feet and 210 feet in a direction south 28 degrees east from No. 1, is merely a showing that exposes a sheeted zone, strike north 50 degrees east, dip vertical, that is 18 inches wide and carries small amounts of arsenopyrite; although the rock immediately adjacent to the joints is somewhat leached, there is very little gouge developed.

"No. 4, at an elevation of 1,335 feet and 30 feet in a direction south 65 degrees east from No. 3, commenced as an open-cut and now (December 15th, 1937) an adit 22 feet long, has been driven in a direction north 42 degrees east along a 1-inch quartz veinlet, striking north 42 degrees east and dipping 85 degrees south-easterly, that contains both grey massive and crustiform quartz with heavy pyrite and a little galena. In addition to the usual 1- to 2-inch zone of leaching on either side of the veinlet, there are recurring films of gouge. The same veinlet is exposed 25 feet south-westward from the portal, where it is of a similar character. It is to be noted that the north-westerly wall of this cut is broken by side-joints, and that each joint is filled with a thin seam of gouge and bordered by a ½-inch zone of leaching. A sample, taken along 2 feet of the ½-inch quartz-sulphide veinlet 20 feet outside the portal, assayed: Gold, 14.40 oz. per ton; silver, 5.6 oz. per ton. A sample from the face of the adit consisting of a ¼-inch quartz-sulphide veinlet and 2 inches of leached quartz diorite assayed: Gold, 0.01; silver, trace. Another sample of a ½-inch veinlet with no adhering quartz diorite assayed: Gold, 0.90 oz. per ton; silver, 0.1 oz. per ton. A sample of the quartz diorite alone that accompanied the last sample assayed: Gold, 0.06 oz. per ton; silver, trace.

"No. 5 showing, at an elevation of 1,420 feet and 260 feet in a direction south 60 degrees east from No. 4, is a combined adit and open-cut, the aggregate length of which is 34 feet. This working has been driven north-east for 34 feet along a curving shear that crosses and follows for short distances a series of joints that come into the shear at a small angle. The shear is widest in the face where it constitutes a zone 2 feet wide, and is cut by curving gouge-slips and so crushed that it is a mass of leached, disintegrated quartz diorite. The foot-wall shear in this zone strikes north 70 degrees east, dips 60 degrees north-westerly, and the hanging-wall shear strikes north 95 degrees east and dips 60 degrees north. The shear-zone is cut by a few criss-crossing stringers of quartz 1 to 2 inches wide, and containing small amounts of pyrite and arsenopyrite. In addition to the quartz in the face, the only other occurrence of appreciable size was a lens 2 feet long and 2 inches wide in the shear at a point 18 feet from the mouth of the cut. Arsenopyrite and pyrite occur disseminated in small amounts in the vicinity of the 95-degree joints.

"The following samples were taken in this cut and adit:—

"(1). A bulk sample from a quartz-pyrite-arsenopyrite lens, 1 foot long by 2 inches thick in the face, assayed: Gold, 0.10 oz. per ton; silver, trace.

"(2.) A sample of the abundant grey-black gouge, 2 inches thick, in the hanging-wall of the shear, assayed: Gold, 0.01 oz. per ton; silver, trace.

"(3.) A 14-inch channel sample taken across the back and consisting mostly of disintegrated quartz diorite assayed: Gold, 0.10 oz. per ton; silver, trace.

" A small showing beyond the mouth of the cut and in the creek-bottom was seen to be a quartz veinlet ½ inch wide that contained abundant sulphide.

" No. 6 is a showing in the bed of a branch creek, at an elevation of 1,500 feet and 660 feet in a direction south 85 degrees east from the office. It is a sheeted zone 18 inches wide formed by joints spaced 2 to 8 inches apart, each of which is accompanied by the usual leached border and disseminated pyrite. The only quartz occurs as discontinuous ½-inch stringers.

" No. 7, or the McDonald stripping, in the bed of the same creek as No. 6, is at an elevation of 1,600 feet and is 220 feet in a direction north 80 degrees east from No. 6. This is a sloping stripping in the bed of the creek exposing a zone 12 to 18 inches in width and consisting of tight joints and a 2-inch blue quartz veinlet. Towards the upper end of the stripping the zone is more open and consists of alternating layers of gouge, crushed rock, and blue quartz veinlets; fine pyrite is abundantly disseminated through the quartz. A sample taken across 12 inches of the mixed material assayed: Gold, 0.01 oz. per ton; silver, trace."

Since the writing of the above report extensive underground work, comprising approximately 650 feet of drifting, crosscutting, and raising, has been done on the showing or vein described as No. 4 in the above excerpt. Several tons of high-grade ore have also been mined from the workings.

The main adit, which is on No. 4 vein, has been driven north 53 degrees east for 27 feet; thence along the vein north 43 degrees east for 280 feet; thence north 28 degrees east for 7 feet; and, lastly, north 53 degrees east for 50 feet to the face (September 8th, 1938), a total distance of 364 feet with a net drift-length on the vein of 357 feet. At 116 feet from the portal a crosscut has been driven south-eastward at south 62 degrees east for 33 feet, and at south 51 degrees east for 40 feet; this intersects only one tight fissure that strikes north 53 degrees east and dips 75 degrees south-eastward at a point 63 feet from the drift. At two points along the drift, raises have been driven and intermediate levels driven on the vein from the raises. At a point 126 feet from the portal a short raise goes up for 2 feet to a short intermediate level that has been driven south-westward for 22 feet and north-eastward for 17 feet. In this drift the quartz-sulphide ribbon ranges from 2 to 4 inches in thickness but dies out in the north-easterly face, although the vein-shear continues as a crush-zone 4 to 18 inches in width. A sample across 4 inches of quartz and sulphides assayed: Gold, 4.24 oz. per ton; silver, 1.5 oz. per ton; lead, *nil;* zinc, 0.5 per cent.

At 230 feet from the portal a raise has been driven on the vein, which dips 77 degrees south-eastward, for 96 feet to the surface (as measured from the main drift to the collar). From this raise three intermediate levels have been driven south-westward on the vein, a lower level at 8½ feet from the floor of the drift for 45 feet, a middle at 16 feet for 28 feet, and an upper at 24 feet for 10 feet, as measured south-westward from the drift. In these intermediate levels the vein varies from a ribbon conspicuously banded by quartz and sulphides and ranging from 1 inch to 3 inches in thickness to a ribbon of crushed sulphides, ranging from ⅛ to 1 inch in thickness. A sample along a 2-inch ribbon in the 7-foot face of the middle level assayed: Gold, 13.2 oz. per ton; silver, 2 oz. per ton; lead, trace; zinc, 2.1 per cent.

