Minister of Mines and Petroleum Resources

PROVINCE OF BRITISH COLUMBIA

ANNUAL REPORT

for the Year Ended December 31

1965

Printed by A. Sutton, Printer to the Queen's Most Excellent Majesty
in right of the Province of British Columbia.
1966

BRITISH COLUMBIA

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

VICTORIA, B.C.

HON. DONALD L. BROTHERS, *Minister.*

P. J. MULCAHY, *Deputy Minister.*

J. W. PECK, *Chief Inspector of Mines.*

S. METCALFE, *Chief Analyst and Assayer.*

HARTLEY SARGENT, *Chief, Mineralogical Branch.*

K. B. BLAKEY, *Chief Gold Commissioner and Chief Commissioner, Petroleum and Natural Gas.*

J. D. LINEHAM, *Chief, Petroleum and Natural Gas Conservation Branch.*

Major-General the Honourable George Randolph Pearkes,
V.C., P.C., C.B., D.S.O., M.C.,
Lieutenant-Governor of British Columbia.

May it please Your Honour:

The Annual Report of the Mineral Industry of the Province for the year 1965 is herewith respectfully submitted.

DONALD L. BROTHERS,
Minister of Mines and Petroleum Resources.

Minister of Mines and Petroleum Resources Office,
March 31, 1966.

CONTENTS

LIST OF ILLUSTRATIONS

Photographs

Drawings

ANNUAL REPORT OF THE MINISTER OF MINES AND PETROLEUM RESOURCES, 1965

Introduction

A report of the Minister of Mines of the Province of British Columbia has been published each year from 1874 to 1959. Beginning in 1960, it is the Report of the Minister of Mines and Petroleum Resources.

The Annual Report records the salient facts in the progress of the mineral industry, also much detail about individual operations, including those undertaken in the search for, exploration of, and development of mineral deposits, as well as the actual winning of material from mineral deposits.

The Annual Report of the Minister of Mines and Petroleum Resources now contains introductory sections dealing with Statistics and Departmental Work, followed by sections dealing with Lode Metals; Placer; Structural Materials and Industrial Minerals; Petroleum and Natural Gas; Inspection of Lode Mines, Placer Mines, and Quarries; Coal; and Inspection of Electrical Equipment and Installations. A tabular index to lode-metal properties, in geographic groupings, precedes the general index.

An introductory review of the mineral industry and notes at the first of several of the main sections deal generally with the industry or its principal subdivisions. Notes in the various sections deal briefly with exploration or production operations during the year or describe a property in more complete detail, outlining the history of past work and the geological setting as well as describing the workings and the mineral deposits exposed in them. Some notes deal with areas rather than with a single property.

The work of the branches of the Department is outlined briefly in the section on Departmental Work. This section is followed by notes dealing briefly with the work of other British Columbia or Federal Government services of particular interest to the mineral industry of British Columbia. Information concerning mine safety and some of the activities of the Inspection Branch of the Department of Mines and Petroleum Resources is contained in the section on Inspection of Lode Mines, Placer Mines, and Quarries, and early in the section on Coal, and in the section dealing with Inspection of Electrical Equipment and Installations at Mines, Quarries, and Well Drilling Rigs.

The section on Statistics begins with an outline of current and past practice in arriving at quantities and calculating the value of the various products.

Review of the Mineral Industry *

The 1965 value of mineral production in British Columbia amounted to more than $280 million, bringing the accumulated value at the end of 1965 to well over $5.5 billion.

The 1965 total value is the greatest to date, as are the values for industrial minerals, structural materials, and fuels. The grand total gained $13,278,334 over 1964, the previous record year. The value of metals was $4 million less than in 1964. Industrial minerals gained $3.4 million, structural materials gained $5.9 million, and fuels gained $8 million. Compared with 1964 the grand total gained 5 per cent, industrial minerals gained 20.3 per cent, structural materials 22.3 per cent, and fuels 18.7 per cent, and metals lost 2.4 per cent. Metals valued at $176,869,306 made up 63.1 per cent, industrial minerals 7.3 per cent, structural materials 11.5 per cent, and fuels 18.1 per cent of the 1965 total value.

Molybdenum, valued at $12,405,344, achieved the status of a major metal. Iron concentrates exported and iron calcine used in making pig iron increased in value by $836,667. Decreases are indicated for other metals except tin and indium. Interruption of production by disputes between labour and management at two mines, with losses of production because of the exigencies of mining, caused a decrease of nearly 30 per cent in the quantity of copper produced. However, the increased price for copper kept the reduction to about 15 per cent of the 1964 value. Less lead and zinc were produced than in 1964. The greater price for lead more than offset the reduction in quantity, so that the value for that metal was more than in 1964. However, greater loss in zinc quantity and lesser increase in price resulted in a reduction of almost $10 million in the value of zinc. The 1965 annual report of the Consolidated Mining and Smelting company makes it clear that the output of refined lead and zinc at the company's Trail smelter was at a new record level, and that ore from Pine Point in the Northwest Territories supplied some 115,800 tons of lead plus zinc out of the record 399,566 tons produced by the company in 1965, whereas the Sullivan mine, which had supplied 238,260 tons out of 350,383 tons in 1964, supplied only 191,800 tons in 1965.

Most items in the industrial-minerals and structural-materials groups gained over 1964. Asbestos, sand and gravel, and cement gained from $2.7 million to $1.1 million each.

The fuels-group gain of $8 million over the 1964 value brings the group total close to $51 million. Natural gas gained about 19 per cent and oil 22 per cent. Smaller gains were made by coal and by the liquid by-products of natural gas. The fuel products of the petroleum and natural-gas wells are valued at $44,101,662, or 15.6 per cent of the 1965 grand total value.

The contributions of the oil and gas industry include a further $1,724,504 for by-product sulphur recovered from sour natural gas; similarly, the contribution of lode-mining includes $2,704,113 for sulphur from roasting sulphide ores and the sulphur content of pyrite sold.

The premium on United States funds in Canada was slightly less in 1965 than in 1964. Consequently the Canadian prices for gold and silver in 1965 were slightly less than in 1964, the United States prices having remained constant.

The prices for copper, lead, and zinc were significantly higher in 1965 than in 1964, reflecting higher average prices for those metals in the United States and other markets. The prices for lead and zinc varied little during the year, but the price for copper increased from an average of 35.840 cents a pound in January to 41.471 cents a pound in December. The average for 1965 was 38.377 cents, compared with 33.412 cents for 1964.

* By Hartley Sargent, Chief of the Mineralogical Branch.

Compared with 1964, custom shipments from British Columbia mines to the Trail smelter included increased quantities of siliceous ore and of lead concentrates and a decreased quantity of zinc concentrates.

Exports of lead concentrates to the United States decreased by 30 per cent and exports of zinc concentrates increased by 5 per cent.

Exports of copper concentrates to the United States decreased by two-thirds and exports to Japan decreased by a fifth. Copper matte exported from the Trail smelter to Tacoma increased moderately. Exports of nickel-copper concentrates to Japan decreased slightly, and exports of iron concentrates to Japan increased slightly. The decreases in copper-concentrate exports reflect the temporary reductions in copper-mining referred to earlier.

Part of the increase in iron production was of pelletized calcine smelted to pig iron at Kimberley. The 1965 increase there reflects the first full year of production of the increased integrated facilities using iron sulphide to provide sulphur for sulphuric acid and sintered pelletized iron calcine to feed the iron smelter, the end products being ammonium-phosphate fertilizer and pig iron. These facilities increased the recovery of sulphur from 44,940 tons in 1963 to 87,473 tons in 1965, and of pig iron from 37,678 tons in 1963 to 102,377 tons in 1965.

In 1965, preparations were being made to carry the integrated processing further by building near the iron smelter at Kimberley a plant to use an oxygen converter to refine molten pig iron to steel. Production of steel ingot is to begin in 1966, and will be the first commercial production of steel in British Columbia from British Columbia ore.

Molybdenum was produced for the first time in large quantity in 1965. In addition to the continued smaller by-product production by Bethlehem Copper Corporation, two new mines, the Boss Mountain Division of Brynnor Mines Limited and Endako Mines Ltd., are substantial operations that began producing in 1965 and raised British Columbia to the position of an important supplier of molybdenum. It is recovered as a high-grade concentrate of the mineral molybdenite. Endako roasted part of its concentrate, converting it to molybdenum trioxide. British Columbia molybdenum was shipped to destinations in Canada, the United States, Japan, the United Kingdom, and four other countries in Europe.

Red Mountain Mines Limited was preparing its property at Rossland for molybdenum production in 1966, and British Columbia Molybdenum Ltd. worked toward bringing its molybdenum property at Alice Arm into production in 1967.

Minoca Mines Ltd. had the Yreka property on Quatsino Sound ready for copper production by the end of 1965. Preparation for a further increase in throughput of the Bethlehem mine was well advanced, with the expectation of reaching 10,000 tons of ore per day by mid-1966. Preparation for underground mining at Craigmont was interrupted by a strike.

At the mine of Wesfrob Mines Limited, at Tasu Sound on Moresby Island, a great deal was done to prepare for production of iron concentrates and copper concentrates, now scheduled to begin early in 1967.

The long campaign to prepare the Granduc mine, northwest of Stewart, for production suffered a serious setback when an avalanche demolished much of the camp and killed 26 men near the Leduc glacier in February. Thereafter, most of the effort was expended at the Tide Lake end of the operation, from which the 11.6-mile adit is being driven. Providing road access to Tide Lake and providing the necessary facilities there were large undertakings in themselves. The tunnel was driven just over a mile from the portal near Tide Lake.

Granisle Copper Limited made substantial progress toward bringing its copper mine on McDonald Island in Babine Lake into production, that is to begin in the latter part of 1966.

Preparation to bring the Lynx-Paramount property on Vancouver Island into production was continued by Western Mines Limited.

Search for and exploration of mineral deposits continue at a very high level. There has probably never been as much exploratory drilling in British Columbia as was done in 1965. Exploration was widespread; many properties were being explored in the large area between Alice Arm and Stewart at the south and Cassiar and Atlin at the north. The very large area in central British Columbia being explored for copper, molybdenum, and locally for silver-lead-zinc and mercury was extended eastward to Quesnel Lake to include an interesting copper discovery at Bootjack Lake. There was much exploration in the Merritt-Highland Valley-Lytton-Kamloops area, and great interest developed in the Brenda Lake area northwest of Summerland. Although most exploration was directed toward copper and molybdenum, work on silver-lead-zinc prospects was done in many parts of the Province.

The statistics *re* mineral claims serve as measures of the extent of lode-metal exploration activity. In 1965, 41,882 mineral claims were recorded and 43,013 certificates of work were issued, compared with 29,244 claims recorded and 32,047 certificates of work in 1964. Reports on geophysical, geological, and geochemical work were accepted for assessment credit to the number 118, compared with 49 such reports in 1964.

The petroleum and natural-gas industry in 1965 established new records in production, and did a very large amount of drilling. A new phase in exploration is indicated by the fact that Shell Oil company decided to prepare for offshore exploratory drilling along the west coast of Vancouver Island and in the Queen Charlotte Sound-Hecate Strait area, and contracted for the construction of a $9,000,000 drilling platform, now being built by a shipyard in Victoria.

Total drilling in 1965 was 1,103,151 feet, compared with 674,842 feet in 1964. In 1965, 658,000 feet of drilling was classified as development, 305,000 feet as exploratory outpost, and 140,671 feet as exploratory wildcat drilling. The drilling resulted in 116 new oil wells and 40 new gas wells, bringing the number of producible oil wells to 497 and producible gas wells to 530.

Ten of the permanent-staff geologists of the Mineralogical Branch, Department of Mines and Petroleum Resources, and two geologists engaged for the field season undertook geological mapping and examinations of properties as outlined on page A 66.

The Geological Survey of Canada reported 35 projects on which members of its geological staff worked, for times ranging from a week to the full field season, in British Columbia. Six of these projects were listed as geological mapping at 4 miles to 1 inch and six at 1 mile to 1 inch. Most of the projects are listed on pages A 79 and A 80.

An air-borne magnetometer survey, of which the cost was borne by the Department of Mines and Petroleum Resources and the Geological Survey of Canada jointly, was done under contract in an area between Revelstoke and Kamloops. The resulting eight adjoining aeromagnetic maps at the scale 1:25,000 have been published.

Revenue to the Government from sales of free miners' certificates and from recording fees, lease rentals, cash paid in lieu of assessment work, etc., amounted to $836,210.14, compared to $583,455.70 in 1964.

Royalty payable on iron concentrates amounted to $235,541, and payments on industrial minerals and structural materials amounted to $47,687. Fees and rentals from coal licences and leases amounted to $14,822.95.

Revenue to the Government from petroleum and natural gas was: Rentals, fees, and miscellaneous, $8,321,961; sale of Crown reserves, $18,161,433; royalties—gas, $1,682,444; oil, $3,697,688; processed products, $93,266; a grant total of $31,956,732, compared with $26,755,820 in 1964.

Not including considerable numbers employed by contractors mainly doing work on lode-metal exploration, the total number employed by the mining industry in 1965* was 11,842, compared with 11,645 in 1964.

The principal expenditures reported for the mining industry in 1965 were: Federal taxes, $17,579,438(2); Provincial taxes including royalties, $8,159,-072(2, 4); municipal taxes, $1,834,024(2, 3); levies for workmen's compensation (including silicosis), $1,612,629(2, 3); unemployment insurance, $693,638(2, 3); salaries and wages, $71,502,967; fuel and electricity, $11,504,343; and process supplies, $30,590,631(1). Dividends were reported as $44,338,124 and capital expenditures $8,668,998(2).

Combined with $3,435,769 for the petroleum and natural-gas industry, the reported expenditures of the whole mineral industry of British Columbia, for salaries and wages, amounted to $74,938,736.

Expenditure on exploration and development by the lode-mining segment of the mineral industry was surveyed by the British Columbia Bureau of Economics and Statistics using a form modified from one used in 1964. Returns were received from 169 companies, including most of the metal producers and the one asbestos producer. The returns show total expenditures of $59,185,097, of which $12,472,-651 was shown as exploration, $42,700,491 as development, and $4,011,955 not charged to properties. Of the $42,700,491 assigned to development, $36,750,000 was at 10 mines being prepared for production, $1,420,000 was at mines being prepared for increased production or conversion from surface to underground mining, and more than $2,000,000 was at other properties. Exploration expenditure was reported by 129 companies; the maximum amount was $1,236,000. The total expenditure of more than $59 million on exploration and development does not completely cover such expenditures as some were not reported by companies known to have done important work in both fields.

Statistics of net cash expenditures by the petroleum and natural-gas industry, collected by the Dominion Bureau of Statistics, have become available for the first time. The 1965 expenditures† reported were: Exploration—geological and geophysical, $5,700,000; land acquisition and rentals, $23,600,000; exploratory drilling $10,400,000. Development drilling $11,600,000. Capital expenditures—field equipment, $9,300,000; secondary recovery and pressure maintenance, $1,300,000; other, $1,600,000. Operation, including wells, flow-lines, etc., $4,700,000. Natural-gas plants, capital, $1,100,000; operating, $600,000. General—taxes excluding income tax, $300,000; royalties, $8,100,000; all other expenditures, $2,000,000. The grand total, $80,300,000, expended in British Columbia made up 8 per cent of the expenditure by the oil and gas industry in Canada. No exact comparison can be made with Departmental figures given in an earlier paragraph. The Dominion Bureau of Statistics' figure of $23,600,000 for land acquisition and rentals appears to be an underestimate. The discrepancy between royalties reported in the Dominion Bureau of Statistics' preliminary estimate ($8,100,000) and the $5,473,338 actually received by the Department of Mines and Petroleum Resources presumably comes in part from the Dominion Bureau of Statistics' figure combining royalties to the Crown with royalties to companies.

* *See* Table XII.

† Preliminary estimates of expenditures of the oil and gas exploration, development, and production industry, 1965, Dominion Bureau of Statistics, April 22, 1966.

(1) Reported incompletely for coal.

(2) Not reported for coal.

(3) Reported incompletely for structural materials.

(4) Including the full amount of royalty payable to the Provincial Government on iron, the total payment to the Provincial Government should be not less than $8,311,000.

Statistics

The statistics of the mineral industry are collected and compiled and tabulated for this Report by the Bureau of Economics and Statistics, Department of Industrial Development, Trade, and Commerce.

CO-OPERATION WITH DOMINION BUREAU OF STATISTICS

In the interests of uniformity and to avoid duplication of effort, beginning with the statistics for 1925, the Dominion Bureau of Statistics and the various Provincial departments have co-operated in the collection and processing of mineral statistics.

Producers of metals, industrial minerals, structural materials, coal, and petroleum and natural gas are requested to submit returns in duplicate on forms prepared for use by the Province and by the Dominion Bureau of Statistics.

So far as possible both organizations follow the same practice in processing the data. The final compilation by the Dominion Bureau is usually published considerably later than the Report of the Minister of Mines and Petroleum Resources for British Columbia. Differences between the figures published by the two organizations arise mainly from the facts that the Dominion Bureau bases its quantities of lode metals on returns made by smelter operators, whereas the British Columbia mining statistician uses the returns covering shipments from individual mines in the same period, and the Dominion Bureau uses average prices for metals considered applicable to the total Canadian production, whereas the British Columbia mining statistician uses prices considered applicable to British Columbia production. Peat, included under the classification of fuel by the Dominion Bureau, has not been regarded as mineral or fuel, and accordingly has not been included in the British Columbia statistics of mineral production.

METHODS OF COMPUTING PRODUCTION

The tabulated statistics are designed to cover mineral production in quantity and value, employment, principal expenditures of the mineral industry, and dividends paid. The data are arranged so as to facilitate comparison of the production records for the various mining divisions, and from year to year (1951, 1958, 1963).*

Beginning with the 1960 Report, Tables I and II were given new forms, Table VIII was amalgamated with Table VII, and subsequent tables were renumbered. Beginning with the 1963 Report, the parts of Tables I and III dealing with metals were combined, so that all metals are now listed alphabetically in a single section. Beginning with the 1964 Report, Table II gives the value for each group of products for each year after 1886.

Beginning with the 1964 Report, most of the explanatory notes that had appeared as footnotes to the production tables have been concentrated, arranged alphabetically in a section headed " Notes on Products," immediately following this introductory section.

From time to time, revisions have been made to earlier figures as additional data became available or errors came to light.

Data from the certified returns made by producers of lode metals, industrial minerals and structural materials, and coal are augmented by data obtained from

* In these notes, references such as (1958) are to this section in the Report for the year indicated, where additional information will be found.

the operators of customs smelters. For placer gold, returns from operators are augmented by data obtained from the Royal Canadian Mint and from Gold Commissioners and other sources. For petroleum, natural gas, and liquid by-products, production figures are supplied by the Petroleum and Natural Gas Branch of the Department of Mines and Petroleum Resources and are compiled from the monthly disposition report, and Crown royalty statement filed with the Department by the producers.

Values are in Canadian funds. Weights are avoirdupois pounds and tons (2,000 lb.) and troy ounces.

Lode Metals

Prior to 1925 the average prices for gold and copper are true average prices, but, as a means of correcting for losses in smelting and refining, the prices of other metals were taken at the following percentages of the year's average price for the metal: Silver, 95 per cent; lead, 90 per cent; and zinc, 85 per cent. For 1925 and subsequent years the value has been calculated using the true average price and the net metal contents, in accordance with the procedures adopted by the Dominion Bureau of Statistics and the Department of Mines and Petroleum Resources.

Gross and Net Contents and Calculated Value

The gross contents for any metal are the total assay contents, obtained by multiplying the assay by the weight of ore, concentrates, or bullion.

The value is calculated by multiplying the quantity, gross for gold, net for silver, copper, lead, and zinc, by the average price for the year and by using appropriate prices for other products. Beginning with 1963, net contents are obtained from the gross as tabulated:—

	Lead Concentrates	Zinc Concentrates	Copper Concentrates	Copper-Nickel Concentrates	Copper Matte
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Silver	98	98	95		95
Copper	(1)		(2)	85	(3)
Lead	98	50		....	50
Zinc	90	90	50	....	....
Cadmium	....	70	70		....
Nickel	....	....	....	88	....

1 Less 26 pounds per ton of concentrates.
2 Less 10 pounds per ton of concentrates except for 1963, when the deduction was 20 pounds per ton.
3 Less 10 pounds per ton of matte.

Formerly the net silver content in copper concentrates was taken as 95 per cent of the gross; the net lead content of lead ores and concentrates was taken as 95 per cent; and the net zinc content in lead ores, lead concentrates, and zinc concentrates was taken as 85 per cent, except that for zinc concentrates exported to foreign smelters the net zinc content was calculated by deducting from the gross 8 units; that is, 160 pounds per ton of concentrates. The net copper content of copper concentrates for 1963 was obtained by deducting from the gross content 20 pounds of copper per ton of concentrates; formerly the deduction was 10 pounds, and for 1964 and subsequent years the deduction is also 10 pounds.

Other metals, including by-product metals refined in British Columbia and iron, tin, and tungsten exported as ores and concentrates, are treated similarly, except that quantities and values for several are as reported by shippers for sales in the year. The value of by-product iron ore used in making pig iron at Kimberley has been computed from the value per ton of ore of comparable grade, at the point of export from British Columbia; 1960 and 1961 valuations have been recalculated on this basis.

Average Prices

The methods of computing prices have varied because of changing conditions (1958). The prices are now arrived at by methods given in footnotes to the table of average prices on page A 20.

Placer Gold and Silver

Beginning with 1962, Mint reports giving the fine-gold content have been available for all but a negligible part of the reported placer-gold production, and the value of the fine-gold content has been used. Previously the value had been calculated, taking the average fineness as 822½.

A record of the silver content of placer gold, received at the Royal Canadian Mint since 1947, has been incorporated in the appropriate tables.

Industrial Minerals and Structural Materials

Prices for these materials approximate the prices at the point of origin.

Fuel

Coal

The price per ton used in valuing coal (*see* p. A 20) is the weighted average of the f.o.b. prices at the mines for coal sold and used.

Petroleum and Natural Gas

The values for natural gas, natural-gas liquid by-products, and for petroleum, including condensate/pentanes plus, are the aggregates of amounts received for the products at the well-head.

NOTES ON PRODUCTS

Antimony.—Production began in 1939. Antimony assigned to individual mining divisions is the reported content of concentrates exported to foreign smelters. Antimony " not assigned " is the antimony content of antimonial lead or of other antimony products at the Trail smelter. *See* Tables I, III, and VIIc.

Arsenious Oxide.—Production began in 1917. Principal productive periods: Omineca, 1928, 16,997 pounds, $340; Osoyoos, 1917–30 and 1942, 22,002,423 pounds, $272,861. *See* Table VIID.

Asbestos.—Production began in 1952. From 1953 to 1961 asbestos was valued at the shipping point in North Vancouver. Beginning with 1962 the value has been taken as the value at that pricing point less shipping cost from the mine to North Vancouver. The values for the preceding years have been recalculated on the same basis. *See* Tables I, III, and VIID.

Barite.—Production began in 1940. *See* Tables I, III, VIID.

Bentonite.—Principal productive period, 1926–44, 791 tons. *See* Table VIID.

Bismuth.—Production began in 1929. Recovered as by-product at Trail smelter. *See* Tables I, III, and VIIc.

Cadmium.—Production began in 1928. Cadmium assigned to individual mining divisions is the reported content of custom shipments to the Trail smelter and to foreign smelters. Cadmium " not assigned " is the remainder of the reported estimated recovery at the Trail smelter from British Columbia concentrates. *See* Tables I, III, and VIIc.

Chromite.—Produced in 1918 and 1929. *See* Table VIIc.

Coal.—All coal produced, including that used in making coke, is shown as primary mine production. Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. For 1910 and subsequent years the quantity is that sold and used. First production: Cariboo, 1942; Fort Steele, 1898; Kamloops, 1893; Liard, 1923; Nanaimo, 1836; Nicola, 1907; Omineca, 1918; Osoyoos, 1926; Similkameen, 1909; Skeena, 1912. For washery loss, change in stock, and differences between gross mine output and coal sold, refer to the table " Production and Distribution by Collieries and by Districts " in section headed " Coal " or " Coal-mining " in this and preceding Annual Reports. The totals " sold and used " include: Sales to retail and wholesale dealers, industrial users, and company employees; coal used in company boilers, including steam locomotives; coal used in making coke. *See* Tables I, III, VIIA, VIIIA, and VIIIB.

Cobalt.—Production of 1,730 pounds, 1928. *See* Table VIIc.

Diatomite.—First production, 1928. *See* Table VIID.

Fluorspar.—Principal productive periods: Greenwood, 1918–29 and 1942, 35,309 tons, $783,578; Osoyoos, 1958, 32 tons, $1,386. *See* Table VIID.

Fluxes.—First reported, 1911, mainly quartz and limestone. *See* Tables I, III, and VIID.

Fuel.—*See* Coal, Petroleum, and Natural Gas.

Gold, Lode.—Gold is mainly the product of lode-gold mines, but a substantial part is a by-product from copper and silver-lead-zinc mines. *See* Tables I, III, VI, and VIIB.

Gold, Placer.—A substantial part of the production, including much of the gold recovered from the Fraser River from Yale upstream (New Westminster Mining Division) and much of the early Cariboo production, is based on early estimates and cannot be accurately assigned to individual mining divisions. In 1965 changes were made in the allocation of placer gold to the New Westminster and Similkameen Mining Divisions, and not assigned, to reconcile those figures with data incorporated in Bulletin No. 28. First year of production for major placer-producing divisions: Atlin, 1898; Cariboo, 1858; Liard, 1873; Lillooet, 1874; Omineca, 1869. *See* Tables I, III, VI, and VIIA.

Granules.—First production, 1930. *See* Tables I, III, and VIID.

Gypsum and Gypsite.—First production, 1911. *See* Tables I, III, and VIID.

Hydromagnesite.—First production, 1904. Principal productive periods: Atlin, 1915–16, 1,450 tons, $20,325; Clinton, 1921, 803 tons, $7,211. *See* Table VIID.

Indium.—Production began in 1942. Not reported as individual metal since 1958, but value taken into total value of all metals.

Iron Concentrates.—Principal productive period began in 1951. Includes calcine used in making pig iron at Kimberley beginning in 1961. The entire production credited to the Fort Steele Mining Division is of calcine. *See* Tables I, III, and VIIc.

Iron Oxide and Ochre.—Principal productive periods: Golden, 1927–39, 27 tons, $920; Nelson, 1948–50, 7,292 tons, $55,901; Vancouver, 1918–50, 10,669 tons, $97,389; Victoria, 1923, 120 tons, $840. *See* Table VIID.

Lead.—Revisions were made in 1958 to some yearly totals for lead and zinc to bring them into agreement with the best records of recoveries of lead and zinc from slags treated at the Trail smelter. *See* Tables I, III, VI, and VIIB.

Magnesium.—Produced 204,632 pounds, 1941 and 1942. *See* Table VIIc.

Magnesium Sulphate.—Principal productive periods: Clinton, 1918 to 1920, 1,923 tons, $39,085; Kamloops, 1918–42, 8,742 tons, $193,967; Osoyoos, 1915–19, 3,229 tons, $21,300. *See* Table VIID.

Manganese.—Principal productive period, 1918–20. *See* Table VIIC. Total includes estimated manganese content of about 40 tons of ore shipped for testing in 1956 by Olalla Mines Ltd.

Mercury.—Principal productive period, 1940–44. *See* Tables I, III, and VIIC.

Mica.—First production, 1932. *See* Tables I, III, and VIID.

Molybdenum.—Principal productive periods, 1914–18 and beginning 1964. *See* Tables I, III, and VIIC.

Natro-alunite.—Principal productive period, 1912–27, 522 tons. *See* Table VIID.

Natural Gas.—Commercial production of natural gas began in 1954. The production shown in Tables I, III, and VIIA is the total dry and residue gas sold; that is, the quantity delivered to the main transmission-line. The quantity is net after deducting gas used on leases, metering difference, and gas used or lost in the cleaning plant. The quantity is reported as thousands of cubic feet at standard conditions (14.4 pounds per square inch pressure, 60° F. temperature, up to and including the year 1960, and thereafter 14.65 pounds per square inch pressure, 60° F. temperature). Gross well output, other production, delivery, and sales data are tabulated in the Petroleum and Natural Gas section of this report.

Natural-gas Liquid By-products.—The liquid by-products are the butane and propane recovered in processing natural gas at Taylor, beginning with 1958. For natural gasoline, condensate/pentane plus, *see* under "Petroleum." *See* Tables I, III, and VIIA, and Petroleum and Natural Gas section of this report.

Nickel.—Production began in 1958. *See* Tables I, III, and VIIC.

Palladium.—Production recorded, 1928. *See* Table VIIC.

Perlite.—In 1953, 1,112 tons valued at $11,120 was produced. *See* Table VIID.

Petroleum, Crude.—Production of petroleum began in 1955, and is shown in Tables I, III, and VIIA. The quantity is "net sales," reported in barrels (35 imperial gallons = 1 barrel). Natural gasoline, condensate/pentanes plus, recovered at the gas-processing plant at Taylor is credited as petroleum production (1962). Production to the end of 1965 includes 50,254,173 barrels of crude petroleum and 6,112,013 barrels of condensate/pentanes plus, valued at $101,067,392 and $4,655,112. *See* Tables I, III, and VIIA. Gross well output, other production, delivery, and sales data are tabulated in the Petroleum and Natural Gas section of this report.

Phosphate Rock.—Produced 1927–33, 3,842 tons. *See* Table VIID.

Platinum.—Produced intermittently 1887–1963. *See* Tables I, III, and VIIC.

Rock.—Rubble, riprap, and crushed stone. *See* Tables I, III, and VIIE.

Selenium.—Produced 731 pounds in 1931. *See* Table VIIC.

Silver, Lode.—Produced yearly, beginning 1887, mainly from silver-lead-zinc ore and as a by-product from copper ore. *See* Tables I, III, VI, and VIIB.

Silver, Placer.—The accumulated value of placer silver is the value of the silver content of placer gold received at the Royal Canadian Mint in 1947 and subsequent years. *See* Tables I, III, VI, and VIIA. The silver shown in Table VI includes placer silver.

Sodium Carbonate.—Principal productive periods: Clinton, 1921–49, 9,524 tons, $109,895; Kamloops, 1931–35, 968 tons, $9,088. *See* Table VIID.

Structural Materials.—Unclassified materials valued at $5,972,171 in Table VIIE is the total for structural materials in the period 1886–1919 that cannot be allotted to particular classes of structural materials or assigned to mining divisions, and includes $726,323 shown against 1896 in Table II that includes unclassified structural materials in that and previous years not assignable to particular years. The figure $3,150,828 in Table VIIE under other clay products is the value in the period 1886–1910 that cannot be allotted to particular clay products or assigned to mining divisions.

Sulphur.—From 1916 to 1927 the figures include the sulphur content of pyrites shipped. From 1928 the tonnages include the estimated sulphur content of pyrites shipped plus the sulphur contained in sulphuric acid made from waste smelter gases. Iron sulphide roasting at the Kimberley acid plant commenced in 1953, and the sulphur content is included. Elemental sulphur has been recovered from the natural-gas plant at Taylor since 1958. *See* Tables I, III, and VIID.

Talc.—Principal productive periods: Golden, 1927, 5 tons, $356; Lillooet, 1916–36, 296 tons, $5,129; Victoria, 1919–35, 1,504 tons, $29,386. *See* Tables I, III, and VIID.

Tin.—First production 1941. *See* Tables I, III, and VIIC.

Tungsten.—Principal productive period, 1937–58. *See* Table VIIC.

Volcanic Ash.—Cariboo, 30 tons. *See* Table VIID.

Zinc.—For 1905–08, inclusive, records show shipments of a combined total of 18,847 tons of zinc ore and zinc concentrates of unstated zinc content. Revisions were made in 1958 to some yearly totals for lead and zinc to bring them into agreement with the best records of recoveries of lead and zinc from slags treated at the Trail smelter. *See* Tables I, III, VI, and VIIB.

Average Prices Used in Valuing Provincial Production of Gold, Silver, Copper, Lead, Zinc, and Coal

Year	Gold,* Crude, Oz.	Gold, Fine, Oz.	Silver, Fine, Oz.	Copper, Lb.	Lead, Lb.	Zinc, Lb.	Coal, Short Ton
	$	$	Cents	Cents	Cents	Cents	$
1901	17.00	20.67	56.002 N.Y.	16.11 N.Y.	2.577 N.Y.	....	2.679
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 ,,	....	3.125
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 ,,	24.63 ,,	6.67 ,,	6.94 ,,	4.464
1919	....	....	105.57 ,,	18.70 ,,	5.10 ,,	6.24 ,,	....
1920	....	....	95.80 ,,	17.45 ,,	7.16 ,,	6.52 ,,	....
1921	....	....	59.52 ,,	12.50 ,,	4.00 ,,	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 ,,	4.018
1932	19.30	23.47	31.671 ,,	6.380 Lond.	2.113 ,,	2.405 ,,	3.795
1933	23.02	28.60	37.832 ,,	7.454 ,,	2.391 ,,	3.210 ,,	....
1934	28.37	34.50	47.461 ,,	7.419 ,,	2.436 ,,	3.044 ,,	....
1935	28.94	35.19	64.790 ,,	7.795 ,,	3.133 ,,	3.099 ,,	....
1936	28.81	35.03	45.127 ,,	9.477 ,,	3.913 ,,	3.315 ,,	....
1937	28.77	34.99	44.881 ,,	13.078 ,,	5.110 ,,	4.902 ,,	....
1938	28.93	35.18	43.477 ,,	9.972 ,,	3.344 ,,	3.073 ,,	....
1939	29.72	36.14	40.488 ,,	10.092 ,,	3.169 ,,	3.069 ,,	....
1940	31.66	38.50	38.249 ,,	10.086 ,,	3.362 ,,	3.411 ,,	....
1941	31.66	38.50	38.261 ,,	10.086 ,,	3.362 ,,	3.411 ,,	....
1942	31.66	38.50	41.166 ,,	10.086 ,,	3.362 ,,	3.411 ,,	....
1943	31.66	38.50	45.254 ,,	11.75 ,,	3.754 ,,	4.000 ,,	....
1944	31.66	38.50	43.000 ,,	12.000 ,,	4.500 ,,	4.300 ,,	....
1945	31.66	38.50	47.000 ,,	12.550 ,,	5.000 ,,	6.440 ,,	....
1946	30.22	36.75	83.650 ,,	12.80 ,,	6.750 ,,	7.810 ,,	4.08
1947	28.78	35.00	72.000 ,,	20.39 ,,	13.670 ,,	11.230 ,,	5.12
1948	28.78	35.00	75.000 Mont.	22.35 U.S.	18.040 ,,	13.930 ,,	6.09
1949	29.60	36.00	74.250 U.S.	19.973 ,,	15.800 U.S.	13.247 U.S.	6.51
1950	31.29	38.05	80.635 ,,	23.428 ,,	14.454 ,,	15.075 ,,	6.43
1951	30.30	36.85	94.55 ,,	27.70 ,,	18.4 ,,	19.9 ,,	6.46
1952	28.18	34.27	83.157 ,,	31.079 ,,	16.121 ,,	15.874 ,,	6.94
1953	28.31	34.42	83.774 ,,	30.333 ,,	13.265 ,,	10.675 ,,	6.88
1954	27.52	34.07	82.982 ,,	29.112 ,,	13.680 ,,	10.417 ,,	7.00
1955	28.39	34.52	87.851 ,,	38.276 ,,	14.926 ,,	12.127 ,,	6.74
1956	28.32	34.44	89.378 ,,	39.787 ,,	15.756 ,,	13.278 ,,	6.59
1957	27.59	33.55	87.057 ,,	26.031 ,,	14.051 ,,	11.175 ,,	6.76
1958	27.94	33.98	86.448 ,,	23.419 ,,	11.755 ,,	10.009 ,,	7.45
1959	27.61	33.57	87.469 ,,	27.708 ,,	11.670 ,,	10.978 ,,	7.93
1960	27.92	33.95	88.633 ,,	28.985 ,,	11.589 ,,	12.557 ,,	6.64
1961	29.24	35.46	93.696 ,,	28.288 ,,	11.011 ,,	11.695 ,,	7.40
1962	29.25	37.41	116.029 ,,	30.473 ,,	10.301 ,,	12.422 ,,	7.43
1963	29.31	37.75	137.965 ,,	30.646 ,,	12.012 ,,	13.173 ,,	7.33
1964	29.96	37.75	139.458 ,,	33.412 ,,	14.662 ,,	14.633 ,,	6.94
1965	**28.93**	**37.73**	**139.374 ,,**	**38.377 ,,**	**17.247 ,,**	**15.636 ,,**	**7.03**

* *See* page A 17, under placer gold.

Prices for fine gold are the Canadian Mint buying prices. Prices for other metals are those of the markets indicated, converted into Canadian funds. The abbreviations are: Mont.=Montreal; N.Y.=New York; Lond.=London; E. St. L.=East St. Louis; and U.S.=United States.

Prior to 1925 the prices for gold and copper are true average prices, but the prices of other metals were taken at the following percentages of the year's average price for the metal: Silver, 95 per cent; lead, 90 per cent; and zinc, 85 per cent.

TABLE I.—MINERAL PRODUCTION: TOTAL TO DATE, LATEST DECADE, AND LATEST YEAR

Products*	Total Quantity to Date	Total Value to Date	Total Quantity, 1956–65	Total Value, 1956–65	Quantity, 1965	Value, 1965	
Metals		$		$		$	
Antimony .... lb.	47,186,459	13,237,033	15,417,636	5,942,030	1,301,787	689,947	
Bismuth .... lb.	6,154,107	10,993,293	1,878,394	4,155,132	144,630	446,907	
Cadmium .... lb.	33,835,696	55,341,929	16,090,088	30,654,880	466,586	1,297,110	
Chromite .... tons	796	32,295					
Cobalt .... lb.	1,730	420					
Copper .... lb.	3,440,357,540	643,999,578	596,475,073	192,186,169	85,197,073	32,696,081	3
Gold—placer, crude .... oz.	5,231,422	96,841,657	37,927	1,076,938	866	25,053	
" —lode .... oz.	16,438,630	481,759,931	1,717,487	60,601,684	117,124	4,419,089	
Iron concentrates .... tons	15,951,009	138,318,541	12,723,292	118,083,137	2,165,403	21,266,154	5
Lead .... lb.	14,752,155,137	1,180,499,646	3,034,389,141	388,339,199	250,183,633	43,149,171	2
Magnesium .... lb.	204,632	88,184					
Manganese .... tons	1,724	32,668					
Mercury .... lb.	4,170,730	10,444,758	7,068	35,149	1,520	12,301	
Molybdenum .... lb.	7,348,673	12,498,605	7,322,784	12,461,907	7,289,125	12,405,344	9
Nickel .... lb.	24,608,459	19,322,873	24,327,006	19,235,149	3,322,000	2,790,480	
Palladium .... oz.	749	30,462					
Platinum .... oz.	1,407	135,008	11	785			
Selenium .... lb.	731	1,389					
Silver—placer .... oz.	20,807	18,103	4,624	4,709	112	157	
" —lode .... oz.	454,108,826	295,480,543	67,443,807	69,923,605	4,971,972	6,929,636	
Tin .... lb.	16,126,093	13,057,495	7,057,603	6,059,370	377,207	735,554	
Tungsten (WO_3) .... lb.	16,019,324	38,663,751	4,877,234	13,476,064			
Zinc .... lb.	12,981,449,476	1,168,669,412	4,047,165,733	504,314,169	311,249,250	48,666,933	1
Others .... lb.		6,983,754		6,718,673		1,339,389	
Totals		4,186,451,328		1,433,268,749		176,869,306	
Industrial Minerals							
Arsenious oxide .... lb.	22,019,420	273,201					
Asbestos .... tons	502,459	99,701,032	473,551	93,335,134	85,851	14,491,195	7
Barite .... tons	230,388	2,765,909	152,617	2,109,949	17,466	182,931	
Bentonite .... tons	791	16,858					
Diatomite .... tons	3,727	140,315	2,344	109,320	82	4,420	
Fluorspar .... tons	35,341	784,964	32	1,386			
Fluxes .... tons	3,916,139	6,896,249	867,107	2,807,712	59,231	240,076	
Granules .... tons	247,047	3,660,683	194,784	2,949,779	29,033	447,954	
Gypsum and gypsite .... tons	2,851,687	10,966,925	1,288,403	3,936,517	207,858	602,788	
Hydro-magnesite .... tons	2,253	27,536					
Iron oxide and ochre .... tons	18,108	155,050					
Jade .... lb.	226,652	95,543	226,252	95,543	7,129	9,249	
Magnesium sulphate .... tons	13,894	254,352					
Mica .... lb.	12,822,050	185,818	750,000	17,295			
Natro-alunite .... tons	522	9,398					
Perlite .... tons	1,112	11,120					
Phosphate rock .... tons	3,842	16,894					
Sodium carbonate .... tons	10,492	118,983					
Sulphur .... tons	5,632,429	62,611,773	2,525,347	32,275,482	341,873	4,428,617	
Talc .... tons	1,805	34,871					
Volcanic ash .... tons	30	300					
Totals		188,727,774		137,638,117		20,407,230	
Structural Materials							
Cement .... tons	9,482,717	143,583,759	4,496,153	77,677,275	601,878	11,199,607	10
Clay products		55,992,765		24,444,734		3,899,634	
Lime and limestone .... tons		38,409,776	6,942,105	16,435,836	1,420,085	2,482,451	
Rock .... tons		34,054,223	18,093,231	17,568,556	2,715,411	1,938,088	
Sand and gravel .... tons		142,307,391	153,684,882	90,938,775	20,936,994	12,686,959	8
Stone .... tons	1,077,751	8,865,168	76,196	872,197	2,252	118,975	
Not assigned		5,972,171					
Totals		429,185,253		227,937,373		32,325,714	
Fuels							
Coal .... tons	138,873,881	589,076,172	9,235,059	65,554,389	950,763	6,713,590	
Natural gas to pipe-line M s.c.f.	778,190,753	71,321,090	777,961,219	71,296,415	138,814,144	14,493,255	6
Liquid by-products .... bbl.	3,885,139	991,321	3,885,139	991,321	836,766	267,765	
Petroleum crude .... bbl.	56,366,186	105,722,504	56,365,604	105,722,024	14,449,968	29,340,642	4
Totals		767,111,087		243,564,149		50,815,252	
Grand totals		5,571,475,442		2,042,408,388		280,417,502	

* *See* notes on individual minerals listed alphabetically on pages A 16 to A 19.

TABLE II.—TOTAL VALUE OF PRODUCTION, 1836–1965

Year	Metals	Industrial Minerals	Structural Materials	Fuels	Total	Totals, 1836–1900, and by Decades*
	$	$	$	$	$	$
1836–86	52,808,750	—	43,650	10,758,565	63,610,965	—
1887	729,381	—	22,168	1,240,080	1,991,629	—
1888	745,794	—	46,432	1,467,903	2,260,129	—
1889	685,512	—	77,517	1,739,490	2,502,519	—
1890	572,884	—	75,201	2,034,420	2,682,505	—
1891	447,136	—	79,475	3,087,291	3,613,902	—
1892	511,075	—	129,234	2,479,005	3,119,314	—
1893	659,969	—	—	2,934,882	3,594,851	—
1894	1,191,728	—	—	3,038,859	4,230,587	—
1895	2,834,629	—	—	2,824,687	5,659,316	—
1896	4,973,769	—	726,323*	2,693,961	8,394,053	—
1897	7,575,262	—	150,000	2,734,522	10,459,784	—
1898	7,176,870	—	150,000	3,582,595	10,909,465	—
1899	8,107,509	—	200,000	4,126,803	12,434,312	—
1900	11,360,546	—	250,000	4,744,530	16,355,076	151,818,407
1901	14,258,455	—	400,000	5,016,398	19,674,853	—
1902	12,163,561	—	450,000	4,832,257	17,445,818	—
1903	12,640,083	—	525,000	4,332,297	17,497,380	—
1904	13,424,755	2,400	575,000	4,953,024	18,955,179	—
1905	16,289,165	—	660,800	5,511,861	22,461,826	—
1906	18,449,602	—	982,900	5,548,044	24,980,546	—
1907	17,101,305	—	1,149,400	7,637,713	25,888,418	—
1908	15,227,991	—	1,200,000	7,356,866	23,784,857	—
1909	14,668,141	—	1,270,559	8,574,884	24,513,584	—
1910	13,768,731	—	1,500,000	11,108,335	26,377,066	221,579,527
1911	11,880,062	46,345	3,500,917	8,071,747	23,499,071	—
1912	18,218,266	17,500	3,436,222	10,786,812	32,458,800	—
1913	17,701,432	46,446	3,249,605	9,197,460	30,194,943	—
1914	15,790,727	51,810	2,794,107	7,745,847	26,382,491	—
1915	20,765,212	133,114	1,509,235	7,114,178	29,521,739	—
1916	32,092,648	150,718	1,247,912	8,900,675	42,391,953	—
1917	27,299,934	174,107	1,097,900	8,484,343	37,056,284	—
1918	27,957,302	281,131	783,280	12,833,994	41,855,707	—
1919	20,058,217	289,426	980,790	11,975,671	33,304,104	—
1920	19,687,532	508,601	1,962,824	13,450,169	35,609,126	332,274,218
1921	13,160,417	330,503	1,808,392	12,836,013	28,135,325	—
1922	19,605,401	251,922	2,469,967	12,880,060	35,207,350	—
1923	25,769,215	140,409	2,742,388	12,678,548	41,330,560	—
1924	35,959,566	116,932	2,764,013	9,911,935	48,752,446	—
1925	46,480,742	101,319	2,766,838	12,168,905	61,517,804	—
1926	51,867,792	223,748	3,335,885	11,650,180	67,077,605	—
1927	45,134,289	437,729	2,879,160	12,269,135	60,720,313	—
1928	48,640,158	544,192	3,409,142	12,633,510	65,227,002	—
1929	52,805,345	807,502	3,820,732	11,256,260	68,689,839	—
1930	41,785,380	457,225	4,085,105	9,435,650	55,763,360	532,421,604
1931	23,530,469	480,319	3,538,519	7,684,155	35,233,462	—
1932	20,129,869	447,495	1,705,708	6,523,644	28,806,716	—
1933	25,777,723	460,683	1,025,586	5,375,171	32,639,163	—
1934	35,177,224	486,554	1,018,719	5,725,133	42,407,630	—
1935	42,006,618	543,583	1,238,718	5,048,864	48,837,783	—
1936	45,889,944	724,362	1,796,677	5,722,502	54,133,485	—
1937	65,224,245	976,17	2,098,339	6,139,920	74,438,675	—
1938	55,959,713	916,841	1,974,976	5,565,069	64,416,599	—
1939	56,216,049	1,381,720	1,832,464	6,280,956	65,711,189	—
1940	64,332,166	1,073,023	2,534,840	7,088,265	75,028,294	521,652,996
1941	65,807,630	1,253,561	2,845,262	7,660,000	77,566,453	—
1942	63,626,140	1,434,382	3,173,635	8,237,172	76,471,329	—
1943	55,005,394	1,378,337	3,025,255	7,742,030	67,151,016	—
1944	42,095,013	1,419,248	3,010,088	8,217,966	54,742,315	—
1945	50,673,592	1,497,720	3,401,229	6,454,360	62,026,901	—
1946	58,834,747	1,783,0'0	5,199,563	6,732,470	72,549,790	—
1947	95,729,867	2,275,972	5,896,803	8,680,440	112,583,082	—
1948	124,091,753	2,358,877	8,968,222	9,765,395	145,184,247	—
1949	110,219,917	2,500,799	9,955,790	10,549,924	133,226,430	—
1950	117,166,836	2.462,340	10,246,939	10,119,303	139,995,418	941,496,981

* *See* note on structural materials, page A 19.

TABLE II.—TOTAL VALUE OF PRODUCTION, 1836–1965—*Continued*

Year	Metals	Industrial Minerals	Structural Materials	Fuels	Total	Totals, 1836–1900, and by Decades*
	$	$	$	$	$	$
1951	153,598,411	2,493,840	10,606,048	10,169,617	176,867,916	
1952	147,857,523	2,181,464	11,596,961	9,729,739	171,365,687	
1953	126,755,705	3,002,673	13,555,038	9,528,279	152,841,695	
1954	123,834,286	5,504,114	14,395,174	9,161,089	152,894,663	
1955	142,609,505	6,939,490	15,299,254	9,005,111	173,853,360	
1956	149,441,246	9,172,792	20,573,631	9,665,983	188,853,652	
1957	125,353,920	11,474,050	25,626,939	8,537,920	170,992,829	
1958	104,251,112	9,958,768	19,999,576	10,744,093	144,953,549	
1959	105,076,530	12,110,286	19,025,209	11,431,938	147,643,963	
1960	130,304,373	13,762,102	18,829,989	14,468,869	177,365,333	1,657,632,647
1961	128,565,774	12,948,308	19,878,921	18,414,318	179,807,321	
1962	159,627,293	14,304,214	21,366,265	34,073,712	229,371,484	
1963	172,852,866	16,510,898	23,882,190	42,617,633	255,863,587	
1964	180,926,329	16,989,469	26,428,939	42,794,431	267,139,168	
1965	176,869,306	20,407,230	32,325,714	50,815,252	280,417,502	
Totals	4,186,451,328	188,727,774	429,185,253	767,111,087	5,571,475,442	

* *See* note on structural materials, page A 19.

TABLE III.—QUANTITY AND VALUE OF MINERAL PRODUCTS FOR YEARS 1956-1965

Description	1956		1957		1958		1959		1960	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Metals		$		$		$		$		$
Antimony .... lb.	2,140,432	768,843	1,360,731	577,344	858,633	284,208	1,657,797	540,276	1,651,786	538,482
Bismuth .... lb.	156,753	346,424	145,634	314,569	154,034	308,068	181,843	345,502	213,009	419,628
Cadmium .... lb.	1,937,927	3,236,338	1,946,397	3,172,627	1,425,108	2,166,164	1,695,821	2,170,651	1,778,866	2,525,990
Copper .... lb.	43,360,575	17,251,872	31,387,441	8,170,465	12,658,649	2,964,529	16,233,546	4,497,991	33,064,429	9,583,724
Gold—placer, crude .... oz.	3,865	109,450	2,936	80,990	5,650	157,871	7,570	208,973	3,847	107,418
„ lode, fine .... oz.	191,743	6,603,628	223,403	7,495,170	194,354	6,604,149	173,146	5,812,511	205,580	6,979,441
Indium .... oz.	363,192	795,390	384,360	693,770	75,434	117,677	—	—	—	—
Iron concentrates* .... tons	369,955	2,190,847	357,342	2,200,637	630,271	4,193,442	849,248	6,363,848	1,160,355	10,292,847
Lead .... lb.	283,718,073	44,702,619	281,603,346	39,568,086	294,573,159	34,627,075	287,423,357	33,542,306	333,608,699	38,661,912
Mercury .... lb.	—	—	—	—	—	—	—	—	—	—
Molybdenum .... lb.	—	—	—	—	—	—	—	—	9,023	9,500
Nickel .... tons	—	—	—	—	1,408,490	996,507	1,061,532	743,072	3,779,878	2,645,915
Platinum .... oz.	—	—	—	—	4	260	—	—	—	—
Silver—placer* .... oz.	474	423	301	262	642	555	942	824	406	360
„ lode .... oz.	8,404,600	7,511,443	8,129,047	7,076,904	7,040,416	6,086,299	6,197,159	5,420,593	7,446,237	6,599,823
Tin .... lb.	756,934	637,792	709,102	555,936	795,496	625,260	747,443	627,852	621,718	522,243
Tungsten (WO_3) .... lb.	2,264,775	6,351,376	1,921,483	5,240,479	690,976	1,884,209	—	—	—	—
Zinc .... lb.	443,853,004	58,934,801	449,276,797	50,206,681	432,002,790	43,234,839	402,342,850	44,169,198	403,399,319	50,656,726
Others	—	—	—	—	—	—	—	632,933	—	760,364
Totals	—	149,441,246	—	125,353,920	—	104,251,112	—	105,076,530	—	130,304,373
Industrial Minerals										
Asbestos* .... tons	20,356	5,398,730	31,714	7,342,966	30,078	6,398,679	33,883	7,878,947	40,748	9,482,923
Barite .... tons	11,436	287,626	20,072	433,200	16,144	341,700	23,142	187,368	23,573	279,716
Diatomite .... tons	40	800	120	2,400	27	540	5	100	44	1,430
Fluxes (quartz, limestone) .... tons	176,311	392,429	137,433	442,204	90,635	311,630*	70,570	248,913	83,370	294,559
Granules (quartz, limestone, granite) .... tons	13,200	173,214	17,295	221,864	22,674	284,330	19,072	254,251	19,063	257,067
Gypsum and products .... tons	72,978	391,919	66,499	142,751	70,498	211,494	112,223	282,030	107,900	337,200
Jade .... lb.	—	—	—	—	—	—	15,000	5,000	50,300	10,325
Mica .... lb.	198,000	4,884	180,000	1,200	—	—	—	—	122,000	3,186
Sulphur .... tons	212,885	2,523,190	228,882	2,887,465	211,300	2,410,395	251,552	3,253,677	264,705	3,095,696
Totals	—	9,172,792	—	11,474,050	—	9,958,768	—	12,110,286	—	13,762,102
Structural Materials										
Brick—common .... No.	2,248,447	75,767	663,828	24,345	427,550	15,125	385,810	11,954	2,262,653	187,673
„ face, paving, sewer .... No.	6,913,682	485,176	4,660,231	345,081	4,871,562	344,133	5,412,822	428,100	1,775,591	145,091
„ firebrick, blocks	—	604,063	—	658,873	—	405,485	—	538,566	—	621,865
Clays .... tons	7,985	30,263	3,849	29,495	4,105	12,579	6,250	17,001	8,003	22,671
Structural tile, hollow blocks	—	129,257	—	200,216	—	122,877	—	149,383	—	83,842
Drain tile, sewer pipe, flue linings	—	696,385	—	697,611	—	639,173	—	680,702	—	616,858
Pottery—glazed or unglazed	—	38,385	—	47,612	—	68,387	—	46,902	—	48,825
Other clay products	—	69,659	—	38,868	—	32,416	—	80,910	—	346,883
Cement .... tons	396,138	6,339,071	443,469	7,078,108	414,396	6,755,619	427,181	7,049,638	384,853	6,432,752
Lime and limestone .... tons	396,012	1,220,792	334,303	1,494,578	269,747	997,819	519,580	1,481,292	565,945	1,602,019
Rubble, riprap, crushed rock .... tons	2,028,143	2,210,315	2,364,301	4,272,768	1,866,950	2,098,952	1,169,854	1,128,353	1,148,305	1,075,373
Sand and gravel .... tons	13,762,227	8,535,348	16,829,816	10,503,274	14,173,169	8,442,676	11,349,121	7,342,698	12,355,955	7,597,278
Stone .... tons	35,266	139,150	2,403	236,110	2,141	64,335	13,710	69,710	4,328	48,859
Totals	—	20,573,631	—	25,626,939	—	19,999,576	—	19,025,209	—	18,829,989
Fuels										
Coal—sold and used .... tons	1,417,209	9,346,518	1,085,657	7,340,339	796,413	5,937,860	690,011	5,472,064	788,658	5,242,223
Natural gas delivered to pipe-line .... M s.c.f.	187,846	20,143	7,126,346	433,830	58,039,491	3,368,327	64,525,633	3,921,583	80,115,399	7,101,949
Natural-gas liquid by-products* .... bbl.	—	—	—	—	150,704	30,935	303,954	43,695	428,553	53,910
Petroleum, crude* .... bbl.	148,454	299,322	373,284	763,751	845,168	1,406,971*	1,374,116	1,994,596	1,589,474	2,070,787
Totals	—	9,665,983	—	8,537,920	—	10,744,093	—	11,431,938	—	14,468,869
Provincial totals	—	188,853,652	—	170,992,829	—	144,953,549	—	147,643,963	—	177,365,333

Description	1961 Quantity	1961 Value	1962 Quantity	1962 Value	1963 Quantity	1963 Value	1964 Quantity	1964 Value	1965 Quantity	1965 Value
Metals		$		$		$		$		$
Antimony ..... lb.	1,331,297	469,948	1,931,397	748,223	1,601,253	624,489	1,591,523	700,270	1,301,787	689,947
Bismuth ..... lb.	283,363	637,567	228,601	507,494	157,099	348,760	213,428	480,213	144,630	446,907
Cadmium ..... lb.	907,432	1,451,891	2,086,692	3,839,513	1,981,004	4,754,410	1,864,255	6,040,186	466,586	1,297,110
Copper ..... lb.	31,692,412	8,965,149	108,979,144	33,209,215	118,247,104	36,238,007	115,554,700	38,609,136	85,197,073	32,696,081
Gold—placer, crude ..... oz.	3,416	99,884	3,315	96,697	4,620	135,411	1,842	55,191	866	25,053
,, lode, fine ..... oz.	159,821	5,667,253	158,850	5,942,101	154,979	5,850,458	138,487	5,227,884	117,124	4,419,089
Indium ..... oz.	—	—	—	—	—	—	—	—	—	—
Iron concentrates* ..... tons	1,335,068	12,082,540	1,793,847	18,326,911	2,060,241	20,746,424	2,002,562	20,419,487	2,165,403	21,266,154
Lead ..... lb.	384,284,524	42,313,569	335,282,537	34,537,454	314,974,310	37,834,714	268,737,503	39,402,293	250,183,633	43,149,171
Mercury ..... lb.	—	—	—	—	—	—	5,548	22,848	1,520	12,301
Molybdenum ..... lb.	—	—	—	—	—	—	28,245	47,063	7,289,125	12,405,344
Nickel ..... lb.	4,180,677	3,194,037	3,476,467	2,902,850	3,699,402	3,107,498	3,398,560	2,854,790	3,322,000	2,790,480
Platinum ..... oz.	—	—	5	375	2	150	—	—	—	—
Silver—placer* ..... oz.	429	402	437	507	651	898	230	321	112	157
,, lode ..... oz.	7,373,568	6,908,738	6,189,367	7,181,400	6,422,029	8,860,152	5,269,412	7,348,617	4,971,972	6,929,636
Tin ..... lb.	1,119,350	727,578	650,941	442,640	927,062	648,943	352,350	535,572	377,207	735,554
Tungsten (WO_3) ..... lb.	—	—	—	—	—	—	—	—	—	—
Zinc ..... lb.	387,951,190	45,370,891	413,430,817	51,356,376	402,863,154	53,069,163	400,796,562	58,648,561	311,249,250	48,666,933
Others	—	676,327	—	535,537	—	633,389	—	533,897	—	1,339,389
Totals	—	128,565,774	—	159,627,293	—	172,852,866	—	180,926,329	—	176,869,306
Industrial Minerals										
Asbestos* ..... tons	45,113	8,648,503	55,133	10,297,360	63,215	11,681,337	67.460	11,714,494	85,851	14,491,195
Barite ..... tons	15,478	151,388	6,511	57,062	8,207	69,588	10,588	119,370	17,466	182,931
Diatomite ..... tons	214	8,817	211	10,228	458	16,030	1,143	64,555	82	4,420
Fluxes (quartz, limestone) ..... tons	53,335	190,500	62,743	228,477	60,490	223,012	73,021	237,298	59,231	240,076
Granules (quartz, limestone, granite) ..... tons	17,463	253,015	18,251	311,902	19,444	348,543	19,289	397,639	29,033	447,954
Gypsum and products ..... tons	153,300	459,900	147,900	443,700	160.954	482,862	188,303	581,873	207,858	602,788
Jade ..... lb.	69,751	20,876	56,935	20,760	16,000	15,529	11,537	13,804	7,129	9,249
Mica ..... lb.	250,000	8,025	—	—	—	—	—	—	—	—
Sulphur ..... tons	242,377	3,207.284	239,191	2,934,725	254,197	3,673,997	278,385	3,860,436	341,873	4,428,617
Totals	—	12.948,308	—	14,304,214	—	16,510,898	—	16,989,469	—	20,407,230
Structural Materials										
Brick—common ..... No.	244,532	14,809	1,179,165	54,849	1.086,688	63,499	614,288	49,826	582,305	27,662
,, face, paving, sewer ..... No.	3,728,779	326,346	3,313,179	309,582	2,845,704	292,535	648,267	60,594	3,889,653	576,173
,, firebrick, blocks	—	584,969	—	640,307	—	758,008	—	811,572	—	753,676
Clays ..... tons	7,908	28,396	8,105	30,027	2,573	33,151	1,853	38,585	454	18,234
Structural tile, hollow blocks	—	45,753	—	36,665	—	31,376	—	31,017	—	23,299
Drain tile, sewer pipe, flue linings	—	686,998	—	898,908	—	846,202	—	1,071,324	—	1,337,928
Pottery—glazed or unglazed	—	11,890	—	23,947	—	14,562	—	13,332	—	24.894
Other clay products	—	667,303	—	513,153	—	785,250	—	931,908	—	1,137,768
Cement ..... tons	417,336	7,122,046	397,435	7,112,890	476,071	8,546,768	537,396	10,040,776	601,878	11,199.607
Lime and limestone ..... tons	758,882	1.864,315	559,028	1,513,579	907,203	1,723,796	1,211,320	2.055,195	1,420.085	2,482.451
Rubble, riprap, crushed rock ..... tons	1,539,640	1,016,086	1,897,272	1,284,301	1,913,906	1,259,002	1.449,449	1,285,318	2,715,411	1.938,088
Sand and gravel ..... tons	11,424,958	7,439,710	17,757,391	8,862,767	17,387,026	9,514,095	17.708,225	10,013,970	20.936,994	12,686,959
Stone ..... tons	5,400	70,300	8,023	85,290	1,827	13,946	846	25,522	2,252	118,975
Totals	—	19,878,921	—	21,366,265	—	23,882,190	—	26,428,939	—	32,325,714
Fuels										
Coal—sold and used ..... tons	919,142	6,802,134	825,339	6,133,986	850.541	6,237,997	911,326	6,327,678	950,763	6,713,590
Natural gas delivered to pipe-line ..... M s.c.f.	95,967,110	8,818,891	108,699,997	10,226,323	105,525,373	10,719,298	118,959,880	12,192,816	138,814,144	14,493,255
Natural-gas liquid by-products* ..... bbl.	473,948	82,592	370,402	96,347	614,249	189,977	706.563	226,100	836,766	267,765
Petroleum, crude* ..... bbl.	1,810,984	2,710,701	9,841,363	17.617,056	13,458,739	25,470,361	12,474,054	24.047.837	14,449,968	29,340,642
Totals	—	18,414,318	—	34,073,712	—	42,617.633	—	42,794,431	—	50,815,252
Provincial totals	—	179,807,321	—	229,371,484	—	255,863.587	—	267,139,168	—	280,417,502

* *See* notes on individual minerals listed alphabetically on pages A 16 to A 19.