In the main drift the vein-shear lacks appreciable quartz-sulphide vein-matter until from a point 50 feet from the portal. At this point the vein-shear consists of 1 inch to 2 inches of quartz and sulphides, 10 inches of leached and partly crushed rock, and a little gouge. The back of the drift is lagged from here to 93 feet. From 93 feet to 170 feet, that is to a point under the north-easterly end of the intermediate level above the first chute, the quartz-sulphide ribbon is fairly continuous, ranging from ⅛ inch to 2 inches in thickness; in the sub-level above it ranges from 2 to 4 inches. However, from 170 feet to 183 feet the quartz-sulphide ribbon, that is the ore, dies out, but the shear continues as a zone consisting of crushed rock and numerous gouge-slips and occasional ½-inch lenses of crushed sulphides. From 183 feet to 243 feet the shear again contains a fairly continuous quartz-sulphide ribbon that ranges from 1 inch to 3 inches in thickness, but from 183 feet to 307 feet the ribbon is badly sheared. In this section the vein-matter occurs only as paper-thin sheets of crushed sulphides lying within the crushed rock and gouge of the shear, the sheets rarely number more than two across the width of the shear. The shear-zone ranges from 1 inch to 1 foot in width, and

dies out at 307 feet as a slip containing from ¼ inch to 1 inch of gouge. From 307 feet to 314 feet the drift bends slightly northward for 7 feet to intersect a second shear similar in strike and shear content to the first. This shear comes into the north-westerly wall at 305 feet, as a zone 2 inches wide consisting of crushed rock and gouge, but containing no sulphides. When the sulphides in the first shear died out, the drift was turned northward for 7 feet and the second shear following from 314 feet to the face at 364 feet. The second shear contains from 2 inches to 1 foot of gouge, crushed rock, and paper-thin streaks of pulverized sulphides.

The similarity of this second shear with the first in strike and kind, and the absence of any apparent connecting fault-surface, suggests that the two shears are parallel, *en echelon* breaks.

Numerous slips, striking east, join the second shear from the north-east; these do not continue into the other wall, but do enter the shear and off-set the paper-thin sulphide streaks. Because of lagging in the back, these slips were not seen on either side of the first shear in the main drift, but similar ones were noted to the north-west of the shear in the open-cut when it was first being explored. These fractures are relatively tight, but all are bordered by a narrow ½-inch zone of leaching and some contain a thin film of gouge. It is suggested that the fractures are shear-fractures and that they probably connect the two main shear-zones.

Hand-mining from the main drift and from the intermediate levels has been in progress throughout the greater part of year, and the ore has been milled in a 10-ton Sundfelt mill.

Rimy Group.* The Man O' War Mines, Limited, of the Bank of Toronto Building, Victoria, B.C., owns the *Rimy Nos. 3* to *8* mineral claims. These claims were staked in 1934 and 1935 by R. A. Pitre, W. J. Pitre, and Chas. Henri. The property is near the top of the mountain-side that slopes into Goldvalley Creek in the vicinity of the *Rey Oro* property. It is reached by a steep pack-horse trail that leaves Goldvalley Creek at the *Rey Oro* camp, at an elevation of 1,300 feet, and follows up the hillside in a series of switchbacks to the *Rimy* camp, at an elevation of 1,940 feet. A foot-trail leads from the camp to the lower adit at an elevation of 2,270 feet, and to the upper adit at 2,420 feet.

The hillside in the vicinity of the workings is covered by a thick growth of large timber; it is very steep, and bluffs and steep, rocky watercourses are numerous.

The deposit consists of a quartz-sulphide fissure-vein in quartz diorite.

At the time of the examination (September 8th, 1938) there were only two main workings; one, an upper adit 150 feet long, and another, an open-cut being faced-up for a lower adit at a point 150 feet below the upper one.

The upper adit has been driven as a drift eastward for 150 feet from the bed of a small draw at an elevation of 2,420 feet. The vein strikes south 84 degrees east and dips 80 degrees south. It is a strong shear ranging from 4 to 10 inches in width and containing, besides crushed rock, a continuous quartz-sulphide ribbon that ranges from 1 inch to 3 inches in thickness. The quartz-sulphide ribbon usually lies closest to the foot-wall; it is succeeded by crushed rock, or breccia, and, lastly, by a fairly continuous film of black gouge on the hanging-wall. The rock formation is quartz diorite.

At the time of examination, operations consisted of driving a lower adit 150 feet below the upper adit, and of mining high-grade ore from the upper. Production for the year was 44 oz. gold and 51 oz. silver from 19 tons of ore.

Torres Zeballos Mines, Ltd.* The Torres Zeballos Mines, Limited, of 475 Howe Street, Vancouver, B.C., owns the mineral claims *Omega Nos. 1* to *4*, staked in 1937 by John Hagmo, and the *Omega Fractional*, staked in 1938 by C. J. Heaney. The property is on Pandora Creek, a creek that flows south-eastward and joins the Zeballos River at a point approximately 700 feet north-westward across the river from the mouth of Spud Creek. The camp is at an elevation of 1,260 feet, approximately 1 mile upstream from the junction of Pandora Creek with the Zeballos River.

The property is reached from the main Zeballos Road by crossing the river on a suspension foot-bridge at a point approximately half a mile south-westward from the *Privateer* mine. A foot-trail leads from the north-westerly end of the bridge, past the old *Jack of Spades*, now *Maquinna*, camp, up the mountain-side diagonally across to the south-

* By John S. Stevenson.

easterly bank of Pandora Creek, and up this to the camp and workings close to the creek-bottom; from the end of the bridge to the camp the horizontal distance is only about 1½ miles, but the trail is very steep and slow for most of the distance.

The camp and workings are in a steep-walled but accessible section of the valley-bottom, but both up-stream and down-stream the creek flows through a series of canyons and is relatively inaccessible. The main showing on the property comprises two strongly branching shears in greenstone and diorite.

The shears, ranging from 4 to 12 inches in thickness, contain within their walls a mass of crushed rock and gouge, all of which has been thoroughly leached. Scattered grains of crushed pyrite, lenses of coarsely cleavable calcite, and a small amount of broken vein-quartz are scattered at infrequent intervals within the gouge and crushed rock. Small amounts of fine-grained sphalerite, galena, and arsenopyrite are disseminated in both the calcite and quartz.