Table IV.—Values for 1836 to 1900 Are Totals for the Period of Production; Values for Subsequent Periods Are Averages per Year or Values for the Particular Year

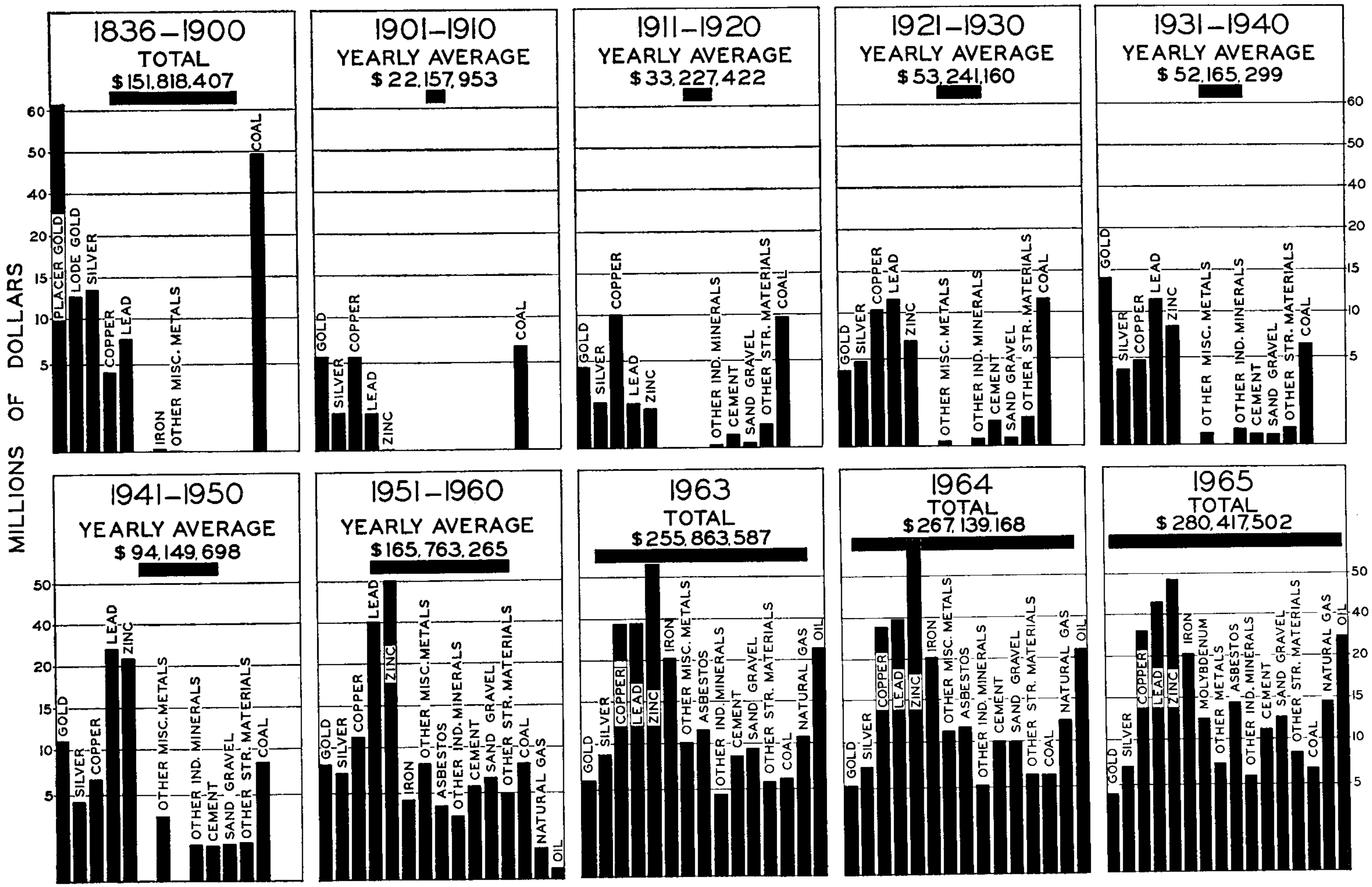


TABLE V.—QUANTITIES FOR 1836 TO 1900 ARE TOTALS FOR THE PERIOD OF PRODUCTION; QUANTITIES FOR SUBSEQUENT PERIODS ARE AVERAGES PER YEAR OR QUANTITIES FOR THE PARTICULAR YEAR

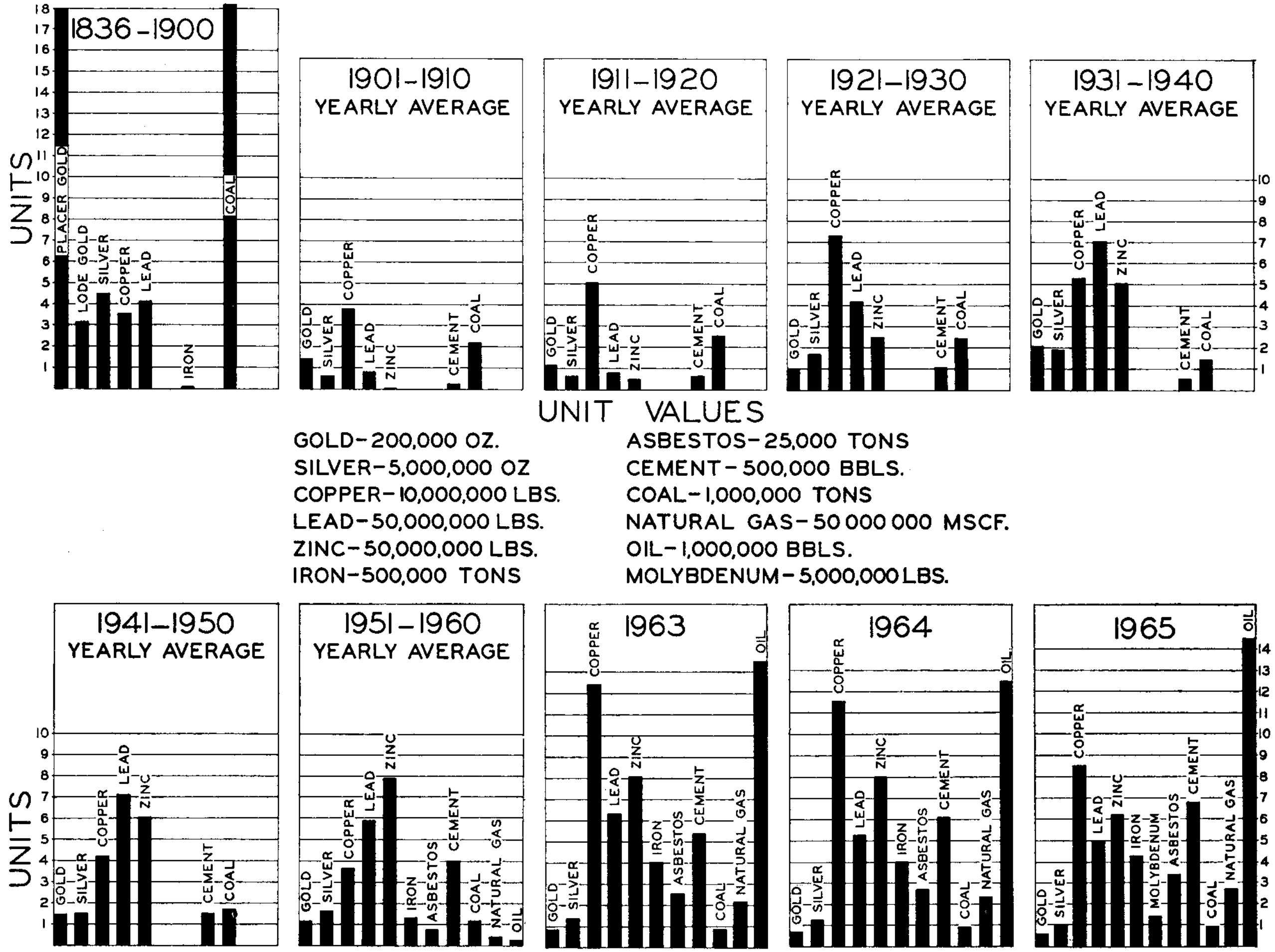


Table VI.—Production of Gold, Silver, Copper, Lead, and Zinc, 1858–1965

Year	Placer Gold (Crude)		Gold (Fine)		Silver*		Copper		Lead		Zinc		Total Value
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
	Oz.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
1858–86, incl.	3,105,775	52,798,364											52,798,364
1887	40,810	693,709			17,690	17,331			204,800	9,216			720,256
1888	36,280	616,731			79,780	75,000			674,500	29,813			721,544
1889	34,640	588,923			53,192	47,873			165,100	6,498			643,294
1890	29,080	494,436			70,427	73,948							568,384
1891	25,280	429,811			4,500	4,000							433,811
1892	23,500	399,526			77,160	66,935			808,420	33,064			499,525
1893	20,950	356,131	1,170	23,404	227,000	195,000			2,135,023	78,996			653,531
1894	23,850	405,516	6,252	125,014	746,379	470,219	324,680	16,234	5,662,523	169,875			1,186,858
1895	28,330	481,683	39,270	785,400	1,496,522	977,229	952,840	47,642	16,475,464	532,255			2,824,209
1896	32,000	544,026	64,441	1,287,820	3,322,161	2,225,877	3,825,756	191,286	24,199,977	721,384			4,970,393
1897	30,210	513,520	106,143	2,122,860	5,472,971	3,272,836	5,325,180	266,258	38,841,135	1,390,517			7,565,991
1898	37,840	643,346	110,061	2,201,217	4,293,025	2,376,190	7,282,278	876,056	31,693,559	1,077,581			7,174,390
1899	79,110	1,344,900	138,316	2,857,588	2,939,413	1,663,708	7,728,255	1,352,445	21,862,436	878,870			8,097,511
1900	75,220	1,278,724	167,153	3,455,050	3,958,175	2,309,200	9,977,080	1,615,289	63,358,621	2,699,077			11,357,340
1901	57,060	970,100	210,384	4,348,637	4,396,447	2,462,008	27,603,746	4,446,963	51,582,905	2,010,186			14,237,894
1902	63,130	1,073,140	236,491	4,888,269	3,817,917	1,891,779	29,652,043	3,450,291	22,536,381	824,832			12,128,311
1903	62,380	1,060,420	232,828	4,812,554	2,996,204	1,521,472	34,359,921	4,547,878	18,089,283	689,744			12,632,068
1904	65,610	1,115,300	222,042	4,589,608	3,222,481	1,719,516	35,710,128	4,578,037	36,646,244	1,421,874			13,424,335
1905	57,020	969,300	238,660	4,933,103	3,439,417	1,971,818	37,692,251	5,876,222	56,580,703	2,399,022	*	139,200	16,288,665
1906	55,790	948,400	224,027	4,630,639	2,990,262	1,897,320	42,990,488	8,288,565	52,408,217	2,667,578	*	17,100	18,449,602
1907	48,710	828,000	196,179	4,055,020	2,745,448	1,703,825	40,832,721	8,166,544	47,738,703	2,291,458	*	46,100	17,090,947
1908	38,060	647,000	255,582	5,282,879	2,631,389	1,321,483	47,274,614	6,240,249	43,195,733	1,632,799	*	99,296	15,223,706
1909	28,060	477,000	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	14,668,141
1910	31,760	540,000	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	13,768,731
1911	25,060	426,000	228,617	4,725,512	1,892,364	958,293	36,927,656	4,571,644	26,872,397	1,069,521	2,634,544	129,092	11,880,062
1912	32,680	555,500	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	18,218,266
1913	30,000	510,000	272,254	5,627,595	3,465,856	1,968,603	46,460,305	7,094,489	55,364,677	2,175,832	6,758,768	324,421	17,700,943
1914	33,240	565,000	247,170	5,109,008	3,602,180	1,876,730	45,009,699	6,121,319	50,625,048	1,771,877	7,866,467	346,125	15,790,065
1915	45,290	770,000	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	20,762,149
1916	34,150	580,500	221,932	4,587,333	3,301,923	2,059,739	65,379,364	17,784,494	48,727,516	3,007,462	37,168,980	4,043,985	32,063,513
1917	29,180	496,000	114,523	2,367,191	2,929,216	2,265,749	59,007,565	16,038,256	37,307,465	2,951,020	41,848,513	3,166,259	27,284,475
1918	18,820	320,000	164,674	3,403,811	3,998,172	3,215,870	61,483,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040	27,910,277
1919	16,850	286,500	152,426	3,150,644	3,403,119	3,592,673	42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429	20,036,997
1920	13,040	221,600	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	19,665,965
1921	13,720	233,200	135,765	2,804,197	2,673,389	1,591,201	39,036,993	4,879,624	41,402,288	1,693,354	49,419,372	1,952,065	13,153,641
1922	21,690	368,800	197,856	4,089,684	7,101,311	4,554,781	32,359,896	4,329,754	67,447,985	3,480,306	57,146,548	2,777,322	19,600,647
1923	24,710	420,000	179,245	3,704,994	6,032,986	3,718,129	57,720,290	8,323,266	96,663,152	6,321,770	58,344,462	3,278,903	25,767,062

	Oz.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
1924	24,750	420,750	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	35,958,997
1925	16,476	280,092	209,719	4,335,069	7,654,844	5,286,818	72,306,432	10,153,269	237,899,199	18,670,329	98,257,099	7,754,450	46,480,027
1926	20,912	355,503	201,427	4,163,859	10,748,556	6,675,606	89,339,768	12,324,421	263,023,936	17,757,535	142,876,947	10,586,610	51,863,534
1927	9,191	156,247	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	45,133,329
1928	8,424	143,208	180,662	3,734,609	10,627,167	6,182,461	97,908,316	14,265,242	305,140,792	13,961,412	181,763,147	9,984,613	48,271,545
1929	6,983	118,711	145,223	3,002,020	9,960,172	5,278,194	102,793,669	18,612,850	307,999,153	15,555,189	172,096,841	9,268,792	51,835,756
1930	8,955	152,235	160,836	3,324,975	11,328,263	4,322,185	92,362,240	11,990,466	321,803,725	12,638,198	250,479,310	9,017,005	41,445,064
1931	17,176	291,992	146,133	3,020,837	7,550,331	2,254,979	64,134,746	5,365,690	261,902,228	7,097,812	202,071,702	5,160,911	23,192,221
1932	20,400	395,542	181,651	4,263,389	7,150,655	2,264,729	50,608,036	3,228,892	252,007,574	5,326,432	192,120,091	4,621,641	20,100,625
1933	23,928	562,787	223,589	6,394,645	7,021,754	2,656,526	43,149,460	3,216,701	271,689,217	6,497,719	195,963,751	6,291,416	25,619,794
1934	25,181	714,431	297,216	10,253,952	8,613,977	4,088,280	49,651,733	3,683,662	347,366,967	8,461,859	249,152,403	7,584,199	34,786,383
1935	30,929	895,058	365,343	12,856,419	9,269,944	6,005,996	39,428,208	3,073,428	344,268,444	10,785,930	256,239,446	7,940,860	41,557,691
1936	43,389	1,249,940	404,578	14,172,367	9,547,124	4,308,330	21,671,711	2,053,828	377,971,618	14,790,028	254,581,393	8,439,373	45,013,866
1937	54,153	1,558,245	460,781	16,122,767	11,305,367	5,073,962	46,057,584	6,023,411	419,118,371	21,417,049	291,192,278	14,274,245	64,469,679
1938	57,759	1,671,015	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	55,548,348
1939	49,746	1,478,492	587,336	21,226,957	10,821,393	4,381,365	73,254,679	7,392,862	378,743,663	12,002,390	278,409,102	8,544,375	55,026,441
1940	39,067	1,236,928	583,524	22,461,516	12,327,944	4,715,315	77,980,223	7,865,085	466,849,112	15,695,467	312,020,671	10,643,026	62,617,337
1941	43,775	1,385,962	571,026	21,984,501	12,175,700	4,658,545	66,435,583	6,700,693	456,840,454	15,358,976	367,869,579	12,548,031	62,636,708
1942	32,904	1,041,772	444,518	17,113,943	9,677,881	4,080,775	50,097,716	5,052,856	507,199,704	17,052,054	387,236,469	13,208,636	57,550,036
1943	14,600	462,270	224,403	8,639,516	8,526,310	3,858,496	42,307,510	4,971,132	439,155,635	16,485,902	336,150,455	13,446,018	47,863,334
1944	11,433	361,977	186,632	7,185,332	5,705,334	2,453,293	36,300,589	4,356,070	292,922,888	13,181,530	278,063,373	11,956,725	39,494,927
1945	12,589	398,591	175,373	6,751,860	6,157,307	2,893,934	25,852,366	3,244,472	336,976,468	16,848,823	294,791,635	18,984,581	49,122,261
1946	15,729	475,361	117,612	4,322,241	6,365,761	5,324,959	17,500,538	2,240,070	345,862,680	23,345,731	274,269,956	21,420,484	57,128,846
1947	6,969	200,585	243,282	8,514,870	5,708,461	4,110,092	41,783,921	8,519,741	313,733,089	42,887,313	253,006,168	28,412,593	92,645,194
1948	20,332	585,200	286,230	10,018,050	6,720,134	5,040,101	43,025,388	9,616,174	320,037,525	57,734,770	270,310,195	37,654,211	120,648,506
1949	17,886	529,524	288,396	10,382,256	7,637,882	5,671,082	54,856,808	10,956,550	265,378,899	41,929,866	288,225,368	38,181,214	107,650,492
1950	19,134	598,717	283,983	10,805,553	9,509,456	7,667,950	42,212,133	9,889,458	284,024,522	41,052,905	290,344,227	43,769,392	113,783,975
1951	23,691	717,911	261,274	9,627,947	8,218,914	7,770,983	43,249,658	11,980,155	273,456,604	50,316,015	337,511,324	67,164,754	147,577,765
1952	17,554	494,756	255,789	8,765,889	8,810,807	7,326,803	42,005,512	13,054,893	284,949,396	45,936,692	372,871,717	59,189,656	134,768,689
1953	14,245	403,230	253,552	8,727,294	8,378,819	7,019,272	49,021,013	14,869,544	297,634,712	39,481,244	382,300,862	40,810,618	111,311,202
1954	8,684	238,967	258,388	8,803,279	9,826,403	8,154,145	50,150,087	14,599,693	332,474,456	45,482,505	334,124,560	34,805,755	112,084,344
1955	7,666	217,614	242,477	8,370,306	7,903,149	6,942,995	44,238,031	16,932,549	302,567,640	45,161,245	429,198,565	52,048,909	129,673,618
1956	3,865	109,450	191,743	6,603,628	8,405,074	7,511,866	43,360,575	17,251,872	283,718,073	44,702,619	443,853,004	58,934,801	135,114,236
1957	2,936	80,990	223,403	7,495,170	8,129,348	7,077,166	31,387,441	8,170,465	281,603,346	39,568,086	449,276,797	50,206,681	112,598,558
1958	5,650	157,871	194,354	6,604,149	7,041,058	6,086,854	12,658,649	2,964,529	294,573,159	34,627,075	432,002,790	43,234,839	93,675,317
1959	7,570	208,973	173,146	5,812,511	6,198,101	5,421,417	16,233,546	4,497,991	287,423,357	33,542,306	402,342,850	44,169,198	93,652,396
1960	3,847	107,418	205,580	6,979,441	7,446,643	6,600,183	33,064,429	9,583,724	333,608,699	38,661,912	403,399,319	50,656,726	112,589,404
1961	3,416	99,884	159,821	5,667,253	7,373,997	6,909,140	31,692,412	8,965,149	384,284,524	42,313,569	387,951,190	45,370,891	109,325,886
1962	3,315	96,697	158,850	5,942,101	6,189,804	7,181,907	108,979,144	33,209,215	335,282,537	34,537,454	413,430,817	51,356,376	132,323,750
1963	4,620	135,411	154,979	5,850,458	6,422,680	8,861,050	118,247,104	36,238,007	314,974,310	37,834,714	402,863,154	53,069,163	141,988,803
1964	1,842	55,191	138,487	5,227,884	5,269,642	7,348,938	115,554,700	38,609,136	268,737,503	39,402,293	400.796.562	58,648,561	149,292,003
1965	866	25,053	117,124	4,419,089	4,972,084	6,929,793	85,197,073	32,696,081	250,183,633	43,149,171	311,249,250	48,666,933	135,886,120
Totals	5,231,422	96,841,657	16,438,630	481,759,931	454,129,633	295,498,646	3,440,357,540	643,999,578	14,752,155,137	1,180,499,646	12,981,449,476	1,168,669,412	3,867,268,870

• *See* notes on individual minerals listed alphabetically on pages A 16 to A 19.

TABLE VIIA.—PRODUCTION, 1964 AND 1965, AND

Division	Period	Placer			Lode Metals	Industrial Minerals	Structural Materials
		Quantity (Crude)	Gold* Value	Silver* Value			
		Oz.	$	$	$	$	$
Alberni	1964				9,131,133		90,942
	1965				**10,021,157**		**121,359**
	To date	1,617	33,253		46,149,761	9,398	1,675,666
Atlin	1964	317	8,720	60			430
	1965	**139**	**4,188**	**27**			**2,584**
	To date	735,609	17,383,114	1,631	37,483,714	20,325	312,009
Cariboo	1964	1,023	31,446	165	754,893	64,555	373,185
	1965	**556**	**16,186**	**100**	**3,183,062**	**4,420**	**704,250**
	To date	2,607,929	54,093,439	2,443	45,545,549	283,795	7,670,380
Clinton	1964	9	189	4			31,834
	1965						**45,085**
	To date	10,171	243,069	23	848,354	162,427	187,847
Fort Steele	1964				70,504,477	855,100	67,610
	1965				**69,449,859**	**1,054,050**	**306,940**
	To date	20,531	468,450	5	1,878,651,075	8,600,471	5,658,672
Golden	1964				2,663,952	701,243	48,732
	1965				**2,108,259**	**798,331**	**188,553**
	To date	469	11,268		56,942,752	7,106,654	1,928,052
Greenwood	1964				4,419,970		26,116
	1965				**5,243,049**		**97,789**
	To date	5,074	115,662	2	142,800,627	2,323,897	956,487
Kamloops	1964	21	604	4	8,838,231		824,396
	1965	**3**	**75**		**8,623,408**		**672,347**
	To date	27,595	604,785	7	26,669,489	6,528,308	11,612,073
Liard	1964					13,339,110	261,181
	1965					**16,217,699**	**548,605**
	To date	50,184	1,248,151	7	6,391	108,034,688	3,434,966
Lillooet	1964				2,831,057	11,404	196,717
	1965				**2,086,810**	**5,249**	**317,196**
	To date	91,916	1,894,304	36	138,728,620	94,272	2,844,862
Nanaimo	1964				11,913,569	74,510	2,186,199
	1965				**13,789,151**	**68,904**	**2,988,741**
	To date	866	19,300		114,815,545	965,514	42,393,862
Nelson	1964				17,838,859	76,956	320,795
	1965				**18,436,152**	**127,459**	**104,101**
	To date	3,585	88,988		286,327,148	367,491	3,798,385
New Westminster	1964				3,409,162	84,000	6,637,614
	1965				**3,442,889**	**98,995**	**8,348,601**
	To date	31,265	593,573		22,769,748	1,165,256	95,156,224
Nicola	1964				18,114,466		5,250
	1965				**11,467,337**		**5,650**
	To date	234	4,764		73,542,856	10,050	567,057
Omineca	1964	180	5,587	32	22,440	2,400	342,796
	1965	**24**	**340**	**1**	**9,955,285**	**2,000**	**697,057**
	To date	56,279	1,499,180	757	43,024,552	15,860	5,184,009
Osoyoos	1964	13	302	1	9,112	399,401	64,304
	1965	**6**	**151**	**1**		**380,000**	**78,289**
	To date	240	5,466	7	51,140,478	5,255,345	1,374,654
Revelstoke	1964						74,662
	1965						**32,819**
	To date	7,582	164,477	57	11,237,401		1,492,370
Similkameen	1964	33	906	10	1,594		142,450
	1965				**1,084**		**109,450**
	To date	45,507	878,204	10	120,195,248	18,558	2,857,277
Skeena	1964				4,033,464		334,117
	1965				**3,502,546**		**677,686**
	To date	4,603	105,569		222,308,689	1,229,400	8,507,686
Slocan	1964				8,190,919		63,582
	1965				**10,215,872**		**35,294**
	To date	366	9,397		220,614,408		1,172,326
Trail Creek	1964				12,186		68,907
	1965				**8,630**		**95,609**
	To date	851	24,260		83,751,751		2,160,719
Vancouver	1964				4,947,375	810	6,152,684
	1965				**2,087,792**	**110,063**	**7,503,777**
	To date	182	5,306		227,168,396	6,570,191	70,693,775
Vernon	1964						98,362
	1965						**151,006**
	To date	2,732	72,885	26	197,845	3,978	3,102,657
Victoria	1964				3,979	70	6,511,971
	1965					**60**	**7,283,938**
	To date	628	15,680		12,928,756	188,511	138,881,575
Not assigned[1]	1964	246	7,437	45	13,230,479	1,379,910	1,504,103
	1965	**138**	**4,113**	**28**	**3,221,754**	**1,540,000**	**1,208,988**
	To date	1,525,407	17,259,113	13,092	225,742,415	39,773,385	16,061,663
Totals	1964	1,842	55,191	321	180,870,817	16,989,469	26,428,939
	1965	**866**	**25,053**	**157**	**176,844,096**	**20,407,230**	**32,325,714**
	To date	5,231,422	96,841,657	18,103	4,089,591,568	188,727,774	429,185,253

[1] *Re* " not assigned," *see* footnotes under Tables VIIB and VIIC.

* *See* notes on individual minerals listed alphabetically on pages A 16 to A 19.

NOTE.—For individual metals, industrial minerals, and structural materials, *see* Tables VIIB, VIIC, VIID, and VIIE.

TOTAL TO DATE, BY MINING DIVISIONS—SUMMARY

Fuels								Division Totals
Coal*		Petroleum*		Natural Gas (Direct to Pipe-line)		Liquid By-products*		
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
Tons	$	Bbl.	$	M S.C.F.	$	Bbl.	$	$
								9,222,075
								10,142,516
								47,868,078
								9,210
								6,799
								55,200,793
								1,223,744
								3,908,018
290	1,100							107,596,706
								32,027
								45,085
								1,441,720
846,059	5,668,799							77,095,986
913,778	**6,305,280**							**77,116,129**
56,451,182	253,739,151							2,147,117,824
								3,413,927
								3,095,143
								65,988,726
								4,446,086
								5,340,838
								146,196,675
								9,663,235
								9,295,830
15,087	59,765							45,474,427
50	750	12,474,054	24,047,837	118,959,880	12,192,816	706,563	226,100	50,067,794
		14,449,968	**29,340,642**	**138,814,144**	**14,493,255**	**836,766**	**267,765**	**60,867,966**
99,433	699,521	56,366,186	105,722,504	778,190,753	71,321,090	3,885,139	991,321	291,458,639
								3,039,178
								2,409,255
								143,062,094
58,382	588,622							14,762,900
31,085	**349,310**							**17,196,106**
74,308,508	300,968,797							459,163,018
								18,236,610
								18,667,712
								290,582,012
								10,130,776
								11,890,485
								119,684,801
								18,119,716
								11,472,987
2,929,584	11,080,836							85,205,563
6,835	69,507							442,762
5,900	**59,000**							**10,713,683**
451,197	2,968,153							52,692,511
								473,120
								458,441
1,122	5,008							57,780,958
								74,662
								32,819
								12,894,305
								144,960
								110,534
4,617,442	19,553,725							143,503,022
								4,367,581
								4,180,232
36	116							232,151,460
								8,254,501
								10,251,166
								221,796,131
								81,093
								104,239
								85,936,730
								11,100,869
								9,701,632
								304,437,668
								98,362
								151,006
								3,377,391
								6,516,020
								7,283,998
								152,014,522
								16,121,974
								5,974,883
								298,849,668
911,326	6,327,678	12,474,054	24,047,837	118,959,880	12,192,816	706,563	226,100	267,139,168
950,763	**6,713,590**	**14,449,968**	**29,340,642**	**138,814,144**	**14,493,255**	**836,766**	**267,765**	**280,417,502**
138,873,881	589,076,172	56,366,186	105,722,504	778,190,753	71,321,090	3,885,139	991,321	5,571,475,442

TABLE VIIB.—PRODUCTION, 1964 AND 1965, AND TOTAL TO DATE, BY MINING DIVISIONS—LODE GOLD, SILVER, COPPER, LEAD, AND ZINC

Division	Period	Lode Gold		Silver		Copper		Lead		Zinc		Division Total
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
		Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
Alberni	1964	734	27,709	101	141							27,850
	1965											
	To date	303,757	11,364,987	162,684	79,053	2,290,699	343,518	121,344	5,419	67	8	11,792,985
Atlin	1964											
	1965											
	To date	344,197	12,126,732	3,375,333	2,893,952	24,777,661	8,160,266	23,765,211	3,437,907	91,067,749	10,864,497	37,483,354
Cariboo	1964	19,867	749,979	3,165	4,414							754,393
	1965	**18,481**	**697,288**	**3,236**	**4,510**							**701,798**
	To date	1,176,458	42,374,367	139,664	99,763	2,352	920	24,560	3,724	505	19	42,478,793
Clinton	1964											
	1965											
	To date	23,390	827,328	31,564	14,214	57,548	5,905	193	7			847,454
Fort Steele	1964	325	12,269	2,840,038	3,960,660			188,345,245	27,615,180	245,548,918	35,931,173	67,519,282
	1965	**281**	**10,602**	**2,808,166**	**3,913,853**			**183,513,420**	**31,650,560**	**195,010,020**	**30,491,767**	**66,066,782**
	To date	6,637	202,128	221,520,381	138,720,539	28,592	6,193	12,409,489,903	955,424,637	9,215,828,108	764,344,327	1,858,697,824
Golden	1964			89,006	124,126			4,455,688	653,293	12,097,985	1,770,298	2,547,717
	1965	**1**	**38**	**59,183**	**82,486**			**3,063,804**	**528,414**	**9,082,414**	**1,420,126**	**2,031,064**
	To date	170	4,882	4,023,619	3,355,397	1,168,211	365,531	246,763,100	24,154,244	303,647,145	28,135,813	56,015,867
Greenwood	1964	13,349	503,924	871,310	1,215,111	7,477,199	2,498,282	601,148	88,140	695,773	101,812	4,407,269
	1965	**16,442**	**620,357**	**724,286**	**1,009,466**	**8,902,490**	**3,416,508**	**604,674**	**104,288**	**537,269**	**84,007**	**5,234,626**
	To date	1,234,846	28,102,648	37,325,086	25,344,573	489,311,322	85,735,311	19,413,393	1,709,704	20,767,878	1,765,722	142,657,958
Kamloops	1964	3,654	137,938	133,995	186,867	25,339,289	8,466,363					8,791,168
	1965	**1,595**	**60,179**	**84,215**	**117,374**	**21,818,680**	**8,373,355**					**8,550,908**
	To date	55,463	1,895,007	607,586	603,666	72,658,360	23,874,751	538,097	45,030	438,023	29,826	26,448,280
Liard	1964											
	1965											
	To date	114	4,120	540	446	56	22	10,102	1,724			6,312
Lillooet	1964	73,848	2,787,762	14,662	20,447							2,808,209
	1965	**54,589**	**2,059,643**	**10,666**	**14,866**							**2,074,509**
	To date	3,935,094	138,004,751	942,911	637,779	400	41	62,513	2,548	15	2	138,645,121
Nanaimo	1964	13,668	515,967	60,643	84,572	13,985,371	4,672,792					5,273,331
	1965	**22,046**	**831,796**	**179,319**	**249,924**	**16,723,599**	**6,418,016**					**7,499,736**
	To date	145,110	4,207,402	994,984	872,772	73,316,994	20,777,380					25,857,554
Nelson	1964	943	35,598	140,678	196,187			24,032,074	3,523,582	84,976,320	12,434,585	16,189,952
	1965	**1,037**	**39,126**	**133,090**	**185,493**			**22,319,008**	**3,849,360**	**83,265,553**	**13,019,402**	**17,093,381**
	To date	1,335,136	41,769,361	8,801,082	5,754,755	14,915,405	1,689,196	423,080,584	51,740,460	1,087,910,669	138,936,356	239,890,128
New Westminster	1964					1,659,200	554,372					554,372
	1965					**1,700,000**	**652,409**					**652,409**
	To date	4,466	114,164	15,114	7,720	10,674,649	3,323,391	28,425	1,119	12,755	481	3,446,875
Nicola	1964					54,215,450	18,114,466					18,114,466
	1965					**29,880,753**	**11,467,337**					**11,467,337**
	To date	8,541	235,481	275,599	134,205	227,152,596	73,071,293	2,239,124	90,923	323,735	10,954	73,542,856
Omineca	1964	8	302	6,392	8,914			60,984	8,941	13,017	1,905	20,062
	1965	**22**	**830**	**26,643**	**37,133**			**164,575**	**28,384**	**206,922**	**32,354**	**98,701**
	To date	25,153	776,797	9,604,823	7,657,485	6,748,062	1,546,025	28,297,411	3,595,988	31,882,742	3,954,634	17,530,929

		Oz.	$	Oz.	$	Lb.	$	Lb.	$	Lb.	$	$
Osoyoos	1964	126	4,757	2,426	3,383	...	...	4,347	637	2,286	335	9,112
	1965	...	...	...	...	...	...	...	...	...	...	...
	To date	1,655,733	50,313,477	599,877	399,994	2,843,616	417,190	140,765	7,208	16,164	1,589	51,139,458
Revelstoke	1964	...	...	...	...	...	...	...	...	...	...	...
	1965	...	...	...	...	...	...	...	...	...	...	...
	To date	37,300	1,069,260	4,108,010	2,767,062	153,686	51,037	36,046,708	3,853,366	27,123,973	3,311,432	11,052,157
Similkameen	1964	1	38	73	102	4,352	1,454	...	...	...	...	1,594
	1965	...	...	**10**	**14**	**417**	**160**	...	...	**5,819**	**910**	**1,084**
	To date	184,016	6,327,410	4,219,551	2,582,419	601,197,638	111,137,983	382,677	13,376	78,094	4,874	120,066,062
Skeena	1964	1,941	73,272	38,257	53,352	...	...	...	...	...	...	126,624
	1965	**669**	**25,241**	**14,886**	**20,747**	...	...	**7,463**	**1,287**	**12,834**	**2,007**	**49,282**
	To date	2,414,410	60,984,966	68,791,334	44,083,071	689,106,270	98,026,007	59,956,377	5,431,069	17,085,864	2,524,121	211,049,234
Slocan	1964	104	3,926	535,255	746,456	...	...	21,905,027	3,211,715	26,734,109	3,912,002	7,874,099
	1965	**24**	**906**	**593,235**	**826,815**	...	...	**25,482,463**	**4,394,960**	**29,868,871**	**4,670,297**	**9,892,978**
	To date	16,006	463,833	73,898,690	48,807,672	13,662	1,861	985,033,707	85,288,159	797,562,668	81,954,022	216,515,547
Trail Creek	1964	158	5,965	356	496	15,419	5,152	707	104	3,205	469	12,186
	1965	**222**	**8,376**	**63**	**88**	...	...	**464**	**80**	**552**	**86**	**8,630**
	To date	2,984,548	63,339,534	3,673,070	2,102,504	122,561,732	18,245,404	146,421	12,293	133,571	16,242	83,715,977
Vancouver	1964	8,854	334,238	43,060	60,051	11,789,676	3,939,166	57,108	8,373	3,812,989	557,955	4,899,783
	1965	**1,246**	**47,012**	**18,249**	**25,434**	**4,981,250**	**1,911,654**	**5,754**	**992**	**621,256**	**97,140**	**2,082,232**
	To date	486,836	15,718,136	5,054,253	3,228,110	1,002,772,931	175,201,194	18,492,745	1,871,026	232,011,804	30,017,393	226,035,859
Vernon	1964	...	...	...	...	...	...	...	...	...	...	...
	1965	...	...	...	...	...	...	...	...	...	...	...
	To date	5,224	176,082	12,823	8,084	654	100	24,913	2,933	10,816	1,146	188,345
Victoria	1964	17	642	359	501	8,488	2,836	...	...	...	...	3,979
	1965	...	...	...	...	...	...	...	...	...	...	...
	To date	40,720	927,715	909,140	548,719	48,977,926	11,113,114	210,097	19,848	3,568,709	283,923	12,893,319
Not assigned[1]	1964	890	33,598	489,636	682,837	1,060,256	354,253	29,275,175	4,292,328	26,911,960	3,938,027	9,301,043
	1965	**469**	**17,695**	**316,725**	**441,433**	**1,189,884**	**456,642**	**15,022,008**	**2,590,846**	**[2]–7,362,260**	**[2]–1,151,163**	**2,355,453**
	To date	15,305	429,363	5,021,108	4,776,589	49,626,518	10,905,945	497,886,767	43,786,934	1,151,978,422	102,512,031	162,410,862
Totals	1964	138,487	5,227,884	5,269,412	7,348,617	115,554,700	38,609,136	268,737,503	39,402,293	400,796,562	58,648,561	149,236,491
	1965	**117,124**	**4,419,089**	**4,971,972**	**6,929,636**	**85,197,073**	**32,696,081**	**250,183,633**	**43,149,171**	**311,249,250**	**48,666,933**	**135,860,910**
	To date	16,438,630	481,759,931	454,108,826	295,480,543	3,440,357,540	643,999,578	14,752,155,137	1,180,499,646	12,981,449,476	1,168,669,412	3,770,409,110

[1] Gold, silver, copper, and some lead " not assigned " were recovered at the Tacoma smelter from dross shipped from the Trail smelter. The zinc and most of the lead were recovered at the Trail smelter by fuming current and reclaimed slag.

[2] The total zinc reported includes the refined new zinc produced from British Columbia ores at Trail plus shipments to foreign smelters. The minus quantity shown for 1965 represents the difference between the actual shipments of the individual properties to Trail and the amount of refined zinc produced.

TABLE VIIc.—PRODUCTION, 1964 AND 1965, AND TOTAL TO DATE, BY MINING DIVISIONS—MISCELLANEOUS METALS

Division	Period	Antimony		Bismuth		Cadmium		Chromite		Iron Concentrates		Manganese		Mercury	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		Lb.	$	Lb.	$	Lb.	$	Tons	$	Tons	$	Tons	$	Lb.	$
Alberni	1964									846,459	9,103,283				
	1965									**926,338**	**10,021,157**				
	To date									3,225,718	34,356,776				
Atlin	1964														
	1965														
	To date														
Cariboo	1964														
	1965														
	To date					319,212	561,762								
Clinton	1964														
	1965														
	To date							126	900						
Fort Steele	1964					518,672	1,680,497			*73,460	769,126				
	1965					**411,944**	**1,145,205**			***155,038**	**1,502,318**				
	To date					932,453	2,829,525			390,682	3,978,047				
Golden	1964					35,875	116,235								
	1965					**27,768**	**77,195**								
	To date	40,062	14,906			473,894	911,979								
Greenwood	1964					3,920	12,701								
	1965					**3,030**	**8,423**								
	To date					57,685	111,274	670	31,395						
Kamloops	1964														
	1965														
	To date									21,167	95,851			10,987	5,795
Liard	1964														
	1965														
	To date														
Lillooet	1964													5,548	22,848
	1965													**1,520**	**12,301**
	To date	13,466	4,321											8,851	38,704
Nanaimo	1964									653,404	6,640,238				
	1965									**688,585**	**6,289,415**				
	To date									11,094,488	88,957,991				
Nelson	1964					508,922	1,648,907								
	1965					**483,011**	**1,342,771**								
	To date					6,397,775	12,518,331								
New Westminster	1964														
	1965														
	To date														
Omineca	1964					734	2,378								
	1965					**1,800**	**5,004**								
	To date	104,489	15,217			265,041	526,443							4,150,892	10,400,259
Osoyoos	1964														
	1965														
	To date											16			

* *See* note under iron concentrates, page A 17.

		Lb.	$	Lb.	$	Lb.	$	Tons	$	Tons	$	Tons	$	Lb.	$
Revelstoke	1964														
	1965														
	To date	9,394	3,455			103,612	176,102								
Similkameen	1964														
	1965														
	To date														
Skeena	1964									429,239	3,906,840				
	1965									**395,442**	**3,453,264**				
	To date					141,890	316,764			1,218,404	10,927,951				
Slocan	1964					97,784	316,820								
	1965					**116,149**	**322,894**								
	To date	31,865	8,133			2,107,805	4,082,568					541	8,160		
Trail Creek	1964														
	1965														
	To date					115	210			550	1,925				
Vancouver	1964					14,689	47,592								
	1965					**2,000**	**5,560**								
	To date					541,172	1,132,537								
Vernon	1964														
	1965														
	To date														
Victoria	1964														
	1965														
	To date					7,000	10,929					1,167	24,508		
Not assigned	1964	1,591,523*	700,270	213,428*	480,213	683,659*	2,215,056								
	1965	**1,301,787***	**689,947**	**144,630***	**446,907**	**[1]–597,116***	**[1]–1,609,942**								
	To date	46,987,183*	13,191,001	6,154,107*	10,993,293	22,488,042*	32,163,505								
Totals	1964	1,591,523	700,270	213,428	480,213	1,864,255	6,040,186			2,002,562	20,419,487			5,548	22,848
	1965	**1,301,787**	**689,947**	**144,630**	**446,907**	**466,586**	**1,297,110**			**2,165,403**	**21,266,154**			**1,520**	**12,301**
	To date	47,186,459	13,237,033	6,154,107	10,993,293	33,835,696	55,341,929	796	32,295	15,951,009	138,318,541	1,724	32,668	4,170,730	10,444,758

* *See* notes on individual minerals listed alphabetically on pages A 16 to A 19.

[1] The total cadmium reported includes the new cadmium from British Columbia ores treated at Trail plus shipments to foreign smelters. The minus quantity shown for 1965 represents the difference between the actual shipments of the individual properties to Trail and the amount of cadmium produced.

TABLE VIIc.—PRODUCTION, 1964 AND 1965, AND TOTAL TO DATE, BY MINING DIVISIONS—MISCELLANEOUS METALS—*Continued*

Division	Period	Molybdenum		Nickel		Palladium		Platinum		Tin		Tungsten (WO_3)		Other, Value	Division Total
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value		
		Lb.	$	Lb.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	$	$
Alberni	1964														9,103,283
	1965														**10,021,157**
	To date														34,356,776
Atlin	1964														
	1965														
	To date											292	360		360
Cariboo	1964														
	1965	**1,615,223**	**2,481,264**												**2,481,264**
	To date	1,615,223	2,481,264					59	2,299			27,698	21,431		3,066,756
Clinton	1964														
	1965														
	To date														900
Fort Steele	1964									352,350	535,572				2,985,195
	1965									**377,207**	**735,554**				**3,383,077**
	To date									16,126,093	13,057,495			88,184[1]	19,953,251
Golden	1964														116,235
	1965														**77,195**
	To date														926,885
Greenwood	1964														12,701
	1965														**8,423**
	To date														142,669
Kamloops	1964	28,245	47,063												47,063
	1965	**51,900**	**72,500**												**72,500**
	To date	80,145	119,563												221,209
Liard	1964														
	1965														
	To date							2	79						79
Lillooet	1964														22,848
	1965														**12,301**
	To date	1,469	2,440					3	113			32,353	37,921		83,499
Nanaimo	1964														6,640,238
	1965														**6,289,415**
	To date														88,957,991
Nelson	1964														1,648,907
	1965														**1,342,771**
	To date	15,035	18,378									13,739,939	33,900,311		46,437,020
New Westminster	1964			3,398,560	2,854,790										2,854,790
	1965			**3,322,000**	**2,790,480**										**2,790,480**
	To date			24,608,459	19,322,873										19,322,873
Omineca	1964														2,378
	1965	**5,622,002**	**9,851,580**												**9,856,584**
	To date	5,622,962	9,853,420					3	154			2,210,892	4,697,710	420[2]	25,493,623
Osoyoos	1964														
	1965														
	To date	612	1,020												1,020

		Lb.	$	Lb.	$	Oz.	$	Oz.	$	Lb.	$	Lb.	$	$	$
Revelstoke	1964														
	1965														
	To date											7,784	5,687		185,244
Similkameen	1964														
	1965														
	To date							1,287	129,186						129,186
Skeena	1964														3,906,840
	1965														**3,453,264**
	To date	7,813	13,020									366	331	1,389[3]	11,259,455
Slocan	1964														316,820
	1965														**322,894**
	To date														4,098,861
Trail Creek	1964														
	1965														
	To date					749	30,462	53	3,177						35,774
Vancouver	1964														47,592
	1965														**5,560**
	To date														1,132,537
Vernon	1964														
	1965														
	To date	5,414	9,500												9,500
Victoria	1964														
	1965														
	To date														35,437
Not assigned	1964													533,897	3,929,436
	1965													**1,339,389**	**866,301**
	To date													6,983,754	63,331,553
Totals	1964	28,245	47,063	3,398,560	2,854,790					352,350	535,572			533,897	31,634,326
	1965	**7,289,125**	**12,405,344**	**3,322,000**	**2,790,480**					**377,207**	**735,554**			**1,339,389**	**40,983,186**
	To date	7,348,673	12,498,605	24,608,459	19,322,873	749	30,462	1,407	135,008	16,126,093	13,057,495	16,019,324	38,663,751	7,073,747	319,182,458

[1] Magnesium, page A 17. [2] Cobalt, page A 17. [3] Selenium, page A 18.

TABLE VIId.—PRODUCTION, 1964 AND 1965, AND TOTAL

Division	Period	Asbestos		Barite		Diatomite		Fluxes (Quartz and Limestone)		Granules, (Quartz, Limestone, and Granite)	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		Tons	$	Tons	$	Tons	$	Tons	$	Tons	$
Alberni	1964										
	1965										
	To date										
Atlin	1964										
	1965										
	To date										
Cariboo	1964					1,143	64,555				
	1965					**82**	**4,420**				
	To date					3,727	140,315			48	168
Clinton	1964										
	1965										
	To date										
Fort Steele	1964										
	1965										
	To date			8	80						
Golden	1964			10,588	119,370						
	1965			**17,466**	**182,931**			**3,259**	**12,612**		
	To date			230,380	2,765,829			3,259	12,612		
Greenwood	1964										
	1965										
	To date							1,790,502	1,540,319		
Kamloops	1964										
	1965										
	To date										
Liard	1964	67,460	11,714,494								
	1965	**85,851**	**14,491,195**								
	To date	502,459	99,701,032								
Lillooet	1964										
	1965										
	To date										
Nanaimo	1964							31,012	74,510		
	1965							**24,266**	**68,904**		
	To date							780,097	965,514		
Nelson	1964									3,418	76,956
	1965									**4,473**	**127,459**
	To date							7,601	8,174	12,484	303,416
New Westminster	1964									4,000	84,000
	1965									**6,260**	**98,995**
	To date									85,747	1,165,256
Nicola	1964										
	1965										
	To date										
Omineca	1964										
	1965										
	To date										
Osoyoos	1964							42,002	162,718	11,871	236,683
	1965							**31,700**	**158,500**	**18,300**	**221,500**
	To date							733,565	3,317,703	109,471	1,616,157
Similkameen	1964										
	1965										
	To date										
Skeena	1964										
	1965										
	To date							601,019	1,050,722		
Vancouver	1964										
	1965										
	To date									29,692	418,606
Vernon	1964										
	1965										
	To date										
Victoria	1964							7	70		
	1965							**6**	**60**		
	To date							96	1,205	9,605	157,080
Not assigned	1964										
	1965										
	To date										
Totals	1964	67,460	11,714,494	10,588	119,370	1,143	64,555	73,021	237,298	19,289	397,639
	1965	**85,851**	**14,491,195**	**17,466**	**182,931**	**82**	**4,420**	**59,231**	**240,076**	**29,033**	**447,954**
	To date	502,459	99,701,032	230,388	2,765,909	3,727	140,315	3,916,139	6,896,249	247,047	3,660,683

See notes on individual minerals listed alphabetically on pages A 16 to A 19.

1 Arsenious oxide.
2 Bentonite.
3 Fluorspar.
4 Hydromagnesite.
5 Iron oxide and ochre.
6 Magnesium sulphate.

TO DATE, BY MINING DIVISIONS—INDUSTRIAL MINERALS

Gypsum and Gypsite		Jade		Mica		Sulphur		Other, Value	Division Totals
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value		
Tons	$	Lb.	$	Lb.	$	Tons	$	$	$
								9,398[7]	9,398
								20,325[6]	20,325
									64,555
									4,420
				10,013,800	143,012			300[12]	283,795
873	6,236							156,191[4,6,10]	162,427
						70,963	855,100		855,100
						87,473	**1,054,050**		**1,054,050**
112,878	298,824					528,187	8,284,673	16,894[9]	8,600,471
188,303	581,873								701,243
207,858	**602,788**								**798,331**
1,488,361	4,326,937							1,276[5,11]	7,106,654
								783,578[3]	2,323,897
1,246,918	6,323,178			424,700	2,075			203,055[6,10]	6,528,308
						69,161	1,624,616		13,339,110
		2,000	**2,000**			**91,364**	**1,724,504**		**16,217,699**
		2,000	2,000			427,538	8,331,656		108,034,688
		10,337	11,404						11,404
		4,129	**5,249**						**5,249**
		222,452	89,143					5,129[11]	94,272
									74,510
									68,904
									965,514
									76,956
									127,459
								55,901[5]	367,491
									84,000
									98,995
									1,165,256
2,407	10,050								10,050
		1,200	2,400						2,400
		1,000	**2,000**						**2,000**
		2,200	4,400					11,460[1,8]	15,860
									399,401
									380,000
				1,588,800	25,938			295,547[1,3,6]	5,255,345
250	1,700							16,858[2]	18,558
						41,624	178,678		1,229,400
						270	810		810
						9,036	**110,063**		**110,063**
				634,250	10,815	642,772	6,048,381	97,389[5]	6,570,191
				160,500	3,978				3,978
									70
									60
								30,226[11]	188,511
						137,991	1,379,910		1,379,910
						154,000	**1,540,000**		**1,540,000**
						3,992,308	39,773,385		39,773,385
188,303	581,873	11,537	13,804			278,385	3,860,436		16,989,469
207,858	**602,788**	**7,129**	**9,249**			**341,873**	**4,428,617**		**20,407,230**
2,851,687	10,966,925	226,652	95,543	12,822,050	185,818	5,632,429	62,611,773	1,703,527	188,727,774

[7] Natro-alunite.
[8] Perlite.
[9] Phosphate rock.
[10] Sodium carbonate.
[11] Talc.
[12] Volcanic ash.

TABLE VIIe.—PRODUCTION, 1964 AND 1965, AND TOTAL

Division	Period	Cement	Lime and Limestone	Building-stone	Rubble, Riprap, and Crushed Rock	Sand and Gravel
		$	$	$	$	$
Alberni	1964				53,337	37,605
	1965				**15,635**	**105,724**
	To date				215,122	1,460,544
Atlin	1964					430
	1965					**2,584**
	To date		1,108		98,478	212,423
Cariboo	1964				50,113	323,072
	1965				**53,481**	**650,769**
	To date		7,500		1,110,355	6,508,648
Clinton	1964					31,834
	1965					**45,085**
	To date				1,606	186,241
Fort Steele	1964				12,065	55,545
	1965				**130,142**	**176,798**
	To date		43,873	71,941	1,441,980	4,084,960
Golden	1964					48,732
	1965			**2,000**		**168,472**
	To date		1,000	26,000	125,339	1,743,978
Greenwood	1964				1,000	25,116
	1965			**6,000**		**91,789**
	To date		42,560	36,500	171,319	584,825
Kamoops	1964				580,216	244,180
	1965				**185,558**	**486,789**
	To date		12,000	18,000	6,196,443	5,313,251
Liard	1964				3,000	258,181
	1965				**60,341**	**488,264**
	To date				97,006	3,337,960
Lillooet	1964				57,382	139,335
	1965				**80,576**	**236,620**
	To date		100	2,000	607,904	1,734,858
Nanaimo	1964		1,869,821		78,554	237,824
	1965		**2,234,790**	**87,000**	**267,921**	**399,030**
	To date		33,556,690	3,286,257	812,579	3,559,344
Nelson	1964			18,279	3,711	298,805
	1965			**23,975**	**2,600**	**77,526**
	To date		34,543	412,969	498,989	2,829,910
New Westminster	1964		116,857	6,664	209,009	3,759,293
	1965		**179,166**		**362,165**	**4,449,744**
	To date		1,771,984	20,974	9,673,047	39,458,050
Nicola	1964					5,259
	1965					**5,650**
	To date			8,000	133,341	425,716
Omineca	1964				26,477	316,319
	1965				**268,075**	**428,982**
	To date		3,077		957,673	4,217,985
Osoyoos	1964		714		1,040	62,550
	1965				**2,600**	**75,689**
	To date		33,784	14,850	153,247	1,172,773
Revelstoke	1964				8,527	66,135
	1965				**4,313**	**28,506**
	To date		1,000	5,575	343,966	1,141,829
Similkameen	1964				5,500	136,950
	1965				**14,925**	**94,525**
	To date	10,500	11,571	24,000	551,269	2,246,582
Skeena	1964		47,983		112,683	173,451
	1965		**49,685**		**371,837**	**256,164**
	To date		1,592,112	144,000	1,827,539	4,930,786
Slocan	1964				4,660	58,922
	1965				**7,185**	**28,109**
	To date		1,000	115,143	118,534	937,649
Trail Creek	1964				5,513	63,394
	1965		**4,500**		**651**	**90,458**
	To date		32,500	81,484	224,049	1,822,686
Vancouver	1964	4,626,619		579		1,525,486
	1965	**5,267,945**			**9,467**	**2,226,365**
	To date	27,750,955	40,885	4,011,360	7,508,388	30,293,595
Vernon	1964				5,412	92,950
	1965				**36,579**	**114,427**
	To date		46,499	81,052	242,009	2,571,843
Victoria	1964	5,414,157	19,820			615,627
	1965	**5,931,662**	**14,310**		**886**	**813,053**
	To date	115,822,304	860,492	45	457,299	15,929,549
Not assigned	1964				67,119	1,436,984
	1965				**63,151**	**1,145,837**
	To date		315,498	505,018	486,742	5,601,406
Totals	1964	10,040,776	2,055,195	25,522	1,285,318	10,013,970
	1965	**11,199,607**	**2,482,451**	**118975**	**1,938,088**	**12,686.959**
	To date	143,583,759	38,409,776	8,865,168	34,054,223	142,307,391

* *See* note under structural materials, page A 19.

TO DATE, BY MINING DIVISIONS—STRUCTURAL MATERIALS

Brick (Common)	Face, Paving, and Sewer Brick	Firebricks, Blocks	Clays	Structural Tile (Hollow Blocks), Roof Tile, Floor Tile	Drain Tile and Sewer Pipe	Pottery (Glazed or Unglazed)	Other Clay Products	Unclassified Material	Division Totals
$	$	$	$	$	$	$	$	$	$
									90,942
									121,359
									1,675,666
									430
									2,584
									312,009
									378,185
									704,250
1,193	184	4,651	15,807				22,042		7,670,380
									31,834
									45,085
									187,847
									67,610
									306,940
7,800							8,118		5,658,672
									48,732
							18,061		**188,553**
							31,735		1,928,052
									26,116
									97,789
114,361			6,922						956,487
									824,396
									672,347
72,379									11,612,073
									261,181
									548,605
									3,434,966
									196,717
									317,196
									2,344,862
									2,186,199
									2,988,741
1,104,295	38,939		35,758						42,393,862
									320,795
									104,101
19,110	2,864								3,798,385
49,826	60,594	811,572	38,585	31,017	1,071,324	13,322	469,541		6,637,614
27,662	**576,173**	**753,676**	**18,234**	**23,299**	**1,337,928**	**24,894**	**595,660**		**8,348,601**
1,808,435	6,048,791	14,402,659	970,449	2,933,087	14,947,265	404,125	2,717,358		95,156,224
									5,250
									5,650
									567,057
									342,796
									897,057
5,274									5,184,009
									64,304
									78,289
									1,374,654
									74,662
									32,819
									1,492,370
									142,450
									109,450
			1,363				11,992		2,857,277
									334,117
									877,686
			4,925				8,324		8,507,686
									63,582
									35,294
									1,172,326
									68,907
									95,609
									2,160,719
									6,152,684
									7,503,777
142,208	241,216	580,778	12,724			23,362	88,304		70,693,775
									98,362
									151,006
131,467	6,202	1,011	5	18,224	4,325		20		3,102,657
							462,367		6,511,971
							524,027		**7,283,938**
1,814,647	29,552	119,930	1,050	705,821	1,072,346	186,504	1,932,036		138,881,575
									1,504,103
									1,208,988
							3,180,828*	5,972,171*	16,061,663
49,826	60,594	811,572	38,585	31,017	1,071,324	13,332	931,908		26,428,939
27,662	**576,173**	**753,676**	**18,234**	**23,299**	**1,337,928**	**24,894**	**1,137,768**		**32,325,714**
5,221,169	6,367,748	15,109,029	1,049,003	3,657,132	16,023,936	563,991	8,000,757	5,972,171	429,185,253

TABLE VIIIA.—QUANTITY[1] AND VALUE OF COAL PER YEAR TO DATE

Year	Tons (2,000 Lb.)	Value	Year	Tons (2,000 Lb.)	Value
1836–59	41,871	$149,548	1914	2,237,042	$7,745,847
1860	15,956	56,988	1915	2,076,601	7,114,178
1861	15,427	55,096	1916	2,583,469	8,900,675
1862	20,292	72,472	1917	2,436,101	8,484,343
1863	23,906	85,380	1918	2,575,275	12,833,994
1864	32,068	115,528	1919	2,433,540	11,975,671
1865	36,757	131,276	1920	2,852,535	13,450,169
1866	28,129	100,460	1921	2,670,314	12,836,013
1867	34,988	124,956	1922	2,726,793	12,880,060
1868	49,286	176,020	1923	2,636,740	12,678,548
1869	40,098	143,208	1924	2,027,843	9,911,935
1870	33,424	119,372	1925	2,541,212	12,168,905
1871	55,458[2]	164,612	1926	2,406,094	11,650,180
1872	55,458[2]	164,612	1927	2,553,416	12,269,135
1873	55,459[2]	164,612	1928	2,680,608	12,633,510
1874	91,334	244,641	1929	2,375,060	11,256,260
1875	123,362	330,435	1930	1,994,493	9,435,650
1876	155,895	417,576	1931	1,765,471	7,684,155
1877	172,540	462,156	1932	1,614,629	6,523,644
1878	191,348	522,538	1933	1,377,177	5,375,171
1879	270,257	723,903	1934	1,430,042	5,725,133
1880	299,708	802,785	1935	1,278,380	5,048,864
1881	255,760	685,171	1936	1,352,301	5,722,502
1882	315,997	846,417	1937	1,446,243	6,139,920
1883	238,895	639,897	1938	1,388,507	5,565,069
1884	441,358	1,182,210	1939	1,561,084	6,280,956
1885	409,468	1,096,788	1940	1,662,027	7,088,265
1886	365,832	979,908	1941	1,844,745	7,660,000
1887	462,964	1,240,080	1942	1,996,000	8,237,172
1888	548,017	1,467,903	1943	1,854,749	7,742,030
1889	649,411	1,739,490	1944	1,931,950	8,217,966
1890	759,518	2,034,420	1945	1,523,021	6,454,360
1891	1,152,590	3,087,291	1946	1,439,092	6,732,470
1892	925,495	2,479,005	1947	1,696,350	8,680,440
1893	1,095,690	2,934,882	1948	1,604,480	9,765,395
1894	1,134,509	3,038,859	1949	1,621,268	10,549,924
1895	1,052,412	2,824,687	1950	1,574,006	10,119,303
1896	1,002,268	2,693,961	1951	1,573,572	10,169,617
1897	999,372	2,734,522	1952	1,402,313	9,729,739
1898	1,263,272	3,582,595	1953	1,384,138	9,528,279
1899	1,435,314	4,126,803	1954	1,308,284	9,154,544
1900	1,781,000	4,744,530	1955	1,332,874	8,986,501
1901	1,894,544	5,016,398	1956	1,417,209	9,346,518
1902	1,838,621	4,832,257	1957	1,085,657	7,340,339
1903	1,624,742	4,332,297	1958	796,413	5,937,860
1904	1,887,981	4,953,024	1959	690,011	5,472,064
1905	2,044,931	5,511,861	1960	788,658	5,242,223
1906	2,126,965	5,548,044	1961	919,142	6,802,134
1907	2,485,961	7,637,713	1962	825,339	6,133,986
1908	2,362,514	7,356,866	1963	850,541	6,237,997
1909	2,688,672	8,574,884	1964	911,326	6,327,678
1910	3,314,749	11,108,335	1965	950,763	6,713,590
1911	2,541,698	8,071,747			
1912	3,211,907	10,786,812	Totals	138,873,881	$589,076,172
1913	2,713,535	9,197,460			

[1] Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. For 1910 and subsequent years the quantity is that sold and used.

[2] Estimated breakdown of previously combined figure for three years.

Table VIIIb.—Quantity[1] and Value of Coal Sold and Used[2]

Mining Division and Period	Total Sales	Used under Company Boilers	Used in Making Coke	Total Sold and Used	
	Tons	Tons	Tons	Tons	$
Cariboo—					
Total to 1950	257	33		290	1,100
Total to date	257	33		290	1,100
Fort Steele—					
Total to 1950	31,287,472	2,006,789	9,704,778	42,999,039	166,468,348
1951–60	7,014,784	145,624	2,195,744	9,356,152	58,606,978
1961	619,828	14,698	200,190	834,716	5,979,805
1962	532,289	10,788	191,454	734,531	5,255,540
1963	557,939	17,089	191,879	766,907	5,454,401
1964	639,265	17,452	189,342	846,059	5,668,799
1965	692,535	15,314	205,929	913,778	6,305,280
Total to date	41,344,112	2,227,754	12,879,316	56,451,182	253,739,151
Kamloops—					
Total to 1950	14,348	739		15,087	59,765
Total to date	14,348	739		15,087	59,765
Liard—					
Total to 1950	58,417	266		58,683	325,395
1951–60	36,083	20		36,103	333,461
1961	2,062			2,062	17,000
1962	1,389			1,389	12,501
1963	1,146			1,146	10,414
1964	50			50	750
Total to date	99,147	286		99,433	699,521
Nanaimo—					
Total to 1950	67,181,037	4,280,602	558,985	72,020,624	278,647,173
1951–60	1,951,075	11,071		1,962,146	19,134,499
1961	76,009			76,009	736,814
1962	83,534			83,534	801,294
1963	76,728			76,728	711,085
1964	58,382			58,382	588,622
1965	31,085			31,085	349,310
Total to date	69,457,850	4,291,673	558,985	74,308,508	300,968,797
Nicola—					
Total to 1950	2,731,340	188,884		2,920,224	10,985,359
1951–60	9,016			9,016	91,725
1961	159			159	1,717
1962	125			125	1,375
1963	60			60	660
Total to date	2,740,700	188,884		2,929,584	11,080,836
Omineca—					
Total to 1950	214,126	4,095		218,221	1,034,134
1951–60	202,931			202,931	1,616,775
1961	5,850			5,850	64,024
1962	5,760			5,760	63,276
1963	5,700			5,700	61,437
1964	6,835			6,835	69,507
1965	5,900			5,900	59,000
Total to date	447,102	4,095		451,197	2,968,153
Osoyoos—					
Total to 1950	1,122			1,122	5,008
Total to date	1,122			1,122	5,008
Similkameen—					
Total to 1950	4,055,080	349,235		4,404,315	18,426,725
1951–60	212,781			212,781	1,124,226
1961	346			346	2,774
Total to date	4,268,207	349,235		4,617,442	19,553,725
Skeena—					
Total to 1950	36			36	116
Total to date	36			36	116
Provincial totals—					
Total to 1950	105,543,235	6,830,643	10,263,763	122,637,641	475,953,123
1951–60	9,426,670	156,715	2,195,744	11,779,129	80,907,664
1961	704,254	14,698	200,190	919,142	6,802,134
1962	623,097	10,788	191,454	825,339	6,133,986
1963	641,573	17,089	191,879	850,541	6,237,997
1964	704,532	17,452	189,342	911,326	6,327,678
1965	729,520	15,314	205,929	950,763	6,713,590
Total to date	118,372,881	7,062,699	13,438,301	138,873,881	589,076,172

[1] For differences between gross mine output and coal sold refer to table " Production and Distribution by Collieries and by Districts " in section headed " Coal " or " Coal-mining " in this and preceding Annual Reports.

[2] The totals " sold and used " include:—
Sales to retail and wholesale dealers, industrial users, and company employees.
Coal used in company boilers, including steam locomotives.
Coal used in making coke.

TABLE IX.—COKE AND BY-PRODUCTS FOR YEARS 1895 TO 1925 AND BY YEARS 1926 TO 1965

Year	Coal Used in Making Coke		Coke Made in Bee-hive Ovens		Coke Made in By-product Ovens		Coke Made in Gas Plants		Total Coke Made		Gas Sold and Used	Tar Produced	Other By-products[1]	Total Production Value of Coke Industry
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value				
	Tons	$	Tons	$	Tons	$	Tons	$	Tons	$	$	$	$	$
1895–1925	7,955,795	25,673,600	4,920,457	25,673,600	—	—	—	—	4,920,457	25,673,600	—	—	—	25,673,600
1926	299,839	1,338,565	105,227	795,841	42,209	244,469	42,468	221,600	189,904	1,261,910	1,009,613	50,035	45,772	2,367,330
1927	269,482	1,290,760	95,281	595,504	35,900	327,215	39,464	178,682	170,645	1,101,401	1,222,379	44,402	18,080	2,386.262
1928	210,207	940,668	68,734	429,590	32,322	263,781	41,711	187,882	142,767	881,253	1,313,407	45,313	14,036	2,254.009
1929	226,363	950,243	75,426	574,279	33,339	308,867	46,573	214,732	155,338	1,097,878	1,461,445	61,084	39,203	2,659,610
1930	225,325	1,002,684	73,708	558,801	31,904	298,004	45,751	232,917	151,363	1,089,722	1,547,092	65,770	11,935	2,714,519
1931	211,334	924,279	73,248	548,550	27,717	236,537	41,836	210,470	142,801	995,557	1,541,454	66,506	32,603	2,636,120
1932	151,750	710,432	33,090	247,615	25,436	217,221	44,645	237,174	103,171	702,010	1,589,656	54,771	14,109	2,360,546
1933	107,400	554,152	6,097	44,813	24,263	213,750	34,156	214,454	64,516	473,017	1,473,433	45,610	3,666	1,995,726
1934	141,384	571,167	24,840	154,105	23,512	213,653	51,184	198,217	99,536	565,975	1,439,287	43,939	4,756	2,053,957
1935	127,776	494,492	27,066	160,565	14,911	109,684	46,111	160,694	88,088	430,943	1,430,057	44,876	3,081	1,908,957
1936	125,810	436,595	34,009	191,843	—	—	48,859	138,787	82,868	330,630	1,422,783	38,872	—	1,792,285
1937	166,124	570,250	48,393	277,726	—	—	59,141	330,821	107,534	608,547	1,746,047	46,698	—	2,401,292
1938	176,877	623,649	54,602	315,294	—	—	58,643	345,790	113,245	661,084	1,770,839	44,324	—	2,476,247
1939	171,242	569,945	50,153	286,491	7,196	37,015	55,395	325,435	112,744	648,941	1,768,977	44,108	—	2,462,026
1940	184,160	577,706	37,845	220,211	29,124	151,931	60,726	303,421	127,695	675,563	1,810,083	54,379	3,060	2,543,085
1941	235,809	717,584	64,707	392,473	86,656	467,440	8,378	43,758	159,741	903,671	1,925,270	63,569	1,716	2,894,226
1942	255,862	866,795	66,824	439,464	96,428	608,521	6,528	54,307	169,780	1,102,292	2,165,888	86,113	22,028	3,376,321
1943	260,334	983,910	42,766	291,843	43,895	274,402	93,714	647,482	180,375	1,213,727	2,453,592	96,249	18,321	3,781,889
1944	212,883	1,439,891	36,966	301,201	47,401	347,245	88,430	565,393	172,797	1,213,839	2,562,610	56,476	19,046	3,851,971
1945	230,868	1,211,584	13,464	117,369	59,098	434,876	91,682	577,479	164,244	1,129,724	2,721,690	83,828	20,756	3,955,998
1946	251,954	1,441,415	20,542	178,556	53,525	423,025	101,094	648,297	175,161	1,249,878	3,079,009	88,947	53,097	4,470,931
1947	284,049	1,682,602	44,517	427,330	59,638	531,114	91,755	579,635	195,910	1,538,079	3,390,713	124,885	25,780	5,079,457
1948	235,297	1,440,415	47,461	559,735	57,112	630,390	57,678	455,096	162,251	1,645,221	4,520,886	153,130	19,489	6,338,726
1949	323,899	1,979,138	66,407	690,045	89,268	1,018,288	67,449	496,933	223,124	2,205,266	4,148,124	194,728	27,406	6,575,524
1950	333,955	2,027,470	23,703	269,728	127,477	997,200	92,704	686,871	243,884	1,953,799	4,298,161	277,138	27,044	6,556,142
1951	332,416	1,949,117	32,598	387,796	138,051	1,552,764	72,215	571,161	242,864	2,511,721	4,263,754	277,786	22,132	7,075,393
1952	323,922	1,972,918	35,110	440,756	142,156	1,729,924	64,906	525,384	242,172	2,696,064	4,625,747	252,070	25,639	7,599,520
1953	310,431	2,005,551	—	—	177,790	2,090,147	60,407	525,411	238,197	2,615,558	4,857,116	238,771	21,046	7,732,491
1954	302,052	2,052,641	—	—	168,982	2,032,902	67,108	566,660	236,090	2,599,562	5,113,334	226,824	20,586	7,960,306
1955	314,994	2,122,303	—	—	177,031	2,180,516	70,387	594,482	247,418	2,774,998	5,407,842	292,984	18,369	8,494,193
1956	328,805	2,277,402	—	—	180,263	2,270,167	78,185	738,292	258,448	3,008,459	5,145,851	287,437	20,961	8,462,708
1957	199,654	1,284,833	—	—	153,493	2,005,570	—	—	153,493	2,005,570	14,600	121,849	—	2,142,019
1958	224,158	1,420,328	—	—	173,920	2,253,102	—	—	173,920	2,253,102	14,600	97,803	—	2,365,505
1959	173,227	1,135,222	—	—	134,134	1,789,906	—	—	134,134	1,789,906	14,600	76,891	—	1,881,397
1960	186,960	1,124,760	—	—	139,040	1,948,370	—	—	139,040	1,948,370	—	108,360	—	2,056,730
1961	200,190	1,201,140	—	—	153,843	2,232,690	—	—	153,843	2,232,690	—	115,291	—	2,347,981
1962	191,454	1,196,588	—	—	152,885	2,171,128	—	—	152,885	2,171,128	—	116,499	—	2,287,627
1963	191,879	1,247,214	—	—	154,844	2,203,689	—	—	154,844	2,203,689	—	120,468	—	2,324,157
1964	189,342	1,183,387	—	—	149,759	2,134,792	—	—	149,759	2,134,792	—	152,423	—	2,287,215
1965	205,929	1,338,539	—	—	167,271	2,478,575	—	—	167,271	2,478,575	—	127,466	—	2,606,041
Totals	17,051,191	74,531,934	6,223,241	35,571,124	3,411,793	39,428,870	1,829,283	11,777,717	11,463,414	86,777,711	83,269,939	4,588,672	553,717	175,190,039

[1] "Other by-products" total includes ammonium sulphate, $52,492; ammonia liquor, $103,850; light oils, $16,571; motor fuel, $7,009; naphthalene, $4,077; creosote, $34; benzol (thinning), $312; solvent naphtha, $644; cinders, $344,682; pitch, $5,131; sulphuric acid, $6,658; tar-paint, $2,330; and miscellaneous, $10.827.

Table X.—Dividends Paid by Mining Companies, 1897–1965

Dividends Paid during 1964 and 1965

	1964	1965
Bralorne Pioneer Mines Ltd.	$645,740	$646,050
Brynnor Mines Ltd.	3,220,000	6,220,000
Cassiar Asbestos Corporation Ltd.	2,376,000	2,748,750
Craigmont Mines Ltd.	5,139,166	3,807,956
Consolidated Mining and Smelting Co. of Canada, Ltd.	26,453,906	30,036,524
Crows Nest Industries Ltd.	582,878	583,865
Giant Mascot Mines Ltd.	279,018	140,429
Sheep Creek Mines Ltd.	225,600	151,240
Others	5,000	3,310
Totals	$38,927,308	$44,338,124

Dividends Paid Yearly, 1917 to 1965, Inclusive

Year	Amount Paid	Year	Amount Paid
1917	$3,269,494	1943	$11,860,159
1918	2,704,469	1944	11,367,732
1919	2,494,283	1945	10,487,395
1920	1,870,296	1946	15,566,047
1921	736,629	1947	27,940,213
1922	3,174,756	1948	37,672,319
1923	2,983,570	1949	33,651,096
1924	2,977,276	1950	34,399,330
1925	5,853,419	1951	40,921,238
1926	8,011,137	1952	32,603,956
1927	8,816,681	1953	22,323,089
1928	9,572,536	1954	25,368,262
1929	11,263,118	1955	35,071,583
1930	10,543,500	1956	36,262,682
1931	4,650,857	1957	24,247,420
1932	2,786,958	1958	14,996,123
1933	2,471,735	1959	16,444,281
1934	4,745,905	1960	20,595,943
1935	7,386,070	1961	20,720,239
1936	10,513,705	1962	24,394,297
1937	15,085,293	1963	30,213,090
1938	12,068,875	1964	38,927,308
1939	11,865,698	1965	44,338,124
1940	14,595,530		
1941	16,598,110	Total	$781,038,921
1942	13,627,104		

TABLE X.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1965—*Continued*

Lode-gold Mines[1]

Company or Mine	Locality	Class	Amount Paid
Arlington	Erie	Gold	$94,872
Athabasca	Nelson	Gold	25,000
Bayonne	Tye Siding	Gold	25,000
Bralorne Mines Ltd.[2]	Bridge River	Gold	17,759,500
Bralorne Pioneer Mines Ltd.[2]	Bridge River	Gold	4,464,955
Belmont-Surf Inlet	Princess Royal Island	Gold	1,437,500
Cariboo Gold Quartz Mining Co. Ltd.	Wells	Gold	1,679,976
Cariboo-McKinney Con. M. & M. Co.	Camp McKinney	Gold	565,588
Canadian Pacific Exploration (Porto Rico)	Nelson	Gold	37,500
Centre Star	Rossland	Gold-copper	472,255
Fairview Amalgamated	Oliver	Gold	5,254
Fern Gold Mining & Milling Co. Ltd.	Nelson	Gold	9,375
Gold Belt Mining Co. Ltd.	Sheep Creek	Gold	668,595[3]
Goodenough (leasers)	Ymir	Gold	13,731
Hedley Mascot Gold Mines Ltd.	Hedley	Gold	1,290,553
Island Mountain Mines Ltd.	Wells	Gold	2,491,236[3]
I.X.L.	Rossland	Gold	134,025
Jewel-Denero	Greenwood	Gold	11,751
Kelowna Exploration Co. Ltd. (Nickel Plate)	Hedley	Gold	2,040,000
Kelowna Mines Hedley Ltd.	Hedley	Gold	780,000[4]
Kootenay Belle Gold Mines Ltd.	Sheep Creek	Gold	357,856
Le Roi Mining Co.	Rossland	Gold-copper	1,475,000
Le Roi No. 2 Ltd.	Rossland	Gold-copper	1,574,640
Lorne (later Bralorne)	Bridge River	Gold	20,450
Motherlode	Sheep Creek	Gold	163,500
Mount Zeballos Gold Mines Ltd.	Zeballos	Gold	165,000
Nickel Plate (Hedley Gold Mining Co. Ltd.)	Hedley	Gold	3,423,191
Pioneer Gold Mines of B.C. Ltd.[2]	Bridge River	Gold	10,048,914
Poorman	Nelson	Gold	25,000
Premier Gold Mining Co. Ltd.	Premier	Gold	18,858,075[5]
Privateer Mine Ltd.	Zeballos	Gold	1,914,183
Queen (prior to Sheep Creek Gold Mines Ltd.)	Sheep Creek	Gold	98,674
Relief Arlington Mines Ltd. (Second Relief)	Erie	Gold	308,000[3]
Reno Gold Mines Ltd.	Sheep Creek	Gold	1,433,640[3]
Sheep Creek Gold Mines Ltd.[6]	Sheep Creek	Gold	3,796,875[7]
Silbak Premier Mines Ltd.	Premier	Gold	2,425,000[5]
Spud Valley Gold Mines Ltd.	Zeballos	Gold	168,000
Sunset No. 2	Rossland	Gold-copper	115,007
Surf Inlet Consolidated Gold Mines Ltd.	Surf Inlet	Gold	120,279
War Eagle	Rossland	Gold-copper	1,245,250
Ymir Gold	Ymir	Gold	300,000
Ymir Yankee Girl	Ymir	Gold	415,002[3]
Miscellaneous mines		Gold	108,623
Total, lode-gold mines			$82,566,825

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

[2] Early in 1959 Bralorne Mines Ltd. and Pioneer Gold Mines of B.C. Ltd. were merged under the name of Bralorne Pioneer Mines Ltd., and dividend payments for 1959 and subsequent years are entered under the new company listing.

[3] Includes "return of capital" and "liquidating" payments.

[4] Former Kelowna Exploration Company Limited; changed January, 1951.

[5] Up to and including 1936, dividends paid by Premier Gold Mining Company Limited were derived from operations of the company in British Columbia. Subsequent dividends paid by Premier Gold Mining Company Limited have been derived from the operations of subsidiary companies in British Columbia and elsewhere and are not included in the figure given. In 1936, Silbak Premier, a subsidiary of Premier Gold Mining Company, took over the former gold operations of that company in British Columbia. Dividends paid by Silbak Premier are given above.

[6] In March, 1956, the company name became Sheep Creek Mines Limited, and in September, 1965, it became Aetna Investment Corporation Limited.

[7] In several years, preceding 1953, company revenue included profits from operations of the Lucky Jim zinc-lead mine.

TABLE X.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1965—*Continued*

Silver-Lead-Zinc Mines

Company or Mine	Locality	Class	Amount Paid
Antoine	Rambler	Silver-lead-zinc	$10,000
Base Metals Mining Corporation Ltd. (Monarch and Kicking Horse)	Field	Silver-lead-zinc	586,143[1]
Beaverdell-Wellington	Beaverdell	Silver-lead-zinc	97,200
Beaver Silver Mines Ltd.	Greenwood	Silver-lead-zinc	48,000
Bell	Beaverdell	Silver-lead-zinc	388,297
Bosun (Rosebery-Surprise)	New Denver	Silver-lead-zinc	25,000
Canadian Exploration Ltd.	Salmo	Silver-lead-zinc	11,175,400
Capella	New Denver	Silver-lead-zinc	5,500
Consolidated Mining and Smelting Co. of Canada, Ltd.	Trail	Silver-lead-zinc	610,464,803[2]
Couverapee	Field	Silver-lead-zinc	5,203
Duthie Mines Ltd.	Smithers	Silver-lead-zinc	50,000
Florence Silver	Ainsworth	Silver-lead-zinc	35,393
Giant Mascot Mines Ltd.	Spillimacheen	Silver-lead-zinc	179,263
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	2,111,840
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	213,000
Lone Bachelor	Sandon	Silver-lead-zinc	50,000
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	70,500
Mountain Con	Cody	Silver-lead-zinc	71,387
McAllister	Three Forks	Silver-lead-zinc	45,088
Noble Five	Cody	Silver-lead-zinc	72,859
North Star	Kimberley	Silver-lead-zinc	497,901
No. One	Sandon	Silver-lead-zinc	6,754
Ottawa	Slocan City	Silver-lead-zinc	110,429
Payne	Sandon	Silver-lead-zinc	1,438,000
Providence	Greenwood	Silver-lead-zinc	142,238[3]
Queen Bess	Alamo	Silver-lead-zinc	25,000
Rambler-Cariboo	Rambler	Silver-lead-zinc	467,250
Reeves MacDonald Mines Ltd.	Remac	Silver-lead-zinc	4,033,050
Reco	Cody	Silver-lead-zinc	334,992
Ruth Mines Ltd.	Sandon	Silver-lead-zinc	125,490
St. Eugene	Moyie	Silver-lead-zinc	566,000
Sheep Creek Mines Ltd.	Invermere	Silver-lead-zinc	1,239,340
Silversmith and Slocan Star[4]	Sandon	Silver-lead-zinc	1,267,600
Silver Standard Mines Ltd.	Hazelton	Silver-lead-zinc	1,715,333
Spokane-Trinket	Ainsworth	Silver-lead-zinc	10,365
Standard Silver Lead	Silverton	Silver-lead-zinc	2,734,688
Sunset and Trade Dollar	Retallack	Silver-lead-zinc	88,000
Sunshine Lardeau Mines Ltd.	Beaton	Silver-lead-zinc	164,000
Torbrit Silver Mines Ltd.	Alice Arm	Silver-lead-zinc	390,000
Utica	Kaslo	Silver-lead-zinc	64,000
Violamac Mines (B.C.) Ltd.	New Denver	Silver-lead-zinc	850,000
Wallace Mines Ltd. (Sally)	Beaverdell	Silver-lead-zinc	135,000
Washington	Rambler Station	Silver-lead-zinc	20,000
Western Exploration Co. Ltd.	Silverton	Silver-lead-zinc	30,867
Whitewater	Retallack	Silver-lead-zinc	592,515
Yale Lead and Zinc Mines Ltd.	Ainsworth	Silver-lead-zinc	278,620
Miscellaneous mines			70,239
Total, silver-lead-zinc mines			$643,831,840

[1] Includes $466,143 " return of capital " distribution prior to 1949.
[2] Earnings of several company mines, and custom smelter at Trail.
[3] Includes $10,504 paid in 1944 but not included in the yearly figure.
[4] These two properties were amalgamated as Silversmith Mines Limited in August, 1939.