In the vicinity of the workings diorite predominates, but 250 feet up-stream from the adit tongues of granitic rock, intrusive into the diorite, become abundant. The workings comprise one short adit and some surface strippings in the creek-bed a short distance up-stream from the one camp-building (as of September 6th, 1938).

The portal of the adit is on the north-easterly side of the creek at an elevation of approximately 1,320 feet—that is, up-stream from and 70 feet higher in elevation than the camp-cabin.

The adit, 44 feet long, has been driven from approximately creek-level in a direction north 40 degrees east as an open-cut for 10 feet, then as an adit in the same direction for 16 feet, then at north 58 degrees east for 28 feet to the face (September 6th, 1938). At the portal it follows a strong shear that strikes north 55 degrees east and dips 80 degrees south-eastward. However, approximately 6 feet from the face the portal shear is joined by a vertical shear, striking north 60 degrees east, which comes into the north-westerly wall of the adit at a point 15 feet within the portal.

A sample taken of the face across 6 inches and along 2 feet of white gouge and crushed rock within the shear assayed: Gold, 0.01 oz. per ton; silver, trace. A sample taken from a 12-inch by 2-foot pile of brown muck within the shear and evidently representing a concentration of material carried down the shear from the surface and reported to contain zinc, assayed: Zinc, *nil*. A sample taken across a 10-inch width of leached wall-rock containing a few irregular ¼-inch stringers of quartz and fine pyrite, assayed: Gold, *nil;* silver, *nil*.

The rock formation in the adit comprises greenstone and diorite. Dense greenstone occurs in both walls of the cut and on both sides of the south-easterly shear, but in the adit it follows along only the south-easterly wall and only in the hanging-wall side of the south-easterly shear; the greenstone is conspicuously leached in the vicinity of the shear. Medium-grained diorite forms the north-westerly wall of the adit and occurs on either side of the north-westerly shear; the diorite is also conspicuously leached near the shear. Both rocks show traces of contact metamorphism in the development of small brown patches of biotite hornfels. The presence of tongues of quartz diorite, 250 feet up-stream from the adit, indicates the close proximity of the body of granitic rock responsible for both the metamorphism of the diorite and greenstone and the mineralization of the shear-zone.

Two hundred feet up-stream from the adit a small cut in the south-westerly bank of the creek exposes ½-inch barren calcite vein in a narrow shear that strikes north 70 degrees west and dips 65 degrees northward.

Van Isle Group.†

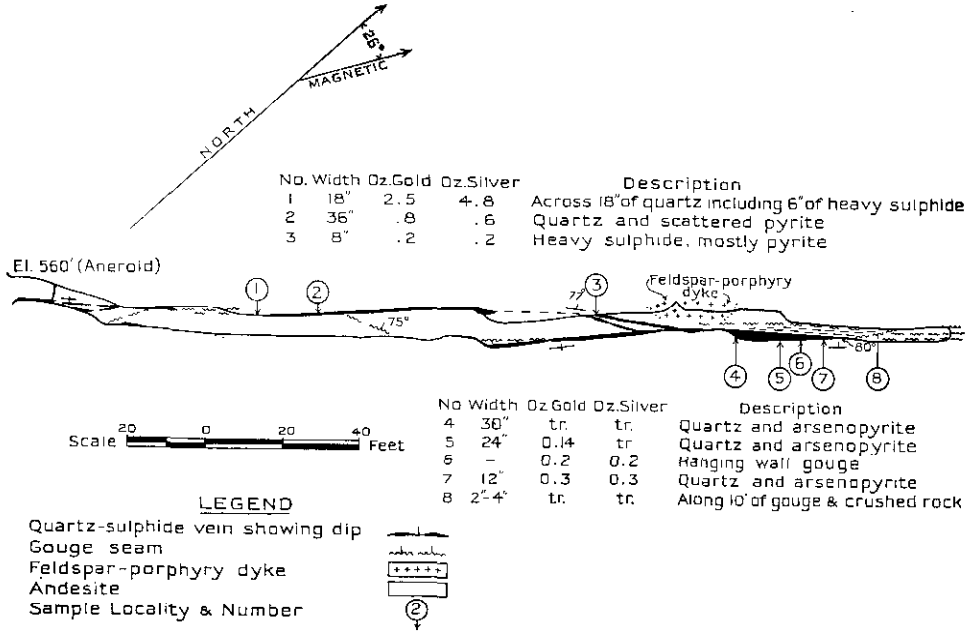
The *Van Isle* property, formerly owned by Man O' War Mines, Limited, but now by Privateer Mine, Limited, consists of the following claims: *Van Isle Nos. 1* and *2*, *Blue Ox Nos. 1* and *2*, *Wolverine*, *Pedro*, *Silver Bear*, staked in 1933; and the *Riverside* and *V.I. Nos. 1* to *4*, staked in 1937. The workings consist of several combined stripping and open-cuts and two adits. The surface cuts are reached by a trail one-third of a mile from the old camp and the upper adit by a precariously perched Jacob's ladder up the north-easterly side of the canyon. New camp buildings have been erected on the side road between the main Zeballos River Road and the old camp site on Van Isle Creek.

† By John S. Stevenson and R. J. Maconachie.

The surface workings are on the steep, heavily-wooded hillside on the south-westerly side of the south-westerly fork of Van Isle Creek; they extend south-westward from the creek-bottom, at an elevation of 650 feet, up the hillside to an elevation of 880 feet; a short distance beyond this the slope, at an elevation of 1,000 feet, flattens for 200 feet before changing direction to a westward slope. Most of the cuts have sloughed badly and only those which were open at the time of the examination (September, 1937) will be described.

These cuts have been driven on a south-westward-striking shear that ranges in width from a tight joint to a sheared zone 12 inches wide, consisting of broken rock and varying amounts of quartz, with fine-grained pyrite and arsenopyrite.

The lowest cut, at an elevation of 780 feet, has been driven in a direction south 45 degrees west for 16 feet. The north-westerly wall of the cut shows a fractured zone 8 inches in width that contains at one place, 3 feet from the portal, a lens of quartz 8 inches long and 2 inches wide, the quartz containing scattered pyrite and arsenopyrite. A sample taken across this lens assayed: Gold, 0.22 oz. per ton; silver, trace. A thin lens of sulphide, 1 inch thick and 2 inches long, occurs in the floor on the south-easterly side of the cut. The face, 5 feet high, contains four equally-spaced, tight joints striking south 45 degrees west and dipping 78 degrees north-westward; the most north-westerly joint is a continuation of the fracture in the same wall, described earlier.