TABLE X.—DIVIDENDS PAID BY MINING COMPANIES, 1897–1965—*Continued*

Copper Mines

Company or Mine	Locality	Class	Amount Paid
Britannia M. & S. Co.[1]	Britannia Beach	Copper	$18,803,772
Canada Copper Corp.	Greenwood	Copper	615,399
Cornell	Texada Island	Copper	8,500
Craigmont Mines Ltd.	Merritt	Copper	13,925,574
Granby Cons. M. S. & P. Co.[2]	Phoenix, Anyox, Copper Mountain	Copper	29,873,226
Marble Bay	Texada Island	Copper	175,000
Hall Mines	Nelson	Copper	233,280
Miscellaneous mines		Copper	261,470
Total, copper mines			$63,896,221

[1] The Britannia Mining and Smelting Co. Limited, a wholly owned subsidiary of the Howe Sound Company (Maine), paid the dividends shown to its parent company. On June 30, 1958, consolidation between the Howe Sound Company (Maine) and Haile Mines Inc. became effective, bringing into existence Howe Sound Company (Delaware). The Britannia mine became a division of the new Howe Sound Company, and in August Britannia Mining and Smelting Co. was liquidated voluntarily. In January, 1963, the Britannia mine was purchased by The Anaconda Company (Canada) Ltd.

[2] The Granby Consolidated Mining Smelting and Power Company dividends commenced in 1904 and cover all company activities in British Columbia to date. The figure includes all dividends, capital distributions, and interim liquidating payments, the latter being $4,500,000 paid, in 1936, prior to reorganization.

Coal Mines

Wellington Collieries Ltd.	Nanaimo	Coal	$16,000,000
Bulkley Valley Collieries Ltd.	Telkwa	Coal	24,000
Crows Nest Industries Ltd.	Fernie	Coal	20,286,342
Canadian Collieries Resources Ltd.	Nanaimo	Coal	828,271
Unsworth & Dunn	Nanaimo	Coal	7,065
Total, coal mines			$37,145,678

Iron Mines

Brynnor Mines Ltd.	Kennedy Lake	Iron	$9,440,000
Nimpkish Iron Mines Ltd.	Beaver Cove	Iron	1,616,750
Total, iron mines			$11,056,750

Asbestos Mines

Cassiar Asbestos Corp. Ltd.	Cassiar	Asbestos	$17,368,750

Aggregate of All Classes

Lode-gold mining	$82,566,825
Silver-lead-zinc mining and smelting	643,831,840
Copper-mining	63,896,221
Coal-mining	37,145,678
Iron-mining	11,056,750
Asbestos-mining	17,368,750
Miscellaneous, structural, and placer gold	7,799,073
Total	$863,665,137

NOTE.—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 XI.—PRINCIPAL ITEMS OF EXPENDITURE, REPORTED FOR OPERATIONS OF ALL CLASSES

Class	Salaries and Wages	Fuel and Electricity[1]	Process Supplies[1 2]
Lode-mining[3]	$59,699,328	$7,597,851	$25,925,734
Placer-mining	12,220	....	....
Fuel—coal, coke, and gas plant	2,921,692	319,002	20,159
„ petroleum and natural gas	3,435,769	....	....
Industrial minerals	3,679,036	1,079,993	2,823,096
Structural-materials industry	5,190,691	2,507,497	1,821,642
Totals, 1965	**$74,938,736**	**$11,504,343**	**$30,590,831**
Totals, 1964	63,624,559	10,205,861	27,629,953
1963	57,939,294	10,546,806	12,923,325
1962	55,522,171	9,505,559	14,024,799
1961	50,887,275	8,907,034	17,787,127
1960	52,694,818	7,834,728	21,496,912
1959	49,961,996	7,677,321	17,371,638
1958	48,933,560	8,080,989	15,053,036
1957	56,409,056	8,937,567	24,257,177
1956	57,266,026	9,762,777	22,036,839
1955	51,890,246	9,144,034	21,131,572
1954	48,702,746	7,128,669	19,654,724
1953	55,543,490	8,668,099	20,979,411
1952	62,256,631	8,557,845	27,024,500
1951	52,607,171	7,283,051	24,724,101
1950	42,738,035	6,775,998	17,500,663
1949	41,023,786	7,206,637	17,884,408
1948	38,813,506	6,139,470	11,532,121
1947	32,160,338	5,319,470	13,068,948
1946	26,190,200	5,427,458	8,367,705
1945	22,620,975	7,239,726	5,756,628
1944	23,131,874	5,788,671	6,138,084
1943	26,051,467	7,432,585	6,572,317
1942	26,913,160	7,066,109	6,863,398
1941	26,050,491	3,776,747	7,260,441
1940	23,391,330	3,474,721	6,962,162
1939	22,357,035	3,266,000	6,714,347
1938	22,765,711	3,396,106	6,544,500
1937	21,349,690	3,066,311	6,845,330
1936	17,887,619	2,724,144	4,434,501
1935	16,753,367	2,619,639	4,552,730
Grand totals, 1935–65	$1,269,376,359	$214,464,173	$453,684,028

[1] In some cases prior to 1964 this detail is not available and is included in a total that contains expenditures on fixed assets plus cost of goods, materials, and supplies not chargeable to fixed assets.

[2] In previous years designated as "process supplies (except fuel)—explosives, flux, chemicals, drill steel, oxygen, acetylene, diamonds, etc." The forms used in collecting data for all minerals excepting fuels and sulphur, beginning with 1964, read: "Process, operating, maintenance and repair supplies . . . used in the mine/mill operations; that is, explosives, chemicals, drill steel, bits, lubricants, electrical, etc., . . . not charged to Fixed Assets Account . . . provisions and supplies sold in any company operated cafeteria or commissary." The amount shown by 1964 returns is substantially greater than for any previous year, and because of the difference in specification is not comparable.

[3] Prior to 1962 this included data related to the principal lode metals as detailed in Table 1. The lode metals classed as miscellaneous metals in Table I were previously included under the heading "Miscellaneous Metals and Industrial Minerals."

TABLE XII.—AVERAGE NUMBER EMPLOYED IN THE MINING INDUSTRY,[1] 1901–65

Year	Placer-mining	Lode-mining			In Concentrators	In Smelters	Coal-mining			Structural Materials		Industrial	Total[2]
		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	536	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
1938	1,303	3,849	2,266	6,115	919	3,158	2,088	874	2,962	900	295	369	16,021
1939	1,252	3,905	2,050	5,955	996	3,187	2,167	809	2,976	652	311	561	15,890
1940	1,004	3,923	2,104	6,027	1,048	2,944	2,175	699	2,874	827	334	647	15,705
1941	939	3,901	1,823	5,724	1,025	3,072	2,229	494	2,723	766	413	422	15,084
1942	489	2,920	1,504	4,424	960	3,555	1,892	468	2,360	842	378	262	13,270
1943	212	2,394	1,699	4,093	891	2,835	2,240	611	2,851	673	326	567	12,448
1944	255	1,896	1,825	3,721	849	2,981	2,150	689	2,839	690	351	628	12,314
1945	209	1,933	1,750	3,683	822	2,834	1,927	503	2,430	921	335	586	11,820
1946	347	1,918	1,817	3,735	672	2,813	1,773	532	2,305	827	555	679	11,933
1947	360	3,024	2,238	5,262	960	3,461	1,694	731	2,425	977	585	869	14,899
1948	348	3,143	2,429	5,572	1,126	3,884	1,594	872	2,466	1,591	656	754	16,397
1949	303	3,034	2,724	5,758	1,203	3,763	1,761	545	2,306	2,120	542	626	16,621
1950	327	3,399	2,415	5,814	1,259	3,759	1,745	516	2,261	1,916	616	660	16,612
1951	205	3,785	3,695	7,480	1,307	4,044	1,462	463	1,925	1,783	628	491	17,863
1952	230	4,171	3,923	8,094	1,516	4,120	1,280	401	1,681	1,530	557	529	18,257
1953	132	3,145	2,589	5,734	1,371	3,901	1,154	396	1,550	1,909	559	634	15,790
1954	199	2,644	2,520	5,164	1,129	3,119	1,076	358	1,434	1,861	638	584	14,128
1955	103	2,564	2,553	5,117	1,091	3,304	1,100	378	1,478	1,646	641	722	14,102
1956	105	2,637	2,827	5,464	1,043	3,339	968	398	1,366	1,598	770	854	14,539
1957	67	2,393	2,447	4,840	838	3,328	1,020	360	1,380	1,705	625	474	13,257
1958	75	1,919	1,809	3,728	625	3,081	826	260	1,086	1,483	677	446	11,201
1959	99	1,937	1,761	3,698	618	3,008	765	291	1,056	1,357	484	459	10,779
1960	86	1,782	1,959	3,741	648	3,034	894	288	1,182	1,704	557	589	11,541
1961	74	1,785	1,582	3,367	626	3,118	705	237	942	1,828	508	571	11,034
1962	35	1,684	2,238	3,922	950	3,356	548	228	776	1,523	481	517	11,560
1963	[3] 43	1,752	2,423	4,175	850	3,239	501	247	748	909	460	528	10,952
1964	5	1,839	2,739	4,578	822	3,281	446	267	713	1,293	444	509	11,645
1965	**2**	**1,752**	**2,805**	**4,557**	**965**	**3,529**	**405**	**244**	**649**	**1,079**	**422**	**639**	**11,842**

[1] Mining industry includes all branches of the mineral industry except petroleum and natural gas.

[2] The average number employed in the industry is the sum of the averages for individual companies. The average for each company is obtained by taking the sum of the numbers employed each month and dividing by 12, regardless of the number of months worked.

[3] Includes estimated employment of 6 at Germansen Mines Ltd. and 35 at Wingdam and Lightning Creek Mining Co. Ltd.

Table XIII.—Lode-metal Mines—Tonnage, Number of Mines, Net and Gross Value,[1] 1901–65

Year	Tonnage[2]	Number of Shipping Mines	Number of Mines Shipping over 100 Tons	Gross Value as reported by Shippers[3]	Freight and Treatment[3]	Net Value to Shipper[4]	Value of Copper, Lead and Zinc[1]	Gross Value of Metals Produced[1] (Excluding Placer)
				$	$	$	$	$
1901	926,162	119	78	......	......	......	6,457,149	13,288,355
1902	1,009,016	124	75	......	......	......	4,275,123	11,090,421
1903	1,288,466	125	74	......	......	......	5,237,622	11,579,663
1904	1,461,609	142	76	......	......	......	5,999,911	12,309,455
1905	1,706,679	146	79	......	......	......	8,414,444	15,319,865
1906	1,963,872	154	77	......	......	......	10,973,243	17,501,202
1907	1,805,614	147	72	......	......	......	10,504,102	16,273,305
1908	2,083,606	108	59	......	......	......	7,972,344	14,580,991
1909	2,057,713	89	52	......	......	......	8,027,781	14,191,141
1910	2,216,428	83	50	......	......	......	6,450,335	13,228,731
1911	1,770,755	80	45	......	......	......	5,770,257	11,454,062
1912	2,688,532	86	51	......	......	......	10,530,279	17,662,766
1913	2,663,809	110	58	......	......	......	9,594,742	17,191,432
1914	2,175,971	98	56	......	......	......	8,239,321	15,225,727
1915	2,720,669	132	59	......	......	......	13,235,224	19,995,212
1916	3,229,942	169	81	......	......	......	24,835,941	31,512,148
1917	2,797,368	193	87	......	......	......	22,155,535	26,803,934
1918	2,912,516	175	80	......	......	......	20,970,596	27,637,302
1919	2,146,920	144	74	......	......	......	13,007,180	19,771,717
1920	2,215,445	121	60	......	......	......	13,726,993	19,465,932
1921	1,586,428	80	35	......	......	......	8,525,043	12,927,217
1922	1,592,163	98	33	......	......	......	10,587,382	19,236,601
1923	2,447,672	77	28	......	......	......	17,923,939	25,349,215
1924	3,413,912	86	37	......	......	......	25,125,528	35,538,816
1925	3,849,269	102	40	......	......	......	36,578,048	46,200,650
1926	4,775,327	138	55	......	......	38,558,613	40,668,566	51,512,289
1927	5,416,411	132	52	......	......	27,750,364	35,395,438	44,978,042
1928	6,241,672	110	49	......	......	29,070,075	38,211,267	48,496,950
1929	6,977,903	106	48	......	......	34,713,887	43,436,831	52,686,634
1930	6,804,276	68	32	......	......	21,977,688	33,645,669	41,633,145
1931	5,549,622	44	22	......	......	10,513,931	17,624,413	23,238,477
1932	4,354,904	75	29	......	......	7,075,393	13,176,965	19,734,327
1933	4,063,775	109	47	......	......	13,976,358	15,915,836	25,214,936
1934	5,141,744	145	69	......	......	20,243,278	19,729,720	34,462,793
1935	4,927,204	177	72	......	......	25,407,914	21,800,218	41,111,560
1936	4,381,173	168	70	......	......	30,051,207	25,283,229	44,640,004
1937	6,145,244	185	113	48,617,920	4,663,843	43,954,077	41,714,705	63,666,000
1938	7,377,117	211	92	40,222,237	4,943,754	35,278,483	29,541,421	54,288,698
1939	7,212,171	217	99	45,133,788	4,416,919	40,716,869	27,939,627	54,737,557
1940	7,949,736	216	92	50,004,909	6,334,611	43,670,298	34,203,578	63,095,238
1941	8,007,937	200	96	52,354,870	5,673,048	46,681,822	34,607,700	64,421,668
1942	6,894,844	126	76	50,494,041	5,294,637	45,199,404	35,313,546	62,584,368
1943	5,786,864	48	32	37,234,070	3,940,367	33,293,703	34,903,052	54,543,124
1944	4,879,851	51	31	29,327,114	2,877,706	26,449,408	29,494,325	41,733,036
1945	4,377,722	36	27	34,154,917	2,771,292	31,383,625	39,077,876	50,275,001
1946	3,705,594	50	32	48,920,971	2,904,130	46,016,841	47,006,285	58,359,386
1947	5,011,271	75	33	81,033,093	4,722,010	76,311,087	79,819,647	95,528,728
1948	5,762,321	97	51	118,713,859	18,585,183	100,128,727	105,005,155	123,505,044
1949	6,125,460	118	54	99,426,678	19,613,185	79,814,604	91,067,630	109,691,706
1950	6,802,482	112	58	108,864,792	22,113,431	86,751,361	94,711,755	116,566,320
1951	6,972,400	119	64	142,590,427	25,096,743	117,493,684	129,460,924	152,877,635
1952	9,174,617	95	58	140,070,389	30,444,575	106,601,451	118,181,241	147,360,895
1953	9,660,281	80	48	94,555,069	27,815,152	66,739,892	95,161,406	126,350,912
1954	8,513,865	63	40	106,223,833	29,135,673	77,088,160	94,887,953	123,594,282
1955	9,126,902	53	34	119,039,285	30,696,044	88,343,241	114,142,703	142,391,009
1956	8,827,037	70	40	125,043,590	31,933,681	93,110,262	120,889,292	149,331,373
1957	7,282,436	59	40	95,644,930	30,273,900	65,370,185	97,945,232	125,272,668
1958	6,402,198	57	28	83,023,111	28,068,396	54,955,069	80,826,443	104,093,241
1959	6,990,985	60	44	92,287,277	27,079,911	65,208,728	82,209,495	104,867,557
1960	8,242,703	67	31	114,852,061	29,505,158	85,346,903	98,902,362	130,196,595
1961	8,392,161	59	39	112,488,918	30,304,050	82,184,868	96,649,609	128,465,488
1962	11,212,106	64	45	137,759,188	34,274,698	103,484,490	119,103,045	159,530,089
1963	11,893,594	65	36	139,881,792	34,008,151	105,873,641	128,721,353	172,716,557
1964	12,523,636	68	42	169,503,670	39,516,641	129,987,029	136,659,990	180,870,817
1965	**15,042,356**	**56**	**39**	**166,386,094**	**28,592,835**[5]	**137,793,259**	**124,512,185**	**176,844,096**

[1] Gross value calculated by valuing gold, silver, copper, lead, zinc, mercury (1938–44, 1955), and nickel (1936–37, 1958–65) at yearly average prices, and iron (1901–03, 1907, 1918–23, 1928, 1948–65), tungsten (1939–45, 1947–58), and molybdenum beginning 1964 at values given by operators.

[2] Includes ores of iron, mercury, nickel, tungsten, and silica (flux).

[3] Data not collected before 1937.

[4] Previous to 1937 the shipper reported " Net Value at Shipping Point," no indication being given as to how the net value was computed. From 1937 on, the shipper has reported " Gross Value," from which deduction of freight and treatment gives " Net Value."

[5] As a result of a change in the questionnaire used, the transportation costs relating to the shipment of 230,689 tons of ore or concentrates are not included.

Table XIV.—Lode-metal Production in 1965

Property or Operator	Location of Mine	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Contents: Gold	Silver	Copper	Lead	Zinc	Cadmium
			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Northern British Columbia										
Atlin Mining Division										
Nil										
Liard Mining Division										
Nil										
Central British Columbia										
Cariboo Mining Division										
Aurum	Wells	The Cariboo Gold Quartz Mining Co. Ltd., Vancouver	28,862	Bullion	18,491	3,236				
Boss Mountain	100 Mile House	Brynnor Mines Ltd., Boss Mountain Division, Vancouver	224,299	Molybdenite concentrates, 1,429 tons						
Clinton Mining Division										
Nil										
Omineca Mining Division										
Cronin	Smithers	New Cronin Babine Mines Ltd., Vancouver	775	Lead concentrates, 109 tons; zinc concentrates, 152 tons	5	12,214		139,933	196,140	2,572
Endako	Endako	Endako Mines Ltd., Vancouver	2,287,000	Molybdenite concentrates, 4,895 tons; molybdenum tri-oxide, 749 tons						
French Peak	Smithers	The Mining Syndicate Ltd., West Vancouver	22	Crude ore	2	6,346		7,376		
Silver Standard	Hazelton	P. Kindrat, Smithers, lessee	94	Crude ore	15	8,627		22,785	33,773	
Coast and Islands										
Alberni Mining Division										
Brynnor	Kennedy Lake	Brynnor Mines Ltd., Vancouver	843,933	Iron concentrates, 658,515 tons						
F.L.	Zeballos	Zeballos Iron Mines, Ltd., Vancouver	364,115	Iron concentrates, 267,823 tons						

			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Nanaimo Mining Division										
Copper Road	Quadra Island	R. I. Bennett, Heriot Bay	553	Crude ore	2	261	40,372			
Mount Washington (Domineer)	Courtenay	Mount Washington Milling Co. Ltd., Vancouver	187,472	Copper concentrates, 8,922 tons	1,730	108,589	3,757,971			
Old Sport	Benson Lake	Coast Copper Co. Ltd., Port McNeill	292,165	Copper concentrates, 15,048 tons; iron concentrates, 93,312 tons	17,640	36,793	9,558,136			
Texada	Texada Island	Texada Mines Ltd., Vancouver	1,310,064	Iron concentrates, 595,273 tons; copper concentrates, 9,318 tons	2,674	43,114	3,705,534			
New Westminster Mining Division										
Pride of Emory	Choate	Giant Mascot Mines Ltd., Vancouver	330,954	Nickel-copper concentrates, 18,800 tons; nickel content, 3,770,000 lbs.			2,000,000			
Skeena Mining Division										
Jessie, Adonis	Jedway	Jedway Iron Ore Ltd., Vancouver	820,890	Iron concentrates, 395,442 tons						
Kennedy Silver	Stewart	Kennedy Silver Mines Ltd., Vancouver	2	Crude ore		274		613	1,039	
Silbak Premier	Premier	Silbak Premier Mines Ltd., Vancouver	2,336	Gold-silver concentrates and precipitates, 70 tons	669	14,915		7,002	13,221	
Vancouver Mining Division										
Britannia	Britannia Beach	The Anaconda Co. (Canada) Ltd., Britannia Beach	226,005	Copper concentrates and precipitates, 8,774 tons; zinc concentrates, 664 tons; tailings, 45,807 tons	1,246	19,194	5,068,990	11,508	690,284	2,857
Victoria Mining Division										
Nil										
SOUTH CENTRAL BRITISH COLUMBIA										
Greenwood Mining Division										
Highland-Bell	Beaverdell	Mastodon-Highland Bell Mines Ltd., Vancouver	23,198	Lead concentrates, 1,924 tons; zinc concentrates, 418 tons; jig concentrates, 219 tons	580	647,993		623,229	595,746	4,329
Phoenix	Greenwood	The Granby Mining Co. Ltd., Phoenix Copper Division, Vancouver	703,420	Copper concentrates, 18,271 tons	15,862	93,906	9,085,200			
Spotted Horse	Greenwood	D. C. Wing, Greenwood	58	Crude ore		43		2,471	1,220	

TABLE XIV.—LODE-METAL PRODUCTION IN 1965—*Continued*

Property or Operator	Location of Mine	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Contents					
					Gold	Silver	Copper	Lead	Zinc	Cad-mium
			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
SOUTH CENTRAL BRITISH COLUMBIA—*Continued*										
Kamloops Mining Division										
Bethlehem	Ashcroft	Bethlehem Copper Corporation Ltd., Vancouver	1,788,371	Copper concentrates, 32,132 tons; molybdenum concentrate, 55 tons	1,595	88,647	22,140,000	......	......	......
Lillooet Mining Division										
Bralorne	Bridge River	Bralorne Pioneer Mines Ltd., Vancouver	115,731	Bullion	54,589	10,666	......	......	......	......
Silverquick	Tyaughton Creek	Silverquick Development Co. (B.C.) Ltd., Vancouver	Mill sludge	Mercury, 20 flasks	......	......	......	......	......	......
Nicola Mining Division										
Craigmont	Merritt	Craigmont Mines Ltd., Vancouver	1,314,199	Copper concentrates, 55,729 tons	......	......	30,438,043	......	......	......
Osoyoos Mining Division										
Nil	......	......	......	......	......	......	......	......	......	......
Similkameen Mining Division										
Red Star	Princeton	Garibaldi Copper Mines Ltd., Squamish	12	Crude ore	......	10	537	......	6,465	......
Vernon Mining Division										
Nil	......	......	......	......	......	......	......	......	......	......
SOUTHEASTERN BRITISH COLUMBIA										
Fort Steele Mining Division										
Sullivan	Kimberley	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	2,516,794	Lead concentrates, 128,559 tons; zinc concentrates, 213,233 tons; zinc middlings, 620 tons; tin concentrates, 252 tons; iron sinter, 155,038 tons	281	2,865,475	358,200	204,001,000	216,677,800	588,491
Golden Mining Division										
Mineral King	Toby Creek	Aetna Investment Corporation Ltd., Vancouver	145,196	Lead concentrates, 2,473 tons; zinc concentrates, 9,127 tons	......	59,335	54,467	3,115,975	10,085,145	39,669

			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Ruth	Parson	Columbia River Mines Ltd., Vancouver	17	Crude ore	1	1,056		10,335	6,425	
Nelson Mining Division										
Gold Belt	Salmo	A. Endersby, Fruitvale	52	Crude ore	17	13		155	263	
H.B.	Salmo	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	415,290	Lead concentrates, 6,326 tons; zinc concentrates, 36,454 tons		55,729		9,355,280	40,603,480	328,813
Jersey	Salmo	Canadian Exploration Ltd., Vancouver	377,124	Lead concentrates, 4,413 tons; zinc concentrates, 20,654 tons		26,680		7,076,299	24,448,253	202,568
Kootenay Belle	Salmo	Bryan's Transfer Ltd. and M. Arishenkoff, Trail	6,085	Crude ore	196	691		13,228	13,968	
New Arlington	Erie	G. D. Fox, Trail	5,406	Siliceous ore	767	3,044		48,159	71,402	
Reeves MacDonald	Remac	Reeves MacDonald Mines Ltd., Vancouver	409,504	Lead concentrates, 7,236 tons; zinc concentrates, 24,846 tons		47,274		8,240,793	27,377,496	158,635
Silver Dollar	Salmo	D. H. Norcross, Nelson	154	Crude ore	57	2,276		3,844	2,401	
Star	Creston	F. J. Brady, Creston	1	Crude ore		13		786	18	
Revelstoke Mining Division										
Nil										
Slocan Mining Division										
Altoona	Sandon	S. Hallgren and J. H. MacMillan, Nelson	272	Lead concentrates, 16 tons; zinc concentrates, 26 tons		941		13,847	28,702	179
Antoine	Sandon	Antoine Silver Mines Ltd., North Vancouver	499	Lead concentrates, 17 tons; zinc concentrates, 17 tons	1	5,467		18,291	19,802	149
Bluebell	Riondel	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	256,332	Lead concentrates, 16,978 tons; zinc concentrates, 27,183 tons		329,907	388,400	24,495,860	27,953,480	124,018
Blue Star (Amazon, Black Fox, Triumph)	Ainsworth	Blue Star Mines Ltd., Kaslo	3,260	Lead concentrates, 45 tons; zinc concentrates, 124 tons	3	2,335		56,972	115,454	605
Charleston	Retallack	Buchanan Mines Ltd., Nelson	330	Lead concentrates, 6 tons; zinc concentrates, 10 tons		617		7,988	12,648	119
Cody Reco	Sandon	Minoca Mines Ltd., Vancouver	Clean-up	Lead concentrates, 8 tons; zinc concentrates, 8 tons		582		9,456	8,558	47
Cork Province	Kaslo	London Pride Silver Mines Ltd., Vancouver	26,081	Lead concentrates, 774 tons; zinc concentrates, 3,284 tons		45,797		1,098,286	3,532,805	31,305
Deadman	Sandon	L. and O. Fried, New Denver	198	Lead concentrates, 9 tons; zinc concentrates, 84 tons; crude ore, 7 tons	1	3,177		20,035	102,434	781
Enterprise	Silverton	R. T. Avison, Silverton	19	Crude ore		1,698		12,638	10,487	
Galena Farm[1]	Silverton									
Greenhorn	Silverton	S. Hallgren, Nelson	13	Crude ore	1	191		2,883	2,373	
Hecla, Mammoth, and custom	Silverton	Johnsby Mines Ltd., Silverton	10,925	Lead concentrates, 674 tons; zinc concentrates, 838 tons		127,999		848,262	958,952	5,666

[1] Ninety tons of low-grade dump material from the Galena Farm was milled with 2,649 tons of ore from the Washington.

TABLE XIV.—LODE-METAL PRODUCTION IN 1965—*Continued*

Property or Operator	Location of Mine	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Contents					
					Gold	Silver	Copper	Lead	Zinc	Cadmium
			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
SOUTHEASTERN BRITISH COLUMBIA—*Continued*										
Slocan Mining Division—Continued										
Ottawa	Slocan	Slocan Ottawa Mines Ltd., Vancouver	1,000	Crude ore		69,544		8,234	3,145	
Shady M.C.	Sandon	N. Sibilleau, Rossland	2	Crude ore		136		2,386	127	
Silversmith (Rabbitt Paw)	Sandon	E. Perepolkin, L. Irwin, and K. Gordon, Hills	95	Lead concentrates, 11 tons; zinc concentrates, 8 tons; crude ore, 10 tons		1,784		23,568	12,132	62
Slocan Sovereign	New Denver	P. Leontowicz and A. Maxinuk, New Denver	6	Crude ore		464		7,367	433	
Victor	Sandon	J. Stewart and A. Anderson, New Denver	287	Zinc concentrates, 53 tons; crude ore, 34 tons	10	8,411		46,965	63,850	400
Washington[1]	Sandon	Red Deer Valley Coal Co. Ltd., Calgary, Alta.	2,739	Lead concentrates, 25 tons; zinc concentrates, 292 tons		6,295		29,068	329,166	2,595
Trail Creek Mining Division										
I.X.L.	Rossland	J. A. Ruelle & Associates, Rossland	30	High-grade ore	68	32		60	60	
W.D.	Trail	Columbia River Mines Ltd., Vancouver	207	Crude ore	154	33		413	553	
Abacon	Unknown	Abacon Mineral Explorations Ltd., Vancouver	106	Gold ore	34	45	170			

[1] Ninety tons of low-grade dump material from the Galena Farm was milled with 2,649 tons of ore from the Washington.

TABLE XV.—LODE-METAL OPERATIONS' EMPLOYMENT DURING 1965[1]

Name of Mine or Operator	Days Operating		Tons		Average Number Employed	
	Mine	Mill	Mined	Milled	Mine	Mill
Shipping Mines						
Bethlehem Copper Corp. Ltd. (including Floods Mining and Aggregate Co.)	251	365	1,788,371	1,788,371	132	55
Bluebell (Cons. M. & S. Co. of Canada Ltd.)	362	362	256,332	256,332	146	10
Bralorne Pioneer Mines Ltd.	255	325	115,731	115,731	273	40
Britannia (The Anaconda Co. (Canada) Ltd.)	190	160	228,450	226,005	239	23
Brynnor Mines Ltd. (Boss Mountain Div.)	214	214	224,299	224,299	116	13
Brynnor Mines Ltd. (Kennedy Lake Div.)	306	263	1,021,691	843,933	151	20
Canadian Exploration Ltd. (Jersey)	365	365	377,124	377,124	196	14
Cariboo Gold Quartz Mining Co. Ltd.	301	365	41,010	28,862	109	9
Coast Copper Co. Ltd.	365	365	292,165	292,165	200	9
Craigmont Mines Ltd. (including Pooley Bros.)	269	269	1,005,476	1,314,199	329	147
Endako Mines Ltd.	365	230	5,143,200	2,287,000	126	131
Giant Mascot Mines Ltd. (Pride of Emory)	268	268	330,954	330,954	138	19
Granby Mining Co. Ltd. (Phoenix)	264	365	703,420	703,420	86	32
H.B. (Cons. M. & S. Co. of Canada Ltd.)	255	363	415,290	415,290	111	18
Jedway Iron Ore Ltd.	345	314	835,231	820,890	63	63
Johnsby Mines Ltd. (Hecla)	260	240	10,973	10,925	20	4
London Pride Silver Mines Ltd. (Cork Province)	365	365	26,081	23,000	26	7
Mastodon-Highland Bell Mines Ltd.	239	239	23,894	23,198	41	8
Mineral King (Aetna Investment Corp. Ltd.)	272	255	145,196	145,196	93	13
Minoca Mines Ltd. (Yreka)	84	66	13,330	9,347	45	3
Mt. Washington Milling Co. Ltd. (including Shaak Contracting Ltd.)	365	365	243,028	187,472	8	44
Reeves MacDonald Mines Ltd.	253	350	409,504	409,504	100	17
Sullivan (Cons. M. & S. Co. of Canada Ltd.)	254	265	2,516,794	2,516,794	724	184
Texada Mines Ltd.	365	365	1,261,178	1,310,064	230	36
Zeballos Iron Mines Ltd.	296	295	364,115	364,115	52	44
Other mines	.....	.....	.....	.....	17	2
Development and Explorations[2]						
Anaconda American Brass	.....	.....	.....	.....	19	.....
Bralorne Pioneer Mines Ltd.	.....	.....	.....	.....	10	.....
Britannia (The Anaconda Co. (Canada) Ltd.)	.....	.....	.....	.....	14	.....
Canex Aerial Exploration Ltd.	.....	.....	.....	.....	39	.....
Consolidated Mining & Smelting Co. of Canada Ltd.	.....	.....	.....	.....	31	.....
Craigmont Mines Ltd.	.....	.....	.....	.....	18	.....
Endako Mines Ltd.	.....	.....	.....	.....	11	.....
Granduc Operating Co.	.....	.....	.....	.....	44	.....
Granduc Mines Ltd.	.....	.....	.....	.....	108	.....
Gunnex Ltd.	.....	.....	.....	.....	10	.....
Julian Mining Co. Ltd.	.....	.....	.....	.....	15	.....
Kennco Explorations (Western) Ltd.	.....	.....	.....	.....	30	.....
Lornex Mining Corp. Ltd.	.....	.....	.....	.....	11	.....
Newmont Mining Corp. of Canada Ltd.	.....	.....	.....	.....	16	.....
Noranda Exploration Co. Ltd.	.....	.....	.....	.....	40	.....
Phelps Dodge Corp. of Canada Ltd.	.....	.....	.....	.....	14	.....
Silver Standard Mines Ltd.	.....	.....	.....	.....	12	.....
Southwest Potash Corp.	.....	.....	.....	.....	32	.....
Stikine Copper Ltd.	.....	.....	.....	.....	13	.....
Utah Construction & Mining Co.	.....	.....	.....	.....	11	.....
Wesfrob Mines Ltd.	.....	.....	.....	.....	245	.....
Other companies	.....	.....	.....	.....	43	.....

[1] The average number employed includes wage-earners and salaried employees. The average is obtained by adding the monthly figures and dividing by 12, irrespective of the number of months worked.

[2] May not include employees of contractors doing diamond drilling and other work.

Departmental Work

ADMINISTRATION BRANCH

The Administration Branch is responsible for the administration of the Provincial laws regarding the acquisition of rights to mineral and to coal, petroleum, and natural gas, and deals with other departments of the Provincial service for the Department or for any branch.

Gold Commissioners, Mining Recorders, and Sub-Mining Recorders, whose duties are laid down in the *Mineral Act* and *Placer-mining Act,* administer these Acts and other Acts relating to mining. Mining Recorders, in addition to their own functions, may also exercise the powers conferred upon Gold Commissioners with regard to mineral claims within the mining division for which they have been appointed. Similar duties may be performed by Mining Recorders with regard to placer claims but not in respect of placer-mining leases. Recording of location and of work upon a mineral claim as required by the *Mineral Act* and upon a placer claim or a placer-mining lease as required by the *Placer-mining Act* must be made at the office of the Mining Recorder for the mining division in which the claim or lease is located. Information concerning claims and leases and concerning the ownership and standing of claims and leases in any mining division may be obtained from the Mining Recorder for the mining division in which the property is situated or from the Department's offices at Victoria, and Room 320, 890 West Pender Street,* Vancouver. Officials in the offices of the Gold Commissioner at Victoria and the Gold Commissioner at Vancouver act as Sub-Mining Recorders for all mining divisions. Sub-Mining Recorders, who act as forwarding agents, are appointed at various places throughout the Province. They are authorized to accept documents and fees, and forward them to the office of the Mining Recorder for the correct mining division. Officials and their offices in various parts of the Province are listed in the table on page A 59.

Central Records Offices (Victoria and Vancouver)

Transcripts of all recordings in Mining Recorders' offices throughout the Province are sent to the office of the Chief Gold Commissioner in Victoria twice each month, and include the names of lessees of reverted surveyed mineral claims. These records and maps showing the approximate positions of mineral claims held by record and of placer-mining leases may be consulted by the public during office hours at Victoria and at the office of the Gold Commissioner at Vancouver, Room 320, 890 West Pender Street.* The approximate position of mineral claims held by record and of placer-mining leases are plotted from details supplied by locators.

* New address, effective August, 1966.

List of Gold Commissioners and Mining Recorders in the Province

Mining Division	Location of Office	Gold Commissioner	Mining Recorder
Alberni	Alberni	T. G. O'Neill	T. G. O'Neill.
Atlin	Atlin	D. P. Lancaster	D. P. Lancaster.
Cariboo	Quesnel	F. E. P. Hughes	F. E. P. Hughes.
Clinton	Clinton	R. H. Archibald	R. H. Archibald.
Fort Steele	Cranbrook	E. L. Hedley	E. L. Hedley.
Golden	Golden	W. G. Mundell	W. G. Mundell.
Greenwood	Grand Forks	R. Macgregor	R. Macgregor.
Kamloops	Kamloops	F. J. Sell	F. J. Sell.
Liard	Victoria	R. H. McCrimmon.	
Lillooet	Lillooet	B. J. H. Ryley	B. J. H. Ryley.
Nanaimo	Nanaimo	E. B. Offin	E. B. Offin.
Nelson	Nelson	G. L. Brodie	G. L. Brodie.
New Westminster	New Westminster	J. F. McDonald	E. W. Pedersen.
Nicola	Merritt	T. S. Dobson	T. S. Dobson.
Omineca	Smithers	G. H. Beley	G. H. Beley.
Osoyoos	Penticton	T. S. Dalby	T. S. Dalby.
Revelstoke	Revelstoke	D. V. Drew	D. V. Drew.
Similkameen	Princeton	B. Kennelly	B. Kennelly.
Skeena	Prince Rupert	T. H. W. Harding	T. H. W. Harding.
Slocan	Kaslo	T. P. McKinnon	T. P. McKinnon.
Trail Creek	Rossland	W. L. Draper	W. L. Draper.
Vancouver	Vancouver	J. Egdell	Mrs. S. Jeannotte (Deputy).
Vernon	Vernon	W. T. McGruder	W. T. McGruder.
Victoria	Victoria	R. H. McCrimmon	E. J. Bowles.

GOLD COMMISSIONERS' AND MINING RECORDERS' OFFICE STATISTICS, 1965

Mining Division	Free Miners' Certificates		Lode-mining						Placer-mining					Revenue		
	Individual	Company	Mineral Claims	Certificates of Work	Cash in Lieu	Certificates of Improvements	Bills of Sale, Etc.	Leases	Placer Claims	Leases	Certificates of Work	Cash in Lieu	Bills of Sale, Etc.	Free Miners' Certificates	Mining Receipts	Total
Alberni	86	1	1,001	1,423	$10,612.00	......	61	7	1	3	......	$250.00	2	$575.00	$26,049.00	$26,624.00
Atlin	131	1	589	1,179	4,024.00	......	41	2	1	11	47	3,100.00	8	755.00	20,059.00	20,814.00
Cariboo	876	12	2,178	2,095	1,600.00	......	105	......	10	104	323	1,750.00	73	6,625.00	40,354.50	46,979.50
Clinton	110	......	479	429	2,448.00	......	46	2	......	54	14	......	18	550.00	10,885.75	11,435.75
Fort Steele	251	3	2,270	922	2,600.00	......	59	6	......	17	64	......	6	1,775.00	22,126.25	23,901.25
Golden	159	2	4,354	261	1,400.00	......	39	5	......	4	2	......	......	995.00	26,047.50	27,042.50
Greenwood	152	6	1,263	1,500	900.00	......	81	35	......	5	14	......	......	1,610.00	22,384.50	23,994.50
Kamloops	392	7	4,895	3,910	8,500.00	......	217	4	......	5	17	500.00	......	3,102.00	64,166.40	67,268.40
Liard	243	4	3,846	4,933	29,030.00	6	189	1	......	27	35	250.00	7	1,820.00	76,578.85	78,398.85
Lillooet	150	1	722	946	3,500.00	......	66	1	1	6	22	......	6	851.00	14,935.00	15,786.00
Nanaimo	158	......	707	1,004	7,240.00	......	102	2	......	......	1	......	......	790.00	17,374.75	18,164.75
Nelson	342	8	525	423	2,800.00	......	48	13	......	6	13	250.00	2	2,810.00	10,830.75	13,640.75
New Westminster	384	5	1,088	1,625	7,000.00	......	81	2	1	16	9	750.00	6	2,832.00	25,117.25	27,949.25
Nicola	131	5	3,295	2,350	2,300.00	......	191	......	......	......	......	......	......	1,555.00	36,996.25	38,551.25
Omineca	434	4	6,164	10,655	13,400.00	......	296	14	1	25	114	1,000.00	30	2,786.00	117,270.75	120,056.75
Osoyoos	189	4	1,125	536	2,100.00	......	73	8	......	......	......	......	......	1,645.00	13,244.50	14,889.50
Revelstoke	91	9	446	525	2,700.00	......	26	3	......	4	25	500.00	......	2,151.00	10,222.75	12,373.75
Similkameen	116	5	828	771	1,200.00	......	66	10	......	26	76	750.00	57	1,180.00	17,980.50	19,160.50
Skeena	290	4	4,003	4,261	12,388.00	......	360	20	......	1	......	......	......	1,950.00	61,399.50	63,349.50
Slocan	180	5	664	1,247	6,540.00	......	96	21	......	......	......	......	......	1,790.00	21,407.50	23,197.50
Trail Creek	126	5	169	202	400.00	......	35	9	......	......	......	......	......	1,532.00	3,812.50	5,344.50
Vancouver	2,194	371	659	920	5,000.00	......	54	6	......	4	1	......	......	78,384.00	23,046.43	101,430.43
Vernon	222	5	131	280	300.00	......	19	1	1	9	34	......	1	1,910.00	4,095.25	6,005.25
Victoria	411	54	481	616	500.00	......	29	......	......	2	7	......	......	10,552.00	19,299.71	29,851.71
Totals for 1965	7,818	521	41,882	43,013	$128,482.00	6	2,380	172	16	329	818	$9,100.00	216	$130,525.00	$705,685.14	$836,210.14
Totals for 1964	7,197	431	29,244	32,047	$96,596.00	13	2,345	192	20	231	940	$5,250.00	330	$95,943.00	$487,512.70	$583,455.70

Coal, Petroleum, and Natural Gas

The Administration Branch is responsible for the administration of the *Petroleum and Natural Gas Act* and for the *Coal Act*. Information concerning applications for permits and leases issued under the *Petroleum and Natural Gas Act* and concerning the ownership and standing of them may be obtained upon application to the office of the Chief Commissioner, Department of Mines and Petroleum Resources, Victoria, B.C. Similar information may be obtained respecting licences and leases issued under the *Coal Act*. Maps showing the locations of permits and leases under the *Petroleum and Natural Gas Act* are available, and copies may be obtained upon application to the office of the Department of Mines and Petroleum Resources, Victoria, B.C. Monthly reports listing additions and revisions to permit-location maps and listing changes in title to permits, licences, and leases and related matters are available from the office of the Chief Commissioner upon application and payment of the required fee.

Coal Revenue, 1965

Licences—		
Fees	$675.00	
Rental	4,697.95	
		$5,372.95
Leases—		
Fees	----------	
Rental	----------	
Cash in lieu	----------	
Miscellaneous (purchase coal rights)	$9,450.00	
		9,450.00
		$14,822.95

At the end of 1965, 35,237,492 acres, or approximately 55,059 square miles, of Crown petroleum and natural-gas rights, issued pursuant to the *Petroleum and Natural Gas Act*, were held in good standing. This acreage, held by operators ranging from small independent companies to major international ones, comprised:—

		Acreage
319	permits	23,517,709
......	natural-gas licence	----------
34	drilling reservations	534,868
3,779	leases (all types)	11,184,915
		35,237,492

Petroleum and Natural-gas Revenue, 1965

Rentals and fees—		
Permits	$1,176,501	
Drilling reservations	114,483	
Natural-gas licences	----------	
Petroleum, natural-gas, and petroleum and natural-gas leases	7,013,187	
Total rentals and fees		$8,304,171

Petroleum and Natural-gas Revenue, 1965—Continued

Sales of Crown reserves—		
Permits	$1,825,322	
Drilling reservations	3,278,641	
Leases	13,057,470	
Total Crown reserve sales		$18,161,433
Royalties—		
Gas	$1,682,444	
Oil	3,697,668	
Processed products	93,226	
Total royalties		5,473,338
Miscellaneous fees		17,790
Total petroleum and natural-gas revenues		$31,956,732

ANALYTICAL AND ASSAY BRANCH

By S. W. Metcalfe, Chief Analyst and Assayer

Rock Samples

During 1965 the chemical laboratory in Victoria issued reports on 2,521 samples from prospectors* and Departmental engineers. A laboratory examination of a prospector's sample generally consists of the following: (1) A spectrographic analysis to determine if any base metals are present in interesting percentages; (2) assays for precious metals and for base metals shown by the spectrographic analysis to be present in interesting percentages. The degree of radioactivity is measured on all samples submitted by prospectors and Departmental engineers; these radiometric assays are not listed in the table below.

The laboratory reports were distributed in the following manner among prospectors who were not grantees, prospectors who were grantees under the *Prospector's Grub-stake Act,* and Departmental engineers:—

	Samples	Spectrographic Analyses	Assays
Prospectors (not grantees)	1,967	1,968	5,197
Prospectors (grantees)	215	215	476
Departmental engineers	339	222	934
Totals	2,521	2,405	6,607

An additional 116 spectrographic analyses were done for Departmental engineers, but the results were not reported.

Samples submitted to the laboratory for identification are examined by the Mineralogical Branch of the Department. During the year 69 such samples were examined.

Petroleum and Natural-gas Samples

Reports were issued on 88 samples. Of this number, 29 were samples of formation waters from wells being drilled for gas and oil in the Province, 55 were crude-oil and condensate samples, and three were samples from suspected oil seeps.

* A reasonable number of samples are assayed, without charge, for a prospector who makes application for free assays and who satisfies the Chief Analyst that prospecting is his principal occupation during the summer months. A form for use in applying for free assays may be obtained from the office of any Mining Recorder.

Finally, a sample of material from the discharge valves of a Westcoast transmission station was examined, and found to be mainly sodium chloride. In this category 26 spectrographic analyses were reported.

Coal Samples

Reports were issued on 37 samples of coal submitted by the Purchasing Commission for proximate analysis and calorific value. One additional sample was submitted by the Water Resources Service.

Miscellaneous Samples

Reports were issued on 386 samples of a miscellaneous nature. Four hundred and twenty-four assays and 17 spectrographic analyses were reported in this category.

For the Department of Mines and Petroleum Resources, for the Inspection Branch, 32 samples of AN/FO (ammonium nitrate-fuel oil mixture) were analysed for their fuel-oil content, and a sample of well water was examined for the presence of mill chemicals; for the Petroleum and Natural Gas Branch, two rock samples were spectrographed for the presence of phosphorus.

For the Department of Highways, Materials Testing Branch, a sample of road de-icing salt was spectrographed; chloride was determined in a salt collecting on a tunnel lining; four concrete surface materials were spectrographed; 54 analyses were made upon six samples consisting of seepage and creek waters, and 10 analyses were made on two other water samples; a spectrographic analysis was conducted on a clay sample, and sodium was determined in the same sample.

For the Water Resources Service, the resistivity of six samples of drilling mud was determined.

For the District Water Rights Engineer at Nelson, a water sample was examined for the presence of diesel oil.

For an official at the Courthouse at Nelson, a sample of limestone was spectrographed, and calcium oxide was determined in the sample.

For the Department of Industrial Development, Trade, and Commerce, a piece of stained foam rubber from a business machine was examined by the spectrograph to determine the nature of the stains.

For the Forest Research Laboratory, a sample of quartz was spectrographed.

For the University of Victoria, cells from a sea cucumber were examined by the spectrograph.

For the Department of Public Works, one sample of soil was examined for the presence of fuel-oil.

For the City of Victoria, for smoke inspection, determination was made of the weight of residues collected in 312 bottles of water placed in various locations in the city; a determination was made of the chloride content of a sample of fly ash and cinder.

For citizens of the Province, three materials suspected of being oil seeps were examined, and a sediment in one of them was assayed for iron; a sample of clay from Sproat Lake was identified by X-ray diffraction analysis; three water samples were examined for arsenic; zinc was determined in a sediment by spectrographic analysis; a grey metal attached to a piece of gold was examined by the spectrograph; finally, the water in a lake near Osoyoos was examined.

X-ray Powder Diffraction Analyses

Eighty-two analyses of this type were performed for identification purposes.

Examination for Assayers

The Provincial Government examinations for certificates of efficiency were held in May. Four candidates were examined—two at Trail and two at Victoria. Two of the candidates were granted licences, and two failed the examination.

INSPECTION BRANCH

Organization and Staff

Inspectors and Resident Engineers

J. W. Peck, Chief Inspector	Victoria
Robert B. Bonar, Deputy Chief Inspector of Mines	Victoria
L. Wardman, Senior Electrical Inspector of Mines	Victoria
E. R. Hughes, Senior Inspector of Mines	Victoria
R. J. Craig, Senior Inspector of Mines, Silicosis Control	Vancouver
S. Elias, Inspector, Silicosis Control	Vancouver
J. E. Merrett, Inspector and Resident Engineer	Vancouver
A. R. C. James, Inspector and Resident Engineer	Vancouver
D. R. Morgan, Inspector and Resident Engineer	Cranbrook
David Smith, Inspector and Resident Engineer	Kamloops
W. C. Robinson, Inspector and Resident Engineer	Kamloops
Harry Bapty, Inspector and Resident Engineer	Prince Rupert
P. E. Olson, Inspector and Resident Engineer	Nelson
W. G. Clarke, Inspector and Resident Engineer	Prince George

The Inspectors are stationed at the places listed and inspect coal mines, metalliferous mines, and quarries in their respective districts. They also examine prospects, mining properties, and roads and trails. The Silicosis Control Inspectors make dust and ventilation surveys at all mines and quarries. E. R. Hughes supervised the Department's roads and trails programme and prospectors' grub-stakes.

Instructors, Mine-rescue Stations

Arthur Williams	Fernie Station
W. H. Childress	Nanaimo Station
T. H. Robertson	Kamloops Station
G. J. Lee	Nelson Station

Staff Changes

A new office was established at Prince George, and W. G. Clarke was appointed to administer a new district extending north from Williams Lake to the Yukon boundary and east from Smithers to the Alberta boundary.

Board of Examiners for Coal-mine Officials

Robert B. Bonar, Chairman and Secretary	Victoria
A. R. C. James, Member	Vancouver
D. R. Morgan, Member	Cranbrook

R. B. Bonar, A. R. C. James, D. R. Morgan, and the mine-rescue instructors for the district in which an examination is being held form the Board for granting certificates of competency to coal-miners.

An Inspector is empowered to grant provisional certificates to coal-miners for a period not exceeding 60 days between regular examinations.

Board of Examiners for Shiftbosses (Metalliferous Mines)

Robert B. Bonar, Chairman	Victoria
A. R. C. James, Member	Vancouver
J. E. Merrett, Member	Vancouver

The Board conducts written examinations in various mining centres for applicants for underground shiftboss certificates. The Board is also empowered to grant provisional certificates without examination under such conditions as the Board considers necessary.

MINERALOGICAL BRANCH

Field work by officers of the Mineralogical Branch includes geological mapping and examinations of mineral deposits and studies related to ground-water and engineering geology. The results are published partly in the Annual Report of the Minister of Mines and Petroleum Resources and partly in a series of bulletins. Since March, 1964, a charge has been made for Annual Reports and bulletins. The Mineralogical Branch supplies information regarding mineral deposits and the mineral industry, in response to inquiries received in great number. The activities of the Branch also include identification of rock and mineral specimens submitted directly by prospectors and others, or through the Analytical Branch.

Professional Staff

On December 31, 1965, the professional staff included the following geologists, all stationed at Victoria:—

H. Sargent	Chief of the Branch
M. S. Hedley	Senior Geologist
Stuart S. Holland	Geologist
J. W. McCammon	Geologist
N. D. McKechnie	Geologist
G. E. P. Eastwood	Geologist
James T. Fyles	Geologist
A. Sutherland Brown	Geologist
J. M. Carr	Geologist
W. G. Jeffery	Geologist
A. F. Shepherd	Geologist
E. W. Grove	Geologist
N. C. Carter	Geologist

R. V. Kirkham was employed for the field season; in the autumn he returned to the University of Wisconsin to continue postgraduate studies in geology. N. Haimila was employed for the field season, finalizing geological mapping in the Buttle Lake area, on which he had worked under W. G. Jeffery in 1964.

A total of 15 field assistants was employed on the various projects undertaken in 1965.

J. E. Hughes was transferred to the geological staff of the Petroleum and Natural Gas Branch at the beginning of the summer.

Technical editing of the Annual Report of the Minister of Mines and Petroleum Resources and of other publications was directed by M. S. Hedley. Copy for printing was prepared by and under the direction of Mrs. Rosalyn J. Moir. Messrs. Hedley and Holland assisted in directing and supervising field work. Most of the other members of the professional staff are assigned to mapping the geology of selected areas and of mineral deposits. Mr. McCammon is responsible for studies of industrial minerals and structural materials, and Mr. Shepherd for records and library.

Mrs. C. Cameron, formerly in charge of manuscript preparation, worked part time during the summer and autumn preparing the first draft manuscript for Index No. 4 to reports and bulletins published in the years 1954 to 1965.

Field Work, 1965 Season

A. Sutherland Brown visited properties on the Queen Charlotte Islands, in the Pinchi Lake area (Fort St. James to Kwanika Creek), and in the Smithers-Terrace-Houston area. In the course of this work, detailed records of exploratory work on the Jedway, Jib, and Tasu properties on the Queen Charlotte Islands were brought up to date, and specimens of intrusive rocks were collected for age determination. Mercury prospects in the Pinchi Lake area were visited and a careful study was made of the use of the Lemaire mercury detector. In visiting molybdenum prospects, in the Smithers-Terrace area, evidence of mercury halos surrounding molybdenum occurrences was found. This information is of probable value in prospecting for molybdenum.

N. C. Carter mapped an area including copper deposits on McDonald Island and Newman Peninsula in the northern Babine Lake area. The work included examining four properties, two of which have been drilled extensively. Mapping was done in detail at the Granisle property on McDonald Island and the Newman property of Noranda Exploration Company, Limited, and in less detail over the remainder of Newman Peninsula and the shores of Babine Lake. Later he examined or visited some 16 properties in the Alice Arm area, including the new molybdenum discovery at the head of Dak River, and visited prospects on the upper Illiance River.

J. M. Carr, with two senior assistants and three junior assistants, mapped areas of Topley intrusive rocks in the vicinity of Francois Lake. This work included mapping a total of some 280 square miles in considerable detail, and a further 100 square miles of reconnaissance mapping. In the course of this work, diamond-drill core was logged and other detailed work was done on nine properties that have been under exploration for molybdenum. In addition to mapping in the Francois Lake area, a molybdenum prospect south of Manson Creek and a copper-silver prospect on Tesla Mountain were examined.

G. E. P. Eastwood, with one field assistant, spent most of the field season on detailed mapping at the nickel-copper mine of Giant Mascot Mines Limited near Choate and spent a lesser period at the A.M. property of Canam Copper Company, Ltd., reached from Mile 27 on the Hope–Princeton Highway.

James T. Fyles, with one field assistant, continued a study of stratiform lead-zinc deposits in the Revelstoke-Arrow Lakes area. The 1965 work included detailed mapping at the Jordan River property and mapping at less detail in a 100-square-mile area on Mount Copeland northwest of Revelstoke.

E. W. Grove, with a junior assistant, continued mapping in the Stewart area. Mapping of Bear River Ridge was essentially completed, using the helicopter for establishing camps at high elevation and to reach points difficult of access.

Work in 1964 and 1965, including reconnaissance extending eastward into the Bowser basin, makes possible some revisions in geological interpretation in this important area. Preliminary consideration was given to the problems of extending mapping westward into the Leduc Glacier-Unuk River area. This work must be supported by helicopter, but completion of the road to the Granduc camp-site at Tide Lake improves the position materially.

Stuart S. Holland examined properties under exploration in the Kamloops, Wells, Mount Haskin, McDame, and Dease Lake areas, and made a start at intensive study of the molybdenum occurrences at Rossland.

N. Haimila, with one assistant, finished a programme of geological mapping in the Buttle Lake-Great Central Lake area on Vancouver Island that was started by W. G. Jeffery in 1963 and continued by Jeffery in 1964 with Haimila as senior assistant.

W. G. Jeffery, with one assistant, spent the field season in the Stikine River area, mapping an area of 31 square miles, including Galore Creek, and visiting prospects in the surrounding district.

R. V. Kirkham, with one assistant, continued detailed studies on Hudson Bay Mountain near Smithers. This work essentially completed surface mapping in an area of about 100 square miles. More detailed work within the area included logging drill core from the principal molybdenum prospect and from a silver-lead-zinc prospect. Reconnaissance was done looking toward a geological study in an area of about 350 square miles, including Hudson Bay Mountain and the area extending to Rocher Deboule Mountain.

J. W. McCammon, with one assistant, examined industrial-mineral and structural-material deposits, including limestone at Clinton, Kunga Island, Terrace, Prince George-Fort McLeod, Creston, and Duncan; talc at North Bend and Illecillewaet; silica at Rose Prairie, Longworth, Sicamous, Ymir, and Sheep Creek; barite at Mile 547 and Mile 397 on the Alaska Highway and at Parson and Brisco; gypsum at Lussier River in the Windermere area; mica schist at Chemainus; and fluorite at Hot Springs (Mile 397 on the Alaska Highway) and on Quesnel Lake.

N. D. McKechnie examined 31 properties under exploration from Vancouver Island to Nelson in the southern part of the Province.

Air-borne Magnetometer Mapping

As a project financed jointly by the Geological Survey of Canada and the British Columbia Department of Mines and Petroleum Resources, the contractor, Spartan Air Services Ltd., did the field work for the production of eight adjoining aeromagnetic maps at the scale 1:25,000, covering the area between 50 degrees 45 minutes and 51 degrees 00 minutes north latitude and between 118 degrees 30 minutes and 120 degrees 30 minutes west longitude. The maps, numbered 4405G to 4412G, inclusive, and named respectively the East Half and West Half of Malakwa, Sorrento, Chase, and Heffley, British Columbia, were released in November, 1965, and January, 1966. Subsequently four sheets at 1 mile to the inch, covering the same area, were released by the Geological Survey.

PETROLEUM AND NATURAL GAS BRANCH

The Petroleum and Natural Gas Branch is responsible for the administration of the Regulations Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas, and the Regulations Establishing Gas-Oil Ratio Adjustment Factors, Oil Production Allowables, Overproduction and Underproduction, made pursuant to the *Petroleum and Natural Gas Act.*

The former provides for the use of efficient and safe practices in the drilling, completion, and abandonment of wells; for the orderly development of fields discovered within the Province; and for the conservation and prevention of waste of oil and natural gas within the reservoir and during production operations.

The regulation concerning gas-oil ratio factors, production allowables, and overproduction and underproduction provides for conservation of reservoir energy by limiting the volume of oil that can be produced during any day, month, or year from a well or pool in accordance with the schedule of gas-oil ratio adjustment factors. The factors, which are applied against oil production, are applicable when the average volume of gas produced with each barrel of oil exceeds a specified level, and when applied result in reduction of the producing rate. Overproduction and underproduction are adjusted on a monthly basis.

Every well location must be approved by the Branch before the well is drilled. All operations related to drilling and production are inspected frequently to ensure compliance with the provision of all regulations, including such features as facilities and practices used, adequate plugging of abandoned wells, surface restoration of well-sites, well testing and measurement procedures employed, disposal of produced water, protection of installations against fire, and general conservation.

Investigations are made of complaints of property damage resulting from drilling and producing operations, and from geophysical work programmes.

Comprehensive records of all drilling and producing operations are maintained at Victoria and are made available for study, or are published, for the use and benefit of anyone interested in oil or gas development in British Columbia. Samples of bit cuttings, as well as all core, obtained from every well drilled in the Province, are collected and retained at the field office located at Charlie Lake, where they may be studied by interested persons. Charlie Lake is adjacent to the Alaska Highway about 5 miles northwest of Fort St. John.

Detailed reservoir engineering and geological studies are conducted on the basis of technical information submitted to the Branch from operating companies, as well as information acquired through field work by Branch personnel. Estimates of the reserves of oil and natural gas are made twice a year, at the end of June and December. Crown-owned oil and natural-gas rights are evaluated prior to being disposed of by public tender.

Administration

The Petroleum and Natural Gas Branch is subdivided for administrative purposes into three sections. The sections and the supervisors are as follows: Reservoir Engineering, R. R. McLeod; Development Engineering, W. L. Ingram; and Geology, S. S. Cosburn.

The field office at Charlie Lake, which includes the core and sample laboratory, is supervised by the District Engineer, G. E. Blue.

Staff

Headquarters, Victoria

J. D. Lineham	Chief of Branch
R. R. McLeod	Deputy Chief of Branch and Senior Reservoir Engineer
K. C. Gilbart	Reservoir Engineer
G. V. Rehwald	Reservoir Engineer
P. K. Huus	Reservoir Technician
W. L. Ingram	Senior Development Engineer
M. B. Hamersley	Development Assistant
J. F. Tomczak	Statistician
S. S. Cosburn	Senior Petroleum Geologist
J. E. Hughes	Petroleum Geologist
D. L. Griffin	Petroleum Geologist
H. B. Fulton	Petroleum Geologist
D. M. Callan	Petroleum Geologist

The headquarters staff includes also one geological draughtsman, one clerk-stenographer, three clerks, and three clerk-typists.

Field Office, Charlie Lake

G. E. Blue	District Engineer
D. L. Johnson	Field Engineer
M. A. Churchill	Field Technician
D. A. Selby	Field Technician
G. T. Mohler	Field Technician

The field staff includes also three core and sample laboratory assistants, one clerk-stenographer, and one clerk.

Staff Changes

J. E. Hughes, of the Mineralogical Branch staff, was assigned to the Petroleum and Natural Gas Branch on July 2nd.

Board of Arbitration

Chairman: A. W. Hobbs, solicitor, Department of the Attorney-General. Members: R. R. McLeod, engineer, Department of Mines and Petroleum Resources; S. G. Preston, agrologist, Department of Agriculture.

The Board of Arbitration is responsible to the Minister of Mines and Petroleum Resources, and is established under the authority of the *Petroleum and Natural Gas Act*. The Board grants right of entry by oil and gas companies upon alienated land and determines conditions of entry and compensation therefor. It also terminates the right of entry when the company has ceased to use the land.

The Board held no hearings in 1965 but made eight orders for immediate right of entry with respect to which it may be necessary to fix compensation at some future time in the event of the parties concerned failing to dispose of the matters by agreement.

Conservation Committee

Chairman: P. J. Mulcahy, Deputy Minister of Mines and Petroleum Resources. Members: N. D. McKechnie, geologist, Department of Mines and Petroleum Resources; M. H. A. Glover, economist, Department of Industrial Development, Trade, and Commerce.

The Conservation Committee is responsible to the Minister of Mines and Petroleum Resources, and was established originally on October 11, 1957, under the authority of the *Petroleum and Natural Gas Act*. Its duties are as follows:—

(1) To act as an advisory committee to the Minister on such questions of conservation that the Minister, in writing, shall refer to the Committee for consideration and recommendation.

(2) To deal with such questions of conservation and production in the various fields of British Columbia as may arise between two or more operators in the same field or between operators and the Branch when appeals on such questions are made to the Minister and referred by him to the Committee.

The Conservation Committee did not meet in 1965.

GRUB-STAKING PROSPECTORS

Under authority of the *Prospectors' Grub-stake Act* the Department has provided grub-stakes each year since 1943 to a limited number of applicants able to qualify. The normal maximum grub-stake is $300, with an additional amount up to $200 for travelling expenses. A limited number of experienced prospectors of proven ability may be granted top priority grub-stakes of as much as $400, plus a maximum of $300 for travelling expenses, where prospecting is to be done in approved areas where air transportation is necessary. Items such as guns, fishing-gear, stoves, boats, and outboard motors are not a legitimate charge against the grant and must be provided by the applicant. Costly items such as geophysical survey equipment, mineralights, Geiger counters, berylometers, packsack diamond drills, two-way radios, horses, and packsaddles are not expendable in any one season and cannot be accepted at full cost against the grant, but a reasonable rental charge may be considered.

To qualify at the present time, the Department requires that the applicant shall be a bona fide prospector holding a free miner's certificate. He must be a British subject, between the ages of 18 and 70 years, and must have resided in British Columbia during the year preceding the date of application. He must be able to identify common rocks and minerals. He should have bush experience and be physically and mentally fit. He must agree to abide by the regulations which the Department may make. The grub-staked prospector is provided with maps, a current list of prices of metals and ores, and information on prospecting and related matters.

It is required that in order to obtain the maximum grub-stake, he agree to spend at least 60 days actually prospecting in the area of his choice in British Columbia considered favourably by officers of the Department. If he prospects a lesser time, the grant will be reduced proportionately. The grub-stakes are not intended for week-end prospecting or for short trips from a home base. The grant is usually made in two payments: the first at the beginning of the season, and the second after he has completed 60 days in the field and has submitted a diary. In the past, rebates have been recovered from grantees to whom payments have exceeded the proper amount for the time and effort devoted to prospecting. A field engineer is employed, who contacts as many prospetcors as he is able during the field season and gives advice and direction to those who need it. Grantees are permitted a reasonable number of free assays.

The grub-stakes are granted with the object of maintaining the search for mineral occurrences with mine-making possibilities. The grants are not intended for the purpose of exploring and developing occurrences already found, but one year is allowed to prospect ground that has been staked by a grantee while on the grub-stake. No interest is retained by the Government in any discovery made by a grantee, other than that which applies in common with all free miners. Time is not allowed for prospecting on old properties which have had work done on them, unless mineral deposits of present economic importance have been discovered on them for the first time. Grub-stakes are not given for prospecting for placer deposits or gem stones. The grantee must not accept pay from other sources for services rendered during the period credited to the grub-stake.

It is recognized that competent and experienced prospectors are capable of looking after themselves in wilderness areas. Nevertheless, experience has shown that less hazard may result when prospecting is done by two or three men in a team. A man working alone may be injured or be taken seriously ill and, if alone, he may have to endure extreme hardship and pain.

Grub-stake grantees are not working for the Government but are self-employed and are not covered under the provisions of the *Workmen's Compensation Act*. Therefore, it is recommended that prospectors make their own arrangements concerning insurance coverage to provide for medical and other expenditures that may be incurred in the event of an accident.

The grants are intended only to assist grantees to go out and prospect and are not intended for the support of dependents. Therefore, applicants who are married and have dependents are required to give assurance that their dependents will be adequately provided for during the time the applicant is absent in the field.

Statistical information covering the grub-stake programme since its inception is given in the following table:—

GRUB-STAKE STATISTICS

Field Season	Approximate Expenditure	Men Grub-staked	Samples and Specimens Received at Department Laboratory	Mineral Claims Recorded
1943	$18,500	90	773	87
1944	27,215	105	606	135
1945	27,310	84	448	181
1946	35,200	95	419	162
1947	36,230	91	469	142
1948	35,975	92	443	138
1949	31,175	98	567	103
1950	26,800	78	226	95
1951	19,385	63	255	137
1952	19,083	50	251	95
1953	17,850	41	201	141
1954	19,989	48	336	123
1955	21,169	47	288	183
1956	20,270	47	163	217
1957	22,000	46	174	101
1958	24,850	47	287	211
1959	21,575	38	195	202
1960	28,115	50	358	241
1961	29,175	47	309	325
1962	26,730	52	233	189
1963	29,000	50	150	843
1964	31,751	53	213	351
1965	24,717	42	241	219

Samples and specimens received from grub-staked prospectors are spectrographed, assayed, and tested for radioactivity. Mineralogical identifications are made on request.

Sixty-one applications were received in 1965, and 42 grub-stakes were authorized. Two grantees were unable to go out, and their initial payments were returned. Grantees who were unable to complete the terms and conditions of the grant received only partial payment. Ten prospectors were given grants for the first time. Three grantees proved to be unsatisfactory. Several grantees used aircraft for transportation to their prospecting areas. One grantee was taken ill and was unable to continue prospecting.

D. H. Rae interviewed applicants in Vancouver and contacted 20 grantees in the field and gave advice and direction to those who needed it. The following notes have been largely compiled from Mr. Rae's observations while in the field and from information provided in the diaries of the grantees.

Alberni Mining Division.—Some prospecting was done close to the northwest side of Nitinat Lake; secondary copper mineralization was found but nothing of importance was reported.

Atlin Mining Division.—Between Blanchard River and Stanley Creek, bedded sedimentary rocks containing pyrite and some small limonite deposits were reported. Near the Haines road a diorite contact was prospected. On the west slopes of the Kusawak Range and along Nadahini Creek valley, pyritized sedimentary rock, some limonite deposits, and narrow quartz veins were reported. In upper Goldrun Creek valley, quartz veins along a diorite-limestone contact were investigated. Nothing of importance was found as a result of this work.

In the Squaw Creek valley, apart from the copper deposit previously reported and worked on for the past two years, an extension of the zone has been found showing malachite in limestone, and close to this heavily pyritized sediments showing traces of chalcopyrite and sphalerite. The O'Connor River area was prospected, as well as around the Rainbow Lakes and Parton River valley. At some indefinite location in this general area a gossan zone was sampled and found to contain very high values in silver.

A large area in the vicinity of Tatsamenie Lake, including the Cheja and Chechidla Ranges, was carefully prospected. On the northwesterly shore of the lake, green copper stain and some copper and iron sulphides were seen in greenstone. In general the geology of the area is interesting, although nothing of importance was reported. In the Chechidla Range some granite float showing disseminated molybdenite was picked up, but the source of this float was not found. Some of the gossans in the area proved to be rusty stained calcite.

Cariboo Mining Division.—Some inconclusive work was done in the Canoe River valley southeast of Valemount.

About 38 miles southwest of Prince George, outcrops of ultrabasic rocks and serpentine were prospected and some narrow asbestos fibre was found.

In the Quesnel Forks region, heavy overburden interfered with prospecting near Le Bourdais Lake and along Maud Creek. At Spanish Creek, barren quartz veins and pyritized limestone were noted. A great deal of work was done between Morehead Lake and Jackpine (Nine Mile) Creek fairly close to the Quesnel River, where important outcrops of copper carbonates in limestone were opened up. (The claims staked here are now under option to a mining company.) On the south side of the Quesnel River, prospecting was done near Buxton Creek and near Jackpine Creek, where copper carbonates in limestone were investigated. Some work was done along the Cariboo River and in the Swift River region.

Some work was done in the Giscome area near Tabor Lake and west of McLeod Lake. Near Great Beaver Lake, minor amounts of cinnabar were reported to occur in andesite.

Fort Steele Mining Division.—Some work was done from a base camp in the St. Mary River valley near Dewar Creek.

Greenwood Mining Division.—Considerable work was done on the high ground east of Christina Lake as far as Mount St. Thomas, but nothing of economic importance was found.

North of Greenwood a large area underlain by quartz porphyry showed some oxidized zones stained with both iron and copper. Northwest of Beaverdell, the drainage basins of Wilkinson, Dale, and Stirling Creeks were investigated.

Close to Baldy Mountain, some narrow quartz veins and some small pegmatite dykes were reported. In the Gregoire Creek valley, diorite containing rusty quartz stringers showed minor amounts of pyrite and arsenopyrite, but assays of samples taken were too low to be of interest.

Kamloops Mining Division.—Near Tunkwa Lake minor occurrences of cinnabar and copper minerals were reported. Some work was done on the North Thompson River near McLure ferry, Dunn Lake, Boulder Creek (where some rhodonite float was found), and near Birch Island.

Some work was done on upper Adams Lake and River, and along the west side of the lake, but nothing of interest was reported other than a deposit of graphite at Sinmax Creek.

Liard Mining Division.—Some prospecting was done in the vicinity of Dease Lake. At the north end of the lake, on the east side, some boulders of jade were examined; on the west side, showings of mariposite, garnierite, and quartz-graphite were prospected. Nothing of economic importance was noted. At Tucha Lake an outcrop of quartz-carbonate-chloritic material was sampled and assays made; no values were found.

Lillooet Mining Division.—Near Lillooet some prospecting was done on McKay, Lee, and Leon Creeks, along the lower Yalakom River, and in the Poison Lake area. Fine gold was panned in both Antoine and Marshall Creeks. Near Tyaughton Lake traces of cinnabar were found, and in Tyaughton Creek cinnabar float was found. Considerable cinnabar float was also found in Relay Creek, not far from the old Manitou mine, also in Mud Creek and North Cinnabar Creek. Some inconclusive work was also done around Swartz Lake, Taylor Creek, and Noaxe Creek. Nothing of much interest resulted from any of this work.

From Anderson Lake, prospecting was done on both of the main branches of Lost Valley Creek. On the east fork, considerable faulting and shearing was evident where massive pyrrhotite was exposed, but assays of samples taken lacked interest. Some small pieces of chalcopyrite float were found, but not the source of it.

Nanaimo Mining Division.—Some prospecting is currently being done in the northern part of this mining division, but no information is available.

Nelson Mining Division.—Some work was done near Crawford Bay on Kootenay Lake, in the Hooker Creek valley, on Sphinx Mountain, and along Gray Creek.

A great deal of prospecting was done along the Priest River southeast of Creston, in the Lost Creek valley, and along logging-roads east of the south end of Kootenay Lake, where narrow veins of galena were uncovered.

Some work was done on Woodbury Creek, in the Hall Creek area, and near Fruitvale. Nothing of interest was reported. Work was also done near Goat Mountain between Big Sheep and Lamb Creeks.

New Westminster Mining Division.—The Anderson River valley east of Boston Bar received some attention, but nothing except abundant quartz float was reported.

In the Stoyoma Mountain area northeast of Boston Bar, open cutting and diamond drilling were done on a mineral zone showing some magnetite and hematite.

Some work was done in the Hicks Lake area on the east side of the south end of Harrison Lake.

Nicola Mining Division.—A short time was spent along both sides of the Nicola River between Merritt and Spences Bridge.

Omineca Mining Division.—North of the Nation River, a short distance west of the Manson Creek road, a carbonate zone was prospected.

In the upper Gaffney Creek valley, a fault zone was prospected. Work was done also on the west fork and at Spring and Skunk Lakes. Near Mount Milligan pyritized argillite and a narrow quartz vein mineralized with chalcocite were prospected.

On the west fork of Boulder Creek, metamorphosed limestone was found to contain minor amounts of galena. Some barren-looking quartz veins were found in the upper Skeleton Creek valley. Marcasite was found in quartz on the west slope of the Wolverine Range and along the lower Germansen River traces of nickel were found in basic rocks. Also in the Wolverine Range, gabbroic float material was found to contain minor amounts of chalcopyrite and molybdenite, but the source was not located. At Mount Gillis minor amounts of molybdenite were found in granodiorite. On the upper Manson River fine gold in quartz was picked up.

Some work was done along the Pinchi fault zone, in the upper Kwanika Creek valley, on Twin Creek and Twenty Mile Creek. At Tom Creek a quartz vein in sedimentary rock was investigated, also some minor showings of manganese.

Near Copley Lake (Nechako River) some chert was observed. At Kasalka Butte on Tahtsa Reach, quartz stringers were found in a dark-coloured pyritized rock, but assays of samples taken showed no values. Near Mount Baptiste some chalcopyrite float was found. Magnetite could be panned in some of the creeks in the area. At both Seel Lake and the Blanket Lakes, mineralized zones with indications of copper were prospected. A contact zone at Mount Balom was investigated. At the southerly end of Troitsa Lake, a wide mineralized zone showing disseminated molybdenite has been prospected and claims have been staked. This area merits further careful investigation.

Shoreline and creek valley prospecting was carried out along the southeasterly side of Morice Lake for about 20 miles. Traces of molybdenite were observed in one piece of float, and magnetite could be panned from most of the creeks' gravel. On Nanika Lake, Passage Peak and Nikun Creek were prospected. On Lamprey Creek, east of Morice Lake, basalt and conglomerate outcrops were seen showing traces of copper sulphides.

At the northwest end of Babine Lake, a considerable area back from the lake was prospected. This work was disappointing as much of the area traversed was underlain by sediments and the access in most places was very difficult due to heavy undergrowth. A few granite outcrops were found, but no interesting mineralization was encountered. The area adjacent to Higgins Creek east of Mount Hyland was prospected; a fairly wide quartz vein mineralized with pyrite, galena, and chalcopyrite was uncovered late in the season. Further work will be done on this discovery during the 1966 prospecting season.

Near the junction of the Clore and Zymoetz Rivers, an extensive area underlain by volcanics was found to be liberally mineralized with copper carbonates. A network of logging-roads has assisted greatly in prospecting this area. Some claims were staked and recorded here.

In the Ivor Creek watershed (Finlay River area), some large sheets of white mica were picked up.

Osoyoos Mining Division.—West of Summerland, some chalcopyrite float was picked up. Prospecting extended west to near Mount Kathleen and south to Mount Brent. South of Dividend Mountain, some magnetite carrying minor amounts of chalcopyrite was found. Some work was done in the Ashnola River valley.

Revelstoke Mining Division.—Some inconclusive work was done on a tributary of Downie Creek and in the Goldstream River valley. At Keystone Creek minor amounts of molybdenite were found in pegmatite dykes.

Similkameen Mining Division.—Some work was done in the Thynne Creek valley, where quartz stringers in volcanics showed minor mineralization of chalcopyrite and copper carbonates.

Skeena Mining Division.—Some prospecting was done in the Kitsumkalum Lake area and up the Nelson River.

A short time was spent near Port Louis on the west coast of Graham Island. Nothing was reported from the Steel Creek area or from Kingfisher Cove. Prospecting was done from a base camp on Dean Channel near the mouth of the Kimsquit River. From a similar camp on the Bella Coola River east of Firvale, work was done as far east as the Rainbow Range. Nothing of interest was discovered.

Slocan Mining Division.—Prospecting was done on both sides of the Kaslo River in the general vicinity of Twelve Mile Creek.

Up Fry Creek valley on the east side of Kootenay Lake, an area underlain by mica schist received some attention.

Vancouver Mining Division.—Some prospecting was done up Knight Inlet in the Klinaklini River valley.

Vernon Mining Division.—Some work was done up Harris Creek valley, south of Lumby. Float containing pyrite and minor amounts of molybdenite was picked up.

Barren-looking quartz veins were examined and sampled on Monashee Creek, and from the north slope of Mount Beavan. No commercial assays resulted from samples taken in this area.

Near Mabel Lake, claims were staked in an area underlain by limestone showing disseminated galena and chalcopyrite. At Joss Mountain, light-coloured dykes were found to be mineralized with minor amounts of chalcopyrite, pyrite, and galena in an area showing some major faulting. No sample results were reported. At Blanket Mountain, iron-stained granite outcrops were examined.

Victoria Mining Division.—On the east side of Nitinat Lake, an extensive logged-off area was carefully prospected. On Doobah Creek, 20 claims were staked on northwesterly trending shear zones containing minor sulphides. Considerable surface oxidation was evident. A grid was marked out, and dip-needle readings were incorporated on a map. Some inconclusive work was done in the vicinity of Clo-oose.

MINING ROADS AND TRAILS

Provision is made in the *Department of Mines and Petroleum Resources Act* whereby the Minister may, with the approval of the Lieutenant-Governor in Council, authorize the expenditure of public funds for the construction or repair of roads and trails into mining areas. Assistance on a half-cost basis may also be provided on roads and trails to individual properties.

Requests for road and trail assistance must be made to the Department before the commencement of work. The type of access upon which assistance may be given depends upon the value of the property, the stage of development, and the amount of work to be done. A trail is sometimes sufficient for initial exploration, and a tractor-road may be adequate for preliminary work. Subsequent development might warrant assistance on the construction of a truck-road. A carefully drawn sketch or plan of the location of the road is required to be submitted and, where warranted by the amount of assistance requested, a report on the property by a professional geological or mining engineer may be required. An engineer from the Department may be required to report on the property before a grant is made and to inspect the road after the work has been done.

Total mileages and disbursements under "Grants in Aid of Mining Roads and Trails" during the year ended March 31, 1966, were as follows:—

	Miles	Cost
Roads—		
Construction	202.50	$288,829.53
Maintenance	321.25	58,117.96
Trails—		
Construction	6.50	1,285.62
Maintenance	12.00	198.90
Bridges—construction		29,000.00
Total		$377,432.01

In addition to the above, work was continued on the Stewart–Cassiar road. The construction is supervised by the Department of Highways on behalf of the Department of Mines and Petroleum Resources. At the south end of the road the 31.87-mile section between Strohn Lake and the lower crossing of the Bell-Irving River was completed. The 38.1-mile section between the south and north crossings of the Bell-Irving River was cleared and grubbed, and a contract was let on the substructure of the bridge to be erected at the south crossing of the Bell-Irving River. At the north end of the road a contract was awarded in November for the construction of the 29.08-mile section between Burrage Creek and the Ningunsaw River.

MUSEUMS

The Department has a large exhibit of mineral and rock specimens in the Douglas Building, Victoria; collections are also displayed in the offices of the Inspectors of Mines at Nelson, Vancouver, and Prince Rupert.

Specimens from the collection in Victoria, accumulated in a period of more than 60 years, are displayed in cases on the fourth floor of the Douglas Building. The collection includes specimens from many of the mines and prospects in the Province, and also specimens of type rocks and special minerals from British Columbia and elsewhere.

British Columbia material includes specimens collected by officers of the Department of Mines and Petroleum Resources and specimens donated by property-owners. The collection also includes type specimens purchased from distributors. Other valued specimens or groups of specimens have been donated or loaned to the museum.

ROCK AND MINERAL SPECIMENS

Information regarding collections of specimens of rocks and minerals available to prospectors and schools in British Columbia may be obtained from the Chief of the Mineralogical Branch.

PUBLICATIONS

Annual Reports of the Minister of Mines and Petroleum Resources, bulletins, and other publications of the Department, with prices charged for them, are listed in the Department of Mines and Petroleum Resources List of Publications, available from the Chief of the Mineralogical Branch.

Publications may be obtained from the offices of the Department in Victoria and from the office of the Geological Survey in Vancouver. They are also available for reference use in the Department's library (Mineralogical Branch) at Victoria, in the reading-room of the office of the Geological Survey of Canada in Vancouver, and in the offices of the Inspectors of Mines in Nelson and Prince Rupert, as well as in public libraries.

MAPS SHOWING MINERAL CLAIMS, PLACER CLAIMS, AND PLACER-MINING LEASES

From the details supplied by the locators, the approximate positions of mineral claims held by record and of placer-mining leases are shown on maps that may be inspected in the central records offices of the Department of Mines and Petroleum Resources in Victoria and Vancouver. Copies of these maps may be obtained on request made to the Chief Gold Commissioner, Victoria. The boundaries of surveyed claims and leases are shown on the reference maps and other maps of the British Columbia Department of Lands, Forests, and Water Resources.

OFFICES OF THE BRITISH COLUMBIA DEPARTMENT OF MINES AND PETROLEUM RESOURCES AND THE DEPARTMENT OF MINES AND TECHNICAL SURVEYS, CANADA.

The Provincial Inspectors of Mines and Resident Engineers for the Vancouver Island and Lower Mainland districts, the Silicosis Control Inspectors, and the Gold Commissioner and Mining Recorder for Vancouver Mining Division occupy offices at Room 320, 890 West Pender Street,* Vancouver. Nearby, at 326 Howe Street, officers of the Geological Survey of Canada are stationed, and a technical library is maintained.

The services offered to the public at these two offices include technical information on mining and the geology of the Province, the identification of mineral specimens, distribution of Federal and Provincial mining and geological publications, a reference library, a display of rocks and minerals, and a central records office.

* New address, effective August, 1966.

Topographic Mapping and Air Photography

The Surveys and Mapping Branch of the British Columbia Lands Service is responsible for maintaining and extending official surveys and mapping programmes in British Columbia. For a complete summary of the Branch's work during the past year, the reader is referred to the Annual Report of the British Columbia Lands Service, 1965.

The Legal Surveys Division issued 1,139 sets of instructions to surveyors and received field-notes or plans for 760 lots surveyed under the *Land Act* and 100 under the *Mineral Act*. A total of 70 mineral-claim field-books were prepared during the year. Fifty departmental reference maps were recompiled and renewed during the year, and in areas of complex land alienation the scale was enlarged to 2 inches to 1 mile.

The Topographic Division made a control survey along the west coast of Vancouver Island to co-ordinate 44 survey stations. Also, in the Stikine River-Iskut River area, control was established for 7½ National Topographic 1:50,000 scale map-sheets. Both projects were prompted by mineral exploration, the west coast of Vancouver Island control survey for use in exploratory offshore petroleum drilling and the Stikine-Iskut survey as an aid to lode-metal prospecting.

In connection with forest surveys and inventory, the Air Division of the Surveys and Mapping Branch photographed 18,540 square miles at approximately 4 inches to 1 mile (20 chains) scale. Blocks of air-photo coverage were obtained in the Hazelton, Monkman, Nisconlith Lake, Purden Lake, Redonda-Sayward, Raft-Adams-Barriere, Slocan-Nakusp, and Tatla-Taseko areas. A 9,830-square-mile block of photography from southern Tweedsmuir Park to Lillooet was covered at approximately 2-inches-to-1-mile (40 chains) scale for map-revision purposes. Other work included photography of the central part of the Peace River Block, National Topographic unit 82L/SE, and parts of the west halves of National Topographic units 92H and 92I, also at 40 chains scale. In National Topographic units 104B and 104G (Stikine-Iskut area), 4,570 square miles of photography at 40 chains scale was obtained for topographic mapping and another 815 lineal miles was photographed along the Stikine and Iskut River valleys.

The mineral industry borrowed or purchased nearly 24,000 standard 9-by-9-inch aerial photographs in 1965, a 70-per-cent increase over 1964. The British Columbia Department of Mines and Petroleum Resources used 1,825 photographs.

The Geographic Division produced six new land status maps during 1965. Another status map, 3E (Peace River), was completely revised. New 1:250,000 scale status editions of National Topographic sheets 82M (Seymour Arm), 82N-O (Golden), 83D-C (Canoe River), and 93H–83E (McBride), were printed during the year. Two sheets were also published at 1-inch-to-2-miles scale, these being 82J/SE-SW (Canal Flats), and 82L/NE (Revelstoke). A total of 12 Provincial topographic manuscripts were reproduced by Federal mapping agencies at 1:50,000 scale. In keeping with the increasing development of electronic computer programmes, calculations by the Trigonometric Control Section of Geographic Division are now almost completely based on such programmes. Two in particular, " Bride " and " Groom," account for most of the volume of calculations.

Complete indexes to topographic and cadastral maps and to Provincial aerial photography may be obtained from the Director, Surveys and Mapping Branch, British Columbia Lands Service, Victoria, B.C.

Department of Mines and Technical Surveys

The Canadian Government Department of Mines and Technical Surveys performs many functions related to mining and the mineral industry in general. The Mines Branch, Geological Survey of Canada, Surveys and Mapping Branch, and Mineral Resources Divisions are services of the Department of direct interest to the mineral industry. Brief reference to the work of the Surveys and Mapping Branch in British Columbia is made in the preceding note headed "Topographic Mapping and Air Photography." A note on the Geological Survey of Canada follows this paragraph and is followed by notes on the Mines Branch and the Mineral Resources Division.

GEOLOGICAL SURVEY OF CANADA

By an arrangement made at the time the Province of British Columbia entered Confederation, geological investigations and mapping in the Province are carried on by the Geological Survey of Canada. Several geological parties are in the field each year. Many excellent reports and maps covering areas of British Columbia have been issued by the Geological Survey of Canada, and they have made available a great amount of information that has been of much benefit to the mining and prospecting activities in British Columbia.

A branch office of the Geological Survey of Canada is maintained in Vancouver. Maps and reports on British Columbia can be obtained there. J. E. Armstrong is in charge of this office at Room 102, 326 Howe Street, Vancouver, 1.

Field Work by Geological Survey of Canada in British Columbia, 1965

Geological mapping was done in the following map-sheets and major areas:—

R. B. Campbell in the Canoe River (83 D) map-area and with H. W. Tipper in the Bonaparte River East Half (92 P, W ½) map-area.

R. J. Fulton on the surficial geology of the Vernon West Half (82 L, W ½) map-area.

E. C. Halstead on the surficial geology of southeastern Vancouver Island.

G. B. Leech in the Kananaskis Lakes West Half (82 J, W ½) map-area.

H. W. Little and J. W. H. Monger in the Greenwood West Half (82 E/2, W ½) map-area.

J. E. Muller in central Vancouver Island area (parts of 92 F, 92 G, 92 K).

V. A. Preto in Grand Forks West Half (82 E/1, W ½) map-area.

R. A. Price and E. W. Mountjoy on Operation Bow-Athabaska extending across the Rocky Mountains into British Columbia.

J. A. Roddick, A. J. Baer, and W. W. Hutchinson on Coast Mountain project.

G. C. Taylor, with six others, on Operation Liard in northeastern British Columbia.

H. W. Tipper in Bonaparte River West Half (92 P, W ½), Quesnel (93 B), and Prince George (93 G) map-areas.

J. O. Wheeler in the Lardeau West Half (82 K, W ½) map-area.

The following special studies and mapping projects were carried out:—

J. E. Armstrong made a study of glacial deposits and history in the Kitimat-Terrace area.

D. J. T. Carson conducted metallogenic studies on Vancouver Island.

J. A. Coates continued work in the Manning Park area.

R. J. Fulton made special studies in connection with Columbia River development.

W. R. Fyson studied structures in the Shuswap Lake area.

E. C. Halstead made ground-water studies in the Fraser Lowland.

G. D. Hobson conducted experimental seismic surveys in Arrow, Shuswap, and Kamloops Lakes.

T. N. Irvine studied ultramafic rock in northern British Columbia.

E. D. Kindle continued a broad study of copper deposits.

D. W. Lawson began a hydrological study of Trapping Creek basin east of the Okanagan.

W. J. McMillan did mapping in the Monashee Mountains east of Seymour Arm.

R. E. Reesor continued his studies of gneisses in the Valhalla Mountains.

J. V. Ross made structural studies in Mount Revelstoke area.

J. G. Souther began a cordilleran volcanic study.

H. P. Trettin studied the Marble Canyon Formation.

Publications of the Geological Survey

A total of 37 publications of the Geological Survey of Canada relating to British Columbia was received by the British Columbia Department of Mines and Petroleum Resources in 1965.

MINES BRANCH

The Mines Branch has branches dealing with mineral dressing and process metallurgy, physical metallurgy, radioactivity, and fuels and explosives. A total of 62 publications of the Mines Branch pertaining to British Columbia was received in 1965 by the British Columbia Department of Mines and Petroleum Resources. They included tabular pamphlets dealing with coal mines, gold mines, stone quarries, petroleum refineries, and milling plants in Canada.

MINERAL RESOURCES DIVISION

The Mineral Resources Division publishes studies on mineral resources, mineral economics, mineral legislation, mineral taxation, mining technology, and other miscellaneous mineral-industry subjects. A total of 11 publications published by this Division was received by the library.

LODE METALS

CONTENTS

Notes on Metal Mines—*Continued*

GENERAL REVIEW

The average Canadian prices paid in 1965 for copper and lead were well up, the price for zinc showed a moderate increase, and the prices for other major metals were substantially unchanged from 1964. The copper and lead prices were about as high as have ever been reached. The United States prices for silver, lead, and zinc were constant throughout the year.

The total quantity of ore mined at all lode mines amounted to 15,042,356 tons and came from 55 mines, of which 40 produced 100 tons or more. The average number employed in the lode-mining industry in 1965, including mines, mills, and smelters, was 9,051.

In 1965, 33 mills were operated, and five slated for production in 1966 or 1967 were either under construction or had the sites prepared. Twenty-two mills operated the year round, six were seasonal or intermittent, and one, that of Cowichan Copper, reopened after a two-year closure. Four mills operated for the first time in 1965. Of the mills that operated, 14 treated ores of silver, lead, and zinc, six of copper alone, one of copper and molybdenum, one of nickel and copper, two of copper and iron, five of iron alone, two of gold, and two treated ores of molybdenum. At Endako a plant was installed to produce molybdic trioxide. Two small mills in the Slocan took custom ore.

The new mills were those at Endako (molybdenum), Boss Mountain (molybdenum), Yreka mine (copper), and Sayward (iron). The mills under construction were those of Wesfrob Mines Limited on Tasu Sound (iron and copper), British Columbia Molybdenum Limited at Alice Arm (molybdenum), Granisle Copper Limited on Babine Lake (copper), Red Mountain Mines Limited at Rossland (molybdenum), and Western Mines Limited at Buttle Lake (gold, silver, copper, lead, zinc).

The Trail smelter recorded custom receipts from British Columbia properties of 13,243 tons of ore, 3,839 tons of lead concentrates, and 15,021 tons of zinc concentrates. The ore came from 19 properties, of which three produced 94 per cent of the total in the form of siliceous gold-bearing ore. Lead concentrates came from 14 properties, one of which produced 55 per cent of the total. Zinc concentrates came from 13 properties, two of which produced 86 per cent of the total. The smelter also treated a considerable amount of concentrates from out-of-Province sources. Concentrates exported to American smelters amounted to: Copper, 8,774 tons (excluding 1,121 tons of matte); lead, 14,123 tons; and zinc, 45,618 tons. Concentrates exported to Japan amounted to: Copper, 124,372 tons; copper-nickel, 18,800 tons; iron, 2,010,365 tons. Molybdenum concentrates and molybdic trioxide were shipped to Europe and Japan.

The total value of lode metals produced, $176,844,096, was down about $4 million from the record value set in 1964. This was in spite of greatly increased prices for copper and lead. Copper production was well down because of pit problems and a strike at Craigmont, the largest producer. The volume of output of lead was the lowest in 10 years, not due to shortage of ore but largely because production at the Sullivan mine was less. The volume of zinc, the other major metal to register a price increase, was also down, for the same reason as lead. At the same time the Trail smelter accepted a considerable amount of concentrates and ore from Pine Point and other sources outside the Province.

There was thus a decrease in the value of metals produced, in spite of the fact that mining was booming in 1965, with four new mills brought into production, five new mills building, some exceedingly interesting development under way, and exploration activity at an unprecedented level. Records of exploration expenditure in the past are unfortunately too fragmentary to make meaningful comparisons, but the exploration side of the mining industry spent in 1965 a sum in excess of $13 million, and it is almost certain that this figure has not been exceeded in the past.

The quantity of gold produced declined for the fifth successive year, reaching the second lowest point in the present century, only fractionally better than the low of 1917. The reason for the most recent decline was a sharp drop in production from the Bralorne mine, a drop that is less ominous in view of the results of recent deep development at Bralorne. The Coast Copper mine, the third ranking producer, had in 1965 an output close to that of the Cariboo Gold Quartz mine, owing to ore with a higher gold content. Thirty-six per cent of the Provincial gold production was a by-product of base-metal mining.

Silver production, just under 5 million ounces, was the lowest in many years. This was due to a number of unrelated causes, and only to a minor extent was due to reduced output from the Sullivan mine.

Copper production dropped largely by reason of the fact that Craigmont, which had just overcome problems in the open pit, was strike bound for the last 10 weeks of the year. As a result, the output of about 30 million pounds was little more than half that mined in the best year, 1963. Britannia also was strike bound at the start of 1965 and did not resume production till May. Otherwise the copper picture was bright—Mount Washington had a full year of operation; the Yreka mine started production, and the Cowichan Copper operation got going after almost a two-year closure, although no concentrates were shipped from either. Bethlehem was in process of enlarging its mill to a capacity of 10,000 tons per day, although, because of change-over from one open pit to another, this fact did not raise the year's figures.

The future for copper is bright. Mills were building at the Granisle mine for a copper operation, at the Tasu mine for an iron-copper operation, and at the Lynx (Western) mine for a combined precious- and base-metal operation, all to be in production by the end of 1966. The Granduc access tunnel was driven 6,300 feet of the projected 11.6 miles. Exploration was widespread and will be dealt with below.

There was little change in the situation of lead and zinc other than the reduced production already mentioned. Increased production in other parts of Canada in recent years has greatly changed the over-all picture, and British Columbia no longer produces most of Canada's lead and zinc.

The production of iron concentrates was slightly higher; increases were recorded at the Coast Copper, Texada, and Zeballos mines. The Orecan property at Sayward was brought into production late in the year, but no shipments were made. Development at the Wesfrob property at Tasu was well under way, with production slated for late 1966. This property has the largest iron-ore reserve known to date. Work continued at the Jib deposit on Burnaby Island, with a substantial tonnage of magnetite ore showing up.

In 1964, 28,245 pounds of molybdenum worth $47,063 was produced as a by-product at the Bethlehem mine. Previous production for the Province had been about twice that amount. In 1965 the Endako mine, starting in June, and the Boss Mountain mine, starting in May, together produced 7,237,225 pounds of molybdenum in concentrates and as molybdic trioxide worth $12,332,844. Almost overnight British Columbia became a major producer of molybdenum.

The mineral molybdenite has been known to be widespread in the Province, but it had been assumed until very recent years that the prospect of ore lay in quartz veins which contained perhaps 1 per cent or more of the mineral. The demonstration of the existence of large amounts of disseminated low-grade ore at Endako and of breccia ore of higher grade at Boss Mountain, where for years only quartz veins were recognized, has changed the outlook on mining and has added an important new metal to the list, a metal that may become the Province's second or third most valuable mineral commodity. Production is slated at Rossland and Alice Arm for 1966 and 1967 respectively, and a good many properties are under serious investigation.

For the second time the annual number of mineral claims recorded exceeded those in all previous years. In 1965, 41,882 claims were recorded, a 43-per-cent increase from the 29,244 recorded in 1964. The great increase in 1965 was due in part to resurgence of activity in Kamloops, Nicola, and Omineca Mining Divisions, and specifically to activity in Golden-Fort Steele (silver-lead-zinc) and Skeena (mostly molybdenum) Mining Divisions. A record was set also in the number of certificates of work issued, 43,013 or 34 per cent more than the 32,047 certificates issued in 1964. A certificate of work is one claim-year work allowance, which is $100 spent on the ground and is consequently less than the actual gross expenditure per claim-year. The fact that the certificates of work have tripled in the last five years shows that much serious work is being done as well as some undoubtedly speculative staking.

All exploration eyes are still focused on the copper deposit at Galore Creek on the Stikine River and the molybdenum deposit at Glacier Gulch near Smithers. These are both deposits of major size that it is hoped will soon reach the development stage. Two others that have rapidly come to the fore, in 1965, are the Lornex deposit, copper-molybdenum, and the Brenda Mines deposit, molybdenum-copper. There are many other properties of promise, but these four appear to be the nearest to commitment to production.

It has taken the exploration industry quite a few years to realize the potential in the many low-grade but extensive copper-molybdenum deposits that for a long time have been known to exist. Problems of interpretation of surveys and of evaluation of sampling, together with problems of metal recovery and mining costs, have few precedents because large low-grade operations have been few in British Columbia and molybdenum is a new metal. Deposits that were abandoned not more than a few years ago as prohibitively low in grade are now being redrilled, in an attempt either to add tonnage or increase grade or both. This is, of course, not new in the history of mining, but copper-molybdenum combinations in very small amounts present problems new to British Columbia experience. This is not a game for faint hearts or small treasuries, with 20,000-tons-per-day operations under consideration.

Starting 10 years ago there have been surges of activity in what has grown to be considered the southern copper belt, including Kamloops, Highland Valley, Merritt, and Princeton. There has been, in 1965, resurgence in these areas, and the belt has been extended nearly to Okanagan Lake. Reassessment has pointed to the possible importance of molybdenum in parts of this belt or region.

Exploration in the northern part of the Province contained disappointments, but there were also encouragements. The decision to put the Alice molybdenum property at Alice Arm into production and the finding of interesting deposits on the Dak River and elsewhere have led to the recording of double the yearly average number of claims in the Skeena Mining Division.

Some of the staking activity in the east Kootenays was for phosphate in the Flathead and Elk River region, but mostly by far showed a renewal of interest in the silver-lead-zinc belt extending from Windermere to Golden. Columbia River Mines touched off the excitement when it found, on the old Ruth-Vermont, a deposit of replacement type lower in grade but more extensive than the veins investigated by the old-timers. Prospecting began in this region in the 1880's, with the first promise of the Canadian Pacific Railway, when, naturally, only high-grade or easily concentrated ore was sought.

Unprecedented high prices for mercury did not lead to more than a moderate amount of activity. What activity there was, was largely at Pinchi Lake and in the vicinity of the Pinchi fault. The dispersion of mercury vapour over deposits of mercury and other metals has been known for some years, and various " mercury sniffers " have been devised for the rapid detection of small amounts of mercury. In 1965 a Departmental geologist equipped with a field instrument, the Lemaire detector, investigated profiles across the Pinchi fault, and at deposits of molybdenite and other metals. The results of this work are to be found on pages 109–112 of this Report.

The growing use of aircraft in mining exploration is shown in the fact that a Sikorsky S-55 helicopter was on duty at the Galore Creek camp of Stikine Copper Limited and transported diamond drillers to and from work, 10 at a time. That company's exploration programme employed 14 diamond drills, the most intensive work done in the Province to date.

Amongst mining operations Bralorne sank the Queen shaft to the 43rd level, almost 6,000 feet below surface and a little over 2,000 feet below sea-level. The temperature of the rock at the bottom of the shaft is 127.5 degrees, and considerable effort is taken to keep the air temperature at a tolerable level, below 83 degrees wet bulb. Granduc commenced driving the 11.6-mile access tunnel, which will be the longest in Canada. Work continued at the Tide Lake camp north of Stewart, but work stopped at the western or mine end of the tunnel when, on February 18, 1965, a catastrophic snowslide or avalanche destroyed the Leduc camp and killed 26 men. A full account of this disaster, written by the Chief Inspector of Mines, appears in the " Inspection of Lode Mines, Placer Mines, and Quarries " section of this Annual Report.

The Department distributed a questionnaire to all exploration companies in an attempt to gather all pertinent exploration data in 1965. This was a modification of a form that was sent out in 1964. The response was very good, and has made the task of keeping abreast of development and of preparing the Annual Report considerably easier and has made the Report itself more inclusive and accurate. A form concerned with exploration and development expenditures sent out by the Bureau of Economics and Statistics also got a good reply.

NOTES ON METAL MINES

ALSEK RIVER

Copper-Cobalt

Alsek (Falconbridge Nickel Mines Limited)*

(59° 137° N.W.) Vancouver office, 1112 West Pender Street. Alex. Smith, manager; J. J. McDougall, engineer in charge at the property. Fourteen recorded mineral claims are held on the Alsek River 4 miles north of the O'Connor River junction. Six men spent one month diamond drilling 1,320 feet in three AX wire-line holes and 100 feet in two packsack holes. The property is reached by helicopter. It was not visited.

ATLIN

Lead-Zinc-Copper

Silver, Barber (Armore Mines Limited)*

(59° 133° N.W.) Head office, 203, 27 Carlton Street, Toronto 2, Ont.; Vancouver office, 625, 925 West Georgia Street; Alrae Exploration Limited, consulting engineers. This property was formerly known as the Atlin-Ruffner and is located 12 miles north-northeast of Atlin. It can be reached by driving 10 miles up Fourth of July Creek from the highway connecting Atlin to the Alaska Highway. This is a group of 58 Crown-granted mineral claims on which are found galena, sphalerite, pyrite, chalcopyrite, minor molybdenite, and ruby silver in veins. Under the supervision of R. Phillips, geologist, four men worked during the summer for three months. During this time geologic mapping and geophysical surveying were done over an area of 3,200 by 500 feet. A bulldozer tractor was used to dig 16 trenches with a total length of 3,500 feet and remove from the surface 3,000 yards of overburden. One and a half miles of road was rehabilitated and five of the old buildings renovated. The property was not visited. (*See* Annual Report, 1925, pp. 115–117.)

Molybdenum

Molly (The Consolidated Mining and Smelting Company of Canada, Limited)*

(59° 134° S.E.) Western district exploration office, 1150 Bay Avenue, Trail. G. Ryznar, supervisor at the property. Two groups, the Molly 13 and Molly 14, containing 48 mineral claims, are held by record on the north slope of Mount Caprice, southwest of Willison Bay on Atlin Lake, 35 miles southwest of Atlin. A crew of seven men worked from June 10th until October 15th. Surface diamond drilling was done to the extent of 1,500 feet in three holes. Mineralization consisted of molybdenite and minor chalcopyrite and pyrite. The host rock is granodiorite and alaskite, part of a satellite of the main Coast Range intrusions. Molybdenite occurs in breccia matrix, along fracture surfaces, and disseminated in quartz veins and also in the host rock. Alteration of host rock is present. Transportation was by float-equipped plane from Atlin to the camp on the shore of Willison Bay. The camp was not visited. (*See* Annual Report, 1964, p. 8.)

* By H. Bapty.

TAKU RIVER

Lead-Zinc-Silver-Antimony

New Taku Mines Ltd.* (58° 133° N.W.) Company office, 1033 Davie Street, Vancouver 5. L. G. White, vice-president in charge of exploration. This company owns the old Polaris-Taku group of 75 Crown-granted mineral claims and some recorded claims on the Tulsequah and Taku Rivers. In 1965 a camp was maintained at the old Tulsequah landing on the Taku River. A small amount of work was done on the Banker showing, and the company participated in the exploration of the Sil group on Erickson Ridge, conducted exploration work on Zohini Creek in the name of Zohini Mines Limited, and did work on an antimony showing on Stuhini Creek.

On the Banker prospect, further trenching was a continuation of work started in 1964 on a silver-lead-zinc showing on the east bank of the Tulsequah River about 3 miles from its mouth. Galena, sphalerite, tetrahedrite, and a little chalcopyrite occur in brecciated and silicified zones in limestone. Stripping and trenching were done on an outcrop passing apparently beneath deep overburden. Some high silver values have been reported, but the work to date has not demonstrated continuous mineralization. W. J. MacKenzie directed the work.

Antimony

Anty* (58° 133° N.E.) A stibnite showing occurs on the south side of Stuhini Creek about 2½ miles from its mouth at Tulsequah. Eight mineral claims on the Anty group are on a showing of stibnite in fine-grained sedimentary rocks that are chiefly argillites. When seen in August, several mineral strands had been partly exposed in the crumpled sediments. The greatest width that had been sampled was 15 feet, although the occurrence of relatively abundant stibnite was in individual widths of an inch or so to about 1 foot. Stripping and ground sluicing were done under the direction of W. J. MacKenzie from the new Taku camp at Tulsequah. Transportation was by helicopter. A later published report stated that a section 110 feet long with an average width of 4.9 feet assayed 3.25 per cent antimony and another 240 feet long with an average width of 5.2 feet assayed 9.5 per cent antimony.

Silver-Lead-Zinc

Sil (Ericksen-Ashby Mines Ltd.)* (58° 133° N.E.) Company office, 1030 West Georgia Street, Vancouver 5. J. M. Powelson, president. This property of 34 recorded mineral claims is under option to Mineral Development Company a subsidiary of Homestake Mining Company, of San Francisco. Work in 1965 was directed by W. J. MacKenzie, of New Taku Mines Ltd., from a camp at the old Tulsequah landing on the Taku River.

The showings are on the summit and nose of the high steep-sided ridge that extends north from Mount Ericksen. The north end of the ridge is at 4,660 feet elevation (company datum). In 1952 The Consolidated Mining and Smelting Company of Canada, Limited, diamond drilled a hole west into the base of the ridge from a point near Ericksen Creek. In 1964 surface work was done and an adit was driven 460 feet at an elevation of 3,200 feet and nine holes were diamond drilled a total of 1,733 feet from underground. In 1965 a crew of seven men, working through a vertical range of 2,400 feet from the summit down, mapped geologically, put in 25 trenches totalling 1,016 feet with a gasoline drill, and stripped 6,500 square feet of bedrock by hand.

* By M. S. Hedley.

Mineralization is in a limestone band about 400 feet wide that trends north 50 to 60 degrees west down the mountainside. Various showings were seen in trenches from the ridge-top down to the top of the bluffs above the river. Ore minerals replace limestone across widths from 5 to as much as 20 feet, although continuity of widths or grade had not been established between trenches on August 12th. The following generalizations may be made: The mineralization includes galena, sphalerite, pyrrhotite, pyrite, stibnite, tetrahedrite, arsenopyrite, and chalcopyrite. Pink manganese minerals are present, including apparently rhodonite and rhodochrosite. Some of the best-grade sections appear to be on or near the ridge-top. The mineralization is a locus of brecciation and silicification within the limestone. The structure of the limestone band is of utmost importance in the conduct of exploration.

Two tent camps on the showings were serviced by helicopter. A crew of seven men was employed for five months.

Silver-Lead-Zinc-Antimony

Zohini, Arn*

(58° 133° N.E.) Zohini Mines Limited owns the Zohini group of 54 mineral claims and holds under agreement the Arn group of 10 claims. Company office, 401, 1033 Davie Street, Vancouver 5; L. G. White, exploration engineer. The property is on the north side of Zohini Creek, which flows westward into the Taku River, 8 miles above Tulsequah. The showing is a steeply dipping zone of shearing, fracturing, and alteration, striking about north 20 degrees east.

The uppermost known end of the zone, where it appears to weaken as well as to pass beneath talus, is at 4,500 feet elevation, and it has been followed by a series of open cuts and trenches down the steep hillside and a short distance below a " flat " area to an elevation of 2,900 feet. The rocks are on the whole flat lying, with agglomeratic volcanic rocks in the upper section above sediments including quartzites, greywackes, and some carbonate rocks. Some fine dioritic rock was seen in the volcanic section.

The zone is as much as 35 feet wide, with a main gouge band 1 to 5 feet wide in a variable situation within the zone. Mineralization consists of fine-grained galena, stibnite, sphalerite, and pyrite. It is concentrated in widths of as much as 5 feet, and in places a few inches wide, commonly in sheared rock. The zone appears to be less clearly defined in the sedimentary rocks.

Thirteen trenches totalling 400 feet were made with the aid of a gasoline drill, and 325 square feet of bedrock was stripped with pick and shovel. The geology in the vicinity of the zone was mapped. A crew of five men in a tent camp on the " flat " area was under the direction of W. J. MacKenzie from the New Taku camp at Tulsequah. Transportation was by helicopter.

ALASKA HIGHWAY

Tootsee River (59° 130° N.E.)

Silver-Lead-Zinc

Amy (Rancheria Mining Company Limited)†

Silver-lead-zinc mineralization at the head of Tootsee River and 2 miles northwest of the north end of Tootsee Lake was found in 1948 by J. St. Godard, of Flin Flon, while prospecting for Hudson Bay Exploration and Development Company Limited. The showings were located in September, 1948, as

* By M. S. Hedley.
† By Stuart S. Holland.

the Gem group. In 1949 that company made a geological examination of the property and drilled eight diamond-drill holes totalling 2,935 feet. Assessment work was recorded for five years in advance, after which time the claims reverted to Mr. St. Godard, who held them until 1962. The ground then was located in October, 1962, as the Amy by W. S. Kennedy, from whom the claims were acquired by Rancheria Mining Company Limited in 1964.

The showings are at an elevation of about 4,750 feet on the south side of a tributary which joins the Tootsee River from the west about 3 miles north of Tootsee Lake. The camp is reached by road from Mile 701 on the Alaska Highway, where the Rancheria River is crossed by the bridge to the microwave station. The road runs along the west side of Tootsee River, crossing to the east side 11 miles south from the highway and then fording the river again at 23 miles from the highway. Total distance to the camp is 25 miles.

The Amy claims are underlain by a succession of grey phyllite, argillite, quartzite, and limestone striking northwest and dipping 50 to 60 degrees southwest. These rocks are cut by granite of the Cassiar Intrusions. The valley occupied by the claims lies in an embayment in the regionally north-trending contact so that locally the contact trends in a northwesterly direction across the claims.

Vein mineralization, comprising replacement of pale-grey limestone by galena, sphalerite, pyrrhotite, and ankerite, outcrops at an elevation of about 5,000 feet. The mineralization strikes north 55 to 65 degrees west and occupies a sheer zone dipping about 60 degrees southwest. The mineralization, at least locally, is along a limestone-argillite contact and is roughly parallel to and about 400 feet northeast of the surface trace of the granite contact.

In 1949 Hudson Bay Exploration and Development Company Limited explored the vein on surface by seven trenches through deep overburden. From the vein outcrop in Camp Creek to the easternmost trench exposure, a vein length of at least 550 feet was indicated. In addition, the company put down eight diamond-drill holes totalling 2,935 feet. The maximum true width of vein was 7 feet intersected in hole No. 2.

In 1964 Rancheria Mining Company began operations. Magnetometer and geochemical surveys were made over an area 14,000 feet long in a northwest direction and 3,600 feet wide. A heavy metal anomaly was found at the exposure of the vein, and a second one was outlined about 2,000 feet to the southeast. A crosscut was driven at an elevation of about 4,935 feet to the vein which was intersected at 185 feet from the portal and at a depth of about 70 feet below the outcrop. The vein was drifted on to the southeast. In a 66-foot length of drift on a vein averaging 5.9 feet wide, face samples taken by the company assayed: Silver, 27.4 ounces per ton; lead, 7.5 per cent; and zinc, 7.4 per cent. The considerable variation in the silver to lead ratio and the occurrence of high silver values when the zinc content is high and the lead content low is explained by the presence of silver-bearing tetrahedrite identified on polished surfaces of ore.

In 1965 the vein was followed about 190 feet northwest to a point beneath Camp Creek. There an open watercourse was encountered, and drifting in that direction was stopped. The vein to the southeast was followed an additional 163 feet. For 72 feet the vein averaged 4.5 feet in width and assayed 28.2 ounces of silver per ton and less than 10 per cent combined lead and zinc. Drifting was stopped in a heavily faulted section of vein.

A lower crosscut portal was faced up about 250 feet below the upper adit.

Additional bulldozer trenching was done in 1965. Several deep trenches about 700 and 1,800 feet northwest of Camp Creek encountered mineralization that possibly indicates an extension of the main vein mineralization in that direction. Vein mineralization was also exposed by trenching in the vicinity of a geochemical anomaly about 2,200 feet southeast of Camp Creek. Total bulldozer trenching amounted to 3,750 lineal feet in 20 trenches.

Diamond drilling in 1965 totalled 7,500 feet in 24 holes. It was undertaken to prove the continuity of the vein at depth and to explore the vein mineralization along strike where deep overburden and permafrost made trenching unsatisfactory. (*See* Annual Report, 1949, pp. 70–71; Assessment Report No. 44.)

RACING RIVER

Copper

Churchill (Magnum Consolidated Mining Co. Ltd.)*

(58° 125° S.E.) Company office, 700, 1030 West Georgia Street, Vancouver 5. There are 69 claims in the group, which is 40 miles south of Mile 410 on the Alaska Highway. Access is by truck-road up the Racing River from Mile 410. The construction of this access road comprised the major work in 1965. The group is under option to Canex Aerial Exploration Ltd., who had two men spend one week on geological mapping. The property was not visited.

CASSIAR

Molybdenum

Storie (New Jersey Zinc Exploration Company (Canada) Ltd.)*

(59° 129° S.W.) Company office, 160 Front Street, New York; western office, 905, 525 Seymour Street, Vancouver 2. This property is 4 miles from Cassiar and can be reached by four-wheel-drive vehicle. New Jersey Zinc Exploration Company (Canada) Ltd. has an option on these claims, which are owned by W. Storie. The deposit is a porphyry copper type. Work included the construction of 1 mile of access road and 2,449 feet of diamond drilling in eight holes. Five men were employed for 4½ months under the direction of W. Metzlaff and P. Crone, field supervisors. The property was not visited.

Silver-Lead-Zinc

Snow, Cobra (Fort Reliance Minerals Limited)†

(59° 129° S.E.) An occurrence of zinc-lead mineralization near the summit of Mount Haskin has been known for at least 60 years and has been staked and held from time to time. Currently the main area of mineralization is covered by the Snow claims, located in 1960. Additional claims of the Cobra and May groups were located in 1965. All are held by Fort Reliance Minerals Limited.

The mineralization is at an elevation of about 6,000 feet near the summit of Mount Haskin. It is reached by 8 miles of steep road, passable for four-wheel-drive vehicles, which branches from the Cassiar road at Mile 72. A tent camp was established at about 5,500 feet elevation and was used during August and September when seven diamond-drill holes totalling 1,647 feet were drilled. This work was done as a joint venture by Fort Reliance Minerals Limited and United States Smelting, Refining & Mining Co.

The rocks on Mount Haskin comprise grey and brown siltstones, which are overlain by pale-grey massive to well-bedded limestone. These rocks belong to the Atan Group of Cambrian age. On the west side and about 200 feet from the limestone contact, the siltstones are intruded by a sill of light-coloured feldspar

* By W. G. Clarke.
† By Stuart S. Holland.

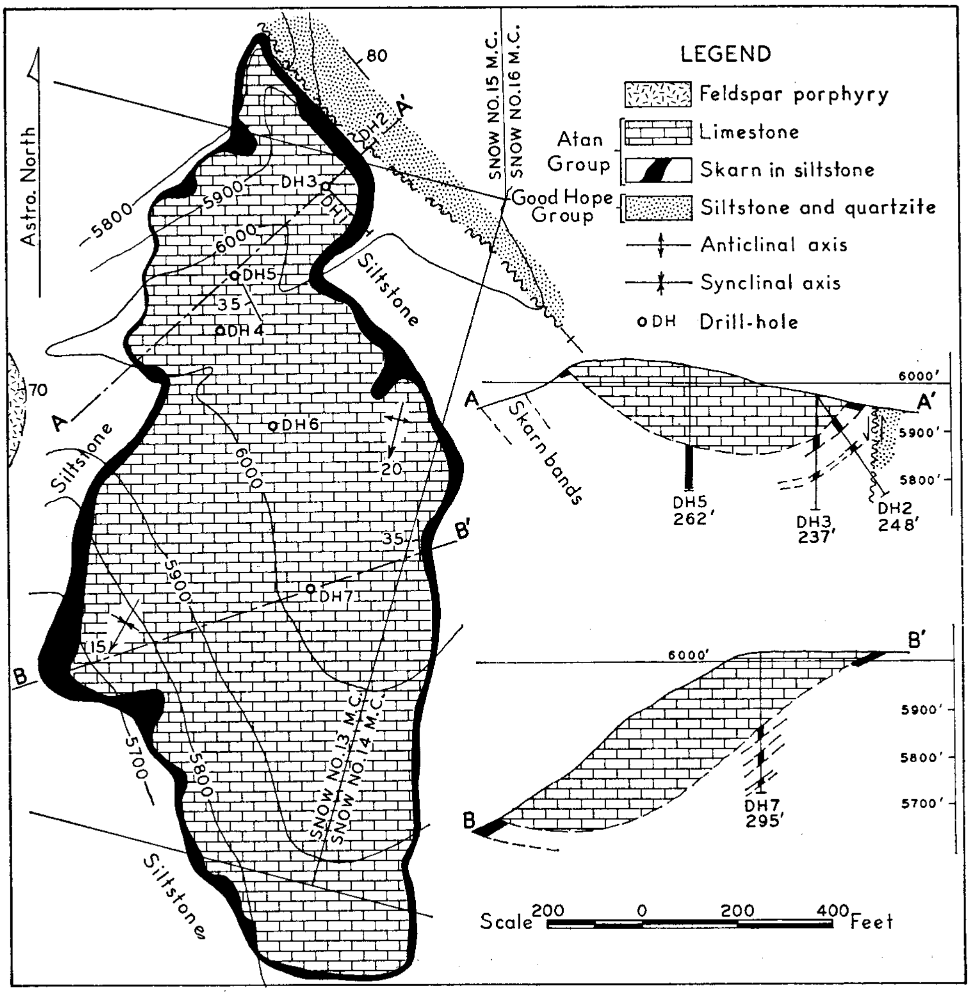


Figure 1. Geology of the Snow group, Mount Haskin.

porphyry which has hornfelsed the immediately adjacent rocks. On their northeast side the Atan rocks are in contact, along a vertical northwesterly trending fault, with steeply northeast-dipping siltstones and quartzites belonging to the Good Hope Group of Proterozoic age.

The limestone is exposed in an ovoid area (*see* Fig. 1) about 2,000 feet long in a northerly direction and with a maximum width of 800 feet. It occupies a northerly trending synclinal structure which has been warped along northeasterly trending axes into a synform with very low plunge; on the south the base of the limestone outcrops at about 5,830 feet elevation and 2,000 feet to the north at 5,750 feet elevation.

Skarn occurs at the lower contact of the limestone with the underlying siltstones and also at several lower horizons in the uppermost 100 feet of siltstone. The skarn at the limestone contact reaches its maximum known thickness of 35 feet in one of the diamond-drill holes. In outcrop it ranges in thickness from 2 to 15 feet.

The skarn in many places is mineralized in varying amount by pyrrhotite and sphalerite, and smaller amounts of galena, pyrite, and chalcopyrite. The best mineralization outcrops at the northeast end of the synform, along and near the northwesterly trending fault. Trenches and bulldozer stripping in 1965 exposed skarn and sulphide along the length of the eastern side. On the steep slopes on the western side, skarn and sulphides are visible in natural exposures in widths up to 15 feet.

Sampling in 1949 by an examining engineer along the fault indicated a length of 300 feet having a grade of: Silver, 2.66 ounces per ton; lead, 2.7 per cent; and zinc, 8.5 per cent across a width of 19 feet. Additional sampling in 1964 by the company averaged about 2 ounces of silver per ton, 2 per cent lead, and 6.4 per cent zinc.

In August seven diamond-drill holes totalling 1,647 feet were put down. Their locations are shown on Figure 1. Holes 1 and 2 were inclined at minus 55 degrees; the rest are vertical. One of the best sections of mineralized skarn was 11.9 feet thick at a depth of 84.4 feet in hole No. 3. It assayed: Silver, 1.96 ounces per ton; lead, 4.5 per cent; and zinc, 9.0 per cent. The last hole, No. 7, was completed on August 29th. (*See* Assessment Report No. 48.)

[Reference: *Geol. Surv., Canada,* Mem. 319, p. 116.]

McDame Belle, Bar, Yellowjack, Etc. (Ventures Mining Ltd.)*

(59° 129° S.E.) The company holds the McDame Belle Nos. 1 and 2, Three Square, and Four Square mineral claims under option from John Bartle and the Bar, Yellowjack, Y.J., North, Creek, and Cathy groups of claims by record. The claims total 122. The McDame Belle has been held by John Bartle since 1949. It covers mineralized showings in the canyon, on which a very old adit was driven on the south side of McDame Creek. These showings are those known in 1900 as the McDame (*see* Annual Report, 1900, pp. 783–784).

The mineralized showings are exposed on both sides of the canyon of McDame Creek about 2 miles downstream from the old settlement of Centreville. The claims extend along the McDame Creek canyon and for some distance back from either side. The Cassiar road extends through the property, and the camp of Ventures Mining Ltd. is reached by a short road turning off to the south at Mile 67.5.

The Ventures company acquired the ground in 1963, and since then it has undertaken extensive exploration. Very detailed geological mapping has been done along the canyon, using surveyed grid lines for control. The grid subsequently was used as a framework for an electromagnetic survey, the results of which were inconclusive. Finally selected zones have been explored by closely spaced diamond-drill holes. In 1964, 14 drill-holes totalling 3,154 feet were completed, and in 1965, 27 drill-holes totalling 6,977 feet were completed. This work has been done under the supervision of R. G. Hawley, with Allan P. Fawley, consulting geologist.

The canyon of McDame Creek cuts through a succession of limestone and dolomite members with minor interbeds of argillite belonging to the Atan Group. These rocks strike northwest and dip steeply to the southwest. At the upper part of the canyon the limy succession is overlain by grey phyllites of the Kechika Group. All these rocks are of Cambrian and Ordovician age.

Detailed geologic mapping by the company discloses that the canyon is the site of a northeasterly trending fault zone up to 50 feet wide. The zone is vertical or dips 75 degrees southeast, and horizontal mullions and offset beds indicate that there has been left lateral wrench movement along it. It is cut by northwesterly striking faults, of which the Yellowjack fault, striking north to north 20 degrees west and dipping 70 to 80 degrees west, is one.

* By Stuart S. Holland.

Seven mineralized zones have been mapped and partly explored, but most work has been concentrated on two, the Cariboo and Yellowjack zones, both of which are on the south side of McDame Creek.

Cariboo Zone.—The Cariboo zone, formerly known as the McDame, is reached by a cable crossing to an island in the creek. In 1900 an adit was driven into the canyon wall on the south side of the creek for a distance of 32 feet bearing south 25 degrees east. The adit crosses 15 feet into the footwall of a mineralized zone about 30 feet wide striking south 80 degrees east and dipping 70 to 80 degrees south. There is skarn alteration (grossularite, diopside, and tremolite) up to 10 feet wide along the footwall of the zone.

Mineralization consists of galena and sphalerite, and some pyrite, pyrrhotite, chalcopyrite, and minor specular hematite and scheelite. Bismuth has been detected in amounts up to 2 per cent in some samples. The mineralization occurs as massive lenticular replacements parallel to bedding, as fracture fillings crossing the bedding, or as disseminations in the skarn zones.

The Cariboo zone was explored by drill-holes about 25 feet apart which traced a strike length of 200 feet. The zones was found to extend to a depth of 250 feet below creek-level and to have a width of from 5 to 20 feet.

At an early stage in 1965 the company's calculation of ore in the Cariboo zone was 30,000 tons, grading 8.6 ounces of silver per ton, 3.6 per cent lead, 3.0 per cent zinc, and 0.35 per cent copper. Additional drilling has been done since, and a later announcement by the company was that 100,000 tons of ore had been indicated.

Yellowjack Zone.—The Yellowjack zone is on McDame Creek about 1,400 feet upstream from the Cariboo. It is near the head of the canyon and is reached by the road that crosses the creek through the dredge tailings of Moccasin Mines Ltd.

The Yellowjack zone is localized by a fault which strikes north to north 20 degrees west and which dips 70 to 80 degrees west. The fault zone has been mapped for a length of 600 feet and in places is as much as 50 feet wide.

Bulldozing on surface disclosed mineralization extending for a length of 40 feet and across a width of 10 feet. Between February and May 15th diamond-drill holes totalling 3,165 feet were put down to explore the zone along strike and at depth. The mineralization was shown to extend to a depth of 170 feet.

The company has stated that the Yellowjack zone contains 6,000 tons grading silver, 7.5 ounces per ton; lead, 4.2 per cent; zinc, 1.2 per cent; and copper, 0.2 per cent.

[References: *Geol. Surv., Canada,* Mem. 319, p 114; *Minister of Mines, B.C.,* Ann. Repts., 1963, p. 6; 1964, p. 11.]

DEASE LAKE

Copper

June, Stikine (Lytton Minerals Limited)*

(58° 129° S.W.) Company office, 602 West Hastings Street, Vancouver 2. The 40 mineral claims in this group are held under option by Lytton Minerals Limited, a subsidiary of The Patiño Mining Corporation Ltd. The property is on the Cassiar–Stewart highway 20 miles south of Dease Lake. Topographic and geological mapping were done and geophysical and geochemical surveys were made. Four trenches with a total length of 800 feet were made by bulldozer, and 4,600 feet of diamond drilling was done in 10 holes. Eight men were employed for six months under the supervision of D. W. Asbury, chief geologist.

* By W. G. Clarke.

May (Newconex Canadian Exploration Limited)*

(58° 129° S.W.) Vancouver office, 914, 525 Seymour Street. This group of 11 claims owned by the company is at Gnat Lakes, on the Cassiar–Stewart highway. Two men spent two months on the property making a magnetometer survey and doing general exploration under the direction of J. S. Ives, senior geologist. The property was not visited.

Copper-Lead-Zinc-Gold

A-L (Cultus Explorations Ltd.)*

(58° 129° S.W.) Company office, 570, 1 Thornton Court, Edmonton, Alta. C. D. Stewart, vice-president. These claims are 17 miles southeast of Dease Lake and may be reached from the Stewart–Cassiar highway by jeep and tractor via a 10-mile access road. There are 64 claims in the group, owned by Cultus Explorations Ltd. Nearly 8,000 feet of trenching was done by bulldozer in 16 trenches. Four miles of jeep-road was built. Six men were employed for three months under the supervision of W. S. Read, consulting geologist. The property was not visited.

Copper-Molybdenum

Joy (Kennco Explorations, (Western) Limited)*

(58° 129° S.E.) Company office, 1111, 1030 West Georgia Street, Vancouver 5. This group of 32 mineral claims, owned by the Company, is 33 miles east of Dease Lake and 6 miles southeast of Eaglehead Lake. Access is from Dease Lake by floatplane and helicopter. Geophysical and geochemical surveys were made. There was 1,432 feet of diamond drilling done in four holes. Seven company and six contractor employees worked for one month under the direction of G. H. Rayner, senior geologist. The property was not visited.

LETAIN LAKE

Copper

ANT (Julian Mining Co. Ltd.)*

(58° 128° S.W.) Company office, Britannia Beach; field office, 122, 744 West Hastings Street, Vancouver 1. This property, consisting of 20 mineral claims owned by Julian Mining Co. Ltd., is 10 miles south of Letain Lake. Access is by tractor-road from Pass Lake, a distance of 4 miles. The deposit is a replacement of limestone. Two men were employed for two weeks doing geological and geochemical mapping under the direction of R. S. Adamson, chief geologist. The property was not visited.

CHUKACHIDA RIVER

Copper

Chuck and Cheta (Canadian Superior Exploration Limited)*

(57° 127° N.E.) Company office, 908, 7 King Street East, Toronto, Ont. There are 52 mineral claims in this group, which is south of Chukachida River near Moosehorn Lake. The property was reached by floatplane and helicopter. Exploration was a joint venture by Canadian Superior Exploration Limited, Canadian Exploration Limited, and Asbestos Corporation Limited. The first company discovered the deposit in 1964. Bornite, chalcocite, and chalcopyrite occur in quartz-filled fractures. C. E. Dunn, Canadian

* By W. G. Clarke.

Exploration Limited senior geologist, was in charge of the programme with a crew of seven. Two months' work was done in geological mapping, sampling, and trenching. Seven trenches of a total length of 344 feet were made by blasting. The property was not visited.

SUTLAHINE RIVER

Copper-Molybdenum-Gold-Silver

Thorn, Club, Kay (Julian Mining Co. Ltd.)* (58° 132° N.W.) Head office, Britannia Beach; Vancouver office, 122, 744 West Hastings Street. R. Macrae, engineer in charge. The Thorn, Club, and Kay groups, totalling 149 mineral claims, are on a tributary of the Sutlahine River, 4 miles from the river and 12 miles south-southeast of King Salmon Lake. A tent camp was established at the junction with a smaller creek, and a sub-camp on the Cirque zone was 2 miles to the northeast up this creek. Transportation was by fixed-wing aircraft to King Salmon Lake and by helicopter to the camps.

On the Kay group the Cirque showing of disseminated chalcopyrite and molybdenite is at the lip of a cirque at 4,500 feet elevation. Geological mapping and induced potential and magnetic surveys were preliminary to six BX holes being drilled a total of 2,716 feet in the syenitic nose of a dioritic body intruding rhyolite and andesite. Four of the six holes were in the intrusive.

A body of quartz feldspar porphyry is crossed by the minor tributary creek. A prominent pyritic zone of kaolinization and some sericitization and silicification follows the creek in porphyry and in the older rocks. Mineralization occurs erratically in the alteration zone, in quartz veins and masses; it consists of pyrite, tetrahedrite, and enargite, and erratic values in gold and silver are reported. Continuity of mineralization is apparently not indicated.

On the A zone on the Thorn claims, mineralization consists of chalcopyrite, pyrite, and sparse galena in rhyolite breccia on the east side of the main creek at about 3,000 feet elevation. The showing is on the south side of a steep east-west fault zone which contains some quartz and barite. Seven X-ray holes totalling 1,003 feet were diamond drilled on the A zone. A total crew of 15 to 20 men was under the direction of R. S. Adamson, chief geologist.

SHESLAY RIVER

Copper

Bing (Newmont Mining Corporation of Canada Limited)* (58° 132° S.E.) Vancouver office, 744 West Hastings Street. D. M. Cannon, manager of exploration. The Bing group of 94 mineral claims is 6 miles east of Tatsamenie Lake, mostly between the Samotua River and Trouble Creek, 5 miles from the Sheslay River. The showings range in elevation from 3,000 to 4,000 feet. The Bing Nos. 15 to 32 claims lie just northwest of the main claim block, west of Trouble Creek. Most of the property is on the gentle, open slopes of the Tahltan Highland at the eastern edge of the Coast Mountains.

The general claim area is underlain by andesitic lavas and tuffs which are cut by foliated diorite, diorite, and monzonite. These in turn are cut by feldspar porphyry and other porphyritic rocks. The volcanic rocks are dioritized and otherwise altered, and include bands of skarn which represent originally limy sediments. Mineralization, consisting of pyrite, pyrrhotite, chalcopyrite, and molybdenite, is related to a

* By M. S. Hedley.

feldspar-silica alteration that occurs for the most part in dioritized volcanic rocks. In the southern part of the western claim group a stibnite-bearing quartz vein was uncovered.

Geological, geochemical, airborne magnetic, ground magnetic, and induced potential surveys were performed on the main claim group. On the Bing Nos. 87 and 89 claims seven trenches, totalling 1,600 feet, were put in with a John Deere 440 tractor and a percussion drill. Seven miles of tote-road was constructed. Fourteen holes were diamond drilled, with an aggregate length of 6,797 feet. Work extended over a period of five months with five company and 13 contractor personnel. Gordon Gutrath was geologist in charge. Transportation was by fixed-wing aircraft from Atlin to Tatsamenie Lake and thence to the camp by helicopter.

BARRINGTON RIVER

Iron

MH* (57° 131° N.W.) The MH group of 82 mineral claims was located early in 1965 as an outcome of an aerial magnetometer survey the previous year. The locators sold to Stikine Iron Mines Ltd., 409 Granville Street, Vancouver 1. Edward Duncan, Calgary, president; J. F. McIntyre, consulting engineer. The property is on Shakes Creek, 20 miles west of Telegraph Creek and 34 miles distant by road.

The showing is an ultramafic body, very poorly exposed but apparently 1 mile or more across. On August 21st the only known outcrop had been extended by stripping, but a grid base laid out by bulldozer had not encountered much bedrock. Abundant float as well as some rock in place showed the body to be a highly variable black rock with some layering and several intrusive phases. Pyroxenite is apparently the main type, and there is also peridotite. No dunite or olivine-rich rock was seen; there is a little gabbroic material and some syenitic or dioritic rock. Magnetite appears to be a primary constituent and is widespread, but little sampling had been done at the time and it was impossible to estimate grade visually. Nowhere did the magnetite appear to be a major constituent. There is associated titanium.

The company built 22 miles of four-wheel-drive road from the existing road below Glenora, did a total of 12,500 feet of trenching and about 3 acres of stripping by bulldozer, and conducted a magnetometer survey along 29.5 line miles on 56 claims. Ten men were employed for a period of 3½ months under the direction of David H. Hawkins.

Copper

Poke (Kennco Explorations, (Western) Limited)* (57° 131° N.W.) Company office, 1111, 1030 West Georgia Street, Vancouver 5. C. J. Sullivan, president. The Poke group of 24 mineral claims is on Limpoke Creek, a tributary of the Barrington River. In an area largely obscured by overburden, copper mineralization occurs in syenitized volcanic and in intrusive rocks. Investigation of an induced polarization anomaly by diamond drilling was dropped when the drill failed to penetrate the overburden. The work involved nine men for a month under the direction of G. H. Rayner.

Copper-Molybdenum

Limpoke* (57° 131° N.W.) The Limpoke group of mineral claims lies northwest of Mount Barrington, at the head of Spann Creek and a southern tributary of Limpoke Creek. It was held under agreement in 1965 by Kerr-Addison Gold Mines Limited, Vancouver office, 1112 West Pender Street; William M. Sirola, manager.

* By M. S. Hedley.

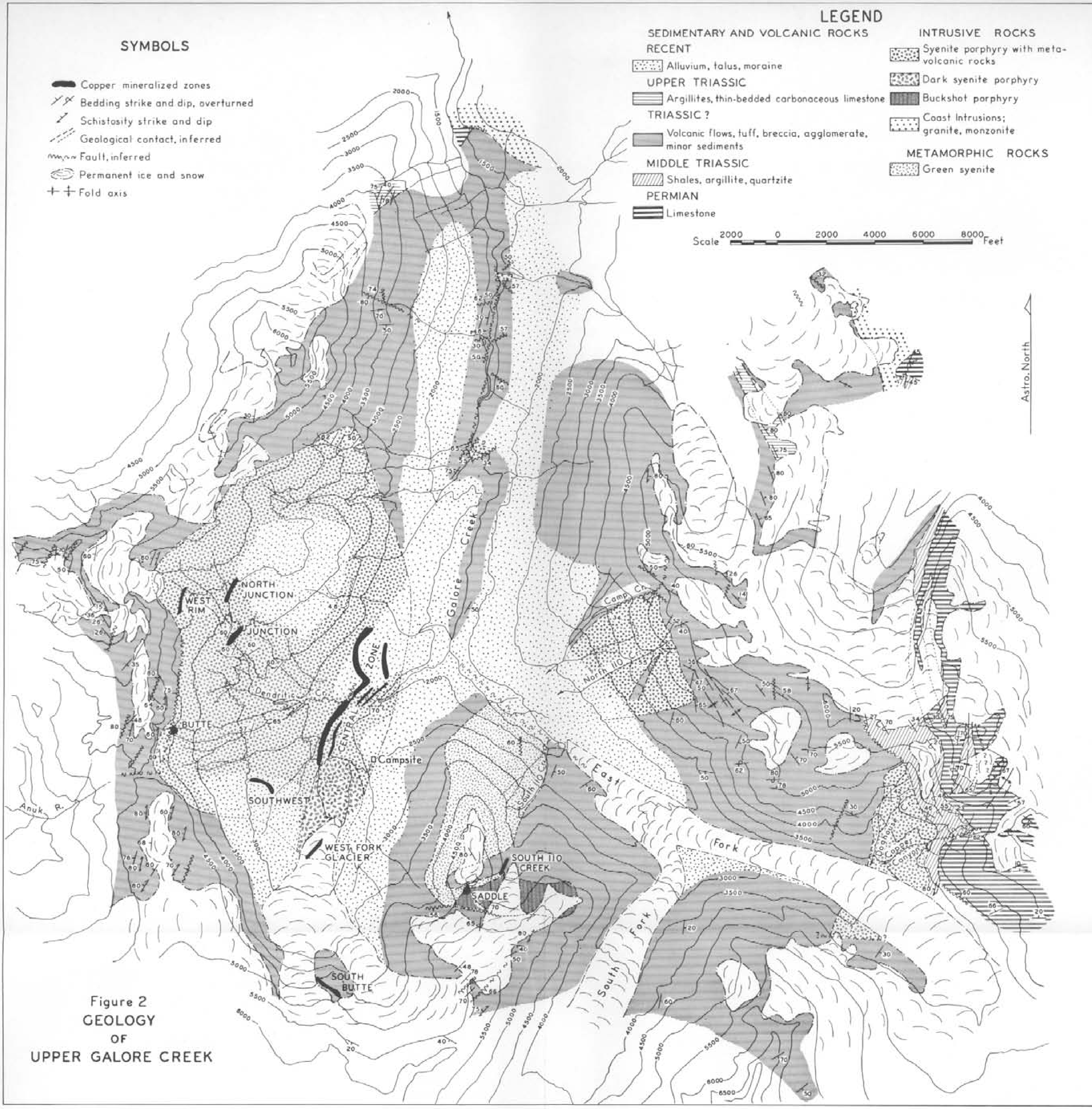


Figure 2
GEOLOGY
OF
UPPER GALORE CREEK

The showings lie mostly on a ridge at about 5,000 feet elevation at the southwest corner of a granodiorite stock measuring about 2 by 4 miles as mapped by the Geological Survey of Canada. The intruded rocks are andesitic volcanics which locally grade by dioritization into the intrusive, and near the contact are altered with formation of biotite and potash feldspar. The marginal phases of the intrusive are complex and show a variety of rock types and evidence of repeated intrusion. Chalcopyrite occurs chiefly in northwest-dipping fractures in the intrusive rather than in the greenstone. There is apparently little disseminated chalcopyrite, and the reported grade is low. Other sulphides include pyrite, pyrrhotite, and molybdenite. A topographic map was made, the area was mapped geologically, and two holes were diamond drilled a total of 1,211 feet on the ridge-top. The work involved 11 men over a 2½-month period and was directed by Clyde Smith.

GALORE CREEK

Geology of Upper Galore Creek*

Introduction

Galore Creek is a north-flowing tributary of the Scud River, which flows westward into the Stikine River. Upper Galore Creek includes the east and south forks. Of a number of copper showings scattered through the area, the deposits of Stikine Copper Limited are mainly situated around the head of Galore Creek whilst the Copper Canyon occurrence is several miles along the east fork.

The terrain is mountainous and rugged. Local relief is about 5,000 feet, ranging from 2,000 feet above sea-level in Galore Creek to about 7,000 feet on the highest of the surrounding summits. Large sections of the country are covered by moraine and till in the valleys and at intermediate elevations, and by permanent snow and ice fields at higher elevations.

The climate is severe in winter, with a snowfall measurable in many feet at the Stikine Copper camp-site. Summers are cool and moist with sunny spells between June and September.

Access into Galore Creek is difficult, and exploration so far has been almost wholly done with helicopters bringing personnel and materials over the mountains from a base at the junction of the Anuk and Stikine Rivers. The Anuk-Stikine base is served by float aircraft and barge transportation from the coast. In 1965 a road was commenced from the junction of the Scud and Stikine Rivers up the south bank of the Scud River and east bank of Galore Creek to the main camp area of Stikine Copper Limited. An aircraft landing-strip was built at the Scud-Stikine junction.

Regional Geology

Upper Galore Creek lies some 5 to 6 miles east of the main mass of intrusive rocks that forms the core of the Coast Range Mountains. In the area mapped, sedimentary and volcanic rocks ranging in age from Permian to Upper Triassic are intruded by Mesozoic and possibly Tertiary stocks. There is also a variety of dykes and sills of unknown ages.

Sedimentary and Volcanic Rocks

The oldest rocks in the area are thick beds of Permian limestone. These light-grey to buff weathering rocks form prominent hills in the eastern part of the area mapped. Much of the limestone is quite pure, although there are limited occurrences of cherty lenses and bands. Crystalline limestone is light coloured and is

* By W. G. Jeffery.

commonly massive, but more organic limestone is darker, with some carbonaceous material, and has bedding planes usually spaced 2 to 3 feet apart. Some fossil collections were made. Intense folding and faulting has occurred, and in at least one cliff exposure nearly vertical isoclinal folds are readily apparent. No estimate of thickness of this formation was made, but Kerr reports thicknesses between 2,000 and 4,000 feet in other parts of the region.

The Permian limestone formation is flanked on the west by a series of thin-bedded black and dark-grey argillites and quartzites. These beds are limy in places and include lenses of crystalline black carbonaceous limestone. The quartzites occur both in a thin-bedded fissile form, giving rise to shattered residual talus piles along the ridges, and as more massive brown to black flinty beds from 6 inches to 1 foot thick. The fissile argillaceous beds are highly fossiliferous in places, indicating a Middle Triassic age. Although this unit has an over-all dip to the east, local dips are greatly variable. There are so many small folds that thickness estimations are difficult, but it would appear that the total thickness of the sediments is not less than 500 feet. These sediments also occur in the form of tight steeply dipping folds within the Permian limestone.

The central ridge east of and parallel to Galore Creek exposes a narrow belt of argillitic limestones and limy argillites, and a distinctive conglomerate bed consisting of quartzitic pebbles and limestone fragments in a limy partially fossiliferous matrix that indicates a post-Permian age. The argillites contain Upper Triassic fossils. All these beds are vertical or near vertical in attitude.

On the western slopes above the lower part of Galore Creek there are carbonaceous argillites and shales with vertical attitudes that are strongly sheared along the bedding planes. No fossils were discovered. On the basis of structural attitude, location, and lack of siliceous sediments, these rocks have been equated with the Upper Triassic sediments to the east.

Volcanic rocks underlie the greater part of the area. The most abundant are pyroclastic rocks, mainly breccias and agglomerates. Andesitic and trachytic flow rocks are commonly massive and locally amygdaloidal. The volcanic rocks are dominantly green, although purple shades are common in some parts and brown and red colours were observed. In places deep-red and brown weathered surfaces are due to the oxidation of disseminated pyrite.

There is great variation in size and shape of the fragments in the pyroclastic rocks and flow breccias. The thickness of the volcanic pile must be considerable, but great variations in dip and extensive evidence of faults of unknown movement make thickness estimates very unreliable.

The ridge between the Anuk River valley and the head of Galore Creek has excellent exposures of volcanic breccias and agglomerates. Some of the volcanic bombs are well rounded. In one location there is a clear cyclic deposition of coarse agglomerate grading to medium-grained tuff with scattered larger fragments. Each cycle is up to 2 feet thick, though the sequence is interrupted by thicker beds of coarse material. There is also a volcanic breccia in which the fragments are predominantly intrusive rocks, many of them porphyritic in texture. On the southern part of the same ridge, southwesterly from the Stikine Copper camp, and adjacent to an icefield, there is a belt of schistose volcanic rocks, striking north-northeastward. Some of these rocks carry phenocrysts of pseudoleucite, up to 1 inch across. The phenocrysts, which can easily be broken away from the weathered rock, are stretched and deformed by the schistosity. The rocks are considered to be pseudoleucite trachyte flows, although there is a possibility that they could be dykes or sills intrusive into other volcanic rocks.

Throughout the volcanic rocks thin and probably lenticular occurrences of sediments can be found in several places. There are thin beds of indurated flaky grey and brown siltstones, but a greater proportion of the sediments consists of volcanic sandstone and grit and reworked tuff. A small outcrop of conglomerate was noted in a snowfield above outcrops of brown sediments on cliffs west of Galore Creek. The brown sedimentary band was seen from air observations to extend along the cliffs on the south side of upper Jack Wilson Creek.

The most abundant outcrops of intravolcanic sediments with clearly defined attitudes occur on the north slopes of the East Fork, approximately above the toe of the glacier. These rocks are purple volcanic sandstones and reworked tuffs. Graded bedding indicates that the beds are overturned in places. The relationship of this belt of rocks with the volcanic rocks higher along the ridge is obscure. Small outcrops of thin conglomerates and clastic limestones were observed near the heads of N110 and Camp Creeks, but no definite evidence of a sequence break was observed. Most of the volcanic rocks seen elsewhere in the area consist of green and brown massive rocks with thin distinct sedimentary horizons. There is a possibility that the volcanic rocks on the north slopes of the East Fork are a separate suite from the rocks in the rest of the area.

Porphyries

The area mapped does not extend as far west as the main Coast Range intrusive masses. However, the margins of two bodies of medium- to coarse-grained equigranular granite were observed. One body lies close to the mouth of Galore Creek and the other on the west slopes above the South Scud River. Neither of these rocks contains much quartz, but sufficient is seen in thin-section to warrant their classification as granite.