Van Isle. Plan of part of the upper adit (as of September, 1937) by chain-and-compass survey.

South-westward and 45 feet higher up the hillside, a showing under a tree-root exposes a lens of quartz 2 feet long and 8 inches wide. This contains very little sulphide, but lies between strong walls.

Farther south-westward along the strike and up the hillside at an elevation of 850 feet, a stripping 10 feet long exposes a strong shear ranging from 8 to 12 inches in width, and containing fragments of blue quartz that have been cut by numerous fractures paralleling the usual south-westerly strike of the shear. This quartz contains finely disseminated arsenopyrite. A sample taken across an 8-inch width of the best-mineralized portion assayed only traces in gold and silver.

The last working, a 15-foot stripping farther south-westward up the hillside, begins at an elevation of 880 feet, exposes a section of the shear, ranging from 10 to 12 inches in width, that contains numerous ½-inch stringers of both blue quartz and vuggy quartz; small amounts of pyrite and arsenopyrite were seen in the quartz. A sample taken across 10 inches of shear, where the quartz and sulphides, pyrite and arsenopyrite, were heaviest, assayed:

Gold, trace; silver, 0.4 oz. per ton; and one across 8 inches of crushed rock without any quartz or sulphides assayed traces only in gold and silver.

The crest of the hill is some 50 feet above this cut, the slope flattening for 200 feet and then sloping steeply westward.

The upper adit, at an elevation of approximately 560 feet, has been driven north-eastward into the steep canyon-wall of the north-easterly branch of Van Isle Creek. Above the portal the vein has been exposed up the bluff-face for some 100 feet. A quotation from the Annual Report of the Minister of Mines, British Columbia, for 1935, page F 40, describes the nature of the vein as it was then, at the time of "facing up" for the adit:—

"A fissured zone, strike north 45 degrees east and dip 80 degrees north-west, in porphyritic andesite has been mineralized by quartz, pyrite, pyrrhotite, galena, and sphalerite. This fissured zone of crushed andesite, where examined, is 3 feet wide and contains quartz-sulphide veins that range in widths from 2 to 12 inches. The quartz is milky and is massive, not crustiform; pyrite, the most abundant sulphide, is fine-grained and is usually in bands parallel to the walls of the vein; pyrrhotite and sphalerite are disseminated in small amounts amongst the pyrite. A grab sample taken in the open-cut from part of a quartz vein 3 inches wide, and containing a little pyrite, assayed: Gold, 0.90 oz. per ton; silver, 0.10 oz. per ton."

Although the general features of the vein-structure may be seen in the accompanying plan, a few additional notes may be given. From the portal to 145 feet in, the main break is approximately constant in attitude and uninterrupted by major deflections from a uniform strike of north 42 degrees east and a vertical dip. In this section the main break, with a clean-cut hanging-wall and accompanying gouge, is persistent, the quantity and nature of vein-matter varies, the width of the vein ranging from 2 inches to 3 feet, and the sulphides in the narrower bands of 2- and 4-inch widths, and in one place an 8-inch width. In these sulphide-bands pyrite predominates; arsenopyrite, as contrasted to farther in, occurs there only sparingly.

Branch fissures along this section include a ⅛-inch joint at 34 feet and a similar break at 84 feet respectively from the portal. At 145 feet from the portal, the main vein, still striking 42 degrees and dipping 77 degrees north-westward, splits into two smaller ones that cross the drift and join with another vein at 160 feet and 172 feet respectively from the portal, to make a parent vein that strikes north 38 degrees east and dips 80 degrees north-westward. The other vein spoken of was broken into at a point 120 feet from the portal; it is a strong quartz-sulphide vein maintaining a fairly constant width of 4 inches to its junction at 160 feet and 172 feet with the branches from the first vein. Between 165 feet and 185 feet the drift cuts a tongue of feldspar porphyry, the attitude of which was indeterminate because the rock in the opposite (south-easterly) wall of the drift was obscured by the vein. Beyond this point a widening of the drift permits a better examination of the vein-matter in the so-called parent vein (*see* above). This vein consists of quartz, in places abundant coarsely-crystallized calcite, and arsenopyrite; arsenopyrite is here the most abundant sulphide, and others are almost absent; this contrasts with the comparative scarcity of arsenopyrite nearer the portal. The width of the vein ranges from 30 inches at 188 feet to 2 inches at 210 feet, and finally appears to disappear into a slip at 220 feet. It is to be noted that a marked shearing, manifested by numerous closely-spaced slips in the back, begins at 182 feet and continues to 220 feet, where the relief of stresses has been concentrated in three main gouge-filled fissures that apparently also represent a continuation of the vein-structure but which lack quartz-sulphide vein-matter—the vein-matter ended, as stated above, at 220 feet. As seen in the face, these three gouge-slips average 1 inch in thickness and one of them contains ¼ inch of calcite; sample No. 8 indicates that the gouge and accompanying crushed rock contains little gold.

The rock formation of this adit is, with the exception of the tongue of feldspar porphyry, both altered even-grained and altered porphyritic andesite.

In an effort to gain more complete information on values in the upper level, samples were taken at 10-foot intervals for the first 105 feet of the drift. The assays of these samples are as follows:—

At portal plus 5 feet, across 11 inches, along 3 inches, including in the width 4 inches solid quartz well mineralized by pyrite, pyrrhotite, and sphalerite, and 7 inches of barren siliceous gouge: Gold, 0.18 oz. per ton; silver, 0.6 oz. per ton.

At portal plus 15 feet across 8 inches and along 6 inches of rusty decomposed material carrying streaks of good mineralization: Gold, 0.16 oz. per ton; silver, trace.

At portal plus 25 feet across 6 inches along 4 inches, the width being made up by 3 inches of solid quartz with fair mineralization and 3 inches of gouge: Gold, 0.02 oz. per ton; silver, trace.

At portal plus 35 feet across 4 inches and along 4 inches of rusty decomposed vein material, containing little visible mineral: Gold, 0.02 oz. per ton; silver, trace.

At portal plus 45 feet across 4 inches and along 4 inches rusty decomposed vein material with fair mineralization: Gold, 3.56 oz. per ton; silver, 2.8 oz. per ton.