The most important intrusive rocks are three syenite porphyry bodies. The two westerly bodies, together with the intervening metavolcanic rocks and two other masses of syenite with differing textures, are termed the Galore Creek Complex by Barr (1965). Approximately 4 miles east-southeasterly of the junction of Galore Creek and the East Fork is the Copper Canyon syenite porphyry body.

Zones of copper mineralization are associated with all the syenitic intrusives. The largest amounts of copper now known occur within the most westerly syenite porphyry body, called in this report the Stikine Copper syenite. The Stikine Copper syenite is an intrusive complex that consists of a crudely sheeted mass of grey to pink porphyritic syenite that has invaded and metasomatized the rocks of Upper Galore Creek. A large part of what is mapped as the Stikine Copper syenite body consists of metavolcanic rocks. These are tuffs, flows, and volcanic breccias with minor sediments that are extensively altered and have porphyroid textures in places. Potash metasomatism has been widespread. Mineralogically the metavolcanic rocks are a heterogeneous assemblage of potash feldspar, amphibole, biotite, muscovite, apatite, garnet, diopside, chlorite, calcite, anhydrite, and magnetite, and contain sulphides in mineralized zones. The varying proportions of these minerals impart textures that range from a massive pink felsitic appearance to dark-brown to black biotite-chlorite-diopside skarn rock. However, the dominant type is a rock with angular grey, light-grey to cream, dark-green fragments and irregularly spotted with subhedral to anhedral white feldspars and dark spots of pyroxene and biotite flakes in a very fine-grained greenish-grey matrix. "Mottled breccia" is a field name that has been used for grey and green mottled metavolcanic rocks that contain distinct to ghost-like fragments.

The intrusive syenite porphyry is composed of approximately 75 per cent orthoclase, one-quarter of which may be pink to grey phenocrysts up to 2 inches long, in a matrix of epidote, pyroxene, and biotite with minor apatite, magnetite, and rare quartz grains. There are commonly two types of feldspars; the smaller are phenocrysts with sericite alteration and fresh growth rims; some of the larger appear to be porphyroblasts that have ragged boundaries in places.

The over-all sheeted form of the intrusive syenite trends north 20 degrees west and dips steeply westward. Some flat-lying sheets branch from the steeply dipping intrusive. Sparse evidence of bedding in the metavolcanic rocks indicates steep to moderate outward dips on the east and west flanks of the syenitic complex.

A similar syenite porphyry mass lying just east of the main forks of Galore Creek is termed the N110 Creek syenite. Other varieties of syenite comprising the Galore Creek complex are termed Dark syenite porphyry, Green syenite, and Buckshot porphyry.

The Dark syenite porphyry is about 3,000 by 2,000 feet in extent and lies on the southeast rim of the Stikine Copper syenite. The relationship of the two porphyries is not clear. Stikine Copper syenite tongues were observed cutting Dark porphyry, but less commonly the reverse relationship was seen. The western contact in part is composed of a syenite porphyry breccia healed by magnetite, and the magnetite was observed to extend as veinlets into the Dark porphyry. The Dark porphyry is normally composed of about 25 per cent stubby grey feldspar phenocrysts about one-half inch long in a fine-grained dark matrix of orthoclase and abundant biotite and scattered magnetite.

The Green syenite is a fine- to medium-grained equigranular rock that for the most part is separate from the other syenitic rocks. Relict banding and lenticular zones of fine-grained syenite indicate that it is derived from alteration of volcanic rocks. The rock is composed of about 80 per cent orthoclase feldspar with epidote, chlorite, and green and brown biotite, although there is considerable textural variation. In places small phenocrysts of amphibole are seen to be aligned as in volcanic flow textures. The rock has a noticeable magnetite content throughout.

Adjacent to the Green syenite and in partial contact with it is the Buckshot porphyry, which in the field appears to have distinct intrusive contacts with the surrounding volcanic rocks. The relationship to the Green syenite is not clear owing to a sheared and brecciated contact that contains both magnetite and chalcopyrite mineralization, but dykes of Buckshot porphyry have been reported cutting the Green syenite. The rock has a fine- to medium-grained purple to green appearance spotted with small cream subhedral feldspar phenocrysts which gave rise to the field name. Under the microscope the rock has a heterogeneous size range of subhedral and anhedral feldspars with about 15 per cent subhedral altered potash feldspar and rare plagioclase phenocrysts. Considerable alteration is evidenced by the widespread distribution of epidote, and breakdown of the amphiboles has taken place. The texture has a crushed appearance, although observable dislocations of minerals are not common.

The N110 Creek syenite mass is a separate body extending over an area roughly 1 by one-half mile. The syenite is porphyritic with phenocrysts of pink to cream feldspar in a feldspar-hornblende-chlorite matrix with abundant epidote. An increase in mafic minerals in the groundmass darkens the rock. Elsewhere an increase in the potash feldspar content imparts an over-all lavender colour to the rock, and there may be some secondary feldspathization connected with such zones. Small 2- to 3-inch-wide violet-coloured veins that cut the syenite may be termed syenite aplites.

A fault in Camp Creek forms the northwest boundary of the N110 Creek syenite. On the eastern margins intercalated metavolcanic rocks and syenite indicate that the upper part of this body is sill-like in form and conformable to the attitudes in the adjacent volcanic rocks.

The other major intrusive rock in the area is the syenite body at Copper Canyon. This has a composition similar to the other syenite masses and has approximately the same extent as the N110 Creek syenite—about 1 by one-half mile. The southern part is covered by ice and moraine of the East Fork glacier, and there is little doubt that the syenite extends under the glacier. On the south side of the glacier the cliffs under a large icefall were not examined by the writer, although a pyroclastic breccia with some porphyry fragments and disseminated pyrite has been reported. The reddish colour seen to extend part way up the southern cliffs when viewed from the north side suggests the occurrence of a rock different from the overlying black to green massive volcanic rocks that appear to have an over-all dip of 30 degrees to the east.

The Copper Canyon syenite is composed of a granular to porphyritic pink, reddish, or grey syenite with considerable variation in texture. In the porphyritic rock the phenocrysts are in a matrix of potash feldspar, biotite, apatite, and white mica. Epidote may be abundant along with chlorite, and abundant biotite alteration with some garnet has been observed. Much of the rock contains finely dispersed magnetite. In Doghouse Creek there are outcrops of intercalated metavolcanic rocks and syenite that dip gently eastward, conformable in attitude with the Middle Triassic and Permian sediments on the west. A conformable layered appearance is evident on the cliffs of Copper Canyon viewed from the East Fork glacier. The Copper Canyon syenite thus appears to be sill-like, in a manner similar to the N110 Creek syenite.

Throughout all the igneous rocks in the area there are numerous dykes composed of a great variety of rocks. These were not studied in detail by the writer, but information by Barr (1965) for the Galore Creek Complex indicates a series of dykes ranging from youngest to oldest in age as follows: Hornblende syenodiorite, basalt, felsite, lamprophyre, and syenite porphyry. Other dykes of syenitic and monzonitic composition occur. Some, but not all, of the syenite porphyry and allied dykes contain dispersed copper and pyrite mineralization in places. At Copper Canyon felsite or aplite, hornblende andesite, and lamprophyre dykes were observed.

Structure

Around the Galore Creek Complex strikes and dips in the volcanic and sedimentary rocks indicate an arch-like structure. However, the evidence is sparse in the dominantly massive volcanic rocks, and the pattern of the arch in relation to the syenite rocks of the Galore Creek Complex is not clear. Most of the volcanic rocks on the west flank of the Stikine Copper syenite have westerly dips. Some drill cores from the east margins of the Stikine Copper syenite contain scattered evidence of bedding in the metavolcanic rocks. These attitudes plotted in cross-sections suggest a dip of about 40 degrees east, and consequently the position of the arch axis may be roughly coincident with the centre of the Stikine Copper syenite body as mapped (Fig. 2). North of the Stikine Copper body the cliffs on the west side of the Galore Creek valley are composed of massive volcanics with thin metasediments that dip steeply to the south.

East of the N110 Creek syenite body there is a zone of tuffs, volcanic breccias, and sediments that dip steeply and in some places are overturned, from evidence of graded bedding. They indicate a zone of tight folding in this area.

The relationship between the volcanic rocks, Middle Triassic sediments, and Permian limestone at the eastern margin of the map-area remains debatable. The

Permian limestone clearly overlies the Middle Triassic sediments so that the stratigraphic sequence is overturned. On the ridge at the head of Doghouse Creek the sedimentary beds dip 30 to 40 degrees eastward, and across the Triassic-Permian contact there is little disruption of the beds. Within the limestone there are isolated areas of steeply dipping thin-bedded Middle Triassic sediments that are conformable with the limestone, indicating that the Middle Triassic and Permian rocks are tightly folded as one unit. Tight isoclinal folds wholly within the limestone can be seen on the large cliff faces in this high area. Off the ridge and down the slopes to the head of Copper Canyon the thin-bedded Middle Triassic sediments are crumpled and folded quite severely, this could be due to local faulting which exists along the length of upper Copper Canyon Creek, or intrusion of the syenite porphyry, or could be the effect of a major fault along the contact between the Middle Triassic sediments and the volcanic rocks. The existence of a contact fault has been suggested by Souther (oral communication). The contact between the Middle Triassic sediments and the volcanic rocks is not seen very clearly on the ridge due to piles of frost-riven debris, but some local crumpling and one steep northeastward-plunging dragfold were observed. Distant views of the cliffs to the north show that the sediment-volcanic contact is very sharp and could be a fault contact.

The thin-bedded carbonaceous limestones and argillites northward from the N110 Creek syenite body are Upper Triassic, on fossil evidence. They stand vertically or near vertically and strike toward the Permian limestone beds. The structural relation between the Upper and Middle Triassic sediments is unknown. On structural evidence and the fact that some Upper Triassic fossils have been found by Souther (oral communication) in thin sediments within the volcanic rocks of the area, the volcanic rocks are Middle to Upper Triassic in age.

Copper

Galore Creek (Stikine Copper Limited)*

(57° 131° S.E.) Company office, 1111, 1030 West Georgia Street, Vancouver 5. C. H. Burgess, president; D. A. Barr, geologist in charge at property. The property consists of 289 recorded mineral claims in the headwaters of Galore Creek. Access to the property is by air either from Prince Rupert or Wrangell, Alaska, to the junction of the Anuk and Stikine Rivers, 10 miles west of Upper Galore Creek. Helicopter transport has been used from the Anuk-Stikine junction to the property. A road 29.5 miles long from the Stikine River up the Scud River and Galore Creek was commenced in 1965 and an airstrip was built at the Scud-Stikine junction.

Claims were first located in the area in 1956. No work was done in 1958 and a large number of claims subsequently lapsed. A few central claims remained in good standing, and in 1960 and 1961 Kennco Explorations, (Western) Limited, located a large part of the ground. By 1963 all the claims were brought together under Stikine Copper Limited. Stikine Copper is 76 per cent owned by Kennco (Stikine) Mining Limited, 19 per cent owned by Hudson Bay Exploration and Development Company, Ltd., and 5 per cent by The Consolidated Mining and Smelting Company of Canada, Limited.

The investigation of this property has proceeded on a very thorough basis. The property covers 18 square miles, and large parts are underlain by glacial moraine. To the end of 1965 there has been 3,400 feet of trenching, 11,000 feet of surface sampling, and 155,000 feet of diamond drilling in 220 holes. The camp and entire drilling operation has been established and maintained by helicopter. In the summer

* By W. G. Jeffery.

season of 1965 there were 14 diamond drills in operation and a camp of between 90 and 100 men. Aircraft consisted of one Hiller 12-E and one Sikorsky S-58 helicopter on charter. Drills of the diamond-drilling contractor operated 24 hours on two 12-hour shifts for seven days per week. Twice-daily shift changes were made by helicopter, and essentially it took three trips to change the crew of 28 men to suitably located points near the drills, a process lasting about 20 minutes. At peak periods the core brought in came close to 1,000 feet per day. The core was handled on a systematic basis by four geologists, with two logging geology and two logging rock alteration. Assistants split and bagged core, checked with ultraviolet lamp and radiation counter, and all assaying was done on the property. All core is marked and stored in well-constructed core racks.

In the 5½-month field season in 1965 the company had an average of 20 men and the contractors 80 men in camp. A total of 49,771 feet of diamond drilling was completed.

During 1965, in addition to the work at the property, the helicopters moved in road-building equipment and established and maintained two camps on the road project from the Scud-Stikine River junction to the property. By courtesy of Stikine Copper Limited the larger helicopter performed a certain amount of work for other exploration companies in the vicinity.

Moraine, talus, and ice cover about 90 per cent of the area under investigation. Terraces of drift on the floor and slopes of Galore Creek are up to 250 feet thick. Limited exposures occur in tributaries of Galore Creek.

The following account is based on surface studies and about 25,000 feet of drill-core examination. The extensive work of D. A. Barr has contributed greatly to the property description.

General Geology

Copper mineralization in 10 different localities occurs within and adjacent to the syenite bodies of the Galore Creek Complex (*see* Fig. 2). Most of these prospects are associated with the Stikine Copper syenite body that is mapped as extending over an area of about 3 by 1½ miles.

The Stikine Copper syenite body is a complex zone composed of intrusive syenite porphyry, altered volcanic breccias, tuffs, and minor sediments, cataclastic breccias, sulphide zones, and numerous dykes.

The intrusive syenite is a medium- to coarse-grained pink and grey crystalline rock. It contains up to 25 per cent cream, grey, and pink phenocrysts up to 2 inches long in a matrix of potash feldspar, pyroxene largely converted to chlorite and green biotite, epidote, and brown biotite with minor apatite, magnetite, rare quartz grains, and variable amounts of sericite and garnet. Where it is abundant, the epidote imparts a green speckled appearance to the rock. In places there are two sets of feldspars, and some of the larger appear porphyroblastic with ragged boundaries that merge with the fine-grained feldspar in the matrix. An estimate based on field traverses is that intrusive syenite porphyry forms approximately 45 per cent of the Stikine Copper body.

Highly altered and in places porphyroid volcanic breccias, tuffs, and minor sediments form about half of the Stikine Copper syenitic complex. These altered rocks are termed metavolcanic in this report and are largely equivalent to rocks named in the field "mottled breccia." The mottled breccia has an over-all grey and green mottling and contains distinct to ghost-like fragments of diverse character and size. The metavolcanic rocks include porphyroid rocks of uncertain origin but which are believed to be originally volcanic. The texture and appearance of the metavolcanic rocks vary greatly, and the mineral assemblage is composed of potash feldspar, amphibole, biotite, chlorite, epidote, muscovite, garnet, diopside, apatite, anhydrite, and calcite. The porphyroid rocks contain porphyroblasts of potash feldspar which may in places be either fresh or altered to sericite, epidote, and garnet. The metavolcanic rocks contain most of the copper mineralization.

Breccia textures are widespread within the metavolcanic rocks, the commonest being the relict texture of volcanic breccia. In some parts of the metavolcanic rocks the sericite-epidote alteration of potash feldspar porphyroblasts results in blurred irregular shapes that impart a fragmental or pseudobrecciated appearance. There are also cataclastic breccias, the most prominent being a syenite porphyry breccia healed by magnetite. The syenite porphyry has in places been broken on a microscopic scale, a fracturing that may not be evident in a hand specimen.

Diamond-drill cores show pseudoleucite to be of infrequent but widespread occurrence in the eastern part of the Stikine Copper syenite body. The pseudoleucite shows distinctive crystalline forms, some distinctly zoned, between one-half and 1 inch in size. They are presumed to be relicts of pseudoleucite trachyte flows that occur along strike on the southwesterly margin of the stock. If everywhere of volcanic derivation, the pseudoleucite may be useful to identify rocks of doubtful origin, but a zoned pseudoleucite crystal has been observed in the Dark porphyry, described above in the geology of Upper Galore Creek. As the Dark porphyry has otherwise been assumed to be an intrusive igneous rock, there remains some doubt about the origin and nature of the pseudoleucite.

The syenite porphyry and the metavolcanic rocks of the Stikine Copper body have been altered and replaced. Potash feldspar is widely distributed in the metavolcanic rocks as porphyroblasts and as a fine-grained groundmass mineral. Epidote is abundant, although there is evidence that it decreases in amount in mineralized areas. Biotite is abundant, especially in the sulphide mineralization. Calcite, chlorite, and sericite or other fine micaceous minerals are widespread. Andradite garnet is of widespread occurrence in metavolcanic rocks and has been observed within feldspars in syenite porphyry. Disseminated chalcopyrite and bornite have been observed with small amounts of fresh albite in a heterogeneous granular mass of potash feldspar, white mica, epidote, and garnet. Massive, coarsely crystalline diopside occurs in parts of the mineralized zones. White-, pink-, and orange-coloured anhydrite and gypsum are common as veins throughout the area. In addition, zeolite, crocidolite, barite, and fluorite have been reported.

Numerous dykes occur within the Stikine Copper syenite body. There are syenite porphyry dykes with a considerable range of textures, together with lamprophyre, felsite, basalt, and hornblende syenodiorite dykes. Some of the syenitic dykes contain dispersed copper mineralization, and the South Butte mineralization is in sheared volcanic rocks intruded by syenite porphyry dykes.

Copper mineralization occurs at the contact of the Green syenite and Buckshot porphyry. The Green syenite occurs over an area of approximately 1¼ miles by three-quarters of a mile on the ridge southeast of the Galore Creek camp-site. The rock is a deep-green colour and has a considerable range in grain size that in many places forms a gradational banded texture, although in hand specimen the rock has an equigranular texture. Potash feldspar forms about 80 per cent of the rock, and the remainder consists of epidote, chlorite, biotite, and magnetite. The Green syenite is derived from the alteration of volcanic rocks and has gradational contacts with the surrounding volcanic rocks.

The Buckshot porphyry is a fine-grained purple to green syenite spotted with small cream subhedral feldspar phenocrysts up to 3 millimetres in size. The phenocrysts are dominantly potash feldspar and form about 15 per cent of the rock in a matrix of potash feldspar with epidote, sericite, and altered cloudy amphibole. The contacts with the surrounding volcanic rocks are sharp, but the relationship to the Green syenite is not clear due to the sheared and brecciated contact that contains magnetite and chalcopyrite.

Structure

Within the Stikine Copper syenite complex the syenite porphyry occurs as crudely sheeted tabular bodies trending north 20 degrees east and dipping 70 to 80 degrees westward. The trend is similar to the over-all strike directions in the surrounding volcanic rocks. On the east side of the Stikine Copper body the detailed drilling on the Central zone shows that sheets of syenite porphyry branch from the main steeply dipping tabular masses, and that the branch sheets are flat lying or have gentle dips. There are four known subparallel branches which may be up to 300 feet thick.

The metavolcanic rocks occur between the intrusive syenite porphyry sheets. In creek exposures in the western part of the Stikine Copper syenite body, some presumed bedding attitudes based on textural variations or variations in size or quantity of fragments all strike northward and mostly dip steeply to the west. On the eastern side of the Stikine Copper syenite body a few diamond-drill cores show limited but clear banding. When these attitudes are considered in cross-sections, they form strong evidence that the metavolcanic bedding dips eastward at about 40 to 50 degrees. These observations indicate that the metavolcanic rocks within the syenitic complex form an arch structure. It follows that if the metavolcanics do dip to the east in the eastern part of the Stikine Copper body, then the flat-lying branch sheets extending from the main syenite porphyry intrusions cut across the bedding of the metavolcanic rocks. Thus it appears that the syenite porphyry intruded a pre-existing arch structure.

Sheet jointing or cleavage with up to 100 parallel and subparallel joints per foot is present throughout the Stikine Copper syenite body. Drill-hole information indicates that the jointing persists to about 800 feet in depth. Over-all, the joint structure appears to be like a shallow dish with gentle dips around the margins and flat in the centre of the syenite complex. The sheeting cuts through all rock types and alteration, and consequently it must be a late-stage development. Only secondary copper oxides and in places a little gypsum have been observed along these joints.

Mineralization

There are 10 mineralized showings on the property, named the Central, Junction, North Junction, West Rim, Butte, South Butte, South West, West Fork Glacier, Saddle, and South 110 Creek deposits (*see* Fig. 2). Of these 10 showings, only the Central zone, which appears to be the largest, has been investigated extensively and in detail by diamond drilling. The South West and West Fork Glacier showings have essentially no surface outcrop, and the remainder have very restricted surface showings. Consequently the following mineralogical observations are derived mainly from the work done on the Central zone.

The ore minerals are chalcopyrite and bornite in the ratio of approximately 10:1. Both sulphides occur in a finely disseminated form in both syenite porphyry and the metavolcanic rocks. The metavolcanic rocks are the host to the bulk of the mineralization. Syenite porphyry is weakly mineralized and contains secondary fine-grained potash feldspar and biotite, chlorite, garnet, and anhydrite. There are richer sections of ore with splotches, blebs, and veinlets of sulphide in dark, skarny, dominantly garnet-biotite-chlorite rock. The sulphides appear to replace mafic minerals, and in the mottled breccia are contained in the matrix around the fragments. Pyrite is disseminated through the copper mineralization, and there are concentrations of pyrite adjacent to the zones of copper sulphides. Magnetite is abundant within the copper-bearing zones and is widely disseminated in the metavolcanic rocks. Other minor and rare primary minerals reported include galena, sphalerite, molybdenite, chalcocite, tetrahedrite, and specularite. Green malachite and blue azurite stains are abundant in the mineralized surface outcrops, but secondary minerals are limited in depth and extend to a maximum of 80 feet in one place. Other secondary minerals reported are chalcocite, cuprite, native copper, and tenorite.

Work on most of the mineralized prospects is not sufficiently advanced to outline the form with certainty, although their general trend can be observed from the map. The Butte, Saddle, and possibly the West Rim prospects are associated with fault and fracture zones. The Central zone consists of two steep westerly dipping tabular bodies of disseminated copper minerals with a distinct bend in plan at one place. The over-all form is parallel and similar to that of the steep-dipping syenite porphyry sheets. The copper mineralization occurs to a limited extent along the base of the flat-lying syenite porphyry sheets that branch from the main intrusive, and the syenite porphyry of the flat sheets is weakly mineralized with disseminated copper minerals in places. Of the two tabular zones of copper mineralization in the Central zone, the westerly body is the larger and more consistent, whereas the easterly zone is in the form of steeply dipping lenses. Unmineralized or pyritic mottled breccia separates the copper mineralization. West of the Central zone there is unmineralized or pyritic mottled breccia at least 500 feet wide separating the copper zone from the main body of syenite porphyry.

The intrusion of the syenite porphyry was accompanied by metamorphism and potash metasomatism of the intervening and adjacent volcanic rocks. Pyrite and magnetite are early in the paragenesis. The elongated north-northeast trend revealed by magnetometer surveys and the occurrence of some magnetite healed breccia zones are features that may indicate that magnetite was introduced into faults or fracture zones. Sericitization of the potash feldspars and the formation of epidote represent a period of retrograde metamorphism. The copper mineralization accompanied by a temperature increase appears to have been preceded by the formation of further potash feldspar and biotite. It is not known whether these potash-rich minerals represent a second introduction of potash or merely a redistribution of the potash already present.

Geophysical Response

Both ground and airborne magnetometer work have shown the north 20 degree east trend of the over-all structure. The airborne work showed a mass effect from the syenite and metavolcanic rocks with lower values over unaltered volcanic rocks.

Induced polarization surveys developed the largest and strongest anomalies over concentrations of disseminated pyrite. Anomalies of weak to moderate intensity occurred over the copper zones. Deep overburden and the flat-lying sheet structures of intrusive syenite weakened the sulphide response to the induced polarization surveys.

Geochemical anomalies were recorded from most creeks in the area, and especially from the water emerging from the toe of the Galore Creek glacier. This indication, coupled with a magnetic anomaly, led to the drilling and discovery of otherwise wholly covered mineralization under the glacier.

More detailed information on the geophysical work will be found in the paper by Barr.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1956; 1961–64; Kerr, F. A., *Geol. Surv., Canada,* Mem. 246; Barr, D. A., *Paper C.I.M.M.* to be published.]

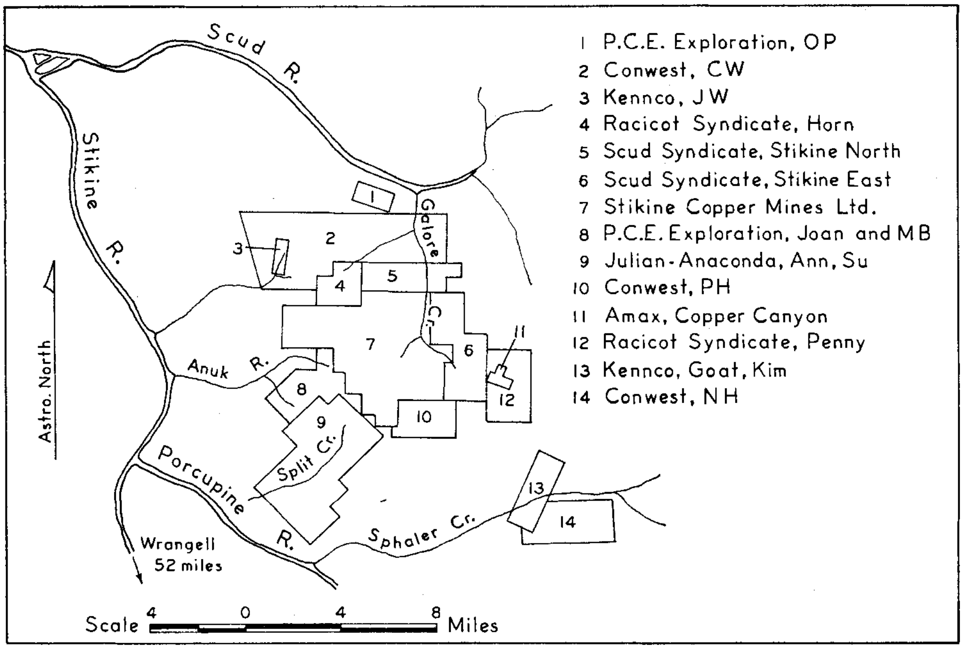


Figure 3. Sketch map of claim groups, between Scud River and Porcupine River.

Stikine East and Stikine North (Scud Syndicate)*

(57° 131° S.E.) The Scud Syndicate is composed of Silver Standard Mines Limited, 808, 602 West Hastings Street, Vancouver 2, and American Smelting and Refining Co., 535 Thurlow Street, Vancouver 5. The work was under the direction of W. St. C. Dunn for Silver Standard Mines Limited. The property consists of 118 BIK claims which, for convenience of field investigation, have been divided into two areas termed Stikine North and Stikine East. The claims straddle central Galore Creek and extend eastward from the upper part of Galore Creek along the northern slopes of the East Fork almost to Copper Canyon. They are accessible by helicopter about 12 miles from the Stikine River, although a road to the property of Stikine Copper, partially completed in 1965, crosses the Scud Syndicate claims.

In 1965 induced polarization surveys and additional geological observations were carried out to supplement the 1964 geological mapping, magnetometer surveys, and geochemical work. Also completed in 1965 were two diamond-drill holes totalling 1,814 feet. In the 5½-month field season the company employed an average number of 12 men and the diamond drilling contractor four men.

The area was mapped as part of the geology of Upper Galore Creek. Large sections are underlain by talus and moraine.

The main rocks are Triassic volcanic flows and breccias. They are mostly andesitic in composition, though there are some massive augite porphyry basalt flows

*By W. G. Jeffery.

in places. There are also thin sedimentary horizons that consist of reworked tuffs, volcanic sandstones, and limited, possibly lenticular, occurrences of clastic limestone and conglomerate.

Outcrops of syenite porphyry on the property are most important, as they are similar to the syenite porphyry associated with the copper mineralization of Stikine Copper on the adjoining property.

The largest amount of syenite porphyry is that part of the N110 Creek syenite mass that lies under the Scud Syndicate claims. The rock is pink to grey and coarsely crystalline with white and pink potash feldspar phenocrysts, although there are medium-grained equigranular phases. In places abundant anhedral epidote imparts a speckled green appearance. In the equigranular phase there is commonly a deep lavendar to violet colour with gradational changes to normal pink and grey varieties.

The northwest margin of the syenite lies in Camp Creek along a fault that strikes northeast and dips 35 to 50 degrees to the southeast. The adjacent rocks appear to be massive volcanic flows and tuffs that contain widespread disseminated pyrite. The eastern margins of the syenite body are poorly defined because there is a substantial intercalation of metamorphosed purplish volcanic tuffs and syenite porphyry material and a large number of porphyritic and fine-grained dykes. The attitudes of the mixed metavolcanic and syenitic rocks appear generally conformable with exposures of tuffs and sediments on the slopes to the east. Thus the N110 Creek syenite mass has indications of a sill-like form at least in the upper parts, and the western margins may have some connection with the southeasterly dipping fault that forms part of the contact in Camp Creek. However, a diamond-drill hole collared in syenite on the lower slopes of the East Fork penetrated syenite of varying texture to a vertical depth of 335 feet.

Elsewhere in the area along the incised channel of central Galore Creek, limited outcrops of two small bodies of syenite have been observed. The lower slopes of the valley are covered with moraine, talus, and dense growth, so that the form and extent of these rocks is not known. The southernmost occurrence is at a sharp bend in Galore Creek, and due to the sweep of the water only the southern cliffs are accessible. The south side of the bend lies within the Stikine Copper claims, but part of the northern cliffs may be composed of syenite on claims owned by the Scud Syndicate.

The syenite is a light-grey fine-grained rock with between 10 and 25 per cent phenocrysts that average one-quarter to one-half inch in length. A considerable amount of the syenite may be porphyroid metavolcanic rock. The outcrop is bounded by faults, and there are numerous faults cutting the syenite, some of which may have controlled the pattern of the creek at this point. Disseminated pyrite and a trace of chalcopyrite can be found in the syenite.

Along the Galore Creek cliffs there are some trachytic syenite dykes cutting the fragmental volcanic rocks. In one location some weak green copper stain was observed on the adjacent volcanic wallrocks.

Farther downstream on the east side of Galore Creek there is an outcrop of fine-grained syenite with dispersed pink to grey potash feldspar phenocrysts up to 2 inches in length. The rock is speckled with epidote and contains abundant fine-grained green biotite. The outcrop is limited to low bluffs along the creek, and the extent of the intrusion cannot be determined.

Evidence of copper mineralization is very limited. There are traces of chalcopyrite and some green copper stain on isolated outcrops of fissile volcanic rocks on the lower western slopes of Galore Creek. Weak disseminated chalcopyrite as scattered specks occurs in small areas within the N110 Creek syenite body. In some places this mineralization appears to be associated with equigranular deep-pink to violet-coloured syenite, similar in appearance to narrow equigranular syenite-aplite veins that cut the syenite.

Disseminated pyrite is prominent in some of the volcanic rocks forming the cliffs on the west side of Galore Creek. Widespread disseminated pyrite is noticeable in the green fine-grained volcanic rocks adjacent to the N110 Creek syenite, in particular on the northeast side of Camp Creek. However, outcrops in this locality are limited to the lower part of Camp Creek, and a large area on the slopes above the Galore Creek-East Fork junction is covered by moraine.

Horn (Racicot Syndicate)*

(57° 131° S.E.) The Racicot Syndicate is composed of Silver Standard Mines Limited, 808, 602 West Hastings Street, Vancouver 2; Magnum Consolidated Mining Co. Ltd., 700, 1030 West Georgia Street, Vancouver 5; and Keevil Mining Group Ltd., 11 Adelaide Street West, Toronto 1. Work was under the direction of W. St. C. Dunn for Silver Standard Mines Limited.

The Horn group consists of 19 recorded claims and is bounded on the east by the Stikine North property of the Scud Syndicate and on the south by the northern part of the property of Stikine Copper Limited in Upper Galore Creek. The claims lie on mountains largely covered by ice and snow at elevations between 4,000 and 6,000 feet along the watershed between the Stikine River and Galore Creek and about 4 miles southwest of the Galore Creek-Scud River junction. Access is only possible by helicopter. In 1965 Silver Standard Mines carried out geological mapping of the property by one geologist.

The property was not examined, except for fringes of the area included in the mapping of Upper Galore Creek. The general area was viewed from a distance and from the air.

The rocks appear to be wholly volcanic flows and breccias with minor intercalated sediments striking north to north-northeast and dipping west. Some weakly disseminated pyrite and very minor copper mineralization has been reported.

CW Group (Conwest Exploration Company Limited)*

(57° 131° S.E.) Company office, 901, 675 West Hastings Street, Vancouver 2. P. O. Hachey, exploration manager. The property consists of a block of 167 claims extending westward from a position roughly 2 miles up Galore Creek from the Scud River. The area is accessible by helicopter 20 miles up the Scud River from the Scud-Stikine junction, and a road partially completed to the Stikine Copper property in late 1965 would give access to the eastern end of the CW property. In 1965 induced polarization and magnetometer surveys were made in an area on the east side of Galore Creek. The company had an average of five men and the geophysical contractor two men to do this work.

The fringes of the property on Galore Creek were visited in 1965 whilst mapping Upper Galore Creek, but otherwise the area was observed only from a distance and from the air.

The greater part of the area is underlain by volcanic rocks consisting of flows and pyroclastics with minor associated sediments. In the eastern part of the group close to Galore Creek there is a band of white limestone and two small areas of black graphitic argillite. At the western end of the group there is a small granite stock at the head of Contact Creek. Another stock in the east that includes most of the Galore Creek canyon is granite to quartz monzonite in composition. Porphyritic syenite outcrops have been reported over a distance of 500 feet in a small southerly

*By W. G. Jeffery.

flowing creek that joins a westerly flowing tributary to Galore Creek at the extreme east end of the claim group.

No sulphide mineralization was observed associated with the syenite. In the remainder of the CW group the only mineralization reported has been sparse chalcopyrite in narrow quartz veins, and some malachite staining and sparse chalcopyrite in fractures in the adjacent volcanic rocks.

JW (Kennco Explorations, (Western) Limited)*

(57° 131° S.W.) Company office, 1030 West Georgia Street, Vancouver 5. G. H. Rayner, geologist in charge at property. The property consists of 14 recorded claims named JW 1 to 14 extending north-south along the north fork of Jack Wilson Creek, which is a westerly flowing tributary of the Stikine River. The claims are accessible by helicopter 8 miles from the junction of the Stikine and Anuk Rivers. During approximately three weeks work in 1965 an average of six company employees and four geophysical personnel carried out line cutting, magnetometer and induced polarization surveys, and geochemical soil-sampling. This augmented previous magnetometer and geochemical work carried out in the summer of 1963.

A brief examination along the north fork creek as far as claim JW 10 was made in 1965 (*see* Fig. 4). A large part of the lower reaches of the north fork is underlain by alluvium and talus. At the junction of Jack Wilson Creek and the north fork there is an outcrop of partially amygdaloidal dark-green volcanic rocks that appear to be andesitic to basaltic in composition.

A section of the lower part of the north fork exposes fine-grained green massive rocks of monzonitic composition that are noticeably magnetic and carry widespread pyrite both disseminated and in fractures. The anhedral feldspar matrix is associated with abundant epidote, amphibole, biotite, chlorite, apatite, and some zoisite. At higher elevations the creek gradient steepens and has cut a small gorge into bedrock. The continuous outcrop in the gorge section appears to be of similar monzonitic composition, though some phases are so fine grained that determination is difficult and they could be volcanic rocks. A specimen of a brown-weathering, dense, fine-grained and mineralized rock collected at the bottom of the gorge section appears to be a crystal tuff. Approximately 40 to 50 per cent of this rock is composed of anhedral to subhedral plagioclase fragments ranging in size up to 1 millimetre and which are dispersed in a very fine matrix that is probably feldspathic. The rocks exposed in the gorge are strongly magnetic in places. The gorge exposures also show evidence of faults trending north-south along the general direction of the creek. Several dark-green fine-grained basaltic dykes were observed.

Throughout the outcrops there are several occurrences of weakly disseminated copper mineralization and small green copper stains. The strongest mineralization is exposed in a trench at the confluence with the north fork of a tributary from the west. Here the rocks exhibit a weak schistosity and contain finely disseminated pyrite and chalcopyrite. A sample taken over a width of 43 feet assayed: Gold, trace; silver, 0.2 ounce per ton; copper, 0.76 per cent. Under the microscope, tourmaline was observed in a specimen taken from this zone.

In the gorge outcrops, copper mineralization, as disseminated chalcopyrite and malachite with some pyrite, was observed in small cavities in the crystal tuff described above, and also as green copper stain on the ramifying fractures and joints that pervade the rock.

* By W. G. Jeffery.

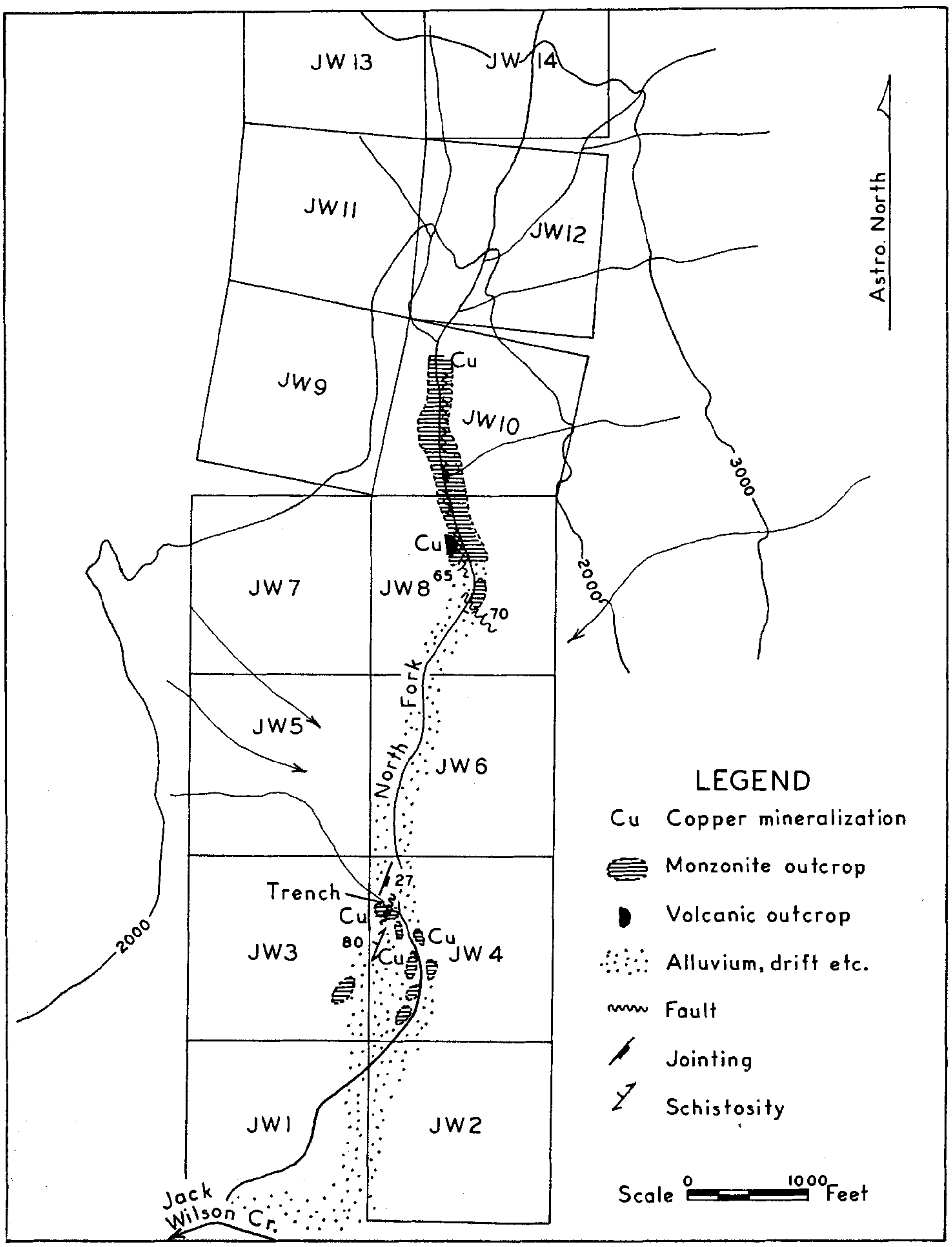


Figure 4. Geology of the JW group, Jack Wilson Creek.

At higher elevations in the creek very little copper stain was seen, though more weak copper mineralization has been reported from the creek above the area of observation.

OP (PCE Explorations Limited)*

(57° 131° S.W.) Company office, 335 Bay Street, Toronto, Ont. G. Kent, supervising geologist. This work was done in conjunction with Canadian Superior Exploration Ltd., 908, 7 King Street East, Toronto, Ont. The property consists of 15 claims situated southwest of the junction of Galore Creek and the Scud River, and about 16 miles up the Scud River from its junction with the Stikine River. In 1965 two men mapped the property and carried out some stream and soil geochemical sampling.

The property was not visited but was viewed from a distance while mapping in the area of Upper Galore Creek. The area is mountainous and precipitous with a large proportion covered by permanent ice and snow. The property is underlain by faulted sediments of late Palæozoic or early Mesozoic age. Some limited pyrite and pyrrhotite mineralization with minor chalcopyrite has been reported.

Joan and M.B. (PCE Explorations Limited)*

(57° 131° S.W.) Company office, 335 Bay Street, Toronto, Ont. G. Kent, supervising geologist. This work was done in conjunction with Canadian Superior Exploration Ltd., 908, 7 King Street East, Toronto, Ont. The property consists of 39 claims named Joan and M.B. located on the ridge at the headwaters of the Anuk River, a tributary flowing westward 8 miles to the Stikine River. The elevation of the area is approximately 3,000 to 6,000 feet, and the only rapid access is by helicopter. In 1965 two men carried out geological mapping and took random geochemical soil samples. The eastern fringes of the property were examined in the course of mapping the geology of Upper Galore Creek, and the remainder was observed from distant views.

The underlying rocks appear to be mainly volcanic in origin, consisting of fine-grained andesitic and trachytic flows and a great deal of volcanic breccia and tuff, all of Triassic age. The volcanic rocks contain thin shaly metasedimentary layers, and as a whole the rocks have north to north-northeast strikes and steep westerly dips. The eastern part of the area is close to the western boundary of the Stikine Copper syenite body, and the rocks are metamorphosed and in places are highly schistose with a north to north-northeast trend. Some of the rocks may be sills. Minor disseminated pyrite and chalcopyrite have been reported, but nothing of economic significance has been found.

Copper Canyon (Amax Exploration, Inc.)*

(57° 131° S.E.) British Columbia office, 535 Thurlow Street, Vancouver 5. No work was done on these claims in 1965. The property consists of eight recorded claims CC 1 to 6 and CC 13 and 14 located on Copper Canyon and Doghouse Creek, two small tributaries flowing south to the East Fork glacier of Galore Creek. Surrounding the CC claim group on the south, east, and north are the Penny 1 to 52 claims of the Racicot Syndicate, which is composed of Silver Standard Mines Limited, Magnum Consolidated Mining Co. Ltd., and Keevil Mining Group Ltd. The Penny claims are reported on briefly in the Annual Report for 1964.

As described above in the geology of Upper Galore Creek, the syenite body at Copper Canyon is bounded by Permian limestone and Middle Triassic argillites

* By W. G. Jeffery.

to the east and volcanic rocks on the west. The syenite probably extends under the East Fork glacier and may form some of the steep cliffs on the south side of the glacier.

The Copper Canyon syenite has considerable textural variations, but in the main it is a pinkish-grey to reddish-brown medium-grained rock with porphyritic phases. Potash feldspar content ranges from 50 to 95 per cent with an average figure of about 85 per cent. Biotite is abundant, and the remainder of the matrix consists of albite, sericite, chlorite, epidote, and apatite.

Dykes are not as abundant as in the Stikine Copper area. They include andesite, lamprophyre, and prominent white-weathering aplitic dykes.

The Middle Triassic and Permian sediments are overturned and have an over-all dip of 30 to 40 degrees easterly. At the head of Copper Canyon the black argillaceous rocks are more crumpled and disrupted than elsewhere, but this is due in part to local faulting along the length of the upper part of Copper Canyon Creek. As described under the geology of Upper Galore Creek, there may be a regional fault at the boundary of the Middle Triassic rocks and the volcanic rocks to the west, and if so the Copper Canyon syenite occurs along this fault. While the lower part of the overturned thin-bedded Middle Triassic rocks are limy in character, the upper part is more siliceous with brown and grey flinty quartzites. Where these rocks are in contact with the upper part of the syenite on the ridge west of Copper Canyon Creek, the quartzites are metamorphosed and welded together.

The upper part of the Copper Canyon syenite body has a layered form apparently conformable with the overlying Permian and Triassic sediments. The western margin of the syenite in Doghouse Creek is largely obscured by glacial moraine and talus, but there are sufficient outcrops to prove the intercalation of syenite sills and metavolcanic rocks with easterly dipping attitudes. Within the main body of the syenite, the stratiform nature is evident over-all, but in detail it is difficult to determine due to the weathering and alteration.

The syenite in the general area of some of the copper mineralization is extensively bleached and pyritized. Consequently the steep slopes form eroded crumbly and rather treacherous outcrops weathered to white, yellow, red, and brown colours, depending upon the extent of pyrite oxidation.

From outcrops of fresh syenite and some diamond-drill core samples there is evidence that the primary alteration of the rock has strong similarities to that in the Stikine Copper syenite. Potash metasomatism has been widespread and there is abundant epidote, biotite, muscovite, and chlorite, together with magnetite, garnet, and apatite. Gypsum has been reported but is not abundant.

Copper mineralization with gold and silver values occurs as disseminated chalcoprite and very limited bornite. The surface distribution of copper mineralization appears to be very irregular and is hard to assess due to the precipitous nature of the slopes and in places the degree of surface alteration, bleaching, and oxidation. A striking feature are the large patches of green malachite and blue azurite staining on some of the cliffs. These showings are commonly precipitated from surface waters that have leached the rocks at higher elevations, and they are not indicative of the extent or degree of copper mineralization in the adjacent rock. A prominent green copper oxide stain in the lower part of Copper Canyon has been precipitated on and partially cements the remnants of an ancient talus pile, most of which has been removed by the creek. Apart from chalcopyrite and bornite, other associated minerals include pyrite, magnetite, specularite, hematite, molybdenite, and fluorite. Cuprite, barite, and galena have been reported in minute quantities.

The form and extent of the mineralization remain unknown, and at present there is no evidence of control by the stratiform nature observed in the syenite.

Surface sampling along open cuts and trenches has given erratic values up to 1.25 per cent copper, although a large number of the values are less than 0.4 per cent copper. There is some evidence that check samples are not consistent, and consequently there is no soundly based determination of over-all grade. Exploration data have also indicated that values from diamond-drill cores have been a little higher than from surface samples, but this factor can be extremely variable. Seven diamond-drill holes totalling 3,311 feet were drilled in 1957 by The American Metal Company, Limited.

SCUD RIVER

Copper-Gold-Silver

Jay, C (Phelps Dodge Corporation of Canada, Limited)*

(57° 131° S.E.) Head office, 55 Yonge Street, Toronto 1, Ont.; British Columbia office, 404, 1112 West Pender Street, Vancouver 1. John DeLeen, resident geologist. A group of 126 recorded mineral claims lies about 8 miles east of Galore Creek at an elevation of 4,500 to 6,600 feet. For one month during the summer 10 men, under the supervision of A. Morris, did some surveying and geological mapping. Twelve trenches were drilled and blasted to a total length of 1,305 feet. Magnetite, chalcopyrite, and malachite minerals were found in fracture filling of shear zones. The host rock is granodiorite. Transportation is by air from Prince Rupert. The property was not visited.

Alberta (Phelps Dodge Corporation of Canada, Limited)*

(57° 131° S.E.) Head office, 300 Park Avenue, New York 22, N.Y.; Vancouver office, 404, 1112 West Pender Street. John DeLeen, resident geologist. This group of 24 recorded mineral claims is 2.4 miles west of Mount Hickman at the headwaters of Schaft Creek, at 7,000 feet elevation. Ten men spent one month on the property doing some surveying and geological mapping. Two trenches were drilled and blasted out to a total length of 200 feet. Magnetite, chalcopyrite, and some malachite were found as fracture filling in volcanics. Transportation is by helicopter from the Anuk River staging camp. The property was not visited.

SPLIT CREEK

Copper

Rex, Sal, Rum (Bralorne Pioneer Mines Limited)*

(57° 131° S.W.) Company office, 320, 355 Burrard Street, Vancouver 1. D. H. James, exploration manager. This group of 40 recorded claims was under option from New Indian Mines Ltd. The group lies between the Anuk River and Split Creek between elevations of 4,000 and 7,000 feet. Four men worked for one month on surveying and geological mapping. The property is reached by air and was not visited.

Sil (Bralorne Pioneer Mines Limited)*

(57° 131° S.W.) Company office, 320, 355 Burrard Street, Vancouver 1. D. H. James, exploration manager. This group of 10 recorded claims is held under option on the northwest side of lower Split Creek 4 miles east of the confluence of the Porcupine and Stikine Rivers and between 2,000 and 4,500 feet elevation. Surveying, geological mapping, and geochemical sampling were done by four men. Twenty-nine trenches were dug by hand to a total length of 143 lineal feet. Transportation to the property was by air. The property was not visited.

* By H. Bapty.

Scud River valley. Galore Creek enters through canyon on right.

Ann property on Split Creek. Bulldozer trenches and two geophysical lines.
Looking into basin of Third Split.

Ann, Su (Julian Mining Co. Ltd.)* (57° 131° S.W.) Company office, Britannia Beach. Field office, 744 West Hastings Street, Vancouver 1. R. Macrae, engineer in charge. The property consists of 150 recorded mineral claims, of which the Ann claims are optioned and the Su claims are owned. The claims extend along the valley of Split Creek, which is a tributary of the Porcupine River, flowing westward into the Stikine River. Access is by helicopter 6½ miles southeast from the junction of the Anuk and Stikine Rivers. Three months of the 1965 field season were spent in geological mapping, induced polarization surveys, 5,000 feet of bedrock stripping, and 7,200 feet of diamond drilling. A crew of seven men was supervised by D. B. Petersen, and the contractors had an average of 11 men on the property.

Previous geological work in the area and some traverses in 1965 show that the regional rocks are moderate to steeply dipping beds of volcanic breccias, tuffs, and flows with thin interbeds of unfossiliferous shales and argillites. In the gorge section of Split Creek toward the Porcupine River there is a fresh coarse-grained monzonite intrusive similar to the Coast Intrusions. Upstream from the main area of investigation there are outcrops of igneous-appearing rocks of monzonite to syenite composition. Stubby cream to yellow altered feldspar phenocrysts in a dark-grey fine-grained matrix are replaced, and in places included, by porphyroblasts of euhedral tabular pink potash feldspar. Amphibole, epidote, and dispersed biotite are the main mafic minerals.

Trenching and a large part of the diamond drilling has been done on the steep slopes of the north side of Split Creek between two precipitous tributaries named First and Second Splits. The two creeks expose the underlying rocks, but between them rubble, overburden, and dense bush cover the area. South of Split Creek there has been a limited amount of diamond drilling and bulldozer excavation in following up magnetic anomalies that extend across the deeply buried channel of Split Creek. The accompanying map (Fig. 5) shows the geology in the main area of investigation north of Split Creek and between First and Second Splits.

The trenching has revealed that the slope is underlain by a body of fine-grained rock of andesite to granodiorite composition. The rock is porphyritic with highly altered feldspar phenocrysts, masses of epidote, and clots of green biotite in a fine feldspathic matrix. This granodiorite is enclosed by fine- to medium-grained greenstone rocks of andesitic composition. The superficial weathering and alteration, together with the similarity of the two types of rock, make field identification difficult and in places arbitrary. The granodiorite tends to have a spheroidal weathered surface and can be distinctly granular. Sparse biotite flakes can be seen under a hand-lens. In places the rock is bleached in outcrops exposed in trenches. Apart from one small exposure all the rocks in First and Second Splits are tuffs and andesite flows. A number of fine-grained greenstone dykes and a few white-weathering alaskite dykes were seen.

The structure of the granitic rock is not apparent from the trench exposures on the property, but approximately on strike at the head of Second Split, at the toe of the glacier, there are metamorphosed strongly magnetic volcanic rocks that overlie, on a 40-degree southwesterly dipping contact, a feldspar porphyry rock with amphibole partially altered to biotite in a very fine-grained feldspathic matrix. This feldspar porphyry has large irregularly shaped inclusions of biotite-chlorite-epidote schist, and contains disseminated pyrite forming red-brown oxide stains on weathered surfaces.

* By W. G. Jeffery.

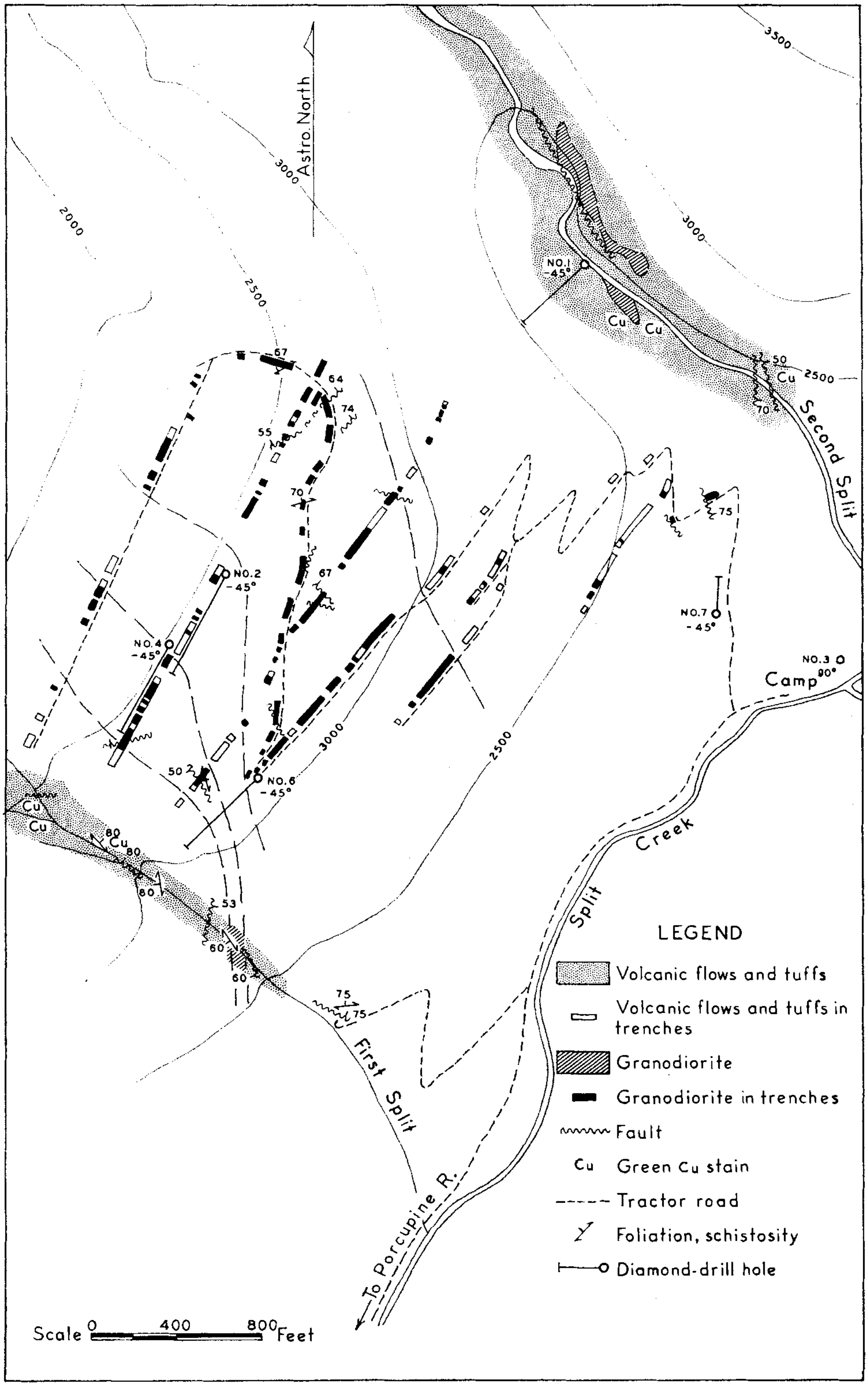


Figure 5. Geology of the Ann property, Split Creek.

Sparse small areas of green copper oxide stain were seen. Small faults, a biotite lamprophyre dyke, and a white quartz vein between 1 and 2 feet wide containing irregular blebs of specularite, galena, and chalcopyrite cut the feldspar-porphyry intrusive.

First and Second Splits expose strong faults that strike northwestward along the creeks. Other faults exposed in the creeks and the trenches appear to be of minor importance.

Disseminated pyrite mineralization is abundant in the granodiorite porphyry and the volcanic rocks. Copper mineralization is sparse. There are scattered small green copper oxide stains on the highly weathered pyritiferous rock at the head of First Split between 3,000 and 3,500 feet elevation. The first outcrops of volcanic rocks encountered on ascending Second Split show a little green copper stain on the surface, and a few specks of chalcopyrite were seen close to some north to northwesterly trending faults. Higher up the creek but still below 2,500 feet above sea-level on the southwest bank there is more green copper stain on highly weathered pyritiferous rocks that in part appear to be a granodiorite dyke within volcanic rocks. The diamond-drill core contains sparsely disseminated copper mineralization in both granodiorite and volcanic rocks. Chalcopyrite also occurs on fracture planes and with occurrences of magnetite healing short sections of brecciated rock. In the diamond drilling the longest section of copper values was obtained from almost the whole length of hole No. 2, in which the values ranged from trace to a maximum of 0.32 per cent copper, with most of the values between 0.10 and 0.20 per cent copper. Diamond-drill holes Nos. 4 and 6 showed similar values, and one 5-foot intersection in hole No. 6 contained 0.72 per cent copper.

S.C. (Bralorne Pioneer Mines Limited)*

(57° 131° S.W.) Company office, 320, 355 Burrard Street, Vancouver 1. D. H. James, exploration manager. This group of 11 recorded claims lying east of Split Creek on the north side of the Porcupine River is held under option. The work done by a crew of four men consisted of surveying, geological mapping, and geochemical sampling. Also 13 trenches were dug a total distance of 96 feet. Transportation to the claims was by plane and helicopter. The property was not visited.

Copper-Molybdenum

AC, PC (Stikine River Mines Ltd.)*

(57° 131° S.W.) Company office, 845 Hornby Street, Vancouver 1. A. E. Swan, director and work supervisor. The group consists of 56 recorded mineral claims north of the Porcupine River and east of Split Creek. A small crew of men with portable equipment blasted out some exploration trenches. Transportation was by air. The camp was not visited.

MESS CREEK

Copper-Molybdenum

Bird (Silver Standard Mines Limited)†

(57° 130° S.W.) Company office, 807, 602 West Hastings Street, Vancouver 2. R. W. Wilson, president. The Bird group consists of four claims owned jointly with Kerr-Addison Gold Mines Limited and McIntyre Porcupine Mines Limited. The property is 36 miles south of Telegraph Creek

* By H. Bapty.
† By W. G. Clarke.

and is accessible by aircraft a distance of 150 miles from Stewart. It is a disseminated deposit in altered volcanics and intrusives. Work included geological mapping, geophysical surveys, and geochemical sampling as well as a total of 2,067 feet of diamond drilling in three holes. Nine men were employed for four months under the direction of W. St. C. Dunn, superintendent of exploration. The property was not visited.

KINASKAN LAKE

Copper-Molybdenum

QC (Conwest Exploration Company Limited)* (57° 130° N.E.) Vancouver office, 901, 675 West Hastings Street. P. O. Hachey, geologist in charge. The QC group of 72 claims is on the south side of Quash Creek, 8 miles northwest of the head of Kinaskan Lake. The showings consist of disseminated chalcopyrite, bornite, and molybdenite in andesitic volcanic rocks in a general contact zone with granodiorite. The actual contact is not definite and appears to be gradational. The rocks are deeply iron stained for the most part and pyrite is abundant, but alteration is not intense. Copper-bearing rock is seen at the summit of a ridge at about 5,500 feet and extends down zones of talus and bluffs to east and west. The rocks are finely shattered, and on the west slope there is evidence of shearing. An induced polarization survey and a magnetometer survey were made on the QC Nos. 41, 42, 44, and 60 claims.

Silver

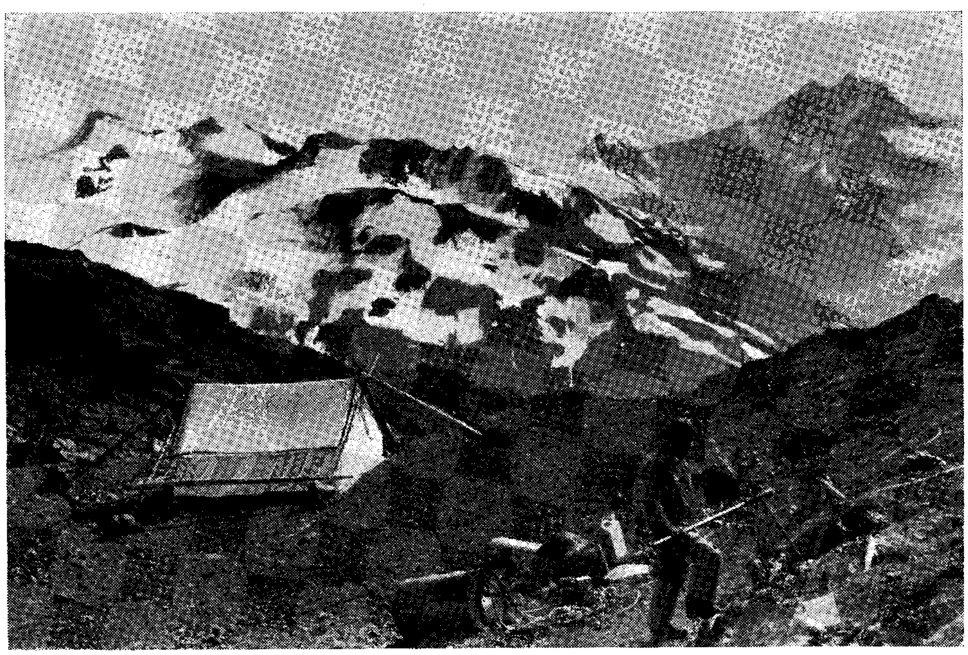
SF (Conwest Exploration Company Limited)* (57° 130° N.E.) Vancouver office, 901, 675 West Hastings Street. P. O. Hachey, geologist in charge. The SF group of 96 claims is on the Klastline Plateau 4 miles east of Nuttlude Lake. A tent camp was in a broad valley bottom at 5,000 feet elevation, about 500 feet below the showings on the north side of the valley.

At the showings the rock is a red or purple conglomerate consisting chiefly of pebbles but including some greywacke. The red conglomerate dips to the west at about 50 degrees and is overlain just above the showings by green pebble conglomerate and higher still by coarse grey conglomerate. Cutting these rocks are four felsite (rhyolitic) sills, the largest less than 100 feet thick, dipping steeply north into the hillside. Veining and stockworks of barite occur, chiefly in the red conglomerate. Sulphides, including galena, sphalerite, chalcopyrite, and tetrahedrite, are not abundant. Flakes of native silver have been found. It is not clear what controls the somewhat erratic silver values. Apparently shearing and fracturing is of first importance, and the general situation close to or between felsite dykes may be significant.

The main explored zone extends for about 1,000 feet on the contour round the shoulder of the mountain. A west zone lies 1,000 feet farther west at the same general elevation and extends along the hillside for 160 feet. A total of 2,858 feet of trenching was done by hand on the SF Nos. 20, 21, and 24 claims. One trench extended for about 1,200 feet north along a branch creek valley. Three holes totalling 1,069 feet were diamond drilled in the main zone. The work was done by a crew of 10 men directed by G. W. Grant, geologist. Transportation was by helicopter.

* By M. S. Hedley.

Diamond drilling on the SF property, Klastline Plateau.



Diamond drilling on the E and L property, Snippaker Creek.

Copper

G.J. (Conwest Exploration Company Limited)*

(57° 130° N.E.) Vancouver office, 901, 675 West Hastings Street. P. O. Hachey, geologist in charge. This property is on the Klastline Plateau between Kinaskan and Kakiddi Lakes. A discovery of copper mineralization was made in the upper stretch of Groat Creek in 1964 and a block of 196 claims was recorded.

The main showing is a quartz stockwork in rhyolite on the west side of the creek. Chalcopyrite mineralization extends along the hillside for a distance of 160 feet, but the attitude of the zone is not clear. Lack of outcrop prevents tracing the mineralization directly. An induced polarization survey and a magnetometer survey were made over an area measuring 6,000 by 6,000 feet. The work was done on the G.J. Nos. 119 to 126 and Nos. 147 to 154, inclusive. Access was by helicopter from a base at the south end of Kinaskan Lake.

ISKUT RIVER

Copper-Lead-Zinc

Bron*

(56° 131° N.E.) The Bron group of 48 mineral claims recorded in the name of R. Zielinski partly surrounds 14 Crown-granted claims which are amongst the oldest in the district. The Consolidated Mining and Smelting Company of Canada, Limited, had these claims under agreement during 1965 as well as a group of 128 claims held by Copper Soo. The claims are at the mouth of Bronson Creek on the south side of the Iskut River, 28 miles from the Stikine. The original work was done by F. E. Bronson between 1908 and 1919 on the steep slope south of the creek and on an extensive flat at about 3,000 feet elevation. In 1949 and in 1960–62 Kennco, Noranda, and Hudson Bay mining companies did some work on the slopes of Mount Johnnie to the south and east. Details of this work are not known. Mineralization is reported to include pyrite, pyrrhotite, chalcopyrite, galena, sphalerite, and arsenopyrite.

The original showing is a red bluff forming part of a steep 2,000-foot-high slope. It is a feldspar porphyry sheet about 100 feet thick dipping steeply with the hillside. It intrudes fine-grained sedimentary rocks, and on the south side there is a yellowish pyritic zone. An old 30-foot adit near the east edge of the bluff, at creek-level, shows bedding dipping to the southwest and steep northeast joints and flat sheeting; copper mineralization is localized by the fracturing.

In mid-August a small diamond drill was high on the west edge of the red bluff in the footwall of the porphyry. Chalcopyrite and pyrite mineralization appeared to be associated with vague shear zones in the dark silty rocks, and perhaps with chloritic alteration. Eight holes with an aggregate length of 1,120 feet were drilled in this general area. Two other holes with a total length of 600 feet were drilled on Copper Soo ground nearby. The work was directed by R. G. Gifford and G. Parsons, exploration geologists.

Nickel-Copper

E and L (Silver Standard Mines Limited)*

(56° 130° N.W.) The E and L group of 28 mineral claims is held by Silver Standard Mines Limited, 808, 602 West Hastings Street, Vancouver 2, and by Kerr-Addison Gold Mines Limited and McIntyre Porcupine Mines Limited. These three companies are partners in the BIK syndicate.

* By M. S. Hedley.

The property is on the north side of Snippaker Creek near its headwaters, between the Iskut and Unuk Rivers. The top of the showing is at 6,200 feet elevation, and a tent camp was set up on the creek at 2,800 feet elevation.

The showings on the E and L Nos. 1 and 2 claims are on a shoulder of the mountain on the edge of bluffs to the south and west and are snow covered to the north and east. Mineralization as masses and disseminations occurs in gabbro intrusive into argillaceous and cherty sediments. The gabbro has pyroxenitic and dioritic phases. The entire body is not exposed, but the part that includes the mineralization measures at least 1,500 by 2,500 feet. The sulphides include pyrrhotite, pyrite, chalcopyrite, and pentlandite.

The sedimentary rocks strike northwest and dip steeply and are crossed by northeast fractures which locally control the gabbro contacts. Mineralization, to a large degree, follows along the contacts and is related to the fractures. The uppermost and largest mineralized area is obscured to the east by rubble, but measures 200 feet along a north-south line by 20 to 150 feet east-west. The mineralized zone can be traced directly through a vertical distance of about 350 feet. The indicated grade is reported to be 0.70 per cent nickel and 0.60 per cent copper.

On the upper part of the showings 400 feet of trenching was done and seven X-ray holes were diamond drilled totalling 352 feet. A crew of seven was employed for 1½ months under the direction of Norman W. Burmeister.

Gold-Silver-Lead-Zinc

Kay (Stikine Silver Ltd.)*

(56° 130° N.E.) Company office, 100 Credit Foncier Building, Vancouver 1; managing director, T. J. McQuillan. The company holds the Kay group of 40 claims located about 3 miles east of Tom MacKay Lake near the headwaters of the Unuk River and 50 miles north-northwest of Stewart. Transportation and supplies to the property were by fixed-wing aircraft and helicopter. During a five-month work period in 1965 a crew of five men supervised by Mr. McQuillan constructed one camp building, extended the adit 300 feet to a length of 586 feet, bulldozed and blasted 18 trenches totalling 1,500 feet, made 13 pits, and drilled three diamond-drill holes with a total length of 52 feet.

Previous work on the Kay group is extensive and dates back to 1932, when the property was located by T. S. Mackay. The local geology and mineralization has been described in the 1953 Annual Report, pages 87–89.

TIDE LAKE

Copper

Granduc (Granduc Mines Limited)†

(56° 130° S.E.) Company office, 621, 744 West Hastings Street, Vancouver 1; mine office, Stewart. M. A. Upham, president; D. E. Howard, resident manager; H. H. Waller, assistant resident manager. The mine is located at the head of the Leduc River, 25 miles north-northwest of Stewart. The property consists of 64 Crown-granted claims, 345 recorded claims, and 10 mineral leases. At the Leduc camp a 9- by 10-foot drainage adit was driven 554 feet to a total length of 814 feet from the portal. A crosscut was driven 155 feet from the main tunnel. Work stopped February 18th when an avalanche demolished most of the camp.‡ The buildings remaining consisted of four damaged bunk-houses, a damaged warehouse, and a small office. These buildings were repaired and a new cookery and dining

* By E. W. Grove.
† By H. Bapty.
‡ A full description of the Leduc disaster appears in the Inspection of Mines section of this Annual Report.

hall were built. The camp-site area was tidied and work was discontinued in July. Avalanche defence mounds were constructed on the slide area above the camp.

Diamond drilling at Leduc totalled 812 feet on surface and 1,780 feet underground. The crew at the Leduc camp was approximately 155 men before the disaster and averaged 15 men after February 18, 1965.

At Tide Lake flats at the head of the Bowser River, construction commenced in late winter on a 180-man camp to service the east end of the 11.6-mile access tunnel to the mine. Buildings constructed included four bunk-houses, staff house, office building, cookery and dining hall, recreation building, warehouse, garage, cold warehouse, vehicle-storage shed, power-house, mine dry, domestic pump and tank-house, and an industrial-water tank-house. An oil-farm was established with a capacity of 175,000 imperial gallons.

The Tide Lake tunnel was driven a distance of 6,308 feet from the portal when the camp closed for Christmas vacation. This is a 14- by 12-foot arched back drive. In the middle of the arch in the back is a 36-inch spiral-wound 16-gauge steel ventilation pipe. Suspended also from the back on rigid struts is a 250-volt d.c. trolley-line to power a 15-ton locomotive and a 100-1 Conway mucking-machine. On the side of the drift is a high-pressure 8-inch air-line, a 4-inch water-line, as well as an electric-power line to supply lighting. The track is 42-inch gauge 100-pound rail inside the portal. Grade is 0.25 per cent in favour of the load. An underground shop was established in a crosscut approximately 300 feet from the portal.

The round at the face is drilled off with a multiple drill jumbo with two 5-inch-diameter burn cut holes drilled with a 5-inch machine. Other drill-holes are 1⅞ inches, drilled to a depth of 12 feet with 4-inch machines. The round is loaded with 500 pounds of 70 per cent Cilgel and is blasted electrically. The waiting time for the crew to return to the face after blasting is 20 minutes. The face and back are hand-scaled before the mucking-machine is brought up to load approximately 170 tons into 20-ton Moran cars. Cars have been exchanged in the Canton switchback from the face, and in lay-bys, but after Christmas a patented Jacobs " Flying Carpet " will be used to advance the track hydraulically at the face and contains a track arrangement to exchange cars behind the mucking-machine. The best advance made during the year was 70 feet in 24 hours, but when wet areas are encountered the rate of advance is severely hampered when the mining crew is put to grouting and sealing off the water entering the tunnel. During the year two porous areas encountered were sealed.

Two ingenious labour-saving pieces of equipment have been designed by the mine staff to assist in the tunnel-driving. One is a car of special design to handle ventilation pipe. This car transports the pipe and then hoists it to the back and holds it in place while it is permanently fastened. The other piece of equipment is a hydraulically operated back-hoe type of mucking-machine with a specially designed bucket contoured for ditch-digging. Both pieces of equipment reduce the ditching and vent-placing times with a minimum of hand-labour.