At portal plus 55 feet across 3 inches and along 6 inches of rusty vein material containing good mineralization: Gold, 0.44 oz. per ton; silver, 1 oz. per ton.

At portal plus 65 feet across 2 inches and along 6 inches of fresh quartz well mineralized: Gold, 3.34 oz. per ton; silver, 2.1 oz. per ton.

At portal plus 75 feet across 3 inches along 6 inches of almost pure quartz with little visible mineral: Gold, 0.42 oz. per ton; silver, 0.2 oz. per ton.

At portal plus 85 feet across 1 inch along 8 inches of banded quartz containing little visible mineral but banded by dark streaks of fine-grained sulphides: Gold, 1.52 oz. per ton; silver, 0.9 oz. per ton.

At portal plus 95 feet across 3 inches and along 7 inches of rusty gouge with little visible mineral: Gold, trace; silver, trace.

At portal plus 105 feet across 1½ inches along 10 inches of good strong quartz banded by fine-grained sulphides and containing a fair amount of other mineralization: Gold, 0.36 oz. per ton; silver, 0.6 oz. per ton.

At a point 205 feet below the upper adit a second adit has been driven south-eastward in andesite. At 382 feet this crosscut intersected what was assumed to be the downward extension of the vein exposed in the upper drift. Continued crosscutting proved a second zone of mineralization 76 feet beyond the first. From the evidence underground in the upper adit and from the surface exposures two such intersections were expected owing to a branching of the main vein, and fulfilment of this condition at the lower level lends authority to the assumption of downward extension.

At the first intersection the vein strikes north-eastward and dips at 80 degrees to the north-west. The quartz is fresh, with some vugs and comb structure. General shearing rather than single fissuring has created horses of andesite within the limits of the quartz. Mineralization is by pyrrhotite, arsenopyrite, pyrite, and a little sphalerite. Samples were taken at this location as follows:—

Across 28 inches on the south-west wall, including a narrow width of andesite in centre of shear, slight mineralization: Gold, trace; silver, trace.

Across 16 inches on the north-east wall, full width of quartz, slight mineralization; Gold, trace; silver, trace.

Select sample of the best mineralization obtainable from muck broken at the intersection and by one swipe on the left wall: Gold, 0.01 oz.; silver, trace.

At the second intersection the exposure, though narrower, is similar to the first. The quartz strikes north 32 degrees east, dips at 75 degrees to the north-west, and splits and branches within a zone of shearing. Samples taken are as follows:—

Across 6 inches on the south-west wall, quartz and calcite gangue and good mineralization by pyrrhotite, pyrite, and arsenopyrite: Gold, 0.12 oz. per ton; silver, 0.3 oz. per ton.

Across 3 inches on the north-east wall, mainly quartz and calcite, with little mineral: Gold, 0.16 oz. per ton; silver, trace.

Across 13 inches of andesite on the foot-wall of the shear on the south-west wall, including two 1-inch stringers of quartz and a small amount of pyrite: Gold, trace; silver, trace.

The first of these two mineralized zones is presumed to be the vein upon which the upper adit was driven. The intersection in the lower tunnel is some 60 feet south-west of the portal of the upper tunnel so that at the present time no data are available as to conditions vertically below the mineralization exposed on the upper level. Drifting to the north-east from the lower crosscut was under way in April, 1938, but ceased some time prior to September, 1938.

Zeballos Goldspring Mines, Ltd.*

The Zeballos Goldspring Mines, Limited, of 1016 Hall Building, Vancouver, B.C., owns the *Goldspring Nos. 1* to *6* mineral claims, staked in 1937 by John B. Madsen. The camp and the showings are on the south side of the valley of Fault Creek, a south-eastward-flowing tributary of the North Fork of the Zeballos River. The camp may be reached by following a steep foot-trail westward up the mountain-side from the *King Midas* camp on the North Fork of the Zeballos River. The *King Midas* camp is reached by a pack-horse trail that follows up the east bank of the North Fork of the Zeballos River, for a distance of 1 mile, measured from its junction with the Nomash River.

The camp and workings are on the south side of the steep-walled valley of Fault Creek. The workings are on fissure-veins that follow up the steep and, in part, bluffy valley-wall; an average slope of 45 degrees was determined for the hillside.

The showings on the property consist of two north-south fissure-veins in andesitic greenstone.

The only workings at the time of the writer's visit were strippings on these veins and an open-cut which was being started as an adit on the easterly of the two veins. This adit is 300 feet westward above both Fault Creek and the camp, the elevation of the adit being 1,555 feet.

The easterly vein is exposed for a considerable distance in the bed of a watercourse tributary to Fault Creek. The writer traced it in the rocky bed of the watercourse from the adit open-cut to the bottom of a rock chimney at a point 100 feet above open-cut; it is reported to have been found at various places up the hillside beyond this chimney.

In the section seen, the quartz vein ranges from 1 inch to 8 inches in thickness, and the accompanying rusty, sheared greenstone from 5 to 12 inches; the shear and vein strike south 75 degrees east and dip 60 degrees north-eastward. The sulphides include abundant pyrite, occasional patches of abundant chalcopyrite, and minor amounts of sphalerite and galena. A sample of heavy pyrite taken from the vein 15 feet above the adit open-cut assayed: Gold, 1.54 oz. per ton; silver, 0.5 oz. per ton, and a sample across the full 8-inch width of the vein, including 5 inches of scattered pyrite from the same place, assayed: Gold, 0.40 oz. per ton; silver, 0.1 oz. per ton.

The lowest stripping on the westerly vein is at an elevation of 1,450 feet, and approximately 150 feet above a point in Fault Creek that is 700 feet up-stream from the camp.

The vein is discontinuously exposed by strippings in the overgrown bed of a small watercourse flowing northward into Fault Creek. The shear and vein strike south 20 degrees west, dip 70 degrees eastward. The shear ranges from 1 inch to 5 inches in width and contains either a few 1-inch ribbons of quartz or a single ribbon ranging from 1 inch to 3 inches thick. Sulphides are less abundant in this than in the easterly shear previously described, the only sulphide, pyrite, occurs in small amounts. A sample taken along a 1-inch ribbon of quartz for 2 feet at an elevation of 1,350 feet, assayed: Gold, 0.30 oz. per ton; silver, trace. A sample taken near the base of a rock chimney at an elevation of 1,465 feet, for 5 feet along a quartz ribbon ranging from 1 inch to 3 inches in thickness, assayed: Gold, 0.20 oz. per ton; silver, trace. A sample taken at an elevation of 1,550 feet along 1 foot of a lean but strong 3-inch quartz ribbon, assayed: Gold, trace; silver, trace.