The number of men on construction varied from 17 in March to 145 at peak construction. The tunnelling crew averaged 130 men.

In August the tote-road broke through, providing road access to the Tide Lake camp from Stewart. Approximately 18 miles of new road was constructed between Premier and the camp and an additional 1.8 miles between the camp and the Tide Lake airstrip. Approximately 6 miles of road was rebuilt or widened and improved in Alaska, between Premier and Hyder. It is now possible to drive 34.3 miles from Stewart to the Tide Lake airstrip.

The Alaskan sector of rebuilt road was almost completely lost on December 1st when Summit Lake flooded the Salmon River. The washed-out section was made passable by the year-end.

The road crew consisted of a maximum of 130 men and tapered off as the work was completed. Three road camps were used in addition to the base camp in Stewart.

Both Leduc and Tide Lake camps were serviced for freight by C46 and Otter aircraft, tractor trains, and a Nodwell carrier. The Nodwell carrier is a tracked vehicle built in Alberta for freighting over snow and muskeg. It is powered with two 100-horsepower engines and runs on steel cleated tracks. The tracks have a bearing of approximately 30 square feet on the ground. This vehicle can carry up to 12 tons on an 8- by 20-foot deck and can travel over the Salmon River glacier at a speed of 12 miles per hour with a 12-ton pay load. Ground pressure at zero penetration with gross vehicle weight is 2.59 pounds per square inch.

After the road break-through in August, the Tide Lake camp was serviced by road only. Helicopters were used to transport personnel until the road was serviceable. A bus service now operates to the camp from Stewart. At the start of 1965 a freight transfer camp was established at Cantu, near the toe of the Salmon glacier. Here freight was transferred from truck to tractor train and Nodwell carrier for transportation to both Leduc and Tide Lake camps. The Cantu camp was dismantled in October.

Work Accomplished

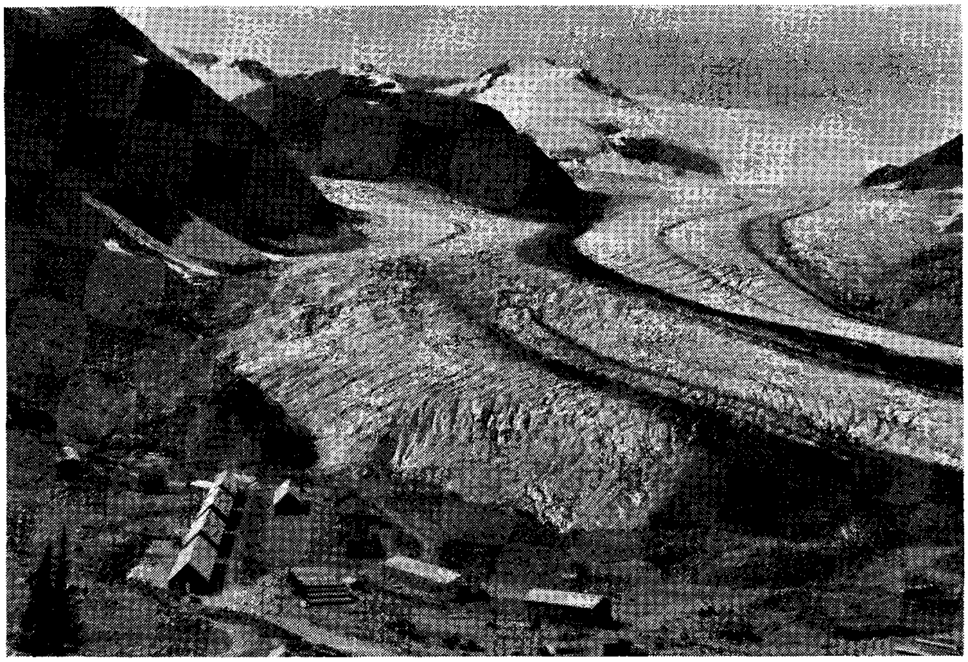
	Ft.
Tunnel—	
Leduc glacier	554
Tide Lake	6,308
Total	6,862
Crosscuts—	
Leduc glacier	155
Tide Lake	127
Total	282

Slash—Tide Lake, 124,398 cubic feet, lay-bys, transfers, and shops.

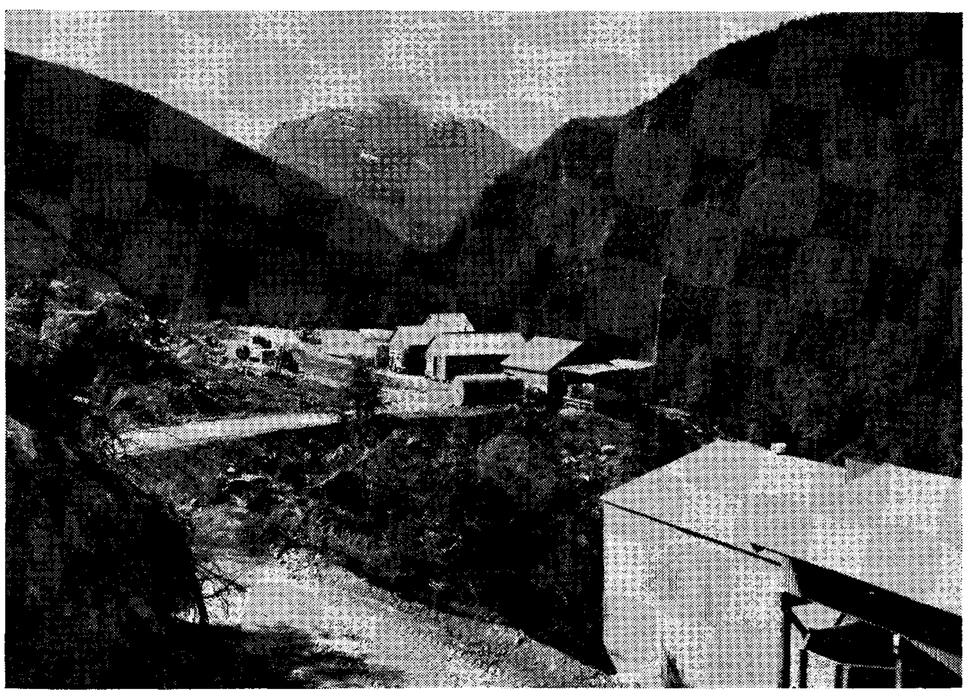
Diamond Drilling

	Ft.
Underground—	
Leduc glacier	1,780
Tide Lake	280
Total	2,060
Surface—	
Leduc glacier	812
Tide Lake	1,231
Total	2,043

Road—19.8 miles of new road was constructed.



Granduc Mines Limited, Tide Lake camp. Site of east portal of main adit, at foot of Berendon glacier.



Silbak Premier mine, new camp at No. 6 level.

Surface Buildings Constructed

Tide Lake camp: Four bunk-houses, one office, one recreation building, one garage, one cold warehouse, one cap magazine, one power-house, one vent-pipe shop, one staff house, one cookery, one warehouse, one vehicle building, two powder magazines, one pump and tank-house, one mine dry.

Leduc camp: One dining-cookery-storage building, one powder magazine, one 2-story bunk-house.

Surface Machinery Installed

Tide Lake camp: Two 500-kw. generators; two 450-h.p. compressors, 2,225 c.f.m. each; one 75-kw. generator, standby power; one 7.5-h.p. domestic pump; two 400-kw. generators; one 200-kw. generator–225-h.p. synchronous motor d.c. generator set; one 10-h.p. fire-pump.

(*See* Annual Report, 1964, pp. 18–20.)

*Summit Lake**

In recent years two floods originating in Summit Lake have washed out sections of the Hyder–Silbak Premier road along the Salmon River. Summit Lake is one of several ice-dammed lakes in the Stewart area which are subject to periodic outbursts. In November, 1961, a large section of the Premier road between Nine Mile and Twelve Mile was completely destroyed by water and ice blocks which coursed down to the Salmon River from Summit Lake. Fortunately, snow dykes bulldozed into place at the last minute held the river from overflowing into the village of Hyder at the Salmon's mouth. Again, on December 1 and 2, 1965, Summit Lake poured into the Salmon valley and destroyed about 6 miles of the newly reconstructed Hyder–Tide Lake highway below Premier.

Numerous similar ice-dammed lakes are found in the British Columbia-Alaska coastal mountain ranges as well as other glacial areas. The mechanism triggering the floods appears to be similar. The lake water rises until it is deep enough to lift the ice barrier which dams it. At a critical depth the ice barrier floats and the water rushes out under or along the glacier, rapidly draining the lake. Because of yearly ablation the confining ice barrier gets thinner and the lake waters do not require as great a depth to trigger the next flood.

Tide Lake flats immediately north of Summit Lake represent the bottom of a recently emptied ice-dammed lake, one of several found along the Salmon-Bowser River valley. Tide Lake was held in check by Frank Mackie glacier, but because of glacial ablation and recession, during the period 1921 to 1931, the lake has permanently emptied, leaving a large, virtually flat valley bottom upon which an airstrip was constructed in 1965.

Recent soundings of Summit Lake indicate that it also has a flat, south-dipping, somewhat stepped or terraced bottom which, when finally exposed in the next few years, should resemble the Tide Lake flats. At the present time Summit Lake water flows north into the Bowser River and is used at the Granduc Tide Lake camp for some purposes and had been considered for the mill water supply.

The south end of the lake is dammed by the Salmon glacier, which fills the Salmon River valley and is about 5,000 feet wide at this point. In the period 1957 to 1965 the ice dam as a whole has retreated about 2,000 feet south, but retreat has been even farther at the southeast corner, where considerable meltwater enters

* By E. W. Grove.

the present lake. The ice has also thinned substantially along the east side of the Salmon glacier south of the lake, increasing the tendency of the ice barrier to float at high-water level, which normally occurs in early winter.

Gold-Silver

East Gold* (56° 130° S.E.) The property is located on the west side of Tide Lake flats about 5 miles north of Summit Lake and about 4½ miles north of Granduc's Tide Lake camp. The group consists of the East Gold 1 to 8 claims plus the East Gold Extension 1 to 6 claims, located in March, 1965, by A. A. Phillips, of Stewart. The property has been active off and on since 1927 (original Pioneer group) and has produced a small tonnage of high-grade gold-silver ore. Access to the mine was considerably improved with the construction of the Granduc road from Stewart to Tide Lake. Operations at the mine were resumed in September, but closed in November when Mr. Phillips was killed in a blasting accident.

A description of the mine geology and workings will be found in the 1946 Annual Report, pages 68–72.

PORTLAND CANAL

SALMON RIVER

Gold-Silver-Lead-Zinc

Silbak Premier Mines Limited* (56° 130° S.E.) Company office, 844 West Hastings Street, Vancouver 1. A. E. Bryant, president. In 1965 Bralorne Pioneer Mines Limited undertook a management agreement with Silbak Premier for the operation of the mine 12 miles north of Stewart. Work during 1965 was carried out by a crew of 10 men supervised by Adam O. Krainec, mine manager. Broken ore was removed from the glory-hole by loader and truck and transported to the stockpile at the mill-site at No. 6 level. Underground development was confined to the glory-hole area where the 110 level was extended to develop sulphide-rich ore forming the walls and extensions of the high-grade "lessees' lens." The flotation circuit of the recently constructed mill was modified and expanded in order to treat the sulphide-rich ores.

In July the mine camp buildings at No. 6 level were moved by the contractor to the west side of the old road to facilitate construction of the Stewart-Tide Lake highway. During construction, mineralization was exposed along the new road north of the No. 6 portal, consisting of massive, crudely banded pyrite and sphalerite with interstitial galena and scattered microscopic tetrahedrite. This mineralization has not been completely outlined, but it appears to consist of a 10- to 12-foot-wide north-trending steeply plunging lens confined to schistose fragmental volcanics which lie as a small pendant within intrusive hornblende potash feldspar porphyry (the so-called Premier Porphyry).

One short diamond-drill hole drilled from the No. 6 portal area to check the mineralization intersected only minor sulphides. No other exploration was carried out during 1965.

In November the mill assay office was destroyed by fire.

During mining operations, ore was stockpiled to operate the mill through the winter at about a 35-ton-per-day rate. Production was from the glory-hole area, and 2,336 tons was milled. (*See* Annual Report, 1964, pp. 21–22.)

* By E. W. Grove.

Lead-Zinc

Silver Crown* (56° 129° S.W.) The Silver Crown group consists of 19 mineral claims, held by record by D. Collison, of Alice Arm. The group lies on the upper west slope of Bear River Ridge between Long and Divide Lakes. Access to the property was by helicopter. A road and trail which formerly gave access to this area from Premier was partially washed out during the spring run-off. Work performed during 1965 consisted of surface work and sampling.

The rocks include well-banded argillites, siltstones, and greywackes as well as minor intercalated limestone and chert pebble conglomerates. Coarse-grained, massive greywacke probably comprises 50 to 60 per cent of the country rock on the property and is part of a predominantly coarse greywacke unit which has been traced northwestward across Bear River Ridge past Divide Lake and along the east slope of Mount Dilsworth. Both the greywacke unit and the enclosing siltstone-argillite formations are cut by strong northerly and northwesterly faults. Quartz-sulphide mineralization located along the faults has been traced from near the south end of Divide Lake to the snow- and ice-covered top of Bear River Ridge.

Bear River

Silver-Lead-Zinc

Porter Idaho (Cassiar Consolidated Mines Limited)* (55° 129° N.W.) Company office, 1500 Marine Building, 355 Burrard Street, Vancouver 1. W. R. Wheeler, president; A. C. Skerl, consulting geologist. The property consists of a block of 53 Crown-granted claims situated southeast of Stewart on Mount Rainey. During the period 1924 to 1931, when the property was operated by Premier Gold Mining Co., Ltd., a total of 5,256 tons of ore containing 276 ounces of gold, 563,466 ounces of silver, 5,235 pounds of copper, and 723,781 pounds of lead was produced from high-grade stopes in the vein system. " I " tunnel is below the old working areas and was not developed sufficiently during the operation to explore the down-dip possibilities of the veins. Work during 1965 started in June and included the establishment of a new camp on the south slope of Mount Rainey and cleaning out and retimbering the " I " tunnel at elevation 4,100 feet. An old shaft was cleaned out to provide ventilation and access to the " I " tunnel workings. J. McBeth supervised the work. The old camp buildings established about 35 years ago at 4,300 feet elevation were wiped out by a snowslide early in 1965, about the same time as the Granduc avalanche. Another small snowslide in December, 1965, carried away the new machine-shop together with some equipment and supplies.

All supplies and personnel were transported from Stewart by helicopter. The old access trail via the Marmot River and Kate Ryan Creek has deteriorated but is still passable with difficulty to the toe of the Marmot glacier. However, the glacial recession has left the old ice crossings high and dry above a deep canyon.

A number of sulphide-bearing veins have been tested and explored on the Porter Idaho, Prosperity, and Silverado groups on Mount Rainey. The veins generally occur as narrow quartz-sulphide fissure fillings in northerly trending west-dipping shear zones. The country rocks consist of massive fragmental andesitic volcanics and thinly laminated volcanic sandstones, siltstones, and rare argillites. Sedimentary features as well as colour bands in the volcanic rocks suggest a northwesterly trending north-dipping sequence. Northerly and westerly faults are prominent features in the area, as is a strong northwest joint system. Shear zones in the

*By E. W. Grove.

massive volcanics on Mount Rainey are generally narrow, but shearing has been general in sedimentary rocks to the south across Kate Ryan Creek. The grade of metamorphism increases sharply toward the Coast Range hornblende-granodiorite intrusions from chlorite to amphibolite grade.

Lead-Zinc-Silver

Dunwell (Silver Arrow Mines Ltd.)*

(55° 129° N.W.) Company office, 800, 789 West Pender Street, Vancouver 1. F. S. Hofman, president. The company holds eight Crown-granted claims located 4½ miles north of Stewart near the Bear River-Bitter Creek junction. The mine road, which gives access to the Bear River highway, was improved and extended to the camp buildings at No. 4 adit. The 1965 work consisted of surveying the old workings and exposures, geologic mapping, and sampling.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1964, p. 22; *Geol. Surv., Canada,* Mem. 175, 1935, pp. 112–113.]

Gold-Silver-Lead-Zinc-Antimony

R.A.F. (Canex Aerial Exploration Ltd.)*

(56° 129° S.W.) Company office, 700, 1030 West Georgia Street, Vancouver 5. The present property includes 11 claims located near the head of Glacier Creek on the west slope of Mount Dickie between elevations of 1,600 to 4,200 feet. The ground under agreement includes the Crown-granted Silver Bow and Washington claims and the new R.A.F. group.

The country rocks are contorted, variably banded siltstones and greywackes cut by a number of small dykes. A vertical fault zone which trends east-northeast has been traced about a mile along the bottom of a steep-sided gully. Mineralization consists of erratic quartz-sulphide replacements and veins localized along the fault. Sulphide minerals include sphalerite, galena, pyrite, chalcopyrite, boulangerite (possibly some jamesonite), and tetrahedrite.

Previous work on the property dates to 1912 and includes two short adits. In 1965 a three-man crew under G. Bird made detailed geochemical and magnetometer surveys. Three diamond-drill holes totalling 285 feet were drilled, but none passed 100 feet because of broken ground. Access to the property was by helicopter from Stewart, about 7 miles to the southwest.

[References: *Geol. Surv., Canada,* Mem. 159, pp. 43–44; *Minister of Mines, B.C.,* Ann. Repts., 1918, pp. 77–78; 1927, p. 88; 1947, pp. 90–91.]

Silver-Lead-Zinc

Mobile*

(56° 129° S.W.) A group of 10 claims was located on the old Mobile group on the south side of Glacier Creek at the head of Big Gulch Creek. The claims are held by G. H. Kendrick, of Merritt. Work on the property in the summer of 1965 included cleaning out the old adits, sampling, and a geochemical soil survey on the Mobile No. 5 claim. Transportation and access from Stewart, 3 miles to the southwest, was by helicopter. (*See* Annual Report, 1930, p. 105; *see also Geol. Surv., Canada,* Mem. 175.)

* By E. W. Grove.

Lead-Zinc

Aztec (Canex Aerial Exploration Ltd.)*

(56° 129° S.W.) Company office, 700, 1030 West Georgia Street, Vancouver 5. Eight claims located by R. Hutchings were examined under agreement by Canex Aerial Exploration Ltd. The property is on the east slope of Bear River Ridge opposite the mouth of Bitter Creek, about 8 miles north of Stewart. Four men supervised by G. Bird made geological, magnetometer, and geochemical (soil) surveys of the property and trenched part of the showings. Access to the property from Stewart was by helicopter.

The Aztec is an old property located about 1920. Pits and trenches on the exposed veins extended from about 1,850 to 4,000 feet elevation. The deposits consist of quartz-sulphide breccia mineralization filling narrow northwesterly trending shears in fragmental volcanics.

The main vein at 3,975 feet elevation is mineralized across 8 to 9 feet with coarse-grained galena, sphalerite, and pyrite in a vuggy quartz matrix with country rock inclusions. Uphill the vein narrows and is cut by lamprophyre dykes at 4,100 feet elevation. Below 3,975 feet the vein has been cut off by a normal fault which has produced an apparent displacement of about 1,500 feet to the north. The probable faulted extension of the vein is relatively continuous but has a lower sulphide content.

Country rocks in the area consist of green fragmental volcanics and volcanic sandstones generally trending northwest and dipping steeply west. Toward the top of Bear River Ridge these stratified green volcanic rocks grade into coarse red and purple volcanic breccias, which in turn are overlain unconformably by gently dipping tuffs and sandstones.

[Reference: *Geol. Surv., Canada,* Mem. 175, 1935, p. 106.]

Silver-Lead-Zinc

Emperor (Silver Arrow Mines Ltd.)*

(56° 129° S.W.) Company office, 800, 789 West Pender Street, Vancouver 1. F. S. Hofman, president. The company holds 65 claims by record on the north side of Glacier Creek about 6 miles north of Stewart. Work at the claims during 1965 included prospecting and tracing surface mineralization. About 300 feet of the Emperor vein was traced and stripped, the old adits were cleaned out, and an old bunk-house rehabilitated.

[Reference: *Geol. Surv., Canada,* Mem. 175, 1935, pp. 113–114.]

BROMLEY GLACIER

*Bromley Glacier Area**

Prospectors were first attracted to the Bitter Creek-Bromley glacier area when gold " colours " were traced up the Bear River and into Bitter Creek. Various small lode deposits were located but no significant production ensued. Concerted exploration in the area in 1960 located nothing of importance. Since 1960 the ice level of Bromley glacier at McAdam Point has dropped about 200 to 250 feet vertically and receded several hundred feet laterally. As a result, part of a small quartz monzonite plug with associated molybdenite, gold, silver, lead, and zinc mineralization has been exposed and now lies partly above the ice margin. The accompanying map of the Bromley glacier area shows some of the stages in the ice recession recorded since 1910 (Fig. 6).

*By E. W. Grove.

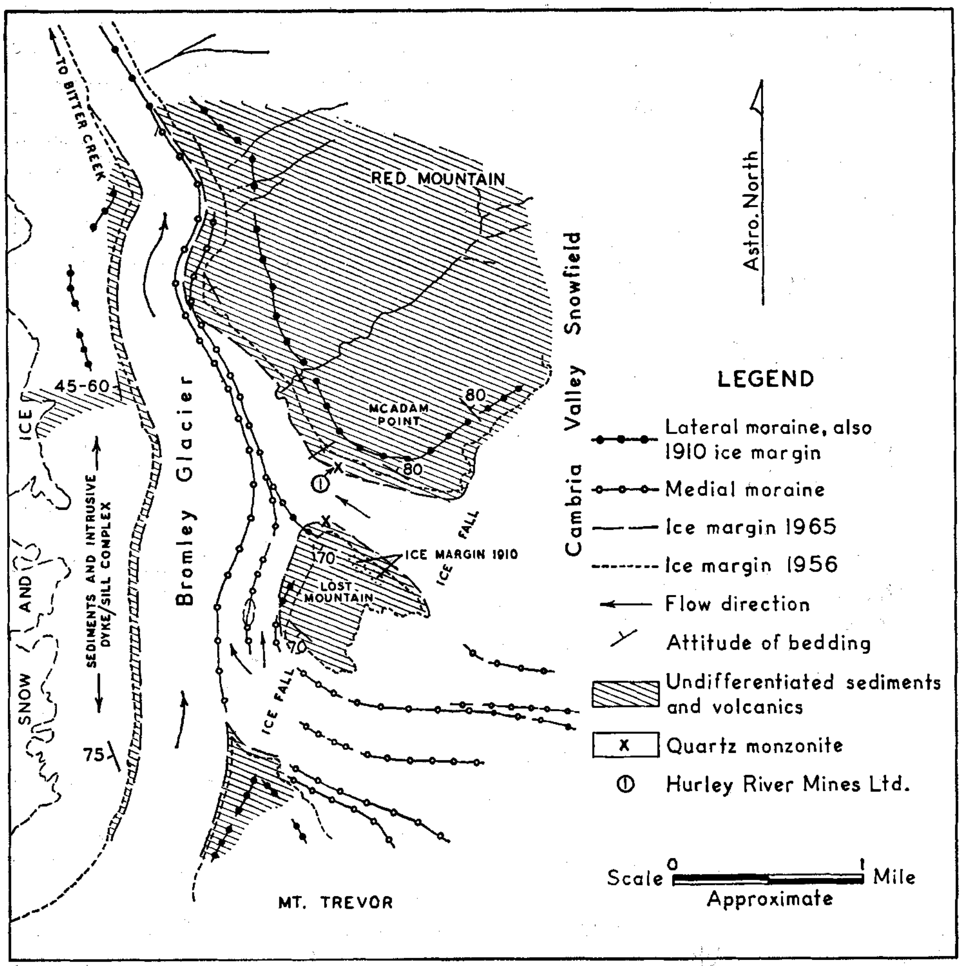


Figure 6. Bromley Glacier area, showing ice recession and geology.

Glacial recession in the general Stewart area is readily apparent and is important in that large tracts of generally accessible country rock have been exposed. Very little of this new ground has been explored, and the possibilities are illustrated by the new molybdenite discovery at McAdam Point. Measurements on the local glaciers in recent years indicate that ablation is proceeding at up to 30 feet vertically per year in areas below the firn line, and that the glacier toes are receding at up to 150 feet per year. At these rates a mineral reassessment of likely areas every 5 or 10 years becomes a necessity.

The Hurley River Mines deposit, located in 1965 at McAdam Point, is one of an increasing number of molybdenite deposits presently being explored and developed along the east margin of the Coast Range complex. The deposit at Bromley glacier can be roughly described as disseminated sulphide mineralization. Thinly laminated, variably schistose and broken quartzites, crystal tuffs, and siltstones have been intruded by a very coarse porphyritic quartz monzonite stock. The bedding, which generally trends northwestward, has been distorted by the intrusive stock, as well as by a number of dykes which emanate from it. Recent studies suggest that these rocks lie on the steep overturned east limb of a regional anticlinal structure that trends and plunges northward. To the west of McAdam Point, quartzite bands are overlain by a thick sequence of contorted siltstones intruded by granitic to dioritic dykes which are well exposed on the opposite steep valley wall. These dykes have been traced from Mount Trevor northwestward about 26 miles to the upper Salmon glacier. To the east of Red Mountain the country rocks are covered by ice and snow of the widespread Cambria snowfield. Rugged peaks of massive volcanic rocks poke up through the snowfield, and further east toward Meziadin Lake the massive volcanics are overlain by steeply tilted well-banded Bowser sediments. The general eastern structure is similar to that described at the Goat group (Noradco Mines), located about 15 miles to the north.

Gold-Silver-Molybdenum

Jackie, MoS_2 (Hurley River Mines Ltd.)*

(56° 129° S.W.) Company office, 535 Howe Street, Vancouver 1. P. Polischuk, president. The property comprises a block of 50 claims located on the south slope of Red Mountain and extending across part of Bromley glacier to Lost Mountain. All men and material were transported by helicopter from Stewart, 10 miles due west of the camp-site. The claims were located in June, 1965, by R. Hutchings, J. Berkosha, and R. Gilroy, of Vancouver and Stewart, and were later optioned to Hurley River Mines Ltd. The property is on the east side of Bromley glacier at McAdam Point. Work on the claims consisted of camp installation, sampling, 1,500 feet of trenching, one 300-foot AX diamond-drill hole, and limited geologic mapping. A crew of eight men was employed during the five-month exploration programme.

A small quartz monzonite mass exposed along the margin of the Bromley glacier forms a crescent-shaped body with steep sides about 600 feet long and up to 250 feet wide. The curvature of the contact with enclosing country rocks and the occurrence of similar quartz monzonite at the northwest base of Lost Mountain suggests that the stock may continue under the ice and would then be one-quarter to one-half mile in diameter. The exposed part of the stock is relatively uniform in composition, consisting of 10 to 15 per cent quartz, 35 to 40 per cent plagioclase ($An_{26\pm2}$), 30 to 35 per cent potash feldspar (minor microcline), and 3 to 5 per cent black biotite. The rock is coarse grained, with potash feldspar phenocrysts up to 3 inches long scattered uniformly through the matrix. Accessory minerals include medium-grained molybdenite, which commonly occurs as irregular fracture or grain boundary fillings and as well-shaped randomly disseminated rosettes. Molybdenite also occurs in irregular veins or lenses along several vertical north-trending shear zones which transect the stock and altered sediments. Several dykes extend out from the stock several hundred feet into the enclosing sediments. These intrusives also contain scattered sulphide mineralization.

The rocks intruded by the quartz monzonite are light green to buff, thinly laminated, very fine-grained metaquartzites and impure quartzites. A few hundred feet northeast these siliceous sediments grade perceptibly into fine-grained volcanic sandstones and agglomerates. Minor minerals found in the quartzites include biotite, muscovite, apatite, sphene, pyrite, and molybdenite. Apatite was found as a major constituent in lenses within the impure quartzites, which possess well-preserved primary structures. It appears that the apatite is a primary mineral in these rocks and may be found useful as a stratigraphic guide. Pyrite and molybdenite are generally associated in the quartz veins and minute veinlets which permeate the rocks along innumerable fractures. Larger quartz veins cutting the sediments con-

* By E. W. Grove.

tain galena, sphalerite, pyrite, tetrahedrite, and fine native gold. This may be one source area for the placer gold found in Bear River and Bitter Creek. The layered rocks in the area include numerous schistose, altered augite andesite sills which are also cut by the quartz monzonite.

BEAR RIVER PASS

Gold-Silver-Zinc

Goat (Noradco Mines Limited)* (56° 129° S.W.) Company office, 425 Howe Street, Vancouver 1. D. N. Cameron, president. The property consists of 80 claims located on Goat Ridge about 3 miles north of the Bear River Pass road and 7 miles west of Meziadin Lake. In 1965 Noradco entered into a share option agreement with Gunnex Limited. A crew averaging 16 men was supervised during a five-month construction programme by G. Vooro, mine manager. Development of the ridge-top vein mineralization included blasting out two helicopter pads, installation of two compressors at the ridge-top site, driving two adits totalling 233 feet and two raises totalling 72 feet, blasting 165 feet of trenches and 13 pits, sampling, and areal prospecting.

The mine road which connects to the Bear River Pass–Stewart–Cassiar highway at Mile 33 was partially rerouted and extended about 3½ miles for a total of 7½ miles to the glacier toe immediately south of and below the veins. An 875-foot tram was built from the valley bottom toward the tram portal to provide access to the ridge for men and material. Previously all men and supplies were lifted by helicopter from the Surprise Creek camp-site.

The property lies astride a steep-sided, easterly trending ridge about 2½ miles long. The country rocks in the mine area are largely green andesitic agglomerates and minor intercalated siltstones of the Hazelton Group. About three-quarters of a mile east of the Goat property the volcanic rocks are overlain by deformed and sheared Bowser sediments. West of the mine area the ridge is composed of thick, massive, very coarse mottled volcanic breccias. These are overlain by flat-lying, well-laminated volcanics and intercalated sediments.

The main Goat mineralization consists of the original " F " vein and the branching subsidiary " G " vein which was located in 1964. Other similar but less extensive mineralization recently found on the property includes the " D " vein, about 1,000 feet east of " F," and the " E " vein, near the tram portal cutout. One small pod of replacement sulphide mineralization was located in a folded thin siltstone band about 40 feet south of and below " F " vein. The alphabetical naming of the veins is arbitrary and has no structural implications.

The " F " and " G " vein mineralization averages about 6 inches wide and consists of crudely laminated sulphides and gangue enclosed in variably altered schistose agglomerates and dykes. The sulphides include coarse-grained black and light-brown sphalerite, disseminated needle-like and massive arsenopyrite, granular to massive pyrite, interstitial tetrahedrite as blebs and veinlets, and some galena. The gangue minerals include siderite, quartz, scheelite, some epidote, and minor calcite. Segregation of sulphides such as tetrahedrite along the hangingwalls has produced a striped effect in the veins. The siderite and tetrahedrite appear to be somewhat later and may have filled in along a hangingwall shear. The extent of host-rock alteration is quite variable. Resampling on surface and underground generally confirmed the values previously reported (*see* Annual Report, 1964, p. 23). Both adits driven on " F " vein proved the continuity of the mineralization over their 72-foot lengths. Also both the 36-foot raises driven from the upper adit intersected the down dip extension of the hangingwall " G " vein.

* By E. W. Grove.

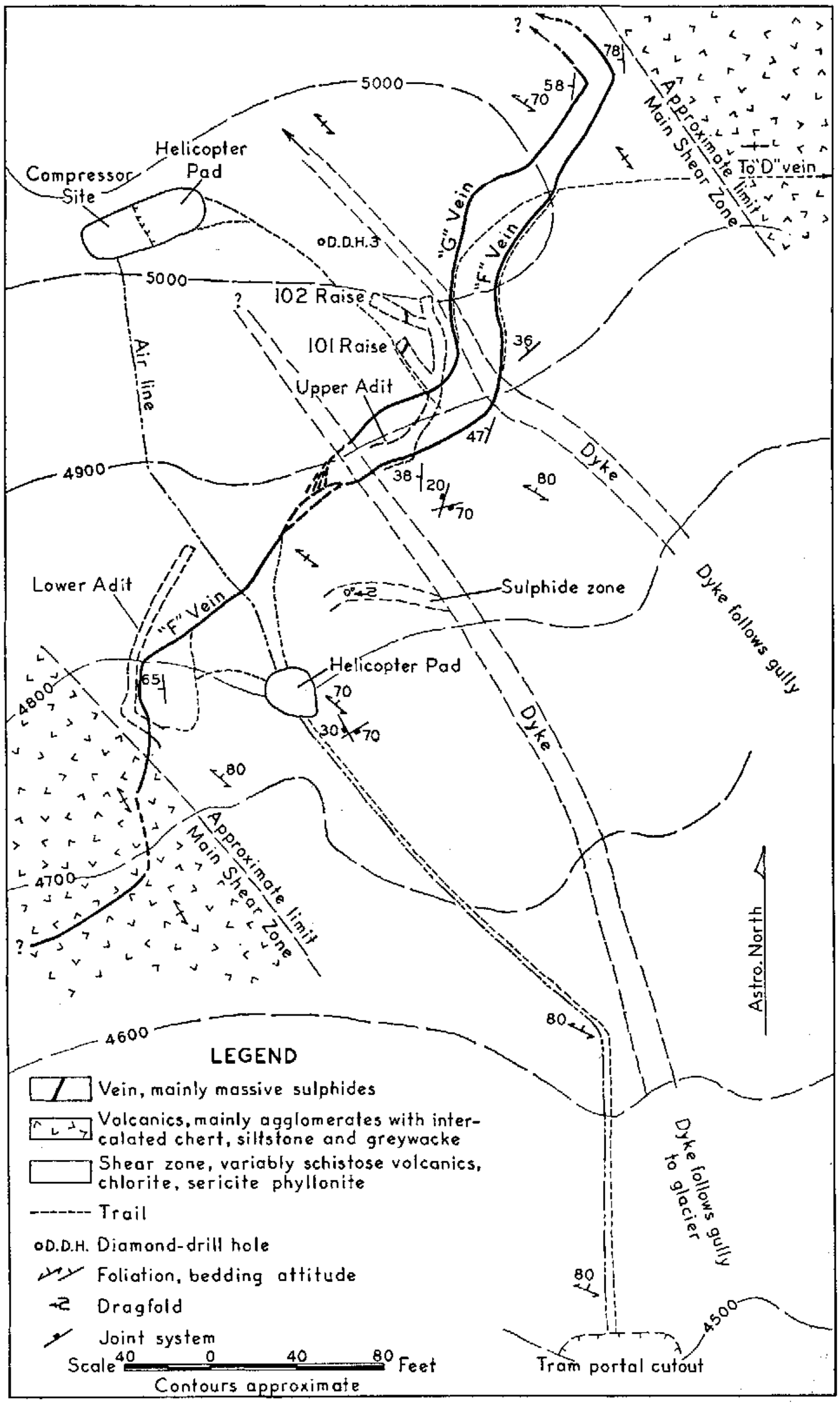


Figure 7. Noradco Mines Limited. Plan of ridge-top on the Goat property.

The Goat "F"-"G" vein system is confined to irregular fractures which transect both country rock and quartz monzonite dykes as well as older structures. In the mine area the agglomerates are strongly schistose within a 400-foot-wide steep, northerly trending shear zone. In addition, both the schistose and massive rocks are marked by two prominent closely spaced, gently curving joint sets, which are indicated on Figure 7. In sharp contrast, the "F"-"G" and "E" fractures are widely spaced and distinctly undulating, as indicated by attitudes on the "F"-"G" vein system and appear to be restricted to the shear zones. "D" vein, found to the east, similarly lies within a subparallel but less extensive shear zone.

Vein deposits of this type require careful prospecting because of the blending effect of weather on both vein material and host rocks. Attention to joint patterns and anomalous fractures may provide an exploration key to other vein mineralization in this general area.

OBSERVATORY INLET

Granby Bay Area*

The general geologic relationships in the Granby Bay or Anyox area are illustrated in Figure 8. This map represents a compilation of field work during parts of the summers of 1964 and 1965, air-photo interpretation, and field mapping by the writer while employed by The Consolidated Mining and Smelting Company of Canada, Limited.

Volcanic and sedimentary rocks which underlie most of the Granby Bay area form a large inclusion in the granitic matrix of the Coast Range complex. The surrounding granitic rocks are generally coarse-grained granodiorites which grade variably between hornblende quartz diorite and leucocratic quartz monzonite. The volcanic rocks in the Granby Bay inclusion consists largely of altered, pillowed, and massive andesites, some banded crystal tuffs, and massive basic sills. The volcanics have been intruded by small gabbroic plugs and various dykes. The overlying sediments include thinly striped argillites, colour-banded dark siltstones, dark sandstones, and minor limestone as lenses. The main contact is usually sharply defined, and is apparently conformable, although complicated by involved concentric folding.

Bedding is not readily discernible in the thick volcanic complex except locally, but is quite apparent in the layered sediments. Studies in the area have shown that both the volcanics and overlying sediments have been deformed simultaneously. Fold structures can be described as "Z" type or kink folds in both northerly and easterly directions. Extreme attenuation of the sedimentary rocks in the fold zones was accompanied by axial-plane faulting. The more massive volcanic rocks are sheared in hinge areas, especially at and near the contact with sediments. Later deformation related to igneous intrusion, such as the stock between Tauw and Glacier Creeks, produced local structural complexities. In addition, both volcanics and sediments are cut by swarms of granitic to gabbroic dykes, largely along northwesterly and northeasterly trends. Very generally, the over-all major structure is that of a northerly trending, tilted, and somewhat twisted syncline. Near the Redwing property the syncline flattens, but it increases plunge sharply toward Anyox. The geology has not been investigated south of Cascade Creek.

Clumps and layers of medium- to coarse-grained andalusite crystals are common throughout the fine-grained sediments and are indicative of amphibolite grade regional metamorphism. Andalusite is also visible in the sediments near the ore zones but is not associated with the mineralization processes and cannot be used as

* By E. W. Grove.

an exploration guide. Volcanics in the area are also generally altered as a result of the regional metamorphism.

The accompanying geological map shows the known major properties in the Anyox area. All occur at or near a volcanic-sedimentary contact and are largely confined to shear zones apparently controlled by hinge (or " nose ") structures in the contact zone. Mineralization in these deposits is similar and generally consists of massive, variably banded sulphides, of which pyrite, pyrrhotite, and chalcopyrite are the most common. The gangue generally includes quartz and calcite, plus epidote and altered wallrocks in various proportions. Very generally, shearing, skarnification, and silicification were followed by sulphide replacement. A lower age limit for the mineralization is indicated at the Redwing property, where quartz monzonite dyke offshoots from the nearby stock are veined by the mineralization. These dykes cut basic dykes as well as sediments and volcanics. Age relations at the other deposits are not as clear.

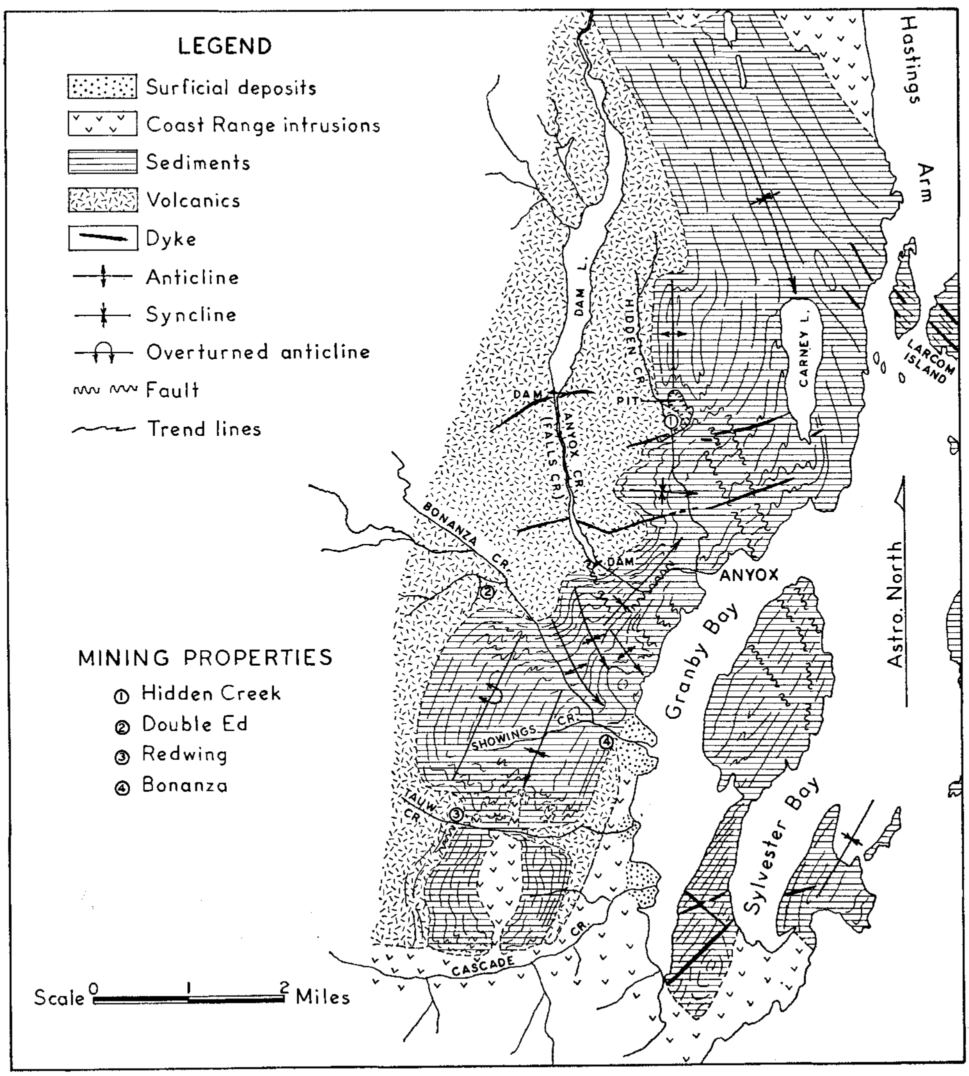


Figure 8. Geology of the Anyox area. Showing structural trends.

The Granby Bay area is best known as a copper camp, and the properties which continue to attract exploration interests are shown on Figure 8. Of these, only the Hidden Creek and Bonanza mines have recorded substantial production, from 1914 to 1936. Production statistics for the Anyox copper area follow:—

	Active	Production (Tons)	Gold (Oz.)	Silver (Oz.)	Copper (Lb.)	Grade (Per Cent Copper)
Hidden Creek	1914–36	23,948,419	121,299	6,638,088	708,891,739	1.55
Bonanza	1928–35	724,193	2,784	281,244	31,525,588	2.18

Mineral exploration in the area has been essentially continuous since 1936, and in 1953 the Double Ed property was located by The Consolidated Mining and Smelting Company of Canada, Limited. In 1965, only the Redwing property was active.

Copper

Redwing (Canusa Mines Limited)*

(55° 129° S.W.) Company office, 1000, 789 West Pender Street, Vancouver 1. J. Dunsmuir, president. The Redwing property consists of 3 Crown-granted claims and 41 claims held by record situated near the head of Tauw Creek (Glacier Creek) on the west side of Granby Bay. Two men were engaged from May to October in driving a 180-foot adit and in setting up a camp, compressor, a helicopter platform, and doing trail work. Five diamond-drill holes totalling 570 feet were drilled from the new adit (No. 2) to explore the mineralized shear zone. Men and supplies were transported from Alice Arm, about 16 miles to the east, by helicopter.

The property was first located in 1909 by Joseph McGrath, and a 120-foot adit was driven on the mineralization in 1911 by Pacific Metals Company. At this time, access to the mineralization exposed on the cliff face was accomplished via a trail over snow and ice which then filled the bottom of a box canyon. Since then the permanent snow has all but disappeared, leaving the adit well out of easy access. In 1964 three diamond-drill holes (C-1, C-2, and C-3) were drilled from the old adit by Magnum Consolidated Mining Co. Ltd., but the project was abandoned because of weather and dangerous rock falls (*see* Fig. 9).

The Redwing is one of several significant copper properties in the Anyox area which are found in shear zones along or near the pillow volcanic-sedimentary contact.

The accompanying plan and cross-section of the Redwing workings show the relative location and general nature of the workings and mineralization in a chlorite schist zone about 400 feet west of the steep west contact between volcanics and siltstones.

The shear zone as presently known has a width of from 60 to 100 feet and has been traced about 200 feet along strike. The zone trends northward with a steep east dip, and roughly parallels the nearby folded volcanic-sedimentary contact.

Northwesterly and higher up the mountainside above the adits the main contact flattens, marking the hinge-line or axial plane of an overturned subsidiary anticlinal structure. Results of the 1964 and 1965 drilling have outlined two major mineralized zones or lenses within the shear and suggest continuity between the two adit levels. The lenses appear to trend northward, dip steeply east, and plunge to the northeast at a high angle.

* By E. W. Grove.

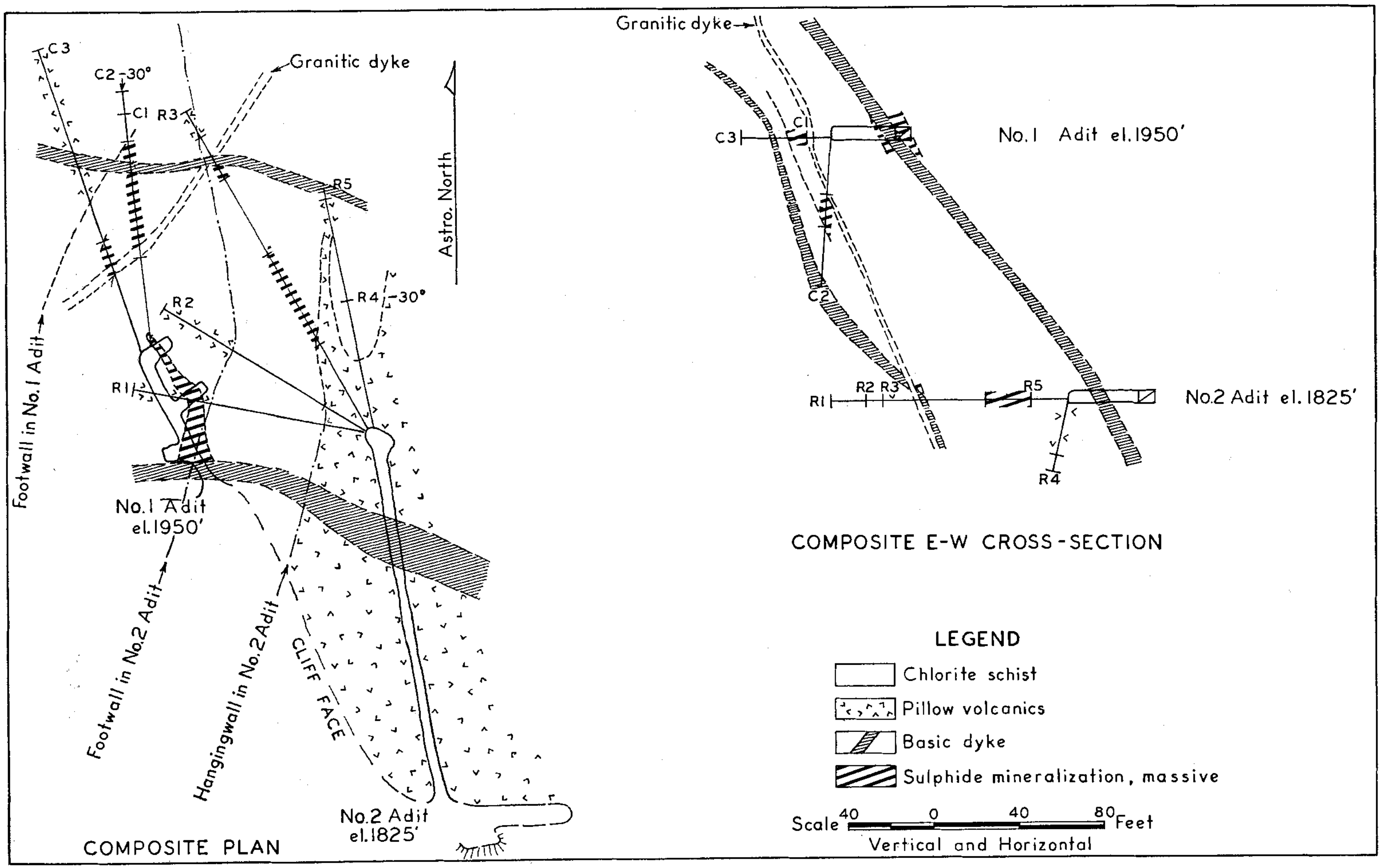


Figure 9. Canusa Mines Limited. Plan and section of the Redwing property.

The mineralization as outlined in No. 1 adit and by the drilling consists of disseminated to crudely banded massive pyrite, pyrrhotite, and chalcopyrite with some brown sphalerite. Massive sulphides form zones which range in width from 10 to 25 feet and are gradational with disseminated sulphides in the enclosing schists. The strike length of the mineralization has not been determined.

Molybdenum

Molly Mack* (55° 129° S.W.) This group of 26 recorded claims is owned by D. Collison, of Alice Arm. The claim group is situated on the west shore of Observatory Inlet near the south end of Granby Point, and is accessible by boat from Alice Arm, 15 miles to the east.

The main mineralized showing is at sea-level west of Frank Point and immediately south of the contact between the Coast Intrusions and the sedimentary rocks to the north. South and west of the showing, leucocratic quartz monzonite porphyries of the Coast Intrusions form low ridges and weather to a uniform near-white colour. Two-millimetre phenocrysts of anhedral glassy quartz and euhedral feldspars make up most of the rock, with muscovite as the dominant mafic mineral. Sedimentary rocks in the area have been metamorphosed to a biotite-quartz hornfels and are cut by numerous 1-foot-wide sills of fine-grained quartz monzonite near the contact.

The main zone of molybdenite mineralization is confined to a small area of biotite-rich granite within the quartz monzonite porphyries. The granite, which consists essentially of anhedral quartz, subhedral perthitic potash feldspar, and coarse flakes of biotite, contains irregular inclusions of hornfelsed sediments and is cut by lenses of quartz monzonite porphyry and fine-grained felsite dykes. Coarse-grained molybdenite mineralization within this zone occurs along the biotite cleavages and near the margins of 1-foot-wide quartz veins and lenses The zone is oriented in a north-south direction and measures 4 by 10 feet. A chip sample from the zone assayed 12.7 per cent MoS_2 with trace amounts of copper and lead.

A few specks of molybdenite were noted in the intrusive rocks to the north and south of the main showing.

Nickel-Copper

Haywire (Falconbridge Nickel Mines Limited)* (55° 129° S.W.) Company office, 7 King Street East, Toronto 1, Ont.; Vancouver office, 504, 1112 West Pender Street. This group of 12 recorded claims is situated north of Davies Point at the entrance to Alice Arm. Access is by boat from the village of Alice Arm, some 10 miles east. A trail leads from the beach to the main showing 500 feet inland. The claims were optioned from D. Collison, of Alice Arm, late in the fall, and a crew of three men spent one month carrying out geochemical and geophysical surveys under the supervision of J. J. McDougall.

When examined by the writer in late September, the mineralized zone was exposed in one open cut. A 1-foot-wide lens of massive pyrrhotite with blebs and stringers of chalcopyrite and capped by a 5-foot-thick gossan zone strikes west-northwest with a 50-degree dip to the north. The lens is associated with coarse-grained olivine gabbro containing ¼-inch blebs of pyrrhotite rimmed by chalcopyrite. A sample across the massive sulphide lens assayed: Gold, trace; silver, 0.3 ounce per ton; platinum, trace; copper, 1.66 per cent; lead, trace; zinc, trace; nickel, 1.11 per cent; cobalt, 0.18 per cent.

* By N. C. Carter.

Outcrops in the vicinity are scarce, and olivine gabbro was noted only in the open cut. Outcrops of sedimentary rocks trending west-northwest and dipping to the north were noted short distances to the north and south of the open cut, and suggest that the gabbro is a sill.

ALICE ARM

Molybdenum

Alice (British Columbia Molybdenum Limited)*

(55° 129° S.E.) Company office, 402 West Pender Street, Vancouver 3. C. H. Burgess, president; C. C. Kamm, project manager. The property is on Patsy Creek, the east fork of Lime Creek, and is 5 miles southeast of Alice Arm. It consists of 85 full and fractional claims held by record. Work in the field was started on May 12, 1965, and continued through to December 20, 1965. The number of men on the property varied from 20 to 100 through the above period and averaged approximately 55 within the period of field work. An access road 4 miles in length, from the foreshore to the plant-site, has been constructed and continued an additional mile to the pit-site. In addition, excavation has been done at the plant-site in preparation for construction of the concentrator.

At the foreshore, clearing has been done for a townsite, and a staff house and residence are under construction. Foundations for two buildings, a warehouse and garage, have been completed. A 100-man construction camp has been established. The camp is served by coastal steamship and regular passenger air lines, as well as camp tender vessels plying between the company float and the government wharf. (*See* Annual Report, 1964, p. 30.)

Gus Mac (Apollo Minerals Ltd.)*

(55° 129° S.E.) Company office, 535 Howe Street, Vancouver 1. A group of 50 recorded mineral claims lying 2 to 4 miles south of Alice Arm on Widdzech and Mohawk Mountains is held under agreement from Mid-West Mines Limited. A preliminary investigation was made during the summer. Transportation to the property is by small boat from Alice Arm and by helicopter.

Roundy Creek (Sileurian Chieftain Mining Company Limited)†

(55° 129° S.E.) Company office, 850 West Hastings Street, Vancouver 1. Walter Eilers, president. The claim group, which consists of 40 full and fractional claims held under option, extends both east and west of Roundy Creek 1¼ miles from tidewater. Work carried out during 1965 included the drilling of 15 holes totalling 1,433 feet and the construction of a 2½-mile road from Silver City up Roundy Creek to an elevation of 500 feet. An average crew of seven men was employed under the direction of A. P. Fawley. A general description of the geology is contained in the Annual Report for 1964.

Drilling was concentrated around a relatively high-grade zone of molybdenite mineralization in Sunshine Creek, a northeasterly flowing tributary of Roundy Creek. The zone is exposed on the north side of the creek at an elevation of 1,100 feet. Drilling in this area extended the width of the exposed molybdenite mineralization, and intersections of good-grade mineralization were encountered on the south side of the creek, where mineralized exposures are lacking.

Molybdenite occurs in quartz veinlets and as $\frac{1}{16}$-inch disseminations in leucocratic quartz monzonite porphyry. Fine-grained alaskite-type rocks, occurring as

* By H. Bapty.
† By N. C. Carter.

dykes and irregular bodies in the quartz monzonite porphyry, are the host for relatively high-grade zones of molybdenite mineralization in the form of irregular blebs and lenses. (*See* Annual Report, 1964, pp. 36–39.)

Tidewater (Corex Mines Ltd.)*

(55° 129° S.W.) Registered office, 404, 510 West Hastings Street, Vancouver 2. Morris Black, president. Under an agreement with Canex Aerial Exploration Ltd., some exploratory work was carried out during 1965. The property is situated 4 miles west of the village of Alice Arm. A trail leads from the beach to the original workings at an elevation of 1,000 feet.

Five vertical drill-holes totalling 958 feet were drilled in and adjacent to a small quartz monzonite porphyry intrusive body 900 feet north of the old underground workings. Drilling near the southern contact of the body suggests that it is a relatively thin sheet in this area, as holes collared in quartz monzonite porphyry pass into hornfelsed sedimentary and volcanic rocks.

Minor amounts of molybdenite mineralization, occurring in ¼-inch quartz veinlets and in hair-line fractures, were intersected in the hornfelsed rocks. Occasional short sections of better-grade mineralization were found in the quartz monzonite porphyry, the molybdenite being present as selvages along the margins of quartz veinlets, as disseminations in the rock matrix, and in irregular quartz lenses.

Between the months of April and June, an average crew of five men was employed under the supervision of S. J. Tennant.

[References: Stevenson, J. S., 1940, Molybdenum Deposits of British Columbia, *B.C. Dept. of Mines,* Bull. 9, pp. 61–67; *Minister of Mines, B.C.,* Ann. Rept., 1964, pp. 39–41.]

Silver

Arcadia (Sileurian Chieftain Mining Company Limited)†

(55° 129° S.E.) Company office, Credit Foncier Building, 850 West Hastings Street, Vancouver 1. A. P. Fawley, consulting geologist. The Wolf and Esperanza group of Crown-granted claims are held under an option agreement, and the Arcadia claims are held by record. A crew of three men worked during the summer drilling five short diamond-drill holes near the portals of the old adits. The property can be reached by a 5-minute walk from Alice Arm. (*See* Annual Report, 1948, p. 76.)

Molybdenum

Ajax (Newmont Mining Corporation of Canada Limited)*

(55° 129° N.E.) Vancouver office, 744 West Hastings Street. J. Drybrough, president; D. M. Cannon, manager. This group, consisting of 91 full and fractional recorded claims, is situated on the east-facing Dak River valley slope of Mount McGuire, 8 miles northeast of Alice Arm. Access to the property is by helicopter. A 13-mile tractor-road, extending from Alice Arm up the Dak River to a point within 300 feet of the camp, was completed during the summer months.

The claims were located in May of 1965, interest in the area having been generated by a description of the Leroy group of mineral claims contained in the Annual Report for 1927. The report indicated the presence of numerous quartz veinlets containing molybdenite, pyrite, pyrrhotite, and chalcopyrite in highly metamorphosed iron-stained cherty sediments, intruded by a granodiorite dyke.

* By N. C. Carter.
† By H. Bapty.

The exploration camp was set up at an elevation of 2,400 feet in a small isolated area of standing timber, 100 feet west of the original Leroy cabin. Slide alder extends from the river to an elevation of 3,200 feet on the steep slope. From this elevation to the summit of Mount McGuire at 5,374 feet, gentler slopes and open meadows are broken by rock bluffs.

Bedrock in the central part of the property is well exposed in the numerous easterly flowing tributary creeks of the Dak River. North-northwesterly trending argillites and siltstones with interbeds of chert, quartzite, and limy sediments are intruded by a plug of quartz monzonite porphyry, exposed in an area lying between 3,200 and 4,200 feet elevation. The plug, elongated in an east-west direction, measures roughly 1,800 by 1,300 feet and is irregular in outline. Several small satellite plugs occur to the north and east of the main intrusive as exposed on surface. The sedimentary rocks are domed and are contact metamorphosed to hornfels a distance of 2,000 to 3,000 feet outward from the quartz monzonite porphyry intrusion. The hornfelsed rocks generally lack sedimentary features and are characterized by a uniform coating of brown iron oxide due to the presence of disseminated pyrrhotite and pyrite. They are intensely fractured and contain numerous quartz veinlets. An inner zone of light-green siliceous quartz-epidote hornfels extends outward from the plug a distance of between 1,000 and 2,000 feet, where it grades into a chocolate-brown biotite-quartz hornfels. The biotite-quartz hornfels zone passes into dark argillaceous sedimentary rocks with a decrease in the biotite content. Irregular inclusions of brown biotite hornfels within the quartz-epidote hornfels zone suggest that it may represent a later stage of alteration, perhaps related to the period of quartz veining and silicification within the quartz monzonite porphyry plug.

The quartz monzonite porphyry is a leucocratic light-grey to white rock containing 2- to 4-millimetre phenocrysts of quartz and feldspar. Ragged porphyroblasts of potash feldspar, often containing inclusions of quartz and plagioclase, occur both in the rock matrix and along the borders of quartz veinlets. Minor amounts of interstitial muscovite and chlorite are the dominant mafic minerals. Locally the plug is cut by dykes and lenses of a fine-grained, buff, equigranular alaskite type of rock consisting essentially of quartz and potash feldspar with graphic intergrowths. Northeast of the main intrusion is a small area of quartz diorite porphyry, which is distinguished from the quartz monzonite porphyry by a darker grey colour due to a more calcic plagioclase and the presence of 2-millimetre flakes of fresh brown biotite. This rock may represent a border phase of the intrusion. The quartz monzonite porphyry is transected by numerous quartz veinlets, and silicified areas containing remnants of the original rock are numerous in the deeper portions of some of the drill-holes.

Basic dykes, consisting mainly of pyroxene and plagioclase, and striking in a north-northeast direction, cut both the hornfelses and the quartz monzonite porphyry.

The structure of the quartz monzonite porphyry plug is imperfectly known. The zone of quartz-epidote hornfels is more extensive to the north-east, suggesting a plunge of the intrusion in that direction. Several small creeks to the east of the intrusion follow east-northeast faults which may extend into the plug with resultant offsetting.

Molybdenite and pyrrhotite are the major sulphide minerals. Minor amounts of pyrite and chalcopyrite are also present.

Molybdenite mineralization is present in both the quartz monzonite porphyry and the hornfelses on the east side of the intrusive. It occurs along the margins of numerous randomly oriented quartz veinlets in both rock types and as disseminations within silicified zones in the quartz monzonite porphyry. Pyrrhotite is widespread as disseminations in the intrusive rocks and the hornfelsed zones, and in quartz veinlets in which it appears to represent an earlier stage of mineralization than the molybdenite.

During 1965, exploration work included line-cutting and trenching and sampling of surface showings. Geological mapping was carried out over a 1-square-mile area, and a total of 5,185 feet was drilled in five holes. A crew of 20 men was employed under the supervision of D. M. Cannon. (*See* Annual Report, 1927, p. 74.)

Copper

Kinskuch (Forest Kerr Mines Ltd.)*

(55° 129° N.E.) Company office, 404, 510 West Hastings Street, Vancouver 2. E. A. Glick, president. This group of 181 recorded claims is situated at Kinskuch Lake, 13 miles northeast of Alice Arm. Access is by helicopter. Copper mineralization, consisting of pyrite and chalcopyrite veins and stringers, occurs in intensely fractured intermediate volcanic rocks near the southeast end of Kinskuch Lake. The volcanic rocks have been affected over a large area by varying degrees of chlorite and carbonate alteration.

Work on the property was carried out between the months of June and September by Sulmac Exploration Services Limited and consisted of geological mapping, induced polarization and magnetometer surveys, and 1,247 feet of drilling. The property was not visited. (*See* Annual Report, 1956, p. 21.)

Copper-Silver

Basin, Silver Basin (Sirmac Mines Limited)*

(55° 129° N.E.) Registered office, 1326, 67 Yonge Street, Toronto, Ont. D. H. Baird, president. The property, consisting of a four-claim mineral lease and five recorded claims, lies near the headwaters of Stark Creek midway between the Kitsault River and Kinskuch Lake. Access to the property is by helicopter from Alice Arm.

Near the south end of the claim group a northeasterly striking shear zone in volcanic breccia is exposed in three open cuts. This zone contains quartz, carbonate, chalcopyrite, tetrahedrite, and pyrite. Roughly 2,000 feet to the northeast a flattish shear zone contains quartz, chalcopyrite, pyrite, and tetrahedrite.

An electromagnetic survey was carried out on the claim group in August by Scope Mining and Exploration Consultants Limited. The property was not visited. (*See* Annual Report, 1924, p. 54; *Geol. Surv., Canada,* Mem. 175, p. 53.)

Copper-Zinc-Lead

Lucky Strike, Cascade Falls, Copper Creek*

(55° 129° N.W.) These three groups, consisting of 31 recorded claims, are owned by D. Collison, of Alice Arm. The claims are located on the west slope of the upper Kitsault River valley approximately 23 miles north of Alice Arm. Access is afforded by helicopter or by a truck-road up the Kitsault valley to a point within 2 miles of the claims.

Elevations in the area covered by the claims range from 3,000 to 5,000 feet with relatively gentle slopes. Timber is sparse, and numerous small ponds exist on the Cascade Falls and Copper Creek groups. The claims are generally a relocation of older claim groups of the same names, records of which are contained in Annual Reports for 1922 and later years. Prospecting carried out by Mr. Collison during 1965 resulted in the finding of new showings and in the extension of older ones. A review of the regional geology is contained in the Annual Report for 1951.

* By N. C. Carter.

Feldspar porphyries, pyritic in part and of quartz diorite composition, underlie most of the area covered by the claims. One- to two-millimetre phenocrysts of plagioclase make up most of the rock, and are set in a fine-grained matrix of quartz and feldspar with varying amounts of chlorite and pyrite. The rock contains 4-millimetre hornblende laths in some areas. Elongate roof pendants of sedimentary rocks including siltstones and banded argillites are common on the Lucky Strike group and are present to a lesser extent on the Cascade Falls claims. These are oriented with their long axis in a northwest direction and are up to 2,000 feet in length.

Mineralization on the claims occurs in two forms: as veins and replacements in bedding shears in the sedimentary rocks and as veins in east-northeast fractures and shear zones in the feldspar porphyries.

The most northerly showing on the claims is on the Lucky Strike group at an elevation of 4,600 feet, where quartz-calcite veins containing chalcopyrite, galena, sphalerite, and pyrite occur in a shear zone in argillaceous sedimentary rocks near their contact with feldspar porphyry. The zone is locally 15 feet wide and can be traced for 100 feet along a northwest strike. South of the above showing and at an elevation of 4,200 feet, a 1-foot-wide quartz vein is exposed in an open cut. The vein strikes east and contains 2-inch stringers of near massive sulphides including tetrahedrite, galena, stibnite, and sphalerite. Twenty-five feet east of the open cut, disseminated galena is contained in silicified feldspar porphyry. South and east of this zone at an elevation of 3,800 feet, a 10-foot-wide mineralized zone with a fair concentration of sphalerite in quartz-carbonate veins was noted. At still lower elevations on the Lucky Strike group, quartz veins and lenses, 2 feet wide, are found in bedding shears in banded sedimentary rocks which are part of a large roof pendant. Showings extend over a distance of 1,000 feet along the north-northwest trend of the sediments. Pyrite is common in the quartz veins with varying amounts of galena, sphalerite, and tetrahedrite.

On the Cascade Falls claims, one showing consists of a northwesterly striking, north-dipping 5-foot-wide quartz vein in argillites. The footwall contact of the vein is sharp in contrast to the hangingwall, which has been partially replaced by quartz a distance of 5 feet outward from the vein. Disseminated galena, sphalerite, chalcopyrite, and tetrahedrite occur in both the vein and silicified wallrock. A chip sample across 10 feet assayed: Gold, trace; silver, 0.9 ounce per ton; copper, 1.31 per cent; lead, 0.05 per cent; zinc, 0.05 per cent.

Several other showings on the Cascade Falls and Copper Creek groups are basically similar, occurring as northeasterly striking 2-foot-wide quartz veins in feldspar porphyry and containing varying amounts of pyrite, galena, sphalerite, and chalcopyrite. (*See* Annual Report, 1951, pp. 87–88.)

UPPER ILLIANCE RIVER

Copper-Silver-Lead-Zinc

Monarch* (55° 129° N.E.) This group of seven recorded claims is owned by S. Uruski, of R.R. 1, Courtenay. The claims are situated near the divide between the Upper Illiance and Tchitin Rivers. Access from Alice Arm, 15 miles west, is by helicopter.

The claim group includes the original Monarch showing, records of which are contained in Annual Reports dating back to 1915. Rocks in this area are light-brown to light-green pyritized sericitic andesite schists which dip steeply and trend north-northwest. The main showing is exposed in a large open cut on the east slope

* By N. C. Carter.

of the river valley at an elevation of 3,800 feet. The mineralized zone, striking in a northerly direction with a steep westerly dip, can be traced over a distance of 100 feet. At the south end, where it is 10 feet wide, it terminates sharply against a west-striking fault with a 50-degree dip to the north. The mineralized zone decreases in width on the north end, where it is only a few feet wide and is transected by northeast-striking faults. Irregular lenses of country rock are present within the wider sections of the zone. Malachite-azurite stain is widespread and the zone is locally well mineralized with tetrahedrite, sphalerite, chalcopyrite, galena, and pyrite in a quartz-calcite-barite gangue. A chip sample across 10 feet of the vein material assayed: Gold, trace; silver, 2.5 ounces per ton; copper, 2.92 per cent; lead, 0.48 per cent; zinc, 1.7 per cent.

Approximately 100 feet below the open cuts is an adit which is now caved at the portal. The Annual Reports for 1921 and 1930 state that no mineralization was encountered in the adit, which was driven in an easterly direction for a distance of 186 feet. The reports suggest that the adit was driven along the footwall side of the fault against which the mineralized zone terminates in the open cuts.

Other showings on the claim group are situated along a prominent northerly trending lineament, 1,000 feet west of the Illiance River headwaters. Small veins 1 foot wide and generally not exceeding 5 feet in length occur in fragmental andesite schists over a distance of 2,000 feet. The largest mineralized zone noted in this area can be traced along strike for 100 feet and attains widths up to 10 feet. Horses of country rock are present in the wider portions of the zone. Mineralization consists of galena with lesser amounts of sphalerite and tetrahedrite in a quartz-carbonate gangue. Malachite and manganese oxide staining is widespread.

Assessment work was carried out by Mr. Uruski between the months of June and October.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1919, p. 59; 1921, p. 56; 1930, p. 90; Hanson, G., *Geol. Surv., Canada,* Mem. 175, 1935, p. 73.]

Silver-Lead-Zinc

Grey Goose, Silver Bell No. 1* (55° 129° N.E.) These two recorded claims are held by S. Uruski, of R.R. 1, Courtenay, and are located on the Illiance River a little over a mile south of its head. The main showing on the Grey Goose claim is an 18-inch-wide quartz-carbonate vein containing galena and pyrite, which occurs in a northwesterly striking, westerly dipping shear zone in andesite schist. The vein is exposed in an open cut and can be traced in a northwesterly direction for 10 feet, where it ends abruptly against a northeast joint plane.

Mineralized zones on the Silver Bell No. 1 claim are exposed in old workings of United Metals company, records of which are available in Annual Reports for the years 1916, 1918–21, and 1930. A north-northwest striking quartz-carbonate-galena-sphalerite vein, ranging in width from several inches to 5 feet, is exposed in a large open cut. The vein is cut by a 1-foot-wide biotite lamprophyre dyke at the north end of the open cut. Four adits on each side of the river crosscut 6-inch quartz-carbonate veins which are locally well mineralized with galena and sphalerite. The veins occur in northerly trending shear zones in contorted sericitic andesite schists containing disseminated pyrite and minor amounts of galena.

Silver Bar* (55° 129° N.E.) This group of 10 recorded claims is owned by Gunn and Inge Fiva, of Alice Arm, and is situated on the Illiance River between the Monarch group and the

* By N. C. Carter.

Grey Goose and Silver Bell No. 1 claims. On the west side of the Illiance River, showings are exposed in small open cuts along a north-trending shear zone over a distance of 1,500 feet. The showings appear to be the southern extension of a mineralized belt on the Monarch claims. The quartz-carbonate-barite veins are not more than 1 to 2 feet wide and pinch and swell along strike, generally not exceeding 10 feet in length. Mineralization consists of varying amounts of galena and sphalerite with some tetrahedrite. Lamprophyre dykes occur locally along the veins.

Assessment work done during the summer months included open cutting and stripping.

QUEEN CHARLOTTE ISLANDS

Graham Island (54° 132° S.W.)

Manganese

Shag Rock (Naden Harbour Manganese Ltd.)*

This property of 17 recorded claims is 25 miles west of Masset on the east side of Klashwun Point near Shag Rock. It is held by Naden Harbour Manganese Ltd., 605 Courtney Street, Victoria. I. M. Sherwin, president. The showing consists of a north-trending fault breccia sealed and partially replaced by manganite with small amounts of other manganese minerals. The fault, which dips about 80 degrees eastward, cuts Masset Formation basalts and andesite porphyries and minor shale and calcareous shale of unknown affiliation. The fault is a large regional structure, but the breccia filling is quite lensoid.

Falconbridge Nickel Mines Limited, during May, 1965, took out bulk samples of the order of 150 to 200 tons of fresh material and drilled 254 feet in two packsack diamond-drill holes. The positions of the holes did not provide conclusive results. One hole may have penetrated the fault zone; the other hole intersected it at a narrow locality, although the breccia lens adjacent on the surface is large. (*See* Annual Report, 1960, p. 11.)

Moresby Island

Iron-Copper

Tasu (Wesfrob Mines Limited)†

(52° 132° N.E.) Wesfrob Mines Limited is a wholly owned subsidiary of Falconbridge Nickel Mines Limited, 7 King Street East, Toronto 1, Ont.; Vancouver office, 504, 1112 West Pender Street, Vancouver 1. P. N. Pitcher, president; F. A. Godfrey, mine manager; L. W. Hall, construction manager. The property contains 21 Crown-granted mineral claims and 70 recorded claims. Work continued throughout the year, commencing with a crew of 125 men in January and ending with a construction crew of 315 men in December. The property is served by barge, coastal ships, and aircraft.

Work Accomplished

Surface diamond drilling 7,048 ft.

Underground work—	Advance (Ft.)	Slashing (Cu. Ft.)
Adits	3,873	5,877
Drifts	135	-------
Raises	1,331	1,155
Conveyor incline	234	11,075
Ore-bins raises	68	2,267
Crusher-room	......	70,346

* By A. Sutherland Brown.
† By H. Bapty.

Pit preparation—	
No. 1 zone, waste mined	91,640 yd.
No. 2 zone, waste mined	1,366,578 yd.
Plant-site excavation	424,271 cu. yd.
Site roads	14,778 ft.
Townsite roads, including causeway	5,885 ft.
Sewell–Newcombe Inlet road	2.3 miles completed

Surface Buildings Installed

Construction offices, three 120-man bunk-houses, 120-man kitchen enlarged, 10 trailers, two powder magazines, temporary pit shop completed, 21 townsite buildings under construction, concentrator and cobbing plant under construction, 10 temporary oil tanks erected.

(*See* Annual Report, 1963, pp. 13–16.)

Iron

Jessie, Adonis, Rose (Jedway Iron Ore Limited)*

(52° 131° S.W.) Company office, 1111 West Georgia Street, Vancouver 5; mine office, Jedway. L. T. Postle, president; G. N. Cornish, manager. During 1964 it was decided to extensively strip the north walls of the Jessie pit to make more ore available rather than to start a full underground programme. A resulting temporary shortage of ore forced the mill to close late in 1964 even though production from the Adonis pit was begun in September. The mill restarted on February 15th and has treated 820,890 tons of ore producing 395,442 tons of concentrate during 1965. Production from the Adonis pit totalled 106,674 tons and was mined chiefly in 1964.

During 1965 diamond drilling at the Adonis extension and the Rose totalled more than 4,600 feet. At the Adonis, reserves of the same order as already mined were established, and at the Rose sufficient to justify the building of a 2½-mile road to connect with the Adonis road. The Rose is on the northwest slope just south of Ikeda Cove. It is one of a group of 23 claims and leases held by Falconbridge Nickel Mines Limited and will be mined under royalty agreement. The orebody is parallel with the hill slope and has a very low stripping ratio. Both the Adonis and the Rose are typical coastal-type metasomatic iron deposits. The magnetite ore chiefly replaces greenstone adjacent to limestone at the top of the Karmutsen Formation. (*See* Annual Reports, 1959, pp. 11–14; 1961, pp. 13–15; 1962, pp. 11–12; 1963, p. 16.)

BURNABY ISLAND

Iron

Jib (Burnaby Iron Mines Limited)*

(52° 131° S.E.) Company office, 1200 West Pender Street, Vancouver 1. K. J. Springer, president; W. R. Bacon, exploration manager. This company is owned jointly by Mastodon-Highland Bell Mines Limited and Leitch Gold Mines Limited. The property of 57 located claims covers much of the southwestern peninsula of Burnaby Island south of Poole Point and extends across Skincuttle Inlet to Skincuttle Island of the Copper Islands.

The property was described in the 1963 Annual Report with a geological plan. At that time 18 AX holes were drilled totalling 12,208 feet. In 1965 drilling resumed from May to September, and an additional 6,735 feet was drilled in five new

* By A. Sutherland Brown.

holes and six holes were deepened. The new drilling confirmed the presence and extent of the "underlime" orebody, and one hole penetrated for the first time a major anomaly offshore. This hole intersected 250 feet of high-grade magnetite that has a true thickness of at least 150 feet. The company announced reserves on the basis of present drilling of 8,200,000 tons of ore grading 49.45 per cent iron.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1962, pp. 13–14; 1963, pp. 18–21; *Western Miner,* Oct., 1965, p. 97.]

TERRACE

Lead-Zinc-Copper

Hope* (54° 128° N.W.) A group of four claims, 15 miles north of Kitsumkalum Lake on the Cedar River, was worked on by C. L. M. Giggey and his partners during the year. A truck-road was built to within 1.5 miles of the claims, and a tractor-road was pushed through from the Columbia Cellulose logging-road. The property was not visited.

Gold-Copper

Lucky Luke* (54° 128° S.E.) Lucky Luke Mining Co. Ltd., P.O. Box 1269, Terrace, holds the Hummer and Lucky Luke Crown-granted claims under option and two other claims by mineral lease. The property is about 1½ miles below Usk, close to the railway, about 12 miles northeast of Terrace. During the summer three men worked on the property removing ore from a small stope. Approximately 100 tons of ore was mined and a little of the gold ore was sorted and shipped. A diesel-electric unit was installed. A good road is maintained to within a mile of the camp, where the steepness requires a truck or four-wheel-drive vehicle.

Copper

Toulon, Copper Cliff (Northlode Exploration Ltd.)* (54° 128° N.E.) Company office, 425 Howe Street, Vancouver 1. J. P. Crean, president; J. P. Elwell, consulting engineer. The property is on Highway 16, 20 miles east of Terrace on Chimdemash River and consists of 11 recorded claims and 4 claims held under agreement. Three men worked for a four-month period, surveying and sampling. Four trenches were cut for a length of 60 lineal feet. One mile of new road was built and old trails were improved. EX diamond drilling in six holes totalled 420 feet. (*See* Annual Report, 1929, pp. 149–150.)

Molybdenum

JB, Molly, HM (Canex Aerial Exploration Ltd.)* (54° 128° N.E.) Company office, 700, 1030 West Georgia Street, Vancouver 5. L. Adie in charge of exploration; W. D. Tompson, geologist and work supervisor on the property. This is a group of 83 recorded mineral claims, of which 20 are held under option from Huestis Mining Corporation Ltd. The property is on a small creek known as Bell Creek at Pitman on the railway 22 miles northeast of Terrace. Eight men worked for three months during the summer on topographic surveying and diamond drilling. Twenty-two holes were drilled totalling 13,579 feet. Films, veinlets, and disseminated molybdenite occur chiefly in granitic rocks. The property was not visited.

* By H. Bapty.

Copper

Northwest* (54° 128° S.E.) This property is on the southern slopes of Treasure Mountain opposite the junction of the Clore and Zymoetz Rivers. It is about 26 miles from Terrace and may be reached by the Columbia Cellulose road system that follows the Zymoetz River. The property consists of 50 recorded claims; the central ones, originally held by L. Belliveau and associates, were optioned to Purdex Minerals Limited and Norpax Nickel Mines Limited, who have formed Treasure Mountain Copper Limited to develop the showings. These showings were first explored in 1913–14 and thereafter received slight attention until 1956, when Premier Border Gold Mines Ltd. did a limited amount of work. Cariboo Gold Quartz and Bralorne both did a certain amount of stripping, but no extensive exploration occurred until 1964, when Purdex drilled about 2,000 feet of core and carried out a reconnaissance soil survey for copper. In 1965 the company participated in construction of a road and drilled 3,011 feet in 10 holes. During the exploration season the company had an average of five men on the property and the drill contractor four.

The property consists of a number of showings, two of which have received most of the attention—No. 1 zone at about 4,100 feet elevation and No. 2 at about 3,300 feet. In 1964 all the drilling was in No. 1 zone and in 1965 one-third in No. 1 and the rest in No. 2 zone.

The property is underlain by the upper division of the Hazelton Group, which on the average strikes north 10 to 20 degrees east and dips about 40 degrees east. The rocks in the vicinity of the two main showings are similar, although those of No. 1 zone are stratigraphically higher. The stratigraphic sequence includes in about equal amounts massive flow rocks and pyroclastic or volcano-sedimentary rocks. The flow rocks are predominantly purple, brown, or, more rarely, grey or green andesites that mostly are porphyritic. Plagioclase phenocrysts rarely form as much as 10 per cent of the rocks and more commonly 2 to 5 per cent. Some of the rocks are vitrophyres, but most have an aphanitic matrix. The fragmental rocks are brown to purple to red rocks that predominantly are formed of lapilli-sized fragments. Most are pyroclastic, including crystal, scoriaceous-lithic, and flow-banded tuffs, but volcano-sedimentary rocks are also common. Many varieties of dykes, sills, and irregular small bodies have been intruded into this sequence. These include three main types, which, from oldest to youngest, are: Andesite porphyry very similar to the flows but which normally contain more abundant plagioclase (15 per cent) and some hornblende phenocrysts. Glomerophenocrysts of plagioclase are characteristic. The largest bodies are coarse trachytic porphyries of pink to green colour, formed of a variable proportion of large (1 to 3 centimetres long) feldspar laths and chlorite rimmed, calcite chalcedony and zeolite filled amygdules. The youngest common type is a dark-green fine pyroxene-bearing andesite to microdiorite.

The No. 2 zone, which received the main attention in 1965, is on either side of the new road at 3,200 to 3,400 feet elevation. Surface exposures over an area of some 300 by 400 feet consist of vesicular purple feldspar porphyry and red and purple tuffs and lapilli tuffs cut by a brown feldspar porphyry sill. Bedding strikes about north 10 degrees east and dips 55 degrees east. Of eight diamond-drill holes, five were drilled north 55 degrees west at minus 40 degrees. These latter holes intersect a coarse trachytic sill that does not outcrop in the immediate vicinity at about 3,100 feet elevation, and this sill is cut by a steep fault zone and parallel green microdiorite body oriented north 80 degrees east. Bornite, chalcopyrite, malachite, and minor chalcocite occur on the surface exposures of the purple flow rocks and

* By A. Sutherland Brown.

tuffs and to a lesser degree in the brown porphyry sill. The mineralization is disseminated and occurs in vesicles and to a minor degree along fractures. It is associated with pink potassic alteration of feldspar phenocrysts and matrix. In the drill core, mineralization is scattered, mainly chalcopyrite and malachite. The best ore occurs along the easterly fault in the top of the coarse trachytic porphyry and adjacent purple porphyry and tuff.

The No. 1 zone showings are about 2,000 feet east of No. 2 and just below the new road at 4,100 feet elevation. They are in a sequence very similar to that of the No. 2 zone, comprising purplish lapilli tuff and vitrophyre intruded by a sill of brown feldspar porphyry. These strike north to north 20 degrees east and dip 35 to 50 degrees eastward. The pyroclastic rocks and to a lesser extent the vitrophyre are quite well mineralized with bornite and malachite on the surface over a length along strike of 200 feet and a width of 80 feet or more. Two consecutive chip samples by the writer across the southern end of the outcrop near the old adit assayed as follows: West sample across 45 feet—copper, 1.6 per cent; silver, 0.20 ounce per ton; east sample across 40 feet—copper, 3.40 per cent; silver, 0.60 ounce per ton. (*See* Annual Report, 1914, pp. 118–119.)

KITIMAT RIVER

Molybdenum

Hony, Bee, Ell, Liza, Barbs, Mel (Amax Exploration, Inc.)*

(54° 128° S.E.) Vancouver office, 535 Thurlow Street. The company holds 256 recorded mineral claims at the headwaters of the Kitimat River above Davies Creek, 30 miles southeast of Terrace. Under the supervision of J. N. Schindler, geologist, 10 men and 8 contract personnel did geological mapping and made an induced polarization survey and a geochemical survey. The property was not visited.

BABINE RANGE

Copper

Motase A (Kennco Explorations, (Western) Limited)*

(56° 127° S.E.) Vancouver office, 1030 West Georgia Street. J. A. Gower, exploration district manager; P. T. Black, senior geologist in charge of work on the property. A group of 70 recorded mineral claims lies 7 miles south of the mouth of the Sustut River. During 10 days of the summer six men made a reconnaissance geochemical survey on the claims. Transportation was by helicopter from Smithers, which is 100 miles south. The property was not visited.

Molybdenum

Motase B (Kennco Explorations, (Western) Limited)*

(56° 126° S.W.) Company office, 1030 West Georgia Street, Vancouver 5. J. A. Gower, exploration district manager; P. T. Black, senior geologist in charge of work at the property. This is a group of 54 recorded mineral claims situated 2 miles south of Drift Lake. For one week during the summer six men took silt samples on a geochemical survey. Disseminated molybdenite was found in syenite porphyry. Transportation was by helicopter from Smithers, which is 87 miles south. The property was not visited.

* By H. Bapty.

Moly, Red, Canyon, Tom, Len (Amax Exploration, Inc.)*

(55° 127° N.E.) Executive office, 1270 Avenue of the Americas, New York 20, N.Y.; Vancouver office, 601, 535 Thurlow Street. R. A. Barker, manager; W. Carithers, geologist in charge of work on the property. The company holds 74 claims under option on Mount Thomlinson at about 6,000 feet elevation. The camp is about 24 miles north of Hazelton to the east of the head of Shegisic Creek. During three months of the summer 17 men did geological mapping and geochemical sampling and diamond drilled four BX holes a total length of 3,551 feet. Transportation was by helicopter. The property was not visited. (*See* Annual Report, 1964, pp. 48–50.)

Molybdenum-Copper

Rob (Noranda Exploration Company, Limited)*

(55° 127° S.E.) Vancouver office, 1050 Davie Street, Vancouver 5. B. O. Brynelsen, manager; R. Woolverton, supervisor of exploration. A group of 112 recorded claims at elevations of 5,000 to 7,000 feet are located on Blunt Mountain, 15 miles southeast of Hazelton. During a one-month period several men did 3 square miles of geological mapping, built 4 miles of trail, and dug 24 shallow test-pits. The host rock is a feldspar porphyry, in which is found a little molybdenite and chalcopyrite. Transportation to the claims was by helicopter. The property was not visited.

SMITHERS

Silver-Lead-Zinc

Cronin (New Cronin Babine Mines Limited)*

(54° 126° N.W.) Company office, 844 West Hastings Street, Vancouver 1. L. C. Creery, president; H. Hill and Associates Limited, consulting engineers. The company owns the Sunrise No. 7 Crown-granted mineral claim and holds seven claims under option. The property is on the east slope of Mount Cronin, about 30 miles by road from Smithers. A description of the property was given in the 1949 Annual Report, pages 94–98. The lessee, P. Kindrat, and two men drifted 50 feet on a new vein on the 600 level and stoped 50 feet up, mining about 775 tons, from which was produced 261 tons of combined concentrates having a net smelter value of $44,600. The vein averages 3 feet wide, with the full length still unknown. All transportation is by road.

Copper-Molybdenum

Astlais, Ast, Billie, Al, Ralph, Ben, Tie (Texas Gulf Sulphur Company)*

(54° 126° N.W.) Vancouver office, 420, 1033 Davie Street. J. R. Loudon, manager. The company has 81 recorded claims under option 12 miles east of Smithers on Astlais (Big Onion) Mountain. Previous work on this property was done by Noranda Exploration Company, Limited, and consisted of geological mapping, geochemical sampling, and geophysical surveying. Two EX diamond-drill holes were drilled, with a total footage of 250 feet, before Noranda dropped the property. Transportation to the property is by the Smithers Landing road and trail. The property was not visited.

* By H. Bapty.

Copper-Silver-Zinc

Len (Copper Ridge Mines Ltd.)* (54° 126° N.W.) Company office, 74 East Pender Street, Vancouver 4. S. J. Hunter, mining consultant. The property is on Grouse Mountain at 4,000 feet elevation and is served by about 4 miles of jeep-road which joins Highway 16, 27 miles southeast of Smithers. For three months during the summer three men made an electromagnetic survey. (*See* Annual Report, 1937, p. C11.)

Silver-Lead-Zinc

Silver Creek, Silver Lake, Trade Dollar, Iron Vault (Hudson Bay Mountain Silver Mines Ltd.)† (54° 127° N.E.) Company office, 602 West Hastings Street, Vancouver 2. The property consists of a number of Crown-granted mineral claims and fractions located at elevations between 5,000 and 7,000 feet on the northwest shoulder of Hudson Bay Mountain. In 1965 the company explored two groups of showings. The upper group consists of a number of small but high-grade silver-lead-zinc veins that occur above 6,000 feet on the Silver Lake No. 2 and Cee claims and on the Key and Trade Dollar fractions. The lower group consists of a number of both high- and low-grade silver-lead-zinc veins and some zinc and silver-lead-zinc replacement bodies in limestone lenses. The lower showings occur mainly on the Iron Vault claim. The replacement bodies occur in areas where veins cut the limestone.

On the upper showings, extensive bulldozer trenching and stripping, initiated in 1964, was continued. Wherever mineralization was uncovered, blasting, drilling, and sampling were carried out to determine its grade and extent. This work was hampered by the presence of permafrost in the thick surface layer of rock rubble.

Near the lower showings about one-half mile of new road was constructed from the 1964–65 camp-site to the 5,375-foot level. This level was extended 280 feet.

Sixteen EX diamond-drill holes totalling 3,360 feet were completed. These holes were to test the best zones of mineralization in the upper silver-lead-zinc veins and the lower zinc replacement bodies in limestone.

A crew averaging 10 men under the supervision of H. Gilleland worked on the property from June through September. (*See* Annual Report, 1928, p. 167.)

Molybdenum

Glacier Gulch (Climax Molybdenum (B.C.) Ltd.)† (54° 127° N.E.) Vancouver office, 535 Thurlow Street; field office, Box 696, Smithers. R. E. Anderson, vice-president. The company holds a total of 247 recorded claims and fractions and 14 Crown-granted claims centred on Glacier Gulch on the east side of Hudson Bay Mountain. The 14 Crown-granted claims and 30 recorded claims are held under lease and option from W. Yorke-Hardy and partners, of Smithers.

Widespread low-grade molybdenite mineralization occurs in a stockwork of narrow quartz veinlets in altered volcanic and intrusive rocks. The best mineralization to date has been found at about 1,100 to 1,600 feet below the surface in a large sheet-like body of highly altered granodiorite. A number of small acid porphyry and aplite bodies occur in the mineralized area. A quartz porphyry body intersected about 3,000 feet below the surface is possibly the top of a stock.

Six BX and BQ diamond-drill holes totalling 15,000 feet were completed and a 3½-mile access road to a proposed portal-site was started late in the year. Company officials have reported that the proposed underground work will be for further

* By H. Bapty.
† By R. V. Kirkham.

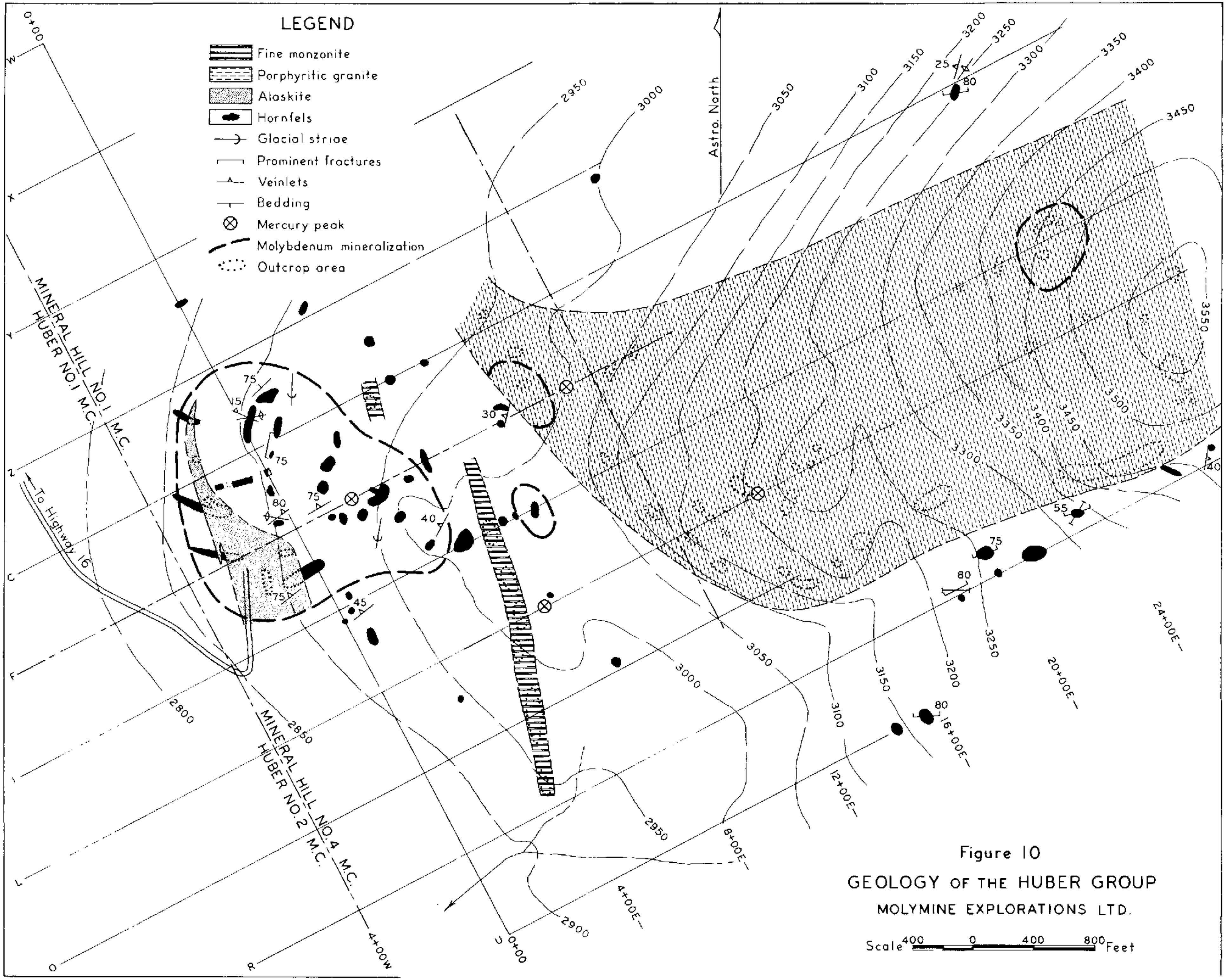


Figure 10

GEOLOGY OF THE HUBER GROUP

MOLYMINE EXPLORATIONS LTD.

exploration and possible future development. From June through October a crew averaging 22 men was employed under the supervision of D. Jonson, of Golden, Colorado.

Huber (Molymine Explorations Ltd.)* (54° 126° N.W.) This property is about 8 miles north of Houston, and the showings are about a mile east of Highway 16 between elevations of 2,800 and 3,500 feet. The property consists of 39 recorded mineral claims and is held by Molymine Explorations Ltd.; company office, 302, 550 Burrard Street, Vancouver 1; W. D. Yorke-Hardy, president. The principal showings are on the Mineral Hill No. 1 and No. 4 claims. The property was formerly known as the Mineral Hill and was explored for copper, lead, and zinc in 1926–28 by means of a shaft, an adit, and some trenching. In recent years it has received some attention from major companies. In 1962 Southwest Potash Corporation carried out soil geochemical and magnetometer surveys and sampled the outcrops (Assessment Reports 509 and 510). In 1965 the present company did some stripping and blasting, additional geochemistry, and an induced polarization survey.

The geology of the Huber group is shown on Figure 10. Hornfelsic sandstones, siltstones, and crystal tuffs of the Hazelton or Bowser Groups are intruded by three separate bodies. At the west there is a tongue-like body of coarse alaskite, whereas the main mass of the hill is underlain by a porphyritic granite that has aplitic border facies. A large dyke of fine-grained monzonite is unmineralized and relatively unmetamorphosed.

The hornfelses are dense dark-purplish to brownish or rarely greenish rocks that weather a light grey where leached or rusty colour where oxidized. The general appearance is similar throughout, and only detailed or microscopic examination shows that the original rock varied widely in lithology and grain size. The degree of metamorphism is fairly uniform, with an overlay of fine-felted brown biotite throughout. Skeletal green hornblende is rare. The alaskite is a coarse-grained rock throughout, of approximately the following composition: Quartz, 35 per cent; perthite and microcline perthite, 20 per cent; plagioclase (An_{38}), 25 per cent; muscovite, 4 per cent; opaques, 1 per cent. The quartz is rounded, the plagioclase lathy, the perthite lathy to irregular, and the muscovite and opaque minerals are interleaved. The porphyritic granite is normally composed of about 65 per cent phenocrysts of perthite, quartz and plagioclase and minor mica in an aplitic fine-grained matrix of quartz, perthite, and micrographic granite and lesser small laths of plagioclase. The approximate mineral composition, combining matrix and phenocrysts is perthite, 41 per cent; quartz, 29 per cent; plagioclase, 27 per cent; and mica, 3 per cent. The perthite and quartz phenocrysts are as large as 7 millimetres in diameter, and the plagioclase ($An_{20\pm}$) slightly smaller. The quartz crystals are slightly rounded. Both feldspars are fairly fresh with minor sericite alteration in the cores of the plagioclase, which is highly zoned over a small compositional range. Combined, zoned plagioclase grains are common. Biotite and muscovite occur as interleaved grains. Most of the opaque grains are pyrite. The porphyry grades to a fine aplitic granite at exposed contacts. The fine-grained monzonite has a diabasic texture with relatively long laths of plagioclase with angular semiophitic hornblende and interstices of quartz and micrographic granite. The zoned plagioclase is mantled with perthitic feldspar. The original mineral composition was about as follows: Plagioclase ($An_{33\pm}$), 35 per cent; hornblende, 25 per cent; perthite, 20 per cent; graphic granite, 10 per cent; quartz, 5 per cent; magnetite, 5 per cent

* By A. Sutherland Brown.

with accessory apatite and zircon. Alteration is moderately intense, with plagioclase containing some clinozoisite and much sericite, and the hornblende, which may originally have been augite, in some grains is altered to clinozoisite and chlorite.

Most of the hornfels shown in the area of Figure 10 is shattered, and much contains very fine veinlets of quartz with some pyrite in a reticulate stockwork. Fractures are commonly an inch or so apart. Veinlets are commonly only a millimetre or so thick, but in certain areas some may be several inches thick. The alaskite tongue is also highly fractured and veined, but in a slightly more regular manner, and larger quartz veinlets are common. The porphyritic granite is less fractured and veined, except in two localities. The monzonite is seemingly unfractured or unmineralized. Within areas outlined on Figure 10 molybdenite is widely present in the veinlets and fractures in small but interesting amounts. Other metallic minerals such as tetrahedrite occur in more restricted distribution in the larger veins near the old shaft. Some interpretation of the available geophysics and geochemistry is possible. Assessment Report 510 shows a lineal magnetic high trending across the area that closely coincides with the location of the fine monzonite dyke. This body carries about 5 per cent magnetite, much more than adjacent hornfels or granitic rocks, and is clearly the source of the anomaly. The writer conducted soil-sampling for mercury along lines F and L and extended these along the road to the highway. One profile is shown in an article by the writer in the Western Miner for February, 1966. The showings have a distinct mercury halo associated with them, with major peaks centred as shown on Figure 19. (*See also* pp. 109–112.)

TELKWA RIVER

Copper

"A" (Phelps Dodge Corporation of Canada Limited)*

(54° 127° S.W.) Head office, 55 Yonge Street, Toronto 1, Ont.; Vancouver office, 404, 1112 West Pender Street. The "A" group of 90 recorded mineral claims is at the headwaters of the Telkwa River between elevations of 3,500 and 6,000 feet. During a five-month period two men under the supervision of M. J. Beley, geologist, did some geological mapping. Two trenches were drilled and blasted for a length of 148 feet. Bornite and chalcopyrite were found occurring in fractures in the feldspar porphyry host rock. Transportation was by helicopter from Smithers, 30 miles southwest, to the property. The property was not visited.

Molybdenum

Serb Creek (Amax Exploration, Inc.)†

(54° 127° N.W.) This property is near the head of Serb Creek, 25 miles west of Smithers. It is on the eastern margin of the alpine peaks of the Bulkley Ranges. The property is reached by the old road south of Hudson Bay Mountain that has been extended past McDonnell Lake to a heliport within 10 miles of the property. The camp and the drills were serviced entirely by helicopter. The property includes 151 recorded claims in four groups: Katie, 36 claims; Petra, 42 claims; Ty, 54 claims; and Pro, 19 claims. It is held by Amax Exploration, Inc., 601, 535 Thurlow Street, Vancouver 5; R. A. Barker, manager. The showings were discovered by geologists of the company in August, 1964, during helicopter reconnaissance, and during the latter part of that year work included surface geology, sampling,

* By H. Bapty.
† By A. Sutherland Brown.

geochemistry, minor packsack drilling, preparation of drill-sites and camp, line-cutting, and surveying. In 1965 work included detailed surface geology, magnetometer, induced polarization, and soil surveys, and 14 diamond-drill holes totalling 16,500 feet. One standard A and three BQ wire-line drills were used. During the season an average of 15 men worked for Amax and 20 worked for drilling contractors under the supervision of J. F. S. Allan.

The geology of the area surounding the claims is not very accurately shown on the Smithers Sheet (*Geol. Surv., Canada,* Prelim. Map 44-23). In particular, the head of Serb Creek is underlain by a stock that is separated from the Howson Batholith by an area of Hazelton Group into which both are intruded. The stock is composed principally of medium-grained granodiorite but has in its core a fine-grained plug of quartz monzonite. The stock is transected in the vicinity of the fine-grained plug by a dyke swarm that trends about north 30 degrees to 40 degrees west.

The geology of the showings is shown on Figure 11. Exposure is good only along the gullies and the steep slopes at the head of the two talus aprons. Included in the figure is most of the fine quartz monzonite plug, but only a small part of the medium-grained granodiorite stock. The contact between the two where exposed is gradational over a small interval. The plug is assumed to be the younger, but the evidence is inconclusive. Approximately co-extensive with the plug but extending somewhat beyond it is a pyrite halo affecting all rocks except some young dykes. The fine quartz monzonite is intruded by small irregularly shaped bodies of quartz diorite porphyry (1), then by a sequence of tabular lineal dykes in the following order from oldest to youngest: (2) Quartz monzonite porphyry; (3) dark-green to grey andesite dykes too small to show on Figure 11; (4) quartz feldspar porphyry; (5) brown sericitized granodiorite porphyry; (6) Basalt—not in area shown on Figure 11. The whole suite of rocks, excluding the basalt and possibly the andesite dykes, is a fairly similar group, with only slight variations in crystallinity or mineral composition. The average composition is a mafic-poor granodiorite, and all are characteristically leucocratic. The sequence overlaps mineralization which must have occurred between the introduction of the quartz monzonite porphyry (2) and the small andesite dykes (3). The following mineral compositions are estimations based on study of only one or two specimens of each:—

GRANITOID ROCKS

	A Medium Granodiorite		B Fine Quartz Monzonite	
	Per Cent	Species	Per Cent	Species
Plagioclase	52	($An_{28} \pm 10$.)	36½	($An_{20} \pm 10$.)
K-feldspar	25	(Perthitic orthoclase.)	28	(Perthitic orthoclase.)
Quartz	15		30	
Mafics	6	(Biotite and rare hornblende.)	3½	(Biotite and muscovite.)
Opaque	2	Pyrite.	1½	Pyrite.
Accessory	Tr.	Sphene, apatite.	Tr.	Sphene, zircon apatite.

Both types are slightly porphyritic and sphene rich; the potash feldspar is slightly perthitic orthoclase; and the plagioclase is oscillatory zoned over a small interval. The quartz monzonite is slightly altered, the plagioclase being sericitized and the biotite chloritized or interleaved with muscovite.

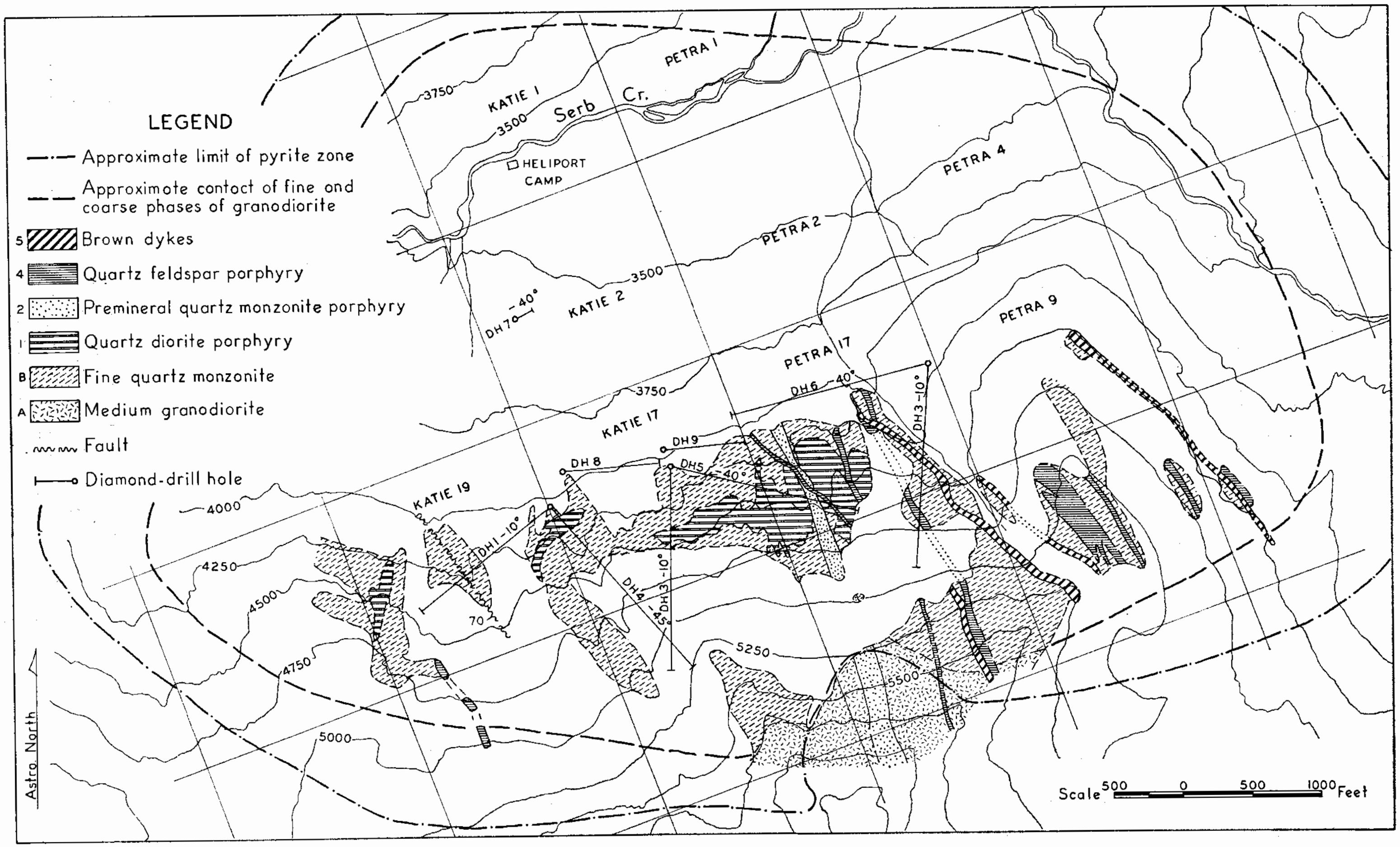


Figure 11. Geology of the Serb Creek property of Amax Exploration, Inc.

PORPHYRIES

	1 Quartz Diorite		2 Quartz Monzonite		5 Brown Granodiorite	
	Per Cent	Species	Per Cent	Species	Per Cent	Species
Phenocrysts—						
Plagioclase	44	$An_{35}\pm_{15}$.	20	$An_{20}\pm_{5}$.	45	An ?
K-feldspar	----	----	15	Orthoclase.	5	Orthoclase.
Quartz	----	----	25	----	10	----
Mafics	6	Biotite (hornblende).	7	Biotite.	5	Biotite.
Opaque	2	Pyrite and magnetite.	3	Pyrite and clouded sphene.	3	Pyrite.
Matrix	48	----	30	----	38	----
Total—						
Plagioclase	64	----	25	----	50	----
K-feldspar	10	----	27	----	20	----
Quartz	15	----	38	----	20	----
Total mafics	11	----	10	----	10	----

All are good porphyries with euhedral phenocrysts. In the quartz monzonite porphyry (2) and the quartz feldspar porphyry (4), the quartz crystals occur as six-sided double pyramids. The plagioclase is everywhere well zoned with slight oscillations, and in the brown granodiorite (5) it is highly sericitized and slightly altered to clinozoisite. A trachytic orientation of plagioclase and biotite is fairly common, especially in the brown granodiorite.

With the exception of the brown granodiorite porphyry (5), most of the rocks are normally quite fresh. Alteration in the fine quartz monzonite (B), quartz diorite porphyry (1), and quartz monzonite porphyry (2) is spatially related to either shear zones on a large scale or to veins, veinlets, or fractures on a small scale. The widespread disseminated pyrite halo is presumably related to intrusion of the fine quartz monzonite.

The area of the showings is dominated by a north 30- to 40-degree west fracture system that is evident in the dyke swarm, the main shears and alteration zone, and in the topography. The fracture system clearly existed during the period of mineralization. This is shown by the coincidence of the over-all orientation of the dyke swarm, the time of intrusion of which overlapped the time of mineralization, and by the similar orientation of the zones of alteration which are clearly related to the period of mineralization because of their association with the veins. The density of dykes and the intensity of fracturing and alteration and mineralization all decrease upward on the surface exposure.

Low-grade molybdenum mineralization is widely distributed within the fine quartz monzonite plug. Sulphide minerals in addition to molybdenite are scant, but include chalcopyrite, galena, and sphalerite. The mineralization is contained in quartz veins and quartz stockworks and in dry fractures. Mineralization seemingly occurred in several stages because there are intersecting veinlets of differing aspect. Reticulate fractures and fine quartz stockworks are widely distributed in the gullies and lower slopes on the Katie 17 and 19 and Petra 17 claims. Larger quartz veins also occur widely in this area, and many are oriented north 30 to 40 degrees west or east-west. The veins and veinlets are dominantly composed of quartz with lesser pyrite and some molybdenite. Some are quartz-epidote veinlets; others are pyrite, pyrite-molybdenite, or molybdenite-epidote coated fractures. The latest veinlets are drusy quartz veins with calcite and some galena and sphalerite. Some of the veins have been sheared or brecciated, particulary those in the north 30- to

40-degree west orientation, and in the vicinity of the larger shears. Two main types of alteration are related spatially to the veins: sericite-orthoclase-carbonate alteration, or epidote-chlorite-orthoclase alteration, accompanied in some cases by pyritization and silicification.

[Reference: *Geol. Surv., Canada,* Paper 44-23.]

HOUSTON

Copper

"B" (Phelps Dodge Corporation of Canada, Limited)* (54° 127° S.E.) Company office, 55 Yonge Street, Toronto 1, Ont.; western office, 404, 1112 West Pender Street, Vancouver 1. This group of 80 mineral claims, owned by the company, is 18 miles west of Houston on the south slopes of the Telkwa Mountains and is reached from Houston by helicopter. Topographical, geological, and geochemical surveys were made. Some trenching was done in outcrops. Three men were employed for 4½ months under M. J. Beley, geologist. The property was not visited.

Molybdenum

Barr, Lybdenum (Amax Exploration, Inc.)† (54° 126° N.E.) British Columbia office, 601, 535 Thurlow Street, Vancouver 5. R. A. Barker, manager; N. Shepherd, project geologist. The 39 Barr recorded mineral claims and 3 Lybdenum optioned claims are 4 miles west of Barrett railway station, west of Houston, at an elevation of 3,200 feet. Molybdenite is found to occur in drusy quartz veins in a host rock of quartz feldspar porphyry. During the summer three men spent time on geological mapping and magnetometer surveying. Geochemical sampling of soil and rock chips was done over a 4-square-mile area. A TD-18A bulldozer with a ripper was used to dig five trenches with a length of 1,900 feet. The property was not visited.

Molybdenum-Copper

Klondike, Star (Amax Exploration, Inc.)† (54° 126° S.W.) Company office, 601, 535 Thurlow Street, Vancouver 5; R. A. Barker, manager; N. Shepherd, project supervisor and geologist. This is a group of 57 recorded mineral claims of which 14 are held under option. The property is on Dungate Creek, 5 miles southeast of Houston. Three men worked over a two-month period during the summer on surveying, geological mapping, making a magnetometer survey, and performing geochemical sampling. A TD-18A bulldozer with a ripper was used to dig 18 trenches with a total length of 3,000 feet. The property can be reached by gravel road but was not visited.

Lead-Zinc-Silver-Gold

Rod, Dot, G.S., L.H.† (54° 126° S.W.) Company office, 711, 543 Granville Street, Vancouver 2. J. V. San Severino, president; G. R. Hilchey, engineer in charge. This venture was a joint undertaking by Triform Mining Ltd. and its associate company, Coast Explorations Ltd. This property, which has had a long history, was successively known under the following names: Bob Creek Porphyry Dyke, Horseshoe, Gold Brick, and Houston Gold Mines. The property is located at the mouth of Bob Creek, a tributary of Buck River, about 8 miles south of Houston, from which

* By W. G. Clarke.
† By H. Bapty.

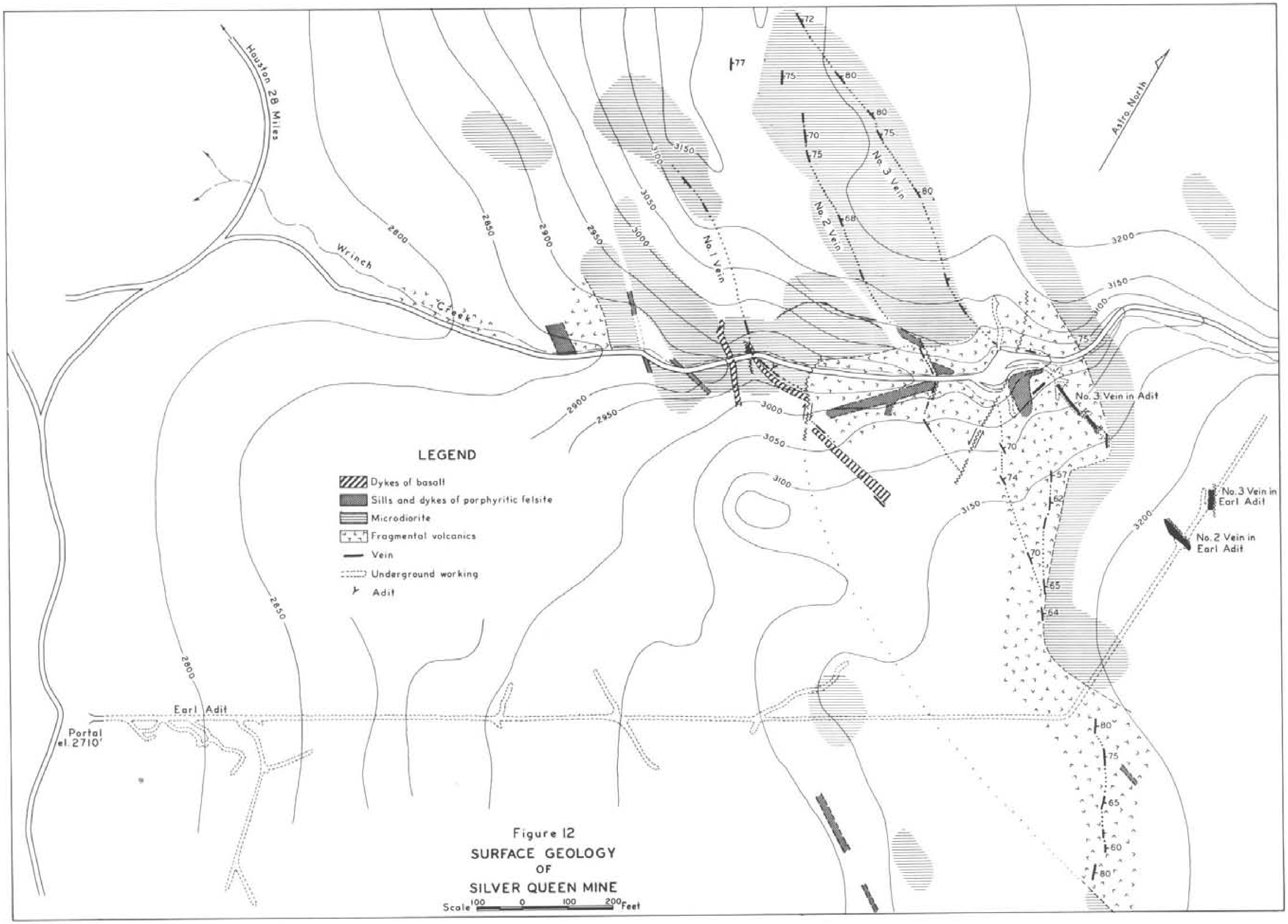


Figure 12
SURFACE GEOLOGY
OF
SILVER QUEEN MINE

there is a road to the property. It consists of 57 mineral claims named the Rod, Dot, G.S., and L.H. groups and two placer leaseholds, held under an agreement with G. W. Smith, of Houston, who has been associated with the property for over 30 years. The bedrock in the vicinity of the showings is an intensely altered volcanic rock, mainly tuffaceous, containing fracture fillings and disseminations of pyrite, sphalerite, galena, and arsenopyrite with gold and silver values. Four men were employed from March 15th to around June 15th. One hundred and sixty-nine soil samples were taken for geochemical testing, and 4,500 yards of stripping and trenching was done, as well as surface and underground sampling. After the results of the exploration were studied, the option was dropped. The property was not visited. (*See* Annual Report, 1933, pp. 98–99.)

Lead-Zinc-Silver

Code (Julian Mining Co. Ltd.)*

(54° 127° S.E.) Company office, Britannia Beach; Vancouver office, 122, 744 West Hastings Street. The 20 Code recorded claims are on Fenton Creek, 20 miles southwest of Houston. For a two-month period during the summer five men under R. S. Adamson, chief geologist, did geochemical sampling over an area 7,500 by 4,500 feet. An access road was built by a bulldozer tractor, and the property can be reached with a four-wheel-drive vehicle. The property was not visited.

Silver-Lead-Zinc

Silver Queen (Nadina Explorations Limited)†

(54° 126° S.W.) After a long period of inactivity, exploration, both surface and underground, has begun at the old Silver Queen mine, now under control of Nadina Explorations Limited, of Vancouver. The company holds 17 Crown-granted mineral claims and fractions centred on Wrinch Creek and 33 located mineral claims in the Big Moose, Owl, Nadina, and Angus groups. The property is on the east side of Owen Lake, between elevations of 2,500 and 3,500 feet, and access is by good gravel road 27 miles south of Highway 16 at a point 2 miles west of Houston.

The original mineral discovery was made in the Wrinch Creek canyon in 1912, and the Silver Queen claims were located on it. The Chisholm group was located shortly afterwards and successively relocated as the McLean and later the Midnight groups. Claims covering these early mineral discoveries have subsequently been Crown granted and are part of the 17 Crown grants held by the company under option from Canadian Exploration Limited.

During the 1920's exploration work was largely done on the mineral showings in the Wrinch Creek canyon. By 1924 three adits had been driven. The longest, called No. 4, has a length of 223 feet and follows the Wrinch vein eastward. Downstream 100 feet and on the west side of Wrinch Creek, No. 3 Drift west was driven about 160 feet northwestward, partly on mineralization and partly along a strong fault, while downstream 100 feet and on the east side the third adit, No. 3 Drift east, was driven 55 feet eastward without encountering vein material, being on the hangingwall side of the vein projection.

Late in 1928 Owen Lake Mining and Development Co. acquired the property and in 1929 began extensive underground work to explore the Wrinch veins and the

* By H. Bapty.
† By Stuart S. Holland.

nearby Diamond Belle veins at depth. A crosscut adit, the Earl adit at 2,710 feet elevation, was driven 2,200 feet on a bearing of north 60 degrees east then 800 feet on a bearing of north 4 degrees east. During the driving of the crosscut, 11 veins were unexpectedly intersected in the first 1,500 feet of drive; none of the veins was known in outcrop. Some work done on these portal veins is described in the Annual Report for 1929, page 173, and in Geological Survey of Canada, Summary Report, 1929, Part A, pages 84–86. Work in the crosscut was discontinued in February, 1930, when it was 3,000 feet long and when Noah A. Timmins relinquished his option on controlling interest in the Owen Lake company. No underground exploration has been done since then.

In 1941 the Silver Queen group was acquired by Canadian Exploration Limited, and the property was examined and mapped. At that time only 850 feet of the Earl crosscut was accessible. In 1947 the adit was cleaned out so that all the workings were accessible, and in 1949 a detailed report on the property was prepared by H. L. Batten for Canadian Exploration Limited. No further work was done, and the portal of the Earl adit caved, making it inaccessible until it was reopened in 1964.

Work by Nadina Explorations Limited has been directed solely toward exploration of the Wrinch veins. With a D-8 bulldozer, a road was built on uniform grade up through Wrinch Creek canyon. This gives access to the old adits and at the same time exposes a very good cross-section of the rocks. The Wrinch veins, three in number, were traced on surface by means of 3,500 lineal feet of bulldozed trenches on both sides of the canyon. The adits in the Wrinch canyon were cleaned out, the portals retimbered, and a start was made in laying track and air-line in the Earl adit preparatory to drifting and raising in 1966 on the Wrinch veins, intersected at distances of 2,655 and 2,770 feet from the portal.

Bedrock is exposed along Wrinch Creek, in random natural exposures to the east and west, and in bulldozed trenches which trace the several veins. Details of the geology were mapped adjacent to the veins on the surface, along Wrinch Creek canyon, and in the inner part of the Earl adit (*see* Fig. 12).

In the vicinity of the workings the oldest rocks are massive grey to buff coarse fragmental volcanics, strongly altered with the introduction of a large amount of carbonate and the almost complete obliteration of the feldspar and pyroxene minerals. These rocks are intruded by massive dark-grey fine-grained porphyritic diorite designated microdiorite in early mapping by the Geological Survey of Canada. In Wrinch Creek canyon the microdiorite has a rather gently dipping foliation of the plagioclase laths. This and the fact that the microdiorite-volcanic contact between surface exposures and the Earl adit dips 45 to 50 degrees suggest that the intrusion may be sill-like rather than stock-like in form.

The fragmental volcanics and, to a lesser degree, the microdiorite are intruded by dykes and sills of brown weathering lavender to grey porphyritic and amygdular felsite having a trachytic texture. This is the rock that was designated soda trachyte in Geological Survey of Canada Summary Report, 1929, Part A, page 76. This rock outcrops between the portals of No. 3 Drift east and No. 4 Drift, and constitutes the sill that is exposed near the face of No. 3 Drift west and that outcrops in the canyon 100 feet downstream to the southwest, where it is clearly visible on the east wall of the canyon.

Several black fine-grained basalt dykes cut both the volcanics and the microdiorite. These dyke rocks are all very much alike. The matrix is fine grained and trachytic textured, and contains a small amount of quartz as well as a small but varying amount of plagioclase phenocrysts.

The Wrinch veins occupy northwesterly striking fractures that cut the volcanics, the microdiorite, and the felsite porphyry and fine-grained basalt dykes. The veins are independent of the enclosing rocks and of the several contacts. On the other hand, the veins are cut by northerly striking faults and in 1528 drift in the Earl adit by a porphyritic felsite dyke.

Three veins outcrop within 600 feet in the canyon of Wrinch Creek. They have been traced on surface to the east and west in bulldozed trenches. No. 1 vein outcrops in the canyon at 2,900 feet elevation. On the west wall the vein is in microdiorite on the southwest side of a black fine-grained basalt dyke which the vein crosses and then follows on its northeast side. The vein has an indicated exposed length of 400 feet west of the canyon and at least 200 feet east of the canyon. An old 7-foot adit on it was covered by recent road-building.

No. 2 vein is at 2,960 feet elevation, about 400 feet upstream from No. 1. The vein fracture is in fragmental volcanics and crosses into microdiorite to the west. The vein fracture cuts and offsets a porphyritic felsite sill and extends eastward about 250 feet before being intersected and offset by a northerly striking fault. The vein segment west of the fault has a length of about 1,000 feet and east of the fault a length of about 400 feet.

No. 3 vein is at 3,000 feet elevation and 250 feet upstream from No. 2. It is at the portal of No. 3 Drift west and is followed for about 180 feet in No. 4 adit. The vein is intersected by a northerly striking fault which offsets the vein and drags a segment out of alignment. West of the fault the vein has an indicated length of 900 feet and east of the fault a length of 700 feet to the point where No. 3 and No. 2 veins appear to join. Two hundred and fifty feet east of this junction there is a vein segment 350 feet long. A vein having a maximum width of 14 feet and thought to be the down-dip extension of the No. 2 vein was crossed in the Earl adit at footage 2,655. A second vein, thought to be the extension of the No. 3 vein, was crossed at footage 2,750 in the Earl adit.

The veins comprise sulphides and gangue replacing wallrock and deposited in veins localized by northwesterly trending shear fractures. In addition to pyrite the sulphide mineralization is of two general types: chalcopyrite-sphalerite and sphalerite-galena with gradations between the two. Gangue minerals are rhodochrosite, quartz, chalcedony, and barite. No. 1 and No. 2 veins are essentially of the sphalerite-galena type, and No. 3 is of the sphalerite-chalcopyrite type.

No. 1 vein comprises sphalerite, galena, pyrite, and chalcopyrite along the side of a basalt dyke. The average assay of four samples taken by the company from surface cuts in a length of 600 feet is: Width, 6.75 feet; gold, 0.02 ounce; silver, 6.3 ounces; lead 1.6 per cent; zinc, 5.3 per cent; copper, 0.66 per cent.

No. 2 vein occupies a persistent fracture that is mineralized largely with sphalerite and galena over an indicated length of about 1,400 feet. The average assay of 12 samples taken by the company from surface cuts along a length of about 1,200 feet is: Width, 6.4 feet; gold, 0.02 ounce; silver, 2.8 ounces; lead, 4.3 per cent; zinc, 6.2 per cent; copper, 0.1 per cent. The vein in the Earl adit intersected at footage 2,655 from the portal is believed to be vein No. 2. Its maximum width there is 14 feet. The average of nine samples taken by examining engineers is: Width, 9.4 feet; gold, 0.02 ounce; silver, 3.76 ounces; lead, 3.3 per cent; zinc, 9.6 per cent; copper, 0.3 per cent.

No. 3 vein occupies another persistent fracture that converges with and joins No. 2 to the east. Its mineralization is dominantly chalcopyrite-sphalerite with some galena and pyrite, and because of this the copper values are higher and the lead values lower than in No. 2 and No. 1. The average of six samples taken by the company from surface cuts in a length of about 750 feet of vein west of the fault is: Width, 4.8 feet; gold, 0.02 ounce; silver, 6.9 ounces; lead, 3.0 per cent; zinc, 6.1 per cent; copper, 2.2 per cent. The average of four samples taken by the company from surface cuts on a length of about 750 feet of vein east of the fault is: Width, 5.5 feet; gold, 0.06 ounce; silver, 9.2 ounces; lead, 2.2 per cent; zinc, 4.4 per cent; copper, 3.3 per cent.

No. 3 vein is followed for 180 feet in No. 4 adit. There it strikes northwest and dips 45 to 70 degrees northeast. It is crossed by two steep northerly striking faults which displace the vein a few feet to the left and break it into three segments. The vein has an average width of 4.15 feet and in one place is 9 feet wide. Channel samples cut at 10-foot intervals in 1941 for Canadian Exploration Limited averaged: Vein length sampled, 190 feet; average width, 4.15 feet; gold, 0.085 ounce; silver, 12.15 ounces; copper 2.6 per cent. These samples were not assayed for lead and zinc.

A 300-foot segment of vein lies 250 feet southeast of the junction of veins Nos. 2 and 3. It strikes northwest and dips 60 to 80 degrees northeast. The vein mineralization is largely sphalerite and galena. Its low chalcopyrite content suggests that the vein is more closely related to No. 2 vein than to No. 3. The average assay of five samples taken by the company from surface cuts along a vein length of 300 feet is: Width, 4.8 feet; gold, 0.06 ounce; silver, 5.9 ounces; lead, 4.3 per cent; zinc 7.7 per cent; copper, 0.14 per cent.

A mercury halo is associated with the vein mineralization. It was detected by A. Sutherland Brown, who ran a profile on the east side of Wrinch Creek from Owen Lake northeastward for about 2 miles. The distinctly higher than background content of mercury in soils adjacent to the veins is shown on Figure 20, page 109.

[References: *Minister of Mines, B.C.,* Ann. Repts., 1916, p. 160; 1923, pp. 114–116; 1924, pp. 99–100; 1928, pp. 170–171; 1929, pp. 171–175; *Geol. Surv., Canada,* Sum. Rept., 1929, Pt. A, pp. 81–89.]

MORICE LAKE

Molybdenum

Lucky Ship (Amax Exploration, Inc.)* (54° 127° S.E.) This property is on the ridge between Morice Lake and the Nanika River near its mouth. It is about 50 miles from Houston and may be reached by a branch of the Morice Lake road. The original showings were located by Mathew Sam and Bartley McCrae, of Topley. These claims were optioned by Plateau Metals Limited (Christopher Riley, president), who in turn optioned them to Amax Exploration, Inc. (then Southwest Potash Corporation). The claims were all relocated in 1965 on a regular grid by Amax and now number 81. Other work carried out in 1965 included additional detailed geochemical surveys, induced polarization and magnetometer surveys, and 16,885 feet of diamond drilling by BQ wire-line drills. Amax had a crew of 16 men and the drill contractors 14 men on the property under the supervision of T. J. R. Godfrey, geologist.

The Lucky Ship prospect is in and about a small rhyolite porphyry plug measuring about 2,000 by 3,000 feet that cuts the Hazelton Group, but may have been one of the volcanic sources of the upper part of this group. Exposure in the vicinity of the showings is fairly good. The Hazelton here includes a diverse assemblage of intermediate to acid volcanic, pyroclastic, and sedimentary rocks, mostly of volcanic aspect. In the immediate vicinity of the plug the group is composed of volcanic pyroclastic breccias and intercalated greywackes and argillites. Some of the pyroclastic rocks contain a significant proportion of rock fragments identical with or

* By A. Sutherland Brown.

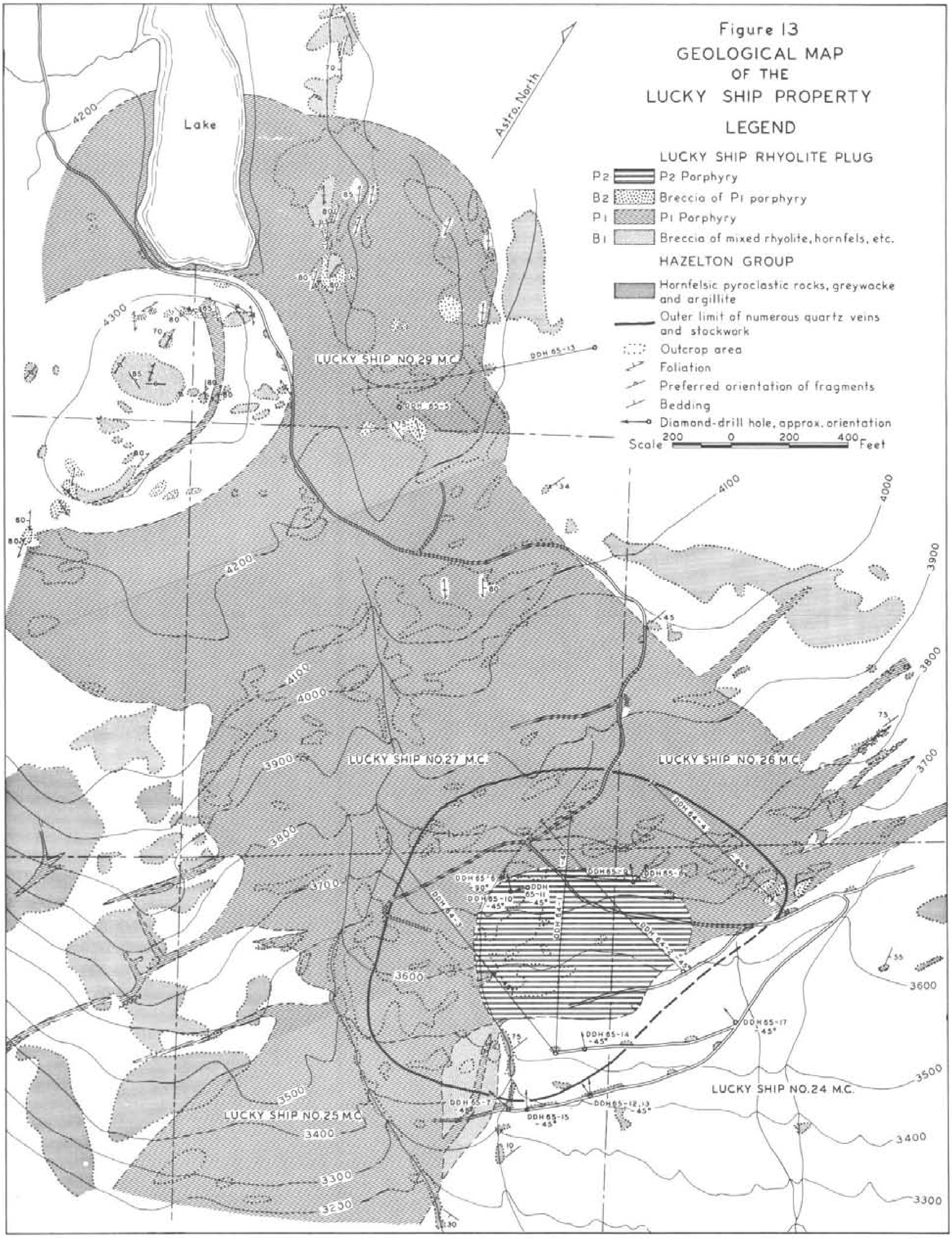


Figure 13
GEOLOGICAL MAP
OF THE
LUCKY SHIP PROPERTY
LEGEND
LUCKY SHIP RHYOLITE PLUG
P2 P2 Porphyry
B2 Breccia of P1 porphyry
P1 P1 Porphyry
B1 Breccia of mixed rhyolite, hornfels, etc.
HAZELTON GROUP
Hornfelsic pyroclastic rocks, greywacke and argillite
Outer limit of numerous quartz veins and stockwork
Outcrop area
Foliation
Preferred orientation of fragments
Bedding
Diamond-drill hole, approx. orientation
Scale 200 0 200 400 Feet
Astro. North
Lake
LUCKY SHIP NO. 29 M.C.
LUCKY SHIP NO. 27 M.C.
LUCKY SHIP NO. 26 M.C.
LUCKY SHIP NO. 25 M.C.
LUCKY SHIP NO. 24 M.C.
DDH 65-13
DDH 65-14 -45°
DDH 65-17 -45°
DDH 65-7 -45°
DDH 65-15 -45°
DDH 65-12,13 -45°
4300
4200
4100
4000
3900
3800
3700
3600
3500
3400
3300
3200

similar to those of the plug. The present structural attitudes of the Hazelton rocks on the whole ridge are fairly uniform, striking north to north 20 degrees east and dipping mostly 30 to 45 degrees east.

The rhyolite porphyry plug is not a simple structure but is formed of at least four distinguishable phases which include two separate porphyries and two breccias (*see* Fig. 13). The porphyry (P_1) that forms the majority of the plug is a white aphanitic rock when fresh, with sparse phenocrysts of bi-pyramidal quartz and chalky feldspars. The other (P_2) when unaltered is a light-grey porphyry of abundant feldspar, quartz, and biotite phenocrysts in an inconspicuous aphanitic matrix. One breccia (B_1) is composed largely of P_1 porphyry but includes a considerable amount of exotic fragments, and in its extreme development shows a marked preferred orientation of fragments. The other (B_2) is a homogeneous breccia of fragments of P_1 of greatly varying size. These four phases do not necessarily represent separate and unique intrusions or episodes, and age relationships are not known with certainty and may differ from place to place. P_1 definitely cuts B_1 as dykes and as whole masses west of the lake and appears to form a partial ring dyke in the breccia plug south of the lake. There is, however, no assurance that all P_1 is of the same age. P_2 appears to be a late phase cutting P_1, largely because of the relation of the veining and silicified and pyritized zones to it. Assuming P_1 is of one age only, then the simplest case of time sequence is: B_1 the oldest, P_1 next, B_2 closely similar, and P_2 youngest.

The exploration drilling has shown several features not clearly revealed on the surface. Firstly, the P_2 porphyry is surrounded by a thin sheath of hornfels even where it is essentially in contact with P_1 porphyry. Secondly, holes 65-5 and 65-13, drilled near the centre of the stock, penetrated much more B_2 breccia than is evident on the surface in the adjacent area. Hole 65-13 ended in 50 feet of hornfels in what should be the centre of the plug. Thirdly, a number of dykes were cored that are not evident in the vicinity of the plug. These include pyroxene porphyry, probably an andesite, that is chloritized, epidotized, and cut by quartz-pyrite veinlets, and post-ore fine-felted mid-grey andesite.

Petrology

The rhyolite porphyries have the following approximate composition based on the study of 10 P_1 and 6 P_2 specimens:—

	P_1	P_2
Phenocrysts—		
Quartz	5.5	8.3
Plagioclase	3.0	12.0
Potash feldspar	2.8	1.3
Mica	0.3	2.0
Matrix	88.4	76.1

P_1 is composed of phenocrysts of very slightly resorbed quartz bi-pyramids, two feldspars in sub-equal amounts, and minor phlogopite mica in a matrix of very fine sugary textured quartz and feldspar. The plagioclase is albite-oligoclase and the potash feldspar is orthoclase. The matrix in many cases contains schlieren of fine mosaic quartz that give a foliation to the rock. P_2 contains more phenocrysts than P_1 in differing proportions; plagioclase is normally more abundant than quartz, and the potash feldspar is subordinate. The mica is more abundant than in P_1 and is biotite in contrast to phlogopite. The plagioclase is highly zoned over the oligoclase interval An_{10-30}. The potash feldspar is orthoclase. Glomeratic zoned plagioclase phenocrysts are common. The matrix is a very fine sugary quartz feldspar mixture, similar to P_1.

The breccia B_2 is essentially the same petrologically as P_1, except that the matrix may be finer grained than that of the contained fragments. B_1 is quite variable in the proportion of rhyolite porphyry to exotic fragments and in the texture of the matrix. In addition to rhyolite porphyry fragments similar to P_1, there are trachytic feldspathic rocks and some greywacke, siltstone, and argillite. The matrix between the rock fragments is composed of broken phenocrysts of quartz and feldspar in a finely comminuted dark-brown or green aggregate that includes incipient new mica and may include very fine chlorite and carbonate. A relatively common feature of these breccias is the presence of quartz veinlets that cut the matrix and fragments but are disrupted into segments. In foliated specimens the rock fragments have a marked preferred orientation and the matrix a swirly, fluidal texture that includes shard-like masses of quartz that have a fine mosaic crystal texture. Specimens from an outcrop northwest of the lake include much new skeletal ilmenite, and these have quite a marked magnetic susceptibility. Some of the breccia fragments can be very large, as, for example, the mass of hornfelsic greywacke that is large enough to map separately in the small breccia area southeast of the lake. In general, metamorphism of these B_1 breccias is slight in comparison with the hornfels but may include growth of new chlorite and more rarely epidote or clinozoisite.

The hornfels of the wallrocks include argillite to lapilli tuffs that in most cases have a new growth of biotite and actinolite throughout matrix and fragments and may also have new clinozoisite. The fragments of the tuffs include a large proportion of trachytic textured intermediate volcanic rocks and many that are similar to the rhyolites of the plug. Distinguishing the pyroclastic rocks from the breccias of the plug would be difficult were it not for the differing textures and metamorphism.

Alteration other than the metamorphism already described includes silicification, carbonatization, pyritization, talcose alteration, and potash metasomatism. The silicification is the most intense alteration and can be so intense that the origin of a rock is completely obscured. Silicification is most abundant in an annular zone around the periphery of the P_2 plug. It affects the P_2 rock most, the P_1 somewhat less, and the hornfels least. It is intimately connected with a stockwork of fractures and veins. The intensity of silicification and abundance of minor quartz veinlets decrease outward. Larger quartz veins continue outward beyond the zone of intense silicification but are also contained in an annular zone. The quartz veinlets have a characteristic fine mosaic grain, and many of them are clearly replacement veinlets cutting across phenocrysts with no dilation. Others are just as clearly dilation veinlets; however, in most cases criteria to distinguish the one from the other are lacking. In intensely silicified areas the quartz phenocrysts are recrystallized to fine mosaics, and the feldspars are clarified by recrystallization and minor replacement by quartz. The quartz veins contain a small percentage of potash feldspar and may contain carbonate, pyrite, or molybdenite. The latter occurs in very fine hexagonal plates, most commonly concentrated along reopened fractures in the quartz veins, but also disseminated to some degree throughout the vein.

Other alterations are less intense but widely distributed. Pyrite occurs predominantly in an irregular annular halo peripheral to the silicification just described through P_1, B_2, and hornfels. It is rarely very intense, but concentrations may approach 2 or 3 per cent in some hornfels. Potash metasomatism particularly affects some B_2 breccia, giving them pinkish casts throughout, but it is widely distributed in less prominent form. The talcose alteration is quite restricted and is associated with minor shearing. Carbonatization is widely distributed but rarely intense. In many localities it is associated with potash metasomatism.

Mineralization

The mineralization consists almost entirely of molybdenite, but minor chalcopyrite and galena-sphalerite occurs in separate localities. Molybdenite is concentrated in the vein zone shown on Figure 13. In general, concentration is highest in a zone immediately peripheral to the contact of P_2 and grades downward in both directions. Other areas of molybdenum mineralization occur, but none appear to be as important. Two drill-holes in the central part of the plug intersect scattered molybdenum mineralization which from 1,050 to 1,150 feet in the vertical hole (13) was of fair grade.

Plateau Metals Limited, in a report to the stockholders, stated that exploration to date has indicated 15,000,000 tons of about 0.17 per cent MoS_2 in the main annular vein zone.

A mercury halo is associated with the ore zone and with the whole plug. This is shown in a profile (*see* Fig. 19, facing p. 109) which is taken from the Nanika River bridge to a cut line (8W) 400 feet east of the lake and down this across the vein zone to the river flat. (*See* Annual Reports, 1957, p. 12; 1962, p. 28.)

TAHTSA LAKE

Copper-Molybdenum

Berg (Kennco Explorations, (Western) Limited)*

(53° 127° N.W.) Company office, 1030 West Georgia Street, Vancouver 5. The group of 68 mineral claims is owned by Kennco Explorations, (Western) Limited. The property is near Nanika Lake, 6 miles south of the southwest end of Kidprice Lake, and may be reached by road and jeep track from Houston, a distance of 100 miles. Geological, geochemical, and geophysical surveys were made. Some 15,000 feet of trenching was done and 17 miles of road constructed. There was 4,055 feet of diamond drilling in six holes. Three company and five contractor employees worked for four months under the direction of C. S. Ney, project engineer. The property was not visited.

Whit (Kennco Explorations, (Western) Limited)*

(53° 127° N.E.) Company office, 1030 West Georgia Street, Vancouver 5. This group of 61 claims, owned by the company, is on the south side of Sibola Mountain, 2½ miles north of Sweeney Lake. It is 70 miles by road from Houston. Geological and geochemical surveys were made and 9,300 feet of trenches and four test-pits were dug. An access road 6 miles long was built. There was 2,068 feet of diamond drilling done in 11 holes. Four company and five contractor employees worked for three months under the direction of R. W. Stevenson, senior geologist. The property was not visited.

WHITESAIL LAKE

Molybdenum

Jumbo (Phelps Dodge Corporation of Canada, Limited)†

(53° 127° S.W.) Head office, 55 Yonge Street, Toronto 1, Ont. British Columbia office, 404, 1112 West Pender Street, Vancouver 1. G. A. Whiton, geologist in charge of work on the property. The 93 Jumbo recorded claims lie at about 1,000 feet elevation between the Gamsby and Tsaytis Rivers, 11 miles south of Seel Lake. During a 3½-month period

* By W. G. Clarke.
† By H. Bapty.

nine men did geological mapping, drilled and blasted two trenches for a length of 201 feet and diamond drilled five AX/WL holes a total length of 2,347 feet. Transportation was by road to Tchesinkut Lake and thence by float-plane and helicopter 90 miles westward to the claims. The property was not visited.

EUTSUK LAKE

Molybdenum

CAFB (Phelps Dodge Corporation of Canada, Limited)*

(53° 127° S.E.) Vancouver office, 404, 1112 West Pender Street. This group of 154 mineral claims is owned by the company. The location is on Red Bird Mountain 8 miles miles west of Pondosy Bay on Eutsuk Lake. Access is by float-plane and helicopter from Burns Lake, 80 miles distant. The claims have been surveyed. A cabin was built on the property. There was 19,290 feet of diamond drilling done in 24 holes. Five company and 12 contractor employees worked for four months under the direction of A. J. Schmidt, geological engineer. The property was not visited.