SPECIAL REPORTS.

Typewritten copies at 25 cents each are available to those who specially request reports on the following properties:—

Quadra Island: Geiler Group; Rebecca Group.

Read Island: Solyman-Freja Group.

* By John S. Stevenson.

PROGRESS NOTES.

BY

J. A. MITCHELL AND JAMES STRANG.

LODE-GOLD DEPOSITS.

BRIDGE RIVER CAMP.*

Pioneer Gold Mines of B.C., Ltd.—H. T. James, general manager; E. F. Emmons, general superintendent. Development-work on the main vein continued in 1938, and was confined mainly to the levels between 14 and 26. In that section of the mine the drifting on intermediate levels completed the blocking-out of ore indicated by previous years' work. This work will be continued on incompleted levels in 1939. This development work accounted for 5,985 feet of lateral development and 3,034 feet of raising.

Work on No. 4 shaft was continued and practically completed by December 31st. This shaft will open up three new levels—27, 28, and 29—for exploration during the coming year. The advance in sinking and shaft pockets amounted to 518 feet for the year.

Ore hoisted during the year totalled 142,775 tons; the milled tonnage amounted to 123,304 tons.

The average employment during the year was: Mine, 197; mill, 27; surface, 59; and salaried officials, 32.

Bralorne Mines, Ltd. (N.P.L.).—Richard Bosustow, general manager; D. N. Matheson, general superintendent; E. J. Chenoweth, mine superintendent. During 1938 a total of 15,888 feet of lateral exploration and development-work was done in the *Bralorne* mine; also 1,586 feet of raising, 94.5 feet of sinking, and 13,202 feet of diamond-drilling.

The average employment during the year was: Mine, 303; mill, 18; surface, 51; and salaried employees, 36.

The installation in the *Crown* shaft of an Ingersoll-Rand double-drum electric hoist, with a rope speed of 1,000 feet per minute and a pull of 15,000 lb., was completed in February, and since then has been in constant service. Most of the development-work was done on the 14th and 12th levels, which are serviced by this shaft.

The compressor building was enlarged and a new 2,100-foot Ingersoll-Rand compressor was installed.

A new coarse-ore bin and sorting plant was constructed during the year. These additions doubled the coarse-ore storage and made it possible to eliminate practically all dilution from the mine run.

B.R.X. (1935) Consolidated Mines, Ltd.—E. R. Shepherd, manager. Early in the year a pilot-mill was erected at this property to determine the average value and correct processing of the large amount of low-grade ore indicated by several thousand feet of development upon the shear-zone.

It was necessary to drive a ventilation and auxiliary exit raise, 12 by 5 feet in section, a total distance of 710 feet in material too low-grade to sustain milling costs. Because of this, and limited finances, the mill had to be shut down until the raise was completed. On November 9th this was accomplished, but there was a temporary shut-down on November 20th. Before the end of the year operations were resumed. The average employment for the year was: Mine, 23; surface, 19; mill, 7, when operating; salaried officials, 4. The development footages are: 1,596 feet of drifting, 213 feet of crosscutting, and 710 feet of raising.

Holland Gold Mines, Ltd.—Frank L. Holland, general manager; John S. Holland, mine foreman. An exploratory adit on this property was advanced to a point over 600 feet from the portal. A crew of five men (maximum) was employed and power-drills were used.

Ho Bo Prospect.—Pioneer Gold Mines of B.C., Limited, drove a prospect adit on this property during 1938.

Golden Ledge Syndicate.—Chas. Plaxton, general manager. Ninety-six feet of hard-rock tunnel was driven at this property during the year.

* By J. A. Mitchell.

Mix Gold Mines, Ltd.—Howard Cameron, managing director. Three hundred and seventy-five feet of crosscut tunnel was driven on this property during the year. In addition to this some diamond-drilling was done.

Lucky Strike Gold Mines, Ltd.—Grant Mahood, managing director. In addition to surface stripping and open-cutting, it is reported that 70 feet of 5- by 7-foot rock tunnel was driven on this property.

Gem.—At the *Gem* mine, operated by this company during 1938, first under the supervision of J. M. Hill and later under G. Donald Emigh, there was accomplished 115 feet of drifting and 257 feet of crosscutting, this in addition to surface work. Work commenced on July 2nd and finished on December 23rd. During this time an average of five miners, one blacksmith, and a cook were employed.

Taseko Lake Area.*

Taylor-Windfall Gold Mining Co., Ltd.—S. H. Davis, superintendent; R. H. Stewart, consulting engineer. At the *Taylor Windfall* mine an adit tunnel was completed to effect a connection with the old workings, which were flooded to a depth of 120 feet. The head of water was reduced by an advance drill-hole from the face of the tunnel and the final drainage completed by blasting this drill-hole; sulphuretted hydrogen escaping from the drill-hole caused a temporary suspension of operations.

After the connection was made, a section of the old workings was enlarged. A shaft-station was cut, and a shaft sunk 121 feet. At 100 feet below the collar a second shaft-station was cut for the new 300-foot level. A crosscut was then driven 70 feet south-eastward to intersect the vein at 58 feet. Drifting on the vein in a north-easterly direction was then carried on until operations ceased on November 8th, when the face was at 81 feet. Water seepage increased noticeably below 50 feet during shaft sinking but at no time amounted to more than 10 gallons per minute.

The mining operations consisted of 604 feet of new tunnel, 210 feet of enlarging of old tunnels, 30 feet of raising, 121 feet of shaft sinking, and 2 shaft-stations.

Hi Do Gold Mines, Ltd.—At this company's property a tent-camp was established at a safe site and about 3 miles of trail made. In addition to numerous open-cuts, an 88-foot adit was driven on No. 5 vein and about 10 feet of tunnel, now caved, was driven in an attempt to locate the source of rich gold-bearing quartz float.

The tunnelling was mainly done in 1937 but has not been previously reported.

Chilcotin Area.*

The following properties in the Chilcotin District were apparently inactive during 1938: Morris Gold Mines, Limited, *Langara*, *Standard*, and *Argo* was surveyed, *Vick* on which assessment-work has been filed for ten years in advance.

Lillooet Area.*

Grange Consolidated Gold Mines, Ltd.—Joseph McPherson, mine manager; John Bennett, consulting engineer. Operations ceased at this property on June 22nd, 1938.

S. F. Mead, of Clinton, is reported to have done extensive open-cutting and to have driven 23 feet of tunnel on what is thought to be the Dawson vein near Clinton.

Ashcroft-Kamloops Area.*

Vidette Gold Mines, Ltd.—D. B. Sterrett, general manager; Richard Avison, mine superintendent. During 1938 there was accomplished at the *Vidette* mine, 1,865 feet of drifting, 1,196 feet of crosscutting, 904 feet of raising, and 2,152 feet of diamond-drilling.

This work developed portions of the *Bluff* and *Broken Ridge* veins above the 4th level and the new " 70 " vein on the 3rd and 4th levels. Finances were inadequate to carry on development, and at the beginning of March it was found necessary to run the mill in order to meet the operating costs. Under this arrangement only two or three crews can be kept on development-work and the progress is slow. The mill was treating 20 to 25 tons per day and the gold production was about 14 oz. daily.

The employment averages for the year are: Mine, 46; mill, 9; surface, 38; and salaried employees, 7.

* By J. A. Mitchell.

Savona Gold Mines, Ltd.—In the early part of the year it is reported that 94 feet of crosscutting and drifting was done on this property. The mine was idle at the end of the year and the workings were reported to be flooded.

Martel Gold Mines, Ltd.—A. E. Jamieson, managing director. When inspected in April, this mine was being worked one shift by contractors. Six men were employed. Work was suspended in the early autumn.

Coronation Gold Prospect.—J. Johnson, managing director. Two or three men were employed intermittently, driving an incline on this property.

Squamish Area.†

Ashloo Gold Mines, Ltd.—This property is situated about 28 miles by road and trail from Squamish, on the Ashlu River. The mine worked the greater part of the year, closing down the last two months due to transportation difficulties in winter weather. The winze was continued from the 1,100- to the 1,000-foot level and a little development-work done on each of these levels. Practically all the ore for the mill came from stopes and raises between the 1,200-foot level and the surface. About 27 men are employed, 15 men underground and 12 on the surface and mill.

Texada Island.†

Gem Gold Mines, Ltd.—This mine remained closed until the latter part of the year when it was reopened. Some development-work is being carried out on the 150-foot level. Five men are employed.

Zeballos District.†

Privateer.—Owned and operated by the Privateer Mine, Limited, is situated in Spud Valley and 4 miles along the highway from the beach. A great deal of development-work has been carried out at this mine during the year. Levels developed from the surface are the 600-, 800-, 900-, 1,000-, and 1,100-foot, all connected by a system of raises with stoping carried on between the 1,000- and 800-foot levels. Before the mill was built, 1,541 tons of ore was shipped to Tacoma, and since then 6,679 tons have been treated in the mill. A 75-ton cyanide mill was completed in September and went into operation. A modern Diesel power plant and air compressors have been installed, the air compressors supplying 1,150 cubic feet of air. Up-to-date bunk-houses, cook-house, and dining-room have been built, with accommodation for well over 130 men.

Spud Valley Gold Mines, Ltd.—This property is about 2½ miles farther up Spud Valley than the *Privateer* mine. Four workings have been driven, Nos. 1, 2, 4, and 8. No. 1 tunnel and No. 4 tunnel have been driven through the mountain to the Goldvalley side. A three-compartment raise was driven from No. 4 tunnel to No. 2 adit and No. 3 level was broken off this raise. Stopes were started on No. 4 level and No. 3 level, the ore being sent to the mill during December; 1,702 tons were treated. A 50-ton mill was ready for operation early in December. A new Diesel power plant capable of producing 475 horse-power and an aerial tramway from the mine to the mill were erected during 1938. New camp buildings, bunk-house, cook-house, and dining-room capable of accommodating forty-eight men, have been built.

White Star Group.‡—At this property work was resumed on October 16th, since when an appreciable amount of development has been done under the management of T. D. Pickard. This includes a new drift adit on the No. 1 vein at 1,088 feet elevation (or 122 feet lower than the upper adit), from which a crosscut was being driven towards No. 2 vein. A 2-drill Ingersoll-Rand Diesel-driven compressor was installed and new buildings include power-house and office. George Moffat, foreman, is in charge of a crew of eleven men.

Sidney Inlet District.†

Sidney Inlet Mining Co., Ltd.—This company's copper property is at Sidney Inlet on the west coast of Vancouver Island, and was formerly operated as the *Indian Chief* mine by the Tidewater Company. The old mill and wharf were dismantled. The mill is a 120-ton concentration plant using flotation process, with bunkers and aerial tramway system to convey the ore from the mine to the mill. New bunk-house and cook-house were built at the beach

† By James Strang.
‡ By B. T. O'Grady.

and the old camp buildings at the mine rehabilitated. The portals of Nos. 2 and 3 adits were cleared out and retimbered, track was laid in these adits and connections were made underground to the Green adit which is driven from the surface on the other side of the mountain. Development-work was started on the faces of Nos. 2 and 3 levels and ore for milling purposes was taken from No. 223 stope pillars. A total of 4,553 tons of ore was produced from September to December. Some 2,200 tons of ore was treated from the dump outside, making a total of 6,750 tons through the mill.

Herbert Arm Section.†

The Premier Mining Company have taken over the *Abco* mines at the head of Herbert Arm. Sixteen men are employed. So far the work consists of repair-work and exploratory work.

COPPER DEPOSITS.†

Howe Sound Area.

Britannia Mining and Smelting Co., Ltd.—C. P. Browning, general manager; C. V. Charlton, secretary-treasurer; C. G. Dobson, mine superintendent. This mine is one of the largest producing mines of British Columbia, and although the price of export refinery copper was lower in 1938 than in 1937, the output and number of men on the pay-roll was steadily increased. The number of men employed in the mine, surface, and mill toward the end of the year totalled 1,300. The production from all the mines amounted to 2,206,992 tons. The recovery of metals was augmented by the operation of the copper precipitation plant which continued to treat the mine waters. From this tonnage 33,337,978 lb. of copper, 12,449 oz. of gold, 161,912 oz. of silver, and 74,951 tons of pyrite were produced.

Development-work totalled 26,208 feet or 4.96 miles, made up as follows: Drifting, 7,177 feet; crosscutting, 3,996 feet; raises, 12,880 feet; powder blast workings, 1,915 feet; sinking, Victoria shaft, 240 feet. In addition to this there was a total of 20,303 feet of diamond-drilling.

During the year the 41-01 raise system was completed giving a continuous ore-pass raise between the 2,700- and 4,100-foot levels. The No. 3 crusher was installed on the 3,900-foot level in this raise system. The 39-0 raise was completed to the 3,500-foot level, this completes a through airway and manway from the 4,100-foot tunnel portal to the 2,700-foot level, and provides good ventilation for all the workings off No. 4 shaft.

MERCURY DEPOSITS.*

Empire Mercury Mines.—Alex. J. Fraser, superintendent; R. F. Brown, of California, construction engineer. At the *Manitou* mine, operated by the above company, development-work done during the year consisted of 318 feet of drifting, 160 feet of crosscutting, 200 feet of raising, and 14 feet of sinking.

A small tonnage of ore was reduced in the mill. This mill has a capacity of 10 tons per twenty-four hours but has worked only intermittently to date.

An average of five men was employed in the mine and eight on the surface.

CHROMIUM DEPOSITS.*

Chrome Pit.—John O. Williams, superintendent. This property is 4½ miles west of Ashcroft, B.C. A syndicate known as the Calgary Mineral Syndicate had four men on this property, employed in uncovering a supposedly large body of chromite mineralization of good grade. This property was located by Lester Starnes, of Ashcroft, B.C., in August, 1938.

PLACER-GOLD DEPOSITS.*

Brodt's Placer.—Luther Fritz, watchman. Brodt completed 134 feet of shaft through hard-packed gravel, but was driven out by the Fraser River water. He later died and Luther Fritz was appointed as watchman. It is reported that coarse gold was recovered from the bottom of the shaft.

† By James Strang.

* By J. A. Mitchell.

The following placer operations were inactive during the year: B.C. Gold Dredges, Limited; Fraser River High Bar Placers; Northwest Mining and Development Company; Bridge River Placers.

A few leases were worked by hand at Franch Bar, Watson Bar, and at the head of Churn Creek.

QUARRIES, SHALE, AND CLAY PRODUCTS.†

Burrard Inlet.

Coast Quarries, Ltd.—T. Burrows, superintendent. Conditions at Granite Falls quarry were generally found to be good. Work during the year has been intermittent. The stone from this quarry is used for general construction-work. The number of men when fully employed ranges from seven to ten.

North Vancouver Area.

Deeks Sand and Gravel, Ltd.—T. O. Burgess, superintendent. Work has been fairly steady throughout the year. Plant equipment at this property is kept in good condition, and every care taken to operate safely. Six men are employed.

Cascade Sand and Gravel Co.—W. A. McCullum, superintendent. Conditions were generally found to be good. Ten men are employed.

B.C. Sand and Gravel Quarry.—K. Morrison, superintendent. This plant worked only occasionally during the year. When working, six men were employed.

Fraser River Delta Area.

Gilley Bros.' Quarry.—Situated at Silver Valley, Pitt River. The stone from this quarry is used in general construction-work. Conditions generally are found to be good at this plant.

Maryhill Sand and Gravel Quarry.—Operated by Gilly Bros., Limited, and situated on the banks of the Fraser River. This plant is kept in very good condition. About sixteen men are employed fairly regularly throughout the year.

New Westminster District.

Clayburn Company, Ltd.—This company's plant is situated at Kilgard, about 50 miles east of Vancouver. Fireclay, firebrick, and various forms of refractory forms as well as common brick and sewer-pipe are produced. The fireclay is obtained from deposits at Kilgard worked by underground methods similar to coal-mining. A shale quarry is operated in conjunction with the mines. About 1,200 tons of fireclay and 275 tons of shale was produced. Seventy men are employed, ten of these being in the mine.

Gabriola Island.

Gabriola Shale Products, Ltd.—Charles T. deLong, manager. This property resumed operations for the 1938 season on May 27th, and gave employment for twenty-eight men until the plant closed down on December 6th for the winter months. The shale is put through the processing plant adjacent to the quarry, where an excellent quality of brick is manufactured and sold principally in the Vancouver market.

Saanich Inlet, Vancouver Island.

B.C. Cement Co.—Operating two quarries and a cement plant at Bamberton. About twenty men are employed in the quarries, with a total crew of around 105 men for the whole plant.

Nelson Island.

Vancouver Granite Co.—This company operates a dimension-stone quarry on Nelson Island. Work here has been intermittent throughout the year.

Texada Island.

Pacific Lime Co.—This company operates two limestone quarries at Blubber Bay, producing quicklime, hydrated lime, and various limestone products. Labour disputes have inter-

† By James Strang.

fered with the regular working of the plant, but twenty-four men are regularly engaged in the quarry. The plant and quarry are kept in good condition. O. Peele is manager.

B.C. Cement Co.—This company operates a limestone quarry on the opposite shore of Blubber Bay from the Pacific Lime Company. The limestone, after passing through crusher plant, is shipped to the cement plant at Bamberton. Seven men are employed. Robert Hamilton is in charge.

Vananda Quarry.—A limestone quarry supplies limestone to various pulp-mills and crushed limestone to the coal-mines of Vancouver Island. Fourteen men are employed.

Fitzhugh Sound, Mainland Coast.

Koeye River Quarry.—P. Christenson, owner. There are two small quarries operating here supplying limestone for the Pacific Mills at Ocean Falls. They are located on Koeye River about 7 miles south of Namu. These quarries can now take care of the entire requirements of the Pacific Mills for lime rock. Twelve men were employed. A total of 7,343 tons was produced.

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VICTORIA, B.C.:
Printed by CHARLES F. BANFIELD, Printer to the King's Most Excellent Majesty.
1939.

The Annual Report of the Minister of Mines is now issued in parts as follows:—

Part A.—THE MINING INDUSTRY (STATISTICAL REVIEW). John F. Walker.

Part B.—NORTH-WESTERN DISTRICT. Joseph T. Mandy.

Part C.—NORTH-EASTERN DISTRICT. Douglas Lay.

Part D.—SOUTH CENTRAL DISTRICT. M. S. Hedley.

Part E.—SOUTH-EASTERN DISTRICT. R. J. Maconachie.

Part F.—SOUTH-WESTERN DISTRICT. H. Sargent.

Part G.—INSPECTION OF MINES. James Dickson.