Copper

Pondosy (Kennco Explorations, (Western) Limited)†

(53° 126° S.W.) Vancouver office, 1030 West Georgia Street. J. A. Gower, district exploration manager; P. T. Black, supervisor of work on the property. The Pondosy group of 70 recorded mineral claims is situated just east of Rivers Peak and south of Eutsuk Lake. The property is 107 air miles south from Smithers. Six men spent one week on the property doing reconnaissance work. Malachite, chalcocite, and pyrite were found disseminated in a porphyry complex rock. The property was not visited.

Copper-Silver

AT (Meteor Mining Co. Ltd.)‡

(53° 126° S.W.) Company office, 574 Yates Street, Victoria. T. E. Kirk, president. This company holds 34 mineral claims including the AT group on the eastern part of Tesla Mountain south of Tesla Lake at elevations between 3,100 and 6,100 feet. The property includes ground held recently by either J. L. Powney or J. C. Kay and before that by G. A. Young, and the principal showings are described by Douglas Lay (in the Annual Report for 1926) under the names of the Chalcopyrite and Tetrahedrite claims. Work by the company in 1964 included prospecting, trail-cutting, and hand-trenching, and in 1965 it included a self potential survey by G. A. MacDonald and detailed soil-sampling by A. C. Carr, both in an area measuring 2,000 by 800 feet which adjoins the main showing. Each summer a small crew camped at about 5,000 feet elevation and maintained a trail 2 miles long to the camp from Tesla Lake, where supplies were landed by float-plane.

The main showing is on the AT No. 1 claim at about 5,500 feet elevation and is on the west-facing slope of a ridge underlain by andesitic volcanic rocks and dykes. The showing consists of five parallel trenches and pits spaced in a north-northeasterly direction more or less at a single elevation, all exposing chalcopyrite mineralization throughout. The strongest mineralization is associated with a highly siliceous zone which has a banding directed north 30 degrees east and dipping east at about 45 degrees. This zone is poorly exposed at the western end of a 50-foot-

* By W. G. Clarke.
† By H. Bapty.
‡ By J. M. Carr.

long trench and better exposed in a short central trench 25 feet to the north and in another short trench 30 feet farther north. In the latter trench the zone has an exposed true width of 4 feet and contains an estimated 8 to 10 per cent copper (as chalcopyrite) which fills fractures. Low-grade chalcopyrite mineralization in fractured and silicified volcanic rock occupies the remainder of the long trench and the end trenches, except where post-mineral dykes of vesicular andesite occur. Similar low-grade mineralization has been partly explored by rock cuts which lie at lower elevations about 200 feet northwest of the long trench. This showing and the main one both adjoin the east wall of a northwesterly fault which is inferred from air photographs.

A third showing is 500 feet to the west of the main one and lies beyond the fault. It consists of a buff-coloured siliceous vein with barite and sulphides which strikes north 40 degrees east, dips to the southeast at between 40 and 55 degrees, and is exposed continuously for a length of about 150 feet. Throughout this distance the vein is split into two parts by a parallel later dyke of unmineralized andesite, which is 10 feet wide. The part of the vein lying southeast of the dyke is as much as 5 feet wide, and the part lying northwest of the dyke is mostly 1 foot wide but is missing altogether for a distance of 20 feet, due partly to its displacement by a cross-fault and partly to a local increase in the width of the dyke. At the southwest limit of the exposure the dyke turns sharply due west and the vein terminates. A small pit made in the south wallrock of the dyke at this point is reported to have provided samples which assayed very high in silver. The only sign of mineralization remaining in the pit is malachite, which occurs in a dark altered volcanic rock. Galena, pyrite, and rarely tetrahedrite occur as splashes and sprinklings in the quartz-barite vein throughout the 150-foot length. A grab sample of broken rock from the 4-foot-wide part of the vein lying southeast of the dyke at a point about 100 feet from the pit assayed: Gold, *nil;* silver, trace; copper, trace; lead, 1.36 per cent. A 2-foot-wide northeasterly extension of the vein which outcrops 50 feet beyond the continuous exposure is apparently unmineralized and the andesite dyke is not present.

In the headwall of a cirque about one-half mile southeast of the described showings a vein with tetrahedrite is intermittently exposed for a distance of 120 feet on a 40-degree slope, the direction of its trace being north 80 degrees west. It strikes north 80 degrees east and dips southward at about 35 degrees and has a maximum exposed thickness of 6 inches. The vein is enclosed by a foliated shear zone which is 4 feet wide and has the same attitude. The surrounding volcanic rocks are jointed and sheared in several directions and are locally altered to jasper and mineralized with disseminated chalcopyrite. The vein is siliceous, crudely banded, and contains tetrahedrite mainly in a central layer which is mostly less than one-half inch wide. Its surface is stained conspicuously by azurite. Samples of the vein are reported to have assayed very high in silver. Similar narrower veins containing tetrahedrite occur in the same area, partly in shear zones following other directions.

DEAN CHANNEL

Molybdenum

Russ (Phelps Dodge Corporation of Canada, Limited)*

(52° 126° N.W.) British Columbia office, 404, 1112 West Pender Street, Vancouver 1. J. Mackie, geologist in charge of work on the property. The Russ group of 64 recorded claims is east of Dean Channel, between 5,000 and 5,500 feet elevation, 25 miles north of Bella Coola. For one month

* By H. Bapty.

two men did geological mapping and dug five test-pits with a total depth of 85 feet. Molybdenite, chalcopyrite, pyrite, and magnetite were found associated with quartz veins in quartz diorite. Transportation to the property was by boat and helicopter. The property was not visited.

BURKE CHANNEL

Copper-Zinc

Treasure Island (Bralorne Pioneer Mines Limited)*

(52° 127° S.W.) Company office, 320, 355 Burrard Street, Vancouver. D. H. James, exploration manager. This is a group of four recorded claims on the west side of Kwatna Inlet 25 miles south of Ocean Falls. Four men spent two months on the property doing geological mapping. Transportation was by launch and air. The property was not visited.

TOPLEY

Silver-Lead-Zinc

Silver Cup (Hudson Bay Mountain Silver Mines Ltd.)†

(54° 126° N.E.) Company office, 808, 602 West Hastings Street, Vancouver 2. H. B. Gilleland, manager. The property of 26 claims is 3 miles from Topley on the Topley Landing road. Hudson Bay Mountain Silver Mines Ltd. took an option in October; this was terminated in December. The mineralization is in quartz veins in andesite. Work was concentrated on the Silver Cup claim and consisted of stripping 8,000 square feet of bedrock and drilling and blasting seven trenches of a total length of 80 feet. In addition, there was 440 feet of diamond drilling done in four holes and 72 feet of Packsack diamond drilling done in six holes. Four men worked for two months under the supervision of the manager. The property was not visited.

BABINE LAKE

NORTHERN BABINE LAKE AREA‡

This report deals with an area of northern Babine Lake bounded by latitudes 54 degrees 50 minutes and 55 degrees 05 minutes and includes Newman Peninsula, McDonald Island, and several large islands to the south.

The area includes two important copper deposits; the McDonald Island property of Granisle Copper Limited, currently preparing for production, and the Newman property of Noranda Exploration Company, Limited, situated on Newman Peninsula at 55 degrees latitude. Original prospecting on both properties was begun prior to 1913. More recent work has been in progress on McDonald Island since 1955, and on Newman Peninsula since 1962.

Topley Landing, with several resorts and a government wharf and camp-site, is the only population centre near the area. Access to Topley and Highway 16, 27 miles to the south, is by a good gravel road. The northern part of the area can be reached by a 45-mile road connecting Smithers with Smithers Landing on the northwest arm of Babine Lake. Travel within the area is afforded most easily by boat. A forest fire access road extends northeastward from Hawthorn Bay on the east shore of Babine Lake to Tochcha and Natowite Lakes and is suitable for four-wheel-drive vehicles. Access roads to the Granisle property include a 7-mile road

* By H. Bapty.
† By W. G. Clarke.
‡ By N. C. Carter.

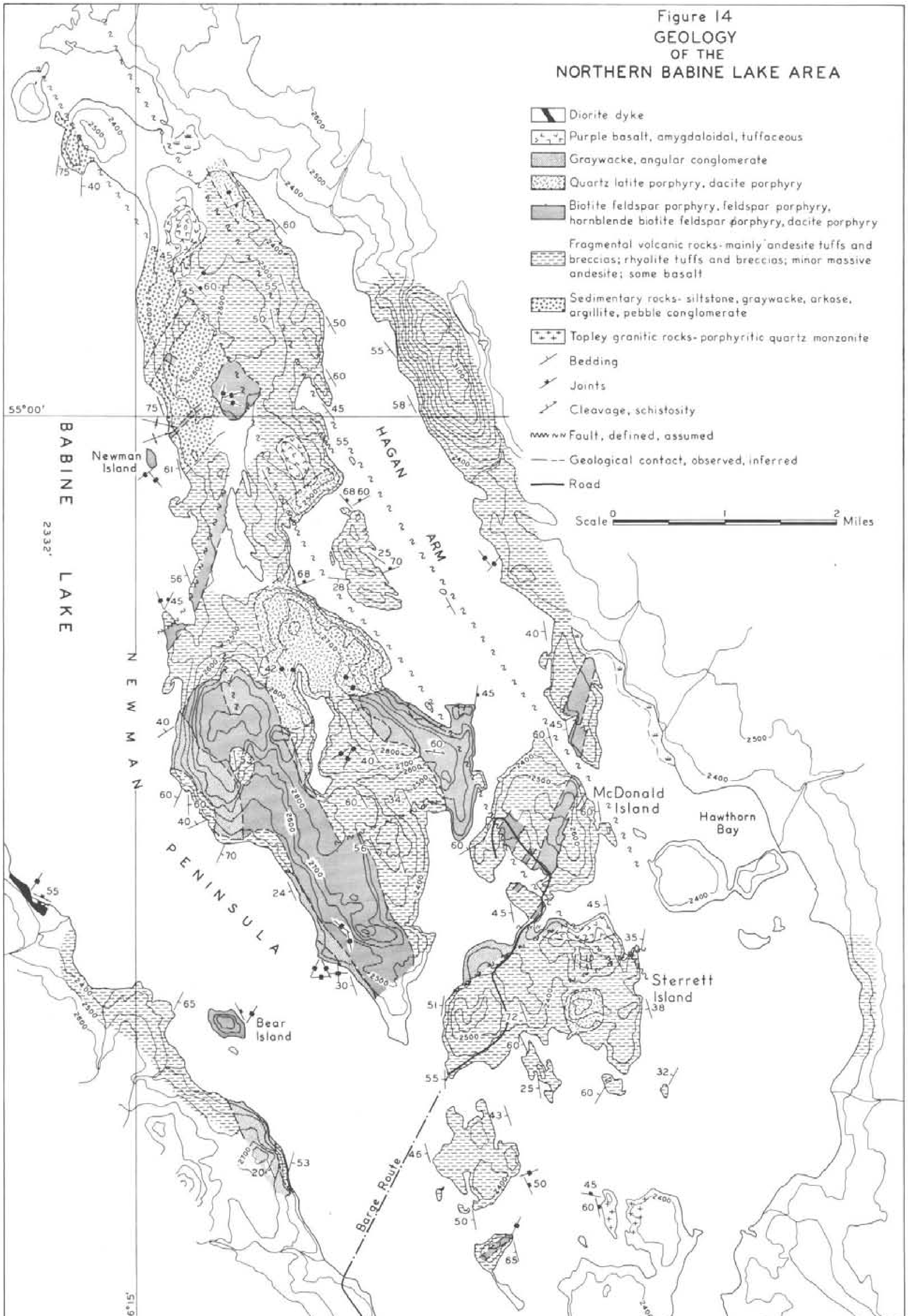


Figure 14
GEOLOGY
OF THE
NORTHERN BABINE LAKE AREA
Diorite dyke
Purple basalt, amygdaloidal, tuffaceous
Graywacke, angular conglomerate
Quartz latite porphyry, dacite porphyry
Biotite feldspar porphyry, feldspar porphyry, hornblende biotite feldspar porphyry, dacite porphyry
Fragmental volcanic rocks- mainly andesite tuffs and breccias; rhyolite tuffs and breccias; minor massive andesite; some basalt
Sedimentary rocks- siltstone, graywacke, arkose, argillite, pebble conglomerate
Topley granitic rocks- porphyritic quartz monzonite
Bedding
Joints
Cleavage, schistosity
Fault, defined, assumed
Geological contact, observed, inferred
Road
Scale 0 1 2 Miles
55°00'
126°15'
BABINE LAKE
2332'
NEWMAN PENINSULA
HAGAN ARM
Newman Island
McDonald Island
Hawthorn Bay
Sterrett Island
Bear Island
Barge Route

from Topley Landing up the west shore of Babine Lake and roads on Sterrett and McDonald Islands.

The area is a part of the Nechako Plateau and is characterized by fairly gentle slopes rising from lake-level at 2,332 feet to elevations between 3,000 and 4,000 feet. The highest point in the vicinity is Old Fort Mountain, directly north of the map-area, which rises to 5,147 feet. Cold winters and warm summers with moderate amounts of precipitation are typical of the northern interior region. Extensive forest-cover is present over much of the area, with dense underbrush and windfall in logged and burned areas. Glacial deposits, including clay and gravel, obscure much of the bedrock, and good exposures are confined to the lake-shore, creek valleys, and ridges.

Much of the area is underlain by bedded fragmental volcanic rocks of probable Middle Jurassic age which overlie clastic sedimentary rocks more or less conformably in the northern part of the area. These rocks, classified tentatively as part of the Hazelton Group, are intruded by dykes, small stocks, and sheet-like masses of biotite-feldspar porphyry of dacite composition, and dykes, sills, and plugs of quartz latite and dacite porphyry. Greywackes, siltstones, and pebble conglomerates, probably representing a part of the Sustut group of Upper Cretaceous age, overlie the preceding rocks unconformably. Other younger, possibly Tertiary, rocks include purple amygdaloidal and tuffaceous basalts.

Rocks older than those of the Hazelton Group are found to the south of the map-area and consist of Topley granitic rocks and three small areas of sedimentary and volcanic rocks. Inclusions of dark-green contorted andesites were noted in the granitic rocks in Tachek Creek south of Topley Landing, and amphibolites are in contact with granitic rocks in the vicinity of Wilkinson Bay on the west shore of Babine Lake. At the outlet of Fulton Lake, west of Topley Landing, tightly folded grey to white-banded limestones and black argillites with some andesite sills are intruded by porphyritic quartz monzonites.

The Topley intrusions consist mainly of quartz monzonite and commonly contain euhedral phenocrysts of pink potash feldspar as much as 1½ inches long. These porphyritic quartz monzonites are cut by numerous north-northeasterly striking dykes of rhyolite and quartz latite porphyry which are 25 feet wide. The most common type is a light-brown to pink intensely fractured rock with 2-millimetre phenocrysts of potash feldspar and plagioclase in a very fine-grained dense matrix of quartz and feldspar.

Andesite breccias containing angular fragments of Topley intrusive rocks were noted near Wilkinson Bay and may be part of the Tachek Group (Armstrong, 1949, p. 64).

Interbedded siltstones, argillites, greywackes, arkoses, and pebble conglomerates of the Hazelton Group make up a predominantly sedimentary sequence in the northwestern part of Newman Peninsula. Sedimentary rocks of similar type were noted north of Hawthorn Bay and near Old Fort village.

Overlying the sedimentary rocks are intermediate to basic water-lain tuffs and breccias which underlie much of Newman Peninsula and the adjacent shores and islands of the northern part of Babine Lake. The most common rock types are green to purple andesite tuffs, breccias, and agglomerates which are locally well stratified, with beds 1 to 4 feet thick. Fragments are sharply angular to subrounded and locally show some indication of having been reworked. The fragments are mainly of andesitic composition, with some dacite, basalt, and scoriaceous types. A horizon characterized by an abundance of chert fragments passes through the east side of McDonald Island, the west shore of Hagan Arm, and the northernmost part of Newman Peninsula near the head of Hagan Arm. Hematitic andesite tuffs and breccias are common on the east side of Sterrett Island and in several other localities. Interbedded with the fragmental types are light-grey to green volcanic sandstones which are well exposed on the west side of Sterrett Island and the islands to the south. The volcanic sandstones are well stratified with 1-inch to 1-foot thick beds. A limy horizon within this unit at the southwest end of Sterrett Island contains well-preserved pelecypod fossils.

Massive and amygdaloidal andesites and basalts, showing little indication of stratification, occur locally within the volcanic sequence and are best exposed in the southwest part of McDonald Island.

Rhyolite, dacite, and felsite tuffs and breccias are found in the southern part of Newman Peninsula and to a lesser extent on McDonald Island. They contain 4- to 32-millimetre fragments of quartz, rhyolite, and dark chert in a light-grey to pink locally porphyritic matrix. These rocks contain varying amounts of disseminated pyrite and often weather to a white colour with some iron staining. The acid fragmental rocks are crudely stratified, and some flow banding was noted in some localities.

The intrusive rocks of the area are of several varieties and ages. Biotite-feldspar porphyries and hornblende-biotite feldspar porphyries, with which the copper deposits are associated, occur as dykes, sills, and stock-like bodies cutting the sedimentary and volcanic sequence. These intrusive rocks, which may be a stage of the Omineca Intrusions, form local topographic highs, including the ridges on McDonald Island and the southern part of Newman Peninsula. Dykes of biotite-feldspar porphyry, such as those on McDonald Island and northern Newman Peninsula, trend northeastward and are leucocratic, fairly fresh types characterized by crowded euhedral 2-millimetre phenocrysts of zoned plagioclase and brown biotite. On Newman Peninsula, roughly flat-lying sheet-like bodies of hornblende-biotite-feldspar porphyry cover the volcanic rocks and are irregular in outline. The porphyries have a light- to medium-green andesitic matrix with 2-millimetre phenocrysts of plagioclase, biotite, and laths of hornblende which locally impart a primary foliation. Well-developed columnar jointing was noted in one locality on the southwest shore of Newman Peninsula. A stock-like body of feldspar porphyry, with which the Newman copper deposit is associated, is distinguished by a lack of mafic minerals and a high degree of sericite and clay mineral alteration.

Other intrusive rocks include quartz latite and dacite porphyries which cut the Hazelton sedimentary and volcanic sequence as stocks, dykes, and sills. Age relationships of these rocks with respect to the biotite-feldspar porphyry intrusions or to flat-lying Sustut-type sedimentary rocks are not completely known. A stock of quartz-latite porphyry in the central part of Newman Peninsula appears to limit the extent of a sill of hornblende-biotite-feldspar porphyry, but no contacts were seen. Quartz latite porphyries contain scattered 2-millimetre quartz, potash feldspar, and plagioclase phenocrysts in a light-brown to pink fine-grained siliceous matrix in contrast to the dacite porphyries, which are distinguished by the presence of closely spaced 2-millimetre phenocrysts of plagioclase in a light greenish-grey matrix. Both types are commonly intensely fractured, and weather to a white colour with varying amounts of iron stain due to the presence of finely disseminated pyrite.

Fairly flat-lying sedimentary rocks, consisting of greywacke, siltstone, and pebble conglomerate, overlie Hazelton fragmental volcanic rocks unconformably along the west shore of Babine Lake and the north side of Sterrett Island. In general, these rocks are similar to flat-lying interbedded conglomerates, sandstones, mudstones, and shales which occur in Tachek Creek south of Topley Landing and are mapped as part of the Sustut Group of Upper Cretaceous age (*Geol. Surv., Can.*, Map 671-A). Poorly sorted angular basal conglomerates, containing one-quarter to 8-inch fragments of hornblende-biotite-feldspar porphyry in a light-grey sandy matrix, were found to overlie hornblende-biotite-feldspar porphyries near the south end of Newman Peninsula. The conglomerates contain carbonaceous material and fossil plant remains and may be correlative with the Sustut rocks.

The age relationships of purple to green amygdaloidal and tuffaceous basalts, which occur in three places in the map-area, are imperfectly known. The basalts appear to overlie the Hazelton sedimentary and volcanic rocks.

Diorite dykes containing varying amounts of magnetite cut the fragmental volcanic rocks in two localities on the shore of Babine Lake. Age relationships are not known.

Sedimentary and volcanic rocks of the Hazelton Group have been folded into a southerly plunging synclinal structure, the axis of which is situated near the central part of Newman Peninsula. Some contortion and cross-folding is evident along the western limb of the syncline; strikes along the eastern limb are fairly uniform to the north in the southern part of the area and swing to the northwest near the head of Hagan Arm. Two parallel northwesterly trending fault zones form prominent lineaments across the area and offset the Hazelton sedimentary and volcanic rocks and some of the intrusive rocks. Sheared volcanic rocks were noted along these lineaments. Northeasterly trending fault zones which preceded the northwesterly ones probably were the zones of weakness into which the biotite-feldspar porphyry dykes on McDonald Island and Newman Peninsula were intruded. A dominant east-northeast joint set and a complementary north-northwest set are present in all rocks of the area, with the exception of the younger flat-lying sedimentary rocks.

Copper

Granisle Copper Limited*

(54° 126° N.E.) Head office, 1111 West Georgia Street, Vancouver 5. L. T. Postle, president; A. J. McDougall, manager. The mine-site is situated 10 miles north of Topley Landing on McDonald Island (also known as Copper Island), the northernmost of a group of several islands at the entrance to Hagan Arm. The property consists of 31 Crown-granted full and fractional mineral claims and 15 claims held by record. In addition, the company holds 44 recorded claims on Sterrett Island and an adjoining island to the south. Access to the property during 1965 was by boat from Topley Landing. Supplies were freighted in by tug and barge.

History.—The earliest record of prospecting work on McDonald Island is contained in the Annual Report for 1913, when the copper deposits in the central part of the island and a small galena-sphalerite vein near the southwest end were being investigated. Intermittent work up to 1927 consisted of the driving of several adits and the sinking of two small shafts. In 1929 the property was optioned to The Consolidated Mining and Smelting Company of Canada, Limited, and eight diamond-drill holes totalling 4,000 feet were completed. This work indicated the presence of 8 million tons grading 0.01 ounce gold, 0.15 ounce silver, and 0.80 per cent copper. The property lay dormant until 1946, when some drilling was done. A biogeochemical survey of the island was carried out in 1951 by Kennco Explorations, (Canada) Limited.

* By N. C. Carter and W. G. Clarke.

Exploration work by The Granby Mining Company Limited was begun in 1955. In early 1957 the subsidiary company, Granisle Copper Limited, was formed. By the end of 1962, 79 holes totalling 26,281 feet had been diamond drilled in the zone of copper mineralization. Some packsack drilling was done in other areas on the island, and topographic, geological, and geophysical surveys were carried out. Bulk sampling for metallurgical testing involved the blasting-out of five large trenches in 1964. Early in 1965 the company announced plans for production at a rate of 5,000 tons per day and indicated a reserve of 22,700,000 tons grading 0.53 per cent copper. Construction of the mill and crusher and of access roads was begun in the summer of 1965, with initial production scheduled for late 1966.

Construction.—Most of the work in 1965 was concentrated on improving the access route and on plant construction. The road to Topley Landing was extended 7 miles along the southwest shore of the lake to a point opposite Sterrett Island, where a dock was constructed. The dock is hinged so it may be raised or lowered to suit changing water levels. A timber deck, 38 feet by 28 feet 10 inches, is laid on I-beams which are suspended from pile dolphins at the water face.

A " bubbler " system is used to keep the 2-mile channel to Sterrett Island open in the winter. The air-line is 10,895 feet long; half is constructed of 1½-inch-diameter galvanized pipe and half is 2½-inch polyethylene pipe. The line is suspended between anchors and buoys at a maximum depth of 170 feet. Air holes are one-thirty-second of an inch in diameter and are 25 to 30 feet apart. Air consumption is 600 cubic feet per minute at a pressure of 110 pounds per square inch. The system keeps a channel 100 feet wide open through the ice. Performance was found to be satisfactory during a period of cold weather at the end of the year. While it was designed to maintain an open channel, the " bubbler " system will melt ice if freezing occurs owing to a failure of the air supply.

At the north end of the channel, on Sterrett Island, a dock has been built similar to that on the southwest shore. A gravel road, 12,500 feet long, was made across the island and has been connected to Copper Island by a causeway. A new road, 5,000 feet long, leads to the mine and plant.

An area of 40 to 50 acres has been cleared for the open pit. Overburden stripping with tractor-drawn scrapers and bulldozers was in progress at the end of the year.

Plant construction commenced in 1965. Three conventional wooden frame buildings for an assay office, an office warehouse, and a dry were completed. A timber-frame metal-clad maintenance building was finished. The structural steel for the concentrator building was erected. Foundations were poured for the fine-ore bins, as was the monolithic concrete for the crusher.

The townsite will be built near the dock on the southwest shore of Babine Lake. Twenty acres were cleared during the year. Major equipment owned by the company includes two tug boats; one 20- by 50-foot 50-ton-capacity steel barge; one 26- by 70-foot 100-ton capacity steel barge; one 22-foot fibreglass motor-launch; one 30-foot river boat with 28-horsepower outboard motor; one 600-cubic-foot-per-minute-capacity compressor; two light trucks; one 2-ton truck; two light plants, one 75 kva. and one 30 kva.

The company has built a construction camp on Copper Island containing eleven 16-man bunk-houses and a kitchen-diner complex. Granisle Copper Limited had seven men on the project, all on staff. Eleven contractors employed up to 115 men.

Geology.—McDonald Island is triangular in shape and each side measures roughly 1 mile. The main topographic feature of the island is a prominent north-easterly trending ridge which rises abruptly with a talus slope near the south end of the island to an elevation of 300 feet above lake-level and slopes gently toward the northeast side of the island. Much of the island is underlain by massive and fragmental andesites and some felsites of the Hazelton Group. These have been intruded by dykes of biotite-feldspar porphyry, the largest of which underlies the prominent ridge, and a sill-like intrusion of dacite porphyry near the western side of the island. The zone of copper mineralization is situated along part of the eastern contact between the biotite-feldspar porphyry dyke and dioritic rocks of probable metasomatic origin.

A covering of sandy clay and poorly sorted gravel obscures much of the bedrock on the island. Good exposures are confined to the lake-shore, the ridge in the eastern part, and areas of construction activity on the southwestern part of the island. The following description of the geology is based on examination of all known surface exposures on the island and a study of the drill core.

General Geology.—Green to purple water-lain andesite tuffs and breccias are confined largely to the western side of McDonald Island and to the north end of Sterrett Island, where they are interbedded with massive types. The fragmental rocks are locally well stratified, with 6- to 12-inch-thick beds, and many of the 2- to 32-millimetre fragments of chert and andesite are sub-rounded, indicating some reworking. Differential weathering and limonite stain are common features. On the small point on the east side of McDonald Island, thinly bedded grey shaly sediments containing poorly preserved fossils are interbedded with the fragmental volcanics. The fragmental rocks have been partially recrystallized, adjacent to the dyke contacts, with the most intense alteration confined to the ore zone, where they have been converted to diorite breccias.

Predominantly massive and amygdaloidal andesites are found in the central and western parts of the island. In the extreme western part these rocks are intensely fractured and contain numerous carbonate stringers and disseminated pyrite. The light-green chloritized andesites are amygdaloidal, containing 1-millimetre calcite vesicles and spots of green chlorite. Pyrite is finely disseminated throughout these types. A hornblende andesite near the south end of the island contains 2- to 4-millimetre hornblende laths which are arranged in subparallel fashion, accentuating the trachytic textured groundmass. At the extreme north end of the island, an amygdaloidal type contains elongate 15-millimetre vesicles of fibrous zeolite and pink calcite that impart a crude lineation. The massive andesites generally lack any indication of stratification, except for some flow banding in the western part of the island.

Associated with the massive andesites are fragmental felsites which are buff to white in colour and contain abundant disseminated pyrite with resultant iron stain on weathered surfaces. These rocks exhibit a high degree of carbonate alteration, and commonly contain 2- to 4-millimetre lithic fragments in a tuffaceous matrix of quartz and plagioclase. The rocks are intensely fractured and sheared in the vicinity of a galena-sphalerite vein on the southwest end of McDonald Island.

Intrusive rocks cut the volcanic rocks in the form of dykes and sills, the most important of which is the north-northeasterly trending dyke of biotite-feldspar porphyry with which the copper deposit is associated. The dyke, which is between 400 and 600 feet wide, is of dacite composition and is characterized by 1- to 2-millimetre phenocrysts of plagioclase and biotite in a fine-grained matrix of quartz and feldspar. Within the zone of copper mineralization the biotite-feldspar porphyry is leucocratic, and the fine-grained quartz-rich matrix contains varying amounts of disseminated magnetite. Between 25 and 50 per cent of the rock is made up of 2-millimetre phenocrysts of fairly fresh, normally zoned oligoclase-andesine and 1-millimetre flakes and books of fresh brown biotite. The rock is well jointed and is transected by numerous ⅛- to ¼-inch quartz veinlets containing some carbonate and by irregular veinlets rich in specularite and magnetite. Malachite-coated joint surfaces are common along the prominent talus slope on the south end of the mineralized zone.

Altered varieties of the biotite-feldspar porphyry are found on the northern and southern ends of the dyke. At the northern end of the dyke, both on the island and on the small peninsula to the northeast, a buff biotite-feldspar porphyry is marked by a more feldspathic and trachytic textured matrix containing occasional 1-millimetre quartz eyes. Plagioclase phenocrysts, more calcic than those in the porphyry of the ore zone, exhibit varying degrees of kaolin and sericite alteration, and the poikilitic, partially chloritized biotite is largely secondary after amphibole. On the southern end of the dyke, kaolin alteration of feldspar is even more intense and biotite has been largely leached out.

Smaller dykes of biotite-feldspar porphyry were noted near the southwest end of McDonald Island and on the northern end of Sterrett Island. These dykes are roughly of the same composition as the main dyke, but in them phenocrysts are more scattered and the rock is a uniform buff colour.

The dioritic rocks occurring along the eastern margin of the biotite-feldspar porphyry dyke are believed to be the product of recrystallization and metasomatism of massive and fragmental andesites to fine-grained quartz diorites and diorite breccias respectively. The diorite breccias contain angular to rounded fragments of chert and trachytic volcanic rocks ranging in size from 4 to 32 millimetres in a fine-grained tuffaceous matrix of quartz, plagioclase, and 4-millimetre areas of very fine-grained quartz and brown biotite. Another variety is characterized by a white felsic matrix containing chert fragments and 4-millimetre clots of very fine-grained quartz and chloritized biotite. Metallic minerals are disseminated throughout the diorite breccias.

The fine-grained quartz diorites are commonly porphyritic, with 1-millimetre phenocrysts of zoned plagioclase set in a fine-grained quartz-feldspar-biotite matrix. The fine-grained biotite, derived from amphibole, is poikilitic and imparts a foliation. These rocks are probably transitional between more or less massive recrystallized andesites and the biotite-feldspar porphyry dyke rocks. Both sharp and gradational contacts exist between the quartz diorites and the biotite-feldspar porphyry, and they are similar in composition, the quartz diorites being distinguished by smaller phenocrysts of slightly more calcic plagioclase and a greater percentage of mafic minerals.

Small bands or dykes of medium to dark-grey intrusion breccia cut both the biotite-feldspar porphyry and the dioritic rocks within the zone of copper mineralization. Most of these bands are 1 to 6 inches wide; however, core lengths of up to 20 feet were intersected in some drill-holes. Where these bands of intrusion breccia are closely spaced, they make up near-vertical northeast-trending zones which are situated along the contact between the biotite-feldspar porphyry dyke and the dioritic rocks. The intrusion breccias contain rounded fragments of biotite-feldspar porphyry and some diorite in a fine- to medium-grained granulated matrix of strained and crackled quartz, plagioclase feldspar chips, and abundant very fine-grained brown biotite. Disseminated magnetite is a common accessory. The wider bands of these breccias exhibit chilled contacts, and consequently they are regarded as being intrusive in origin.

An intrusive body of dacite porphyry is partially exposed in the western part of the island. Contact relationships are completely lacking, the only exposures being uncovered at the crusher-site and along the main access road. Prominent sheeting, striking north-northeastward and dipping moderately to the west, suggests that the intrusion may be a north-northeasterly trending sill-like structure. The rock is light grey-green in colour on fresh surfaces and contains considerable very finely disseminated pyrite. The rock weathers to a near-uniform white colour with widespread iron staining. Euhedral 1-millimetre phenocrysts of zoned plagioclase constitute half the rock, and are contained in a very fine-grained matrix of quartz and feldspar and local concentrations of very fine chloritized hornblende and biotite. Carbonate and sericite alteration of feldspars is widespread, as exemplified by chalky white phenocrysts. Small northeasterly trending dykes of a similar type were observed cutting the andesites in two places along the southwest shore of McDonald Island. Age relationships of the dacite porphyry with respect to the biotite-feldspar porphyry dyke are not known. They are similar in composition and may be nearly contemporaneous.

Apparently younger rocks, probably post-dating the period of intrusive activity and related mineralization, occur along the northern side of Sterrett Island and consist of fairly flat-lying greywackes and red to purple basaltic tuffs and breccias.

Alteration and Structure.—Metamorphic and metasomatic processes associated with the intrusion of the biotite-feldspar porphyry dyke have converted massive and fragmental andesites to granular dioritic types along part of the eastern side of the dyke. Elsewhere along the dyke contacts, the volcanic rocks exhibit varying degrees of crystallinity and silicification.

The biotite-feldspar porphyries and the dioritic rocks within the ore zone are both affected only to a slight degree by argillic and sericitic alteration of feldspar, although the same type of alteration is intense adjacent to small shear zones. Potash feldspar metasomatism is present to a minor degree. It is represented by irregular porphyroblasts of pink potash feldspar replacing plagioclase adjacent to some quartz veinlets. Several 3-foot-wide lenses exhibiting intense potash feldspar metasomatism were noted in the biotite-feldspar porphyry at depth near the central part of the ore zone.

Propylitization of the massive and fragmental andesites is particularly extensive near the southwest part of the island. The fragmental felsites exhibit widespread carbonate alteration.

Contact relationships between the biotite-feldspar porphyry dyke and the dioritic and volcanic rocks are well known in the area of the ore zone. The dyke has nearly vertical contacts, and numerous offshoots, which have the same north-northeast trend as the main dyke, cut the dioritic rocks. In plan, the contact between the dyke and the diorites and volcanic rocks is irregular, with numerous embayments in the dyke contact, particularly within the ore zone.

The biotite-feldspar porphyry is everywhere well jointed, with dominant vertical east-northeast, north-northeast, west-northwest and flat-lying joint sets. Some movement has occurred along some of the northeasterly trending joints, and numerous gouge zones were noted in the drill core.

Small shear zones noted in other rocks include west-northwest shears in the dacite porphyry sill and northeasterly trending shear zones in the felsites along the southwest shore of McDonald Island.

The andesite tuffs and breccias to the west of the dyke strike slightly west of north and have moderate westerly dips. Minor flow banding in the predominantly massive andesites on the southeast part of the island indicates a north-northeast trend with northwesterly dips.

The major structural features on and in the vicinity of McDonald Island are two parallel northwesterly trending fault zones. The southwestern fault zone is marked by a topographic break where it crosses the western part of McDonald Island and the northeastern part of Sterrett Island. The dacite porphyry sill terminates at this break, and the main biotite-feldspar porphyry dyke on the north point of Sterrett Island appears to have been offset. Intense fracturing, propylitization, and abundant disseminated pyrite were noted in the andesitic rocks along the trace of the fault on McDonald Island. Excavations for the mill-site exposed numerous small northwesterly trending shear zones in this area. Strikes of the volcanic rocks in the southwestern part of the island do not conform to the regional northerly trend, suggesting some rotation or drag effects along this fault.

The existence of a fault zone extending along the channel separating McDonald Island from the east shore of Babine Lake is deduced from the presence of sheared and pyritized fragmental andesites on the most easterly point of the island and an offsetting of the main biotite-feldspar porphyry dyke to its position on the peninsula to the northeast.

Mineralization.—The zone of copper mineralization is situated along part of the southeastern contact of the biotite-feldspar porphyry dyke where it is in contact with the dioritic rocks. The zone is oriented in a north-northeasterly direction and consists of a near-circular southern half roughly 700 feet in diameter and a northern extension measuring 800 by 300 feet. Available information indicates that the zone roughly parallels the vertical dyke contact and that copper mineralization extends to a depth of 950 feet.

In the biotite-feldspar porphyry, medium-grained chalcopyrite, bornite, and pyrite with some quartz and carbonate coat all prominent joint surfaces but the flat-lying ones. Chalcopyrite and bornite also occur in hair-line fractures in the middle of closely spaced, randomly oriented ⅛- to ¼-inch quartz veinlets. Finely disseminated bornite is also present to a degree in the biotite-feldspar porphyry.

Copper mineralization in the dioritic rocks is finer grained than that in the biotite-feldspar porphyry, and consists of chalcopyrite and bornite as disseminations in numerous quartz veinlets, hair-line fractures, and in the matrix. Some parts of the diorite breccias contain ⅛-inch blebs of chalcopyrite.

Bornite is most widespread in the southern part of the ore zone, where it occurs to a depth of 250 feet. Malachite and azurite, coating fractures to a depth of between 25 and 60 feet, is also most extensive in the southern part. Small amounts of secondary chalcocite and minor molybdenite were noted in the southern part of the ore zone.

Magnetite and specularite, occurring in ⅛-inch veinlets with some quartz, are common throughout the ore zone, being most extensive in the northern end. These veinlets are offset locally by copper-bearing quartz veinlets, but in general specularite and magnetite are intimately associated with the copper mineralization.

The strike of the biotite-feldspar porphyry dyke, the presence of several offshoots from the main dyke, and irregularities in the contact outline of the dyke within the ore zone suggest that the prominent regional pattern of northeast and northwest fractures was well developed in this particular area prior to the intrusion of the dyke. Intensified fracturing during the period of intrusive activity provided channelways for quartz veining and related mineralization. Some later movement along northwest fractures may have occurred in the central part of the ore zone subsequent to the period of intrusion and mineralization and may account for the distinctive shape of the ore zone and the confinement of bornite mineralization to the southern half of the zone.

A pyrite halo extends outward from the ore zone in the form of disseminations and stringers of pyrite, which are present in all rocks on McDonald Island with the exception of those on the extreme north end of the island. Disseminated pyrite was noted in the rocks on the north shore of Sterrett Island, with the exception of the greywackes and purple basalt tuffs.

A quartz-carbonate breccia vein, containing fair amounts of sphalerite and galena with minor amounts of pyrite and chalcopyrite, is exposed in a small adit

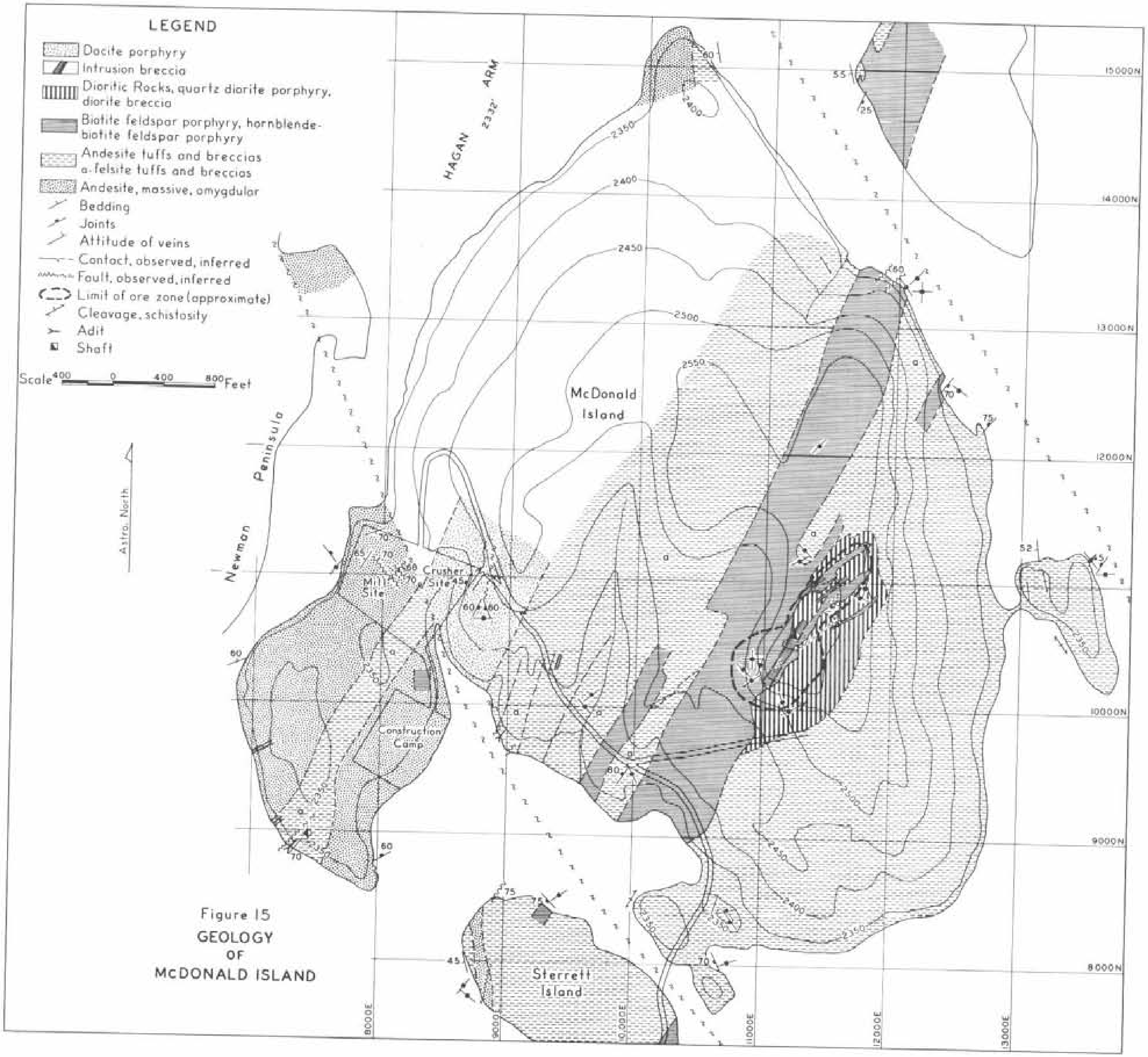


Figure 15
GEOLOGY
OF
McDONALD ISLAND

near the southwest end of the island. The vein follows a northeasterly trending shear zone in fragmental felsites and is apparently limited in length.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1913, pp. 113–114; 1927, pp. 149–150; 1929, pp. 180–181; 1955, p. 29; 1956, p. 29; 1957, p. 13; 1959, p. 18; 1962, p. 16; 1963, pp. 27–28; Lang, A. H., 1941, *Geol. Surv., Canada*, Paper 40-18.]

Newman (Noranda Exploration Company, Limited)* (54° 126° N.E.) Vancouver office, 1050 Davie Street. B. O. Brynelsen, president. A total of 197 claims held by record includes the Newman group of 11 claims and several other groups, all of which are situated in the northern half of Newman Peninsula. The Newman group, on which most of the exploration work has been done, is at latitude 55 degrees. The property is accessible by boat from Smithers Landing, 11 miles west. The claims were located in 1962 following a reconnaissance geophysical survey. Work the following year included silt and soil sampling, and in 1964, 98 holes totalling 24,061 feet were drilled. In addition, geological mapping, geophysical surveys, and trenching and road-building were carried out. An additional 34 holes totalling 15,889 feet were drilled in 1965, and 10 men were employed for most of the year under the supervision of G. C. Camsell.

Initial work on the property, dating back to 1913, was directed to mineralized showings on the west shore of the peninsula opposite Newman Island. By 1927 three adits had been driven along small shear zones containing pyrite, pyrrhotite, and some chalcopyrite and sphalerite.

The area of the claims is fairly flat and is covered by glacial deposits of gravel and clay. Good exposures are found only on the lake-shore and small ridges and along some of the drill roads.

Copper mineralization is associated with a stock-like body of feldspar porphyry which intrudes sedimentary and fragmental volcanic rocks near the northern end of a regional synclinal structure on Newman Peninsula. Some offsetting of the sedimentary and volcanic sequence has occurred along two parallel fault zones which trend northwestward across the property.

The sedimentary rocks, consisting of siltstone and lesser amounts of argillite, greywacke, arkose, and pebble conglomerate, make up a northerly striking, easterly dipping sequence. Some contortion and cross-folding of the siltstones is in evidence along the west shore of the peninsula in the vicinity of the old workings. Here the siltstones are buff coloured, fine grained, and well stratified, consisting of 1- to 2-foot beds separated by 2-inch shaly partings. Interbedded with the siltstones in this locality are small amounts of siliceous and andesitic fragmental rocks and some dark-banded argillites. At the old adits the siltstones are much sheared and fracturned and contain stringers and disseminations of pyrite which impart a brown iron stain to the rocks. Adjacent to the feldspar porphyry stock, the siltstones are intensely fractured and contain numerous quartz veinlets. The rocks are characterized by a granoblastic texture and consist essentially of interlocking quartz grains and some interstitial carbonate and sericite. In some areas along the stock contact, the siltstones have been silicified and porphyritized, with 1-millimetre chalky feldspar phenocrysts contained in a matrix of carbonate, quartz, and clay minerals. North and west of the feldspar porphyry stock the sedimentary sequence is made up of interbedded greywacke, arkose, pebble conglomerate, and some black to green siltstone and argillite.

* By N. C. Carter.

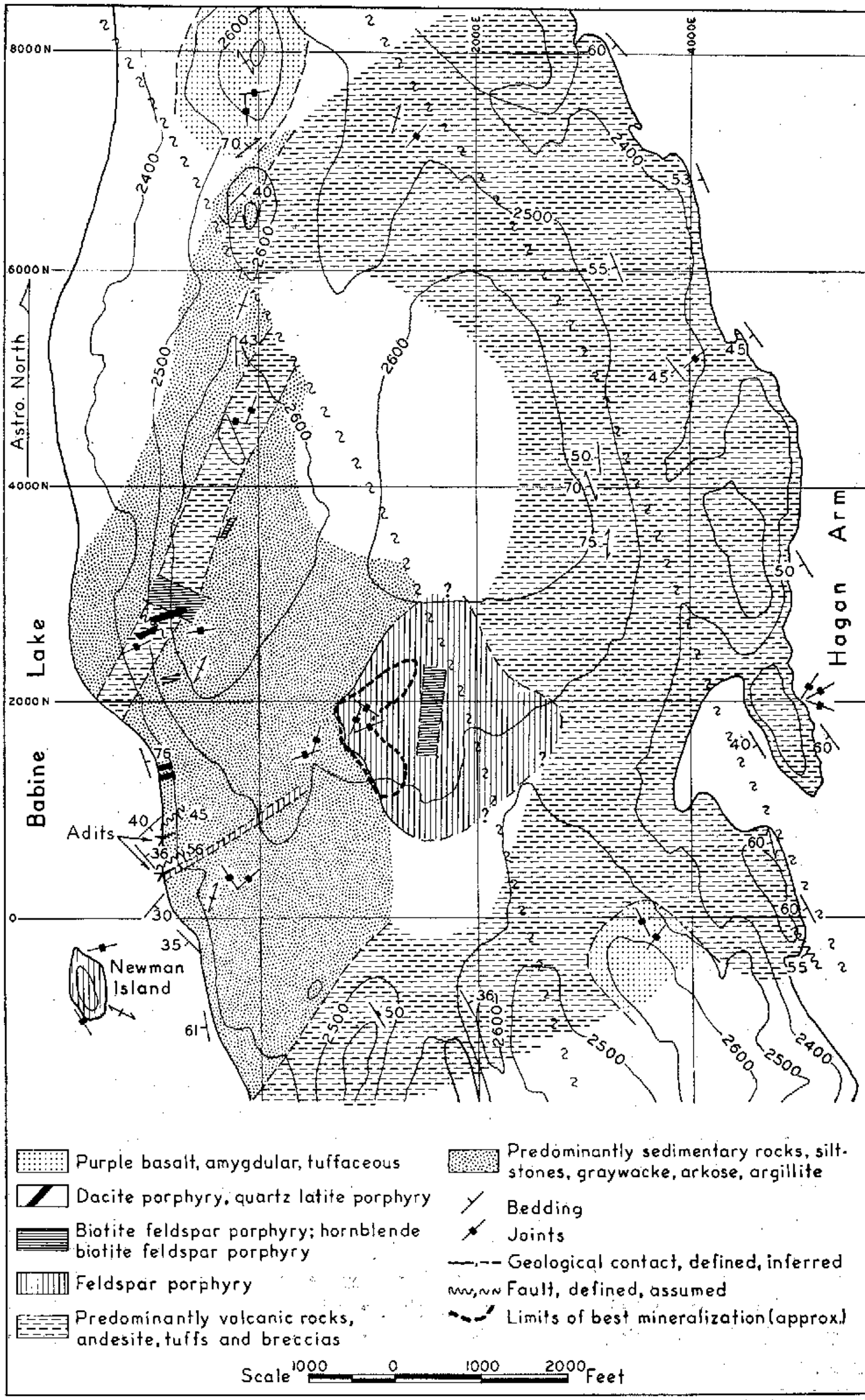


Figure 16. Geology of the Newman property.

Fragmental volcanic rocks, mainly andesite tuffs and breccias, underlie the eastern half of Newman Peninsula and are locally interbedded with the sedimentary sequence in the west part of the property. Along the east shore of the peninsula the rocks are a uniform light-green colour and are well stratified, with uniform northwesterly strikes and moderate westerly dips. Fragments range in size from ⅛- to ¼-inch sub-rounded andesite and chert fragments to sharply angular 1-foot blocks of dark amygdaloidal volcanic rocks. Some schistose basalt and dacite tuffs and breccias were also noted in the eastern part of the peninsula. Adjacent to the feldspar porphyry intrusive, the fragmental andesites are brecciated and silicified.

The stock-like intrusive body, composed of feldspar porphyry and biotite-feldspar porphyry, measures roughly 2,600 feet in diameter. The vertical to steeply dipping western contact between the stock and the siltstones is fairly well defined, but contact relationships in the eastern half are imperfectly known due to lack of exposures. Several dykes of feldspar porphyry and biotite-feldspar porphyry appear to be radiating outward from the western edge of the stock, the most prominent of which is the southwesterly trending dyke which intrudes the siltstones near the old adits and is sheet-like on Newman Island.

The feldspar porphyry that makes up most of the stock is a porous white rock composed of numerous 1- to 2-millimetre chalky white feldspar phenocrysts set in a quartz-rich matrix. Along the western contact, sericite, clay mineral, and carbonate alteration of feldspar is extreme, in some cases obliterating the original texture. The rock is cut by numerous randomly oriented quartz and carbonate veinlets. Original biotite has been leached out, leaving golden-brown stained areas in the matrix. Metallic minerals, including pyrite and chalcopyrite, are finely disseminated throughout the rock matrix and the quartz veinlets. Quartz veining and silicification of the feldspar porphyry is most extensive throughout the northern part of the western contact of the stock, where irregular areas of light-purple and grey quartz contain ragged inclusions of the feldspar porphyry. The degree of quartz veining and silicification has not been as extreme in the southern part of the western contact area, where larger 2-millimetre phenocrysts of kaolin and carbonate, pseudomorphic after plagioclase, are contained in a quartz-altered feldspar matrix. Irregular siltstone inclusions, having both sharp and gradational contacts, are common within the feldspar porphyry along the western contact.

Medium-grey biotite-feldspar porphyry, containing fairly fresh 2-millimetre phenocrysts of oligoclase-andesine and brown biotite with some hornblende, was intersected in several drill-holes in the central part of the stock, where it appears to be in the form of a northerly trending dyke. Extensive zones of biotite-feldspar porphyry were also intersected at depth in a number of drill-holes in the western part of the stock, where contacts with the feldspar porphyries were found to be both sharp and gradational. Quartz veinlets are not as numerous in the biotite-feldspar porphyries, and they may represent a relatively unaltered phase of the intrusion.

Other intrusive rocks on the property include an elongate body of quartz-latite porphyry near the head of Hagan Arm and several dykes and sills of a light grey-green dacite porphyry intruding the sedimentary rocks on the west side of Newman Peninsula. The quartz-latite porphyry is pink to light brown on both fresh and weathered surfaces, and the very fine-grained quartz and feldspar matrix contains fresh euhedral potash feldspar and plagioclase phenocrysts up to 4 millimetres in size. The dacite porphyries occur as sills and northeasterly trending dykes and range in width from 15 feet near the old adits to more than 100 feet on the northwest shore of Newman Peninsula. They are light green on fresh surfaces and contain numerous plagioclase phenocrysts. Both the dacite and quartz-latite porphyries contain finely disseminated pyrite. A feldspar-quartz porphyry of somewhat similar composition was noted cutting the feldspar porphyry near the western stock contact, suggesting that these rocks may post-date the main intrusive.

Areas of apparently younger purple, amygdaloidal and tuffaceous basalts, situated between two parallel fault zones, are found to the southeast and northwest of the feldspar porphyry stock. Hematite stain is widespread and amygdules of calcite are common in these rocks. In contrast to other rocks in the area, the basalts contain no disseminated pyrite.

The crescent-shaped zone of copper mineralization, measuring approximately 1,600 by 500 feet, is situated along the west contact between the feldspar porphyry stock and the siltstones. The zone of better-grade copper mineralization is in the form of a 200- to 300-foot thick flat-lying blanket-type deposit which is connected to a central pipe-like zone in its central part. The pipe-like zone of copper mineralization, measuring 500 feet in diameter near surface, pinches and swells to depths exceeding 1,000 feet.

Primary mineralization, consisting of pyrite, chalcopyrite, and some bornite, occurs as fine disseminations in the rock matrix, and in irregular quartz lenses and a stockwork of ⅛- to ¼-inch quartz veinlets which cut the feldspar porphyries and the siltstones. Quartz veinlets and hair-line fractures containing specularite and magnetite are also common. Disseminations of molybdenite occur locally in the feldspar porphyry in the northern part of the zone. A zone of secondary enrichment, in the form of chalcocite coating chalcopyrite, is present over the entire mineralized body, extending to a depth of 500 feet over the central pipe-like zone. Elsewhere the depth of enrichment corresponds to the limits of the better-grade mineralization in the northeast and southeast extensions of the zone of mineralization.

Surface exposure of the zone of copper mineralization is limited to a few surface trenches in which malachite and red hematite staining is widespread. Prominent quartz veinlets trend northeast and northwest, reflecting the regional fracture pattern.

Relationships in the drill cores suggest several ages of fracturing and quartz veining, including at least two stages of primary copper mineralization. Hair-line fractures and ¼-inch quartz veinlets containing specularite and magnetite represent the initial stage of mineralization, and these are cut by nearly flat-lying light-grey quartz-pyrite veinlets containing some chalcopyrite. Offsetting these are chalcopyrite-bearing hair-line fractures and veinlets of purple quartz oriented at angles of 40 degrees with respect to core surfaces in vertical drill-holes. Associated with this stage is pervasive purple quartz silicification. Milky-white quartz veins, several inches wide, and 2-foot lenses of pink calcite cut all other veinlets. Secondary enrichment, consisting of sooty chalcocite coating chalcopyrite, represents the final stage of copper mineralization.

Controls for the zone of copper mineralization are incompletely known. The crescent-shaped form of the zone accentuates the regional pattern of northeast and northwest fractures, and the stock contact acted as a locus for intense fracturing and brecciation of the siltstones and feldspar porphyry. In general, areas of better-grade primary copper mineralization are situated in the central part and northeast extension of the zone, where silicification is more extensive and the quartz veinlets are more numerous than in the southern part of the zone.

Pyrite, with some chalcopyrite and sphalerite, occurs in narrow northeasterly trending shear zones in the adits on the lakeshore. Disseminated pyrite is present in all rocks, with the exception of the purple basalts, for a distance of between 2,000 and 3,000 feet outward from the zone of copper mineralization. (*See* Annual Reports, 1913, p. 114; 1927, p. 150; 1964, p. 52.)

MAG, STHUF (The Granby Mining Company Limited)*

(54° 126° N.E.) Company office, 1111 West Georgia Street, Vancouver 5. L. T. Postle, president. These two groups, comprising 60 mineral claims held by record, are situated north of Hawthorn Bay on the east side of Babine Lake. Much of the bedrock on the claims is obscured by glacial deposits of gravel and sandy clay. Andesite tuffs and breccias on a small peninsula north of Hawthorn Bay have been intruded by the northeast extension of the biotite-feldspar porphyry dyke occurring on the Granisle Copper Limited property immediately to the south. Interbedded argillites and greywackes, which strike north and dip to the west at moderate angles, are exposed in a creek 2½ miles north of Hawthorn Bay. In one locality, 1-foot-wide calcite veins containing disseminated galena and sphalerite with some pyrite and chalcopyrite follow a westerly trending shear zone. Disseminated pyrite, accompanied by iron staining, occurs in the argillites and greywackes adjacent to the shear zone.

During 1965 a crew of four men under the supervision of K. C. Fahrni was engaged in prospecting and some geophysical surveying.

PENN*

(54° 126° N.E.) This group of claims, situated in the central part of Newman Peninsula, is owned by R. W. Falkins, of 409 Granville Street, Vancouver 2. Rock types on the claim group include andesite tuffs and breccias which have been intruded by sills of hornblende-biotite-feldspar porphyry. Younger greywackes overlie the volcanic and intrusive rocks locally. Work on the claims during 1965 consisted of an airborne geophysical survey and some pitting and trenching.

Ketza, Jen, Rum (Meridian Exploration)*

(54° 126° N.E.) Company office, 808, 837 West Hastings Street, Vancouver 1. These three claim groups are situated on and near Newman Peninsula. The Ketza and Jen groups, covering an area of the southern part of Newman Peninsula, are underlain by fragmental andesites and rhyolites which are capped by nearly flat-lying sills of hornblende-biotite-feldspar porphyry. Greywacke and angular conglomerate, containing fragments of hornblende-biotite-feldspar porphyry and some carbonaceous material and fossil plant remains, overlie the porphyry sills locally. The Rum group of claims, situated on the northernmost island in Hagan Arm, is underlain by andesite tuffs and breccias which have been intruded by a small area of felsite porphyry on the northernmost tip of the island.

Soil-sampling and electromagnetic and magnetometer surveys were carried out on part of the Ketza group during 1965, and a reconnaissance electromagnetic survey was made of the Jen group.

Copper-Molybdenum

OFF, RAID, DDT (Falconbridge Nickel Mines Limited)*

(55° 126° S.E.) Vancouver office, 504, 1112 West Pender Street. S. N. Charteris, manager. These three groups, consisting of 80 recorded claims, are situated on the east flank of Old Fort Mountain and extend from Babine Lake and the Old Fort Indian Reservation on the south to an elevation of 4,000 feet near the northwest boundary of the claims. Access from Smithers, 60 miles to the southwest, is by truck and boat.

Between 2,900 and 3,400 feet elevations, northerly trending ridges are underlain by a small stock of dioritic composition, roughly 3,000 feet in diameter. Argillaceous rocks adjacent to the stock have been contact metamorphosed to brown

* By N. C. Carter.

biotite-quartz hornfels. The intrusive rocks consist largely of fine- to medium-grained diorites and monzonites and their porphyritic varieties. Small areas of biotite-feldspar porphyry and diorite breccias, similar to the rock types found in the Granisle pit area, occur near the eastern margin of the intrusive. Two thousand feet east of the stock is a small sill-like body of grey feldspar porphyry.

Mineralization occurs as fine-grained disseminations of chalcopyrite, molybdenite, pyrrhotite, and pyrite in hair-line fractures in the diorites and monzonites and as ⅛- to ¼-inch blebs of chalcopyrite in malachite-stained diorite breccias. Disseminated magnetite is widespread throughout the intrusive body, and finely disseminated pyrite is common in the hornfelsed rocks.

Exploration work was carried out between the months of July and November and included line-cutting, geochemical and geophysical surveys, and geological mapping. Some trenching and stripping was done with the aid of a D-7 bulldozer. Ten men were employed under the supervision of E. D. Dodson.

Copper

Morrison (Noranda Exploration Company, Limited)*

(55° 126° S.E.) Company office, 1050 Davie Street, Vancouver 5. B. O. Brynelsen, president. This group of 12 recorded claims is situated at the southeast end of Morrison Lake. A 5-mile jeep-road connects the property with the northeast arm of Babine Lake. Since 1962, exploration work on the property has included geophysical and geochemical surveys, bulldozer trenching, and geological mapping. Seven holes were drilled in 1963 totalling 2,406 feet. Some 270 feet of packsack drilling was done in 1965.

Bedrock is well exposed in a number of east-west trenches on two northerly trending ridges separated by a small creek valley. The ridges, roughly 300 feet above lake-level, are underlain by calcareous and locally silicified grey siltstones which have been intruded by numerous dykes of hornblende-biotite-feldspar porphyry and feldspar porphyry. The dykes range in width from 10 to 200 feet and may represent either a dyke swarm or the peripheral zone of an intrusive mass that is not exposed. The hornblende-biotite-feldspar porphyries, of quartz diorite composition, are fairly fresh and have gradational contacts with grey feldspar porphyries which are characterized by a high degree of argillic alteration. South of the trench areas, steeply dipping interbedded shales and greywackes are overlain unconformably by a well-sorted conglomerate. Small sills of dacite porphyry, containing disseminated pyrite, intrude the conglomerate.

Pyrite is finely disseminated in all rocks in the trench areas. Chalcopyrite, with some bornite and varying amounts of magnetite, occurs most commonly as fine disseminations in siliceous zones in the hornblende-biotite-feldspar porphyries. Lesser amounts of chalcopyrite were noted in quartz carbonate veinlets in the feldspar porphyries and siltstones. A small dyke of aplite and quartz breccia, noted in one of the trenches, contains very finely disseminated molybdenite.

Haut, BI (Noranda Exploration Company, Limited)†

(55° 126° S.E.) Vancouver office, 1050 Davie Street. The Haut and BI groups of 27 mineral claims, owned by the company, are 5 miles south of Nakinilerak Lake and are accessible by 15 miles of tractor-road from Babine Lake. The deposit is of porphyry copper type. Two men worked for two months on geophysical and geochemical surveys under R. Woolverton, exploration supervisor. A tractor-road was built to the claims from Nakinilerak Lake. The property was not visited.

* By N. C. Carter.
† By W. G. Clarke.

TAKLA LAKE

Antimony-Silver-Lead-Zinc

Lustdust (Takla Silver Mines, Limited)*

(55° 125° N.W.) This property of 29 recorded claims is on the mountain 1 mile west of Takla Mercury mine, north of the junction of Kwanika and West Kwanika Creeks. Takla Silver Mines, Limited (L. Belliveau, president), was incorporated in 1964 to explore and develop the Lustdust property (originally the Kay group). The showings range from the adit level at 4,300 feet elevation to above 4,500 feet. A new adit was driven starting in November, 1964, by-passing the old one and advancing nearly 700 feet by April, 1965, with an additional 150 feet of crosscutting. During the summer some bulldozer stripping and about 840 feet of diamond drilling was carried out (after the writer's visit).

The area of the showings is underlain by tightly folded rocks of the Cache Creek Group that were originally massive limestone, interbedded grey chert and argillite, and minor basic vesicular pyroclastic rocks. These have been variably schisted, so there is a fairly complete range from the massive rocks to calcareous schist, quartz mica schist, and calcareous chlorite schist. They are cut by dykes of at least two varieties of undeformed feldspar porphyry and by biscuit-coloured aplite. The folds trend about north 30 degrees west and schistosity planes generally dip steeply westward. The area is cut by a number of faults trending roughly parallel to the folds and dipping generally steeply eastward.

The property has several distinct showings. The main attention in 1965 was given to the No. 1 zone, an antimony-rich vein-like replacement zone along a shear. On the surface the ore is exposed in numerous pits extending along strike for over 1,000 feet and up to 220 feet above the adit level. In the central pits the ore is up to 9 feet wide between limestone walls, and is a gossan of limonite and orpiment with remaining sphalerite and stibnite. The portal and first 250 feet of the adit are in schist, but the remainder is in limestone with two main porphyry dykes. The vein zone is encountered in the adit near the face and in a crosscut. The zone is a narrow stringer in a stub drift, but in the crosscut about 50 feet south it is composed of two veins up to 3 feet wide with minor replacement in the 10 feet or so between them. The ore is composed of fresh stibnite, boulangerite, sphalerite, and pyrite with some ruby silver; traces of realgar occur in a faulted portion.

No. 3 zone was explored further by bulldozer stripping. This zone is on the same general trend as the No. 1 but farther north. It is deeply weathered on the surface to a gossan of limonite with sphalerite. The body is up to 20 feet wide and some 600 feet long, replacing limestone with schistose pyroclastic rocks along the east side.

[References: Armstrong, J. E., 1949, *Geol. Surv., Canada,* Fort St. James, Memoir 252; *Minister of Mines, B.C.,* Ann. Repts., 1953, p. 94; 1954, p. 96; 1960, pp. 14–15.]

Copper-Molybdenum

Boom and Frankie Groups (Hogan Mines Ltd.)*

(55° 125° S.E. and N.E.) The Boom and Frankie groups of six and four recorded claims respectively are in the centre of a large group of located claims held by Hogan Mines Ltd. Company office, 301, 550 Burrard Street, Vancouver 1, incorporated July 19, 1965. S. W. Wright, president. The claim group extends along the Pinchi fault and Kwanika Creek from north of the junction with West Kwanika Creek to opposite the south end of Tsayta Lake. Much

* By A. Sutherland Brown.

of the area has been held before during interest in mercury, but it was first located for copper by A. Almond. Exploration during the summer of 1965 was concentrated on the Boom Group and immediately adjacent claims, with showings extending along the creek from 3,000 feet south of the junction of West Kwanika Creek to 9,000 feet south. Rock is only exposed along the creek, and much of the exploration involved bulldozer stripping near the banks. In addition, 15 miles of line was cut in preparation for geophysical surveying. Two X-ray diamond-drill holes totalling 140 feet were drilled.

The showings are between two main strands of the Pinchi fault that are about 1½ miles apart. Just south of the Boom claims, limestone and chert strike northwest across the creek. To the north of this band of presumed Cache Creek rocks, all exposures as far as West Kwanika Creek are granitic rocks of the Hogem batholith. The rocks are chiefly medium- to fine-grained biotite hornblende granodiorites, although some appear hybrid or contaminated. In general the rocks are highly fractured and in some localities show a reticulate shattering. Much of the fracturing strikes east-west, but exposed small faults chiefly strike about north 15 degrees east. Most rocks are variably altered with pink potash feldspar and books of fresh-looking biotite, and less commonly are silicified. Most rocks are also mineralized with disseminated pyrite and less chalcopyrite, malachite, and molybdenite. A chip sample in one of the better-looking trenches assayed copper 0.44 per cent across 50 feet.

Mercury

Snell* (55° 125° N.E.) This old property on Silver Creek is held as the Amy group of 28 recorded mineral claims. It extends from Kenny Creek to Vital Creek, south of Old Hogem. In 1965 it was under investigation by three companies—Bralorne Pioneer Mines Limited, Canadian Exploration Limited, and Noranda Exploration Company, Limited. Work was directed by Noranda, 1050 Davie Street, Vancouver 5. Geological and geochemical surveys were made and some trenching was done. Two men worked for one month under the direction of A. Burton, geologist. The property was not visited.

Merc* (55° 125° N.E.) This recently located group of 22 mineral claims extends along Silver Creek north of the Snell property. It was under investigation by the same interests. Geological and geochemical surveys were made and 600 feet of drilling was done in three holes. A crew of seven under A. Burton worked for two months. The property was not visited.

MANSON CREEK

Molybdenite

Blackjack† (55° 124° N.E.) Forty-six claims, which include the Blackjack group, are owned by William Rigler and associates and lie at the headwaters of Manson River about 8 miles south of Manson Creek. They were visited in September by helicopter but can be reached by a trail along Manson River for 12 miles. The showings visited are four in number and lie at elevations below 4,000 feet in country which is mostly drift-covered. Three of the showings are spaced more or less along a west-southwesterly line, and the fourth is a short distance south of the central one of the three.

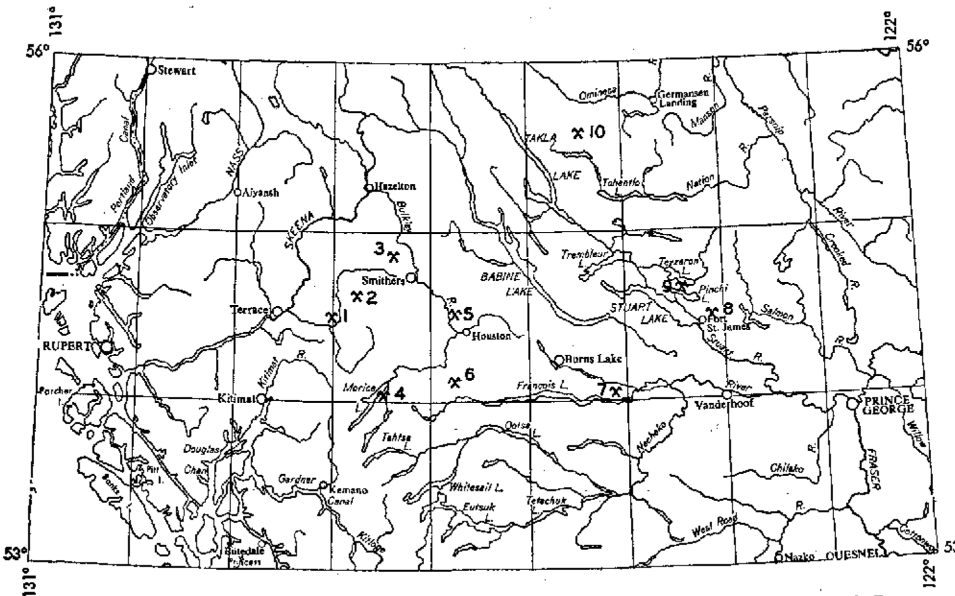
* By W. G. Clarke.
† By J. M. Carr.

The eastern showing is on the Blackjack claims a few hundred feet to the north of hay meadows at the divide between Manson River and Boulder Creek. At the showing a grey, rather fine-grained granodiorite with black and white micas occurs on either side of an easterly depression and is a fairly fresh rock. South of the depression a white quartz vein is intermittently exposed in trenches and outcrops for a distance of about 100 feet and has a width in places exceeding 1 foot. It strikes north 80 degrees east and dips southward, partly at a low angle and partly at 50 degrees. The vein is finely banded in places, as if by shearing and the introduction of new quartz; its walls are unsheared. It is crossed by numerous steep, parallel fractures which trend north 30 degrees east and contain small amounts of molybdenite. About 20 feet farther south is a second quartz vein that is exposed for several feet and is between 4 and 6 inches wide. It strikes parallel to the first vein and dips southward at 65 degrees but is jogged in several places. The jogs are Z-shaped and are deflections of the vein on steep planes directed north 30 degrees east, parallel to cross-fractures which occur in the vein and are weakly mineralized. Granodiorite between the veins is traversed by quartz veinlets one-quarter of an inch wide which partly follow the direction of cross-fracturing and locally contain molybdenite in very small quantity. Seventy feet to the southeast a boulder of rusty quartz is partly exposed and contains pyrite and molybdenite. North of the depression and uphill, at a distance of about 440 feet to the north-northwest of the described veins, two pits about 100 feet apart in an easterly direction expose bouldery material that is probably in place and includes rusty vein quartz. The quartz evidently has been derived partly from a vein as much as 2 feet wide; it contains abundant pyrite and conspicuous molybdenite as scattered rosettes and fine aggregates either on or near fractures. Lying near the showing and mixed in with rounded glacial pebbles and boulders are angular pieces of granodiorite, some of which contain quartz veins and minor amounts of molybdenite. These loose pieces are from an undetermined local source.

The central showing was discovered by Mr. Rigler and is in the steep eastern bank of Manson River at a distance of less than 1 mile to the west-southwest of the eastern showing. A mixed biotite and hornblende hornfels contains disseminated pyrite and is schistose on vertical planes striking north 60 degrees west. It is cut by two or more widely spaced, narrow shear zones which also follow this direction. Three parallel quartz veins, each a few inches wide, are spaced several feet apart and possess low dips; they contain molybdenite on fractures where they pass through the shear zones but apparently nowhere else.

The showing to the south of the central one is 1,000 feet farther upstream. It exposes hornfels which has a similar steep northwesterly foliation and is cut by two vertical cross-faults which strike northeastward and are 15 feet apart. The southern fault contains a 6-inch vein of quartz and calcite which is brecciated and contains molybdenite smears and coatings on fractures and coarse pyrite aggregates. Other pyrite disseminations which are developed in hornfels near the faults are not accompanied by visible molybdenite.

The western showing is more than 1 mile distant from the central one and is on the west bank of a tributary of Manson River. About 30 feet above the creek an old trench exposes foliated biotite-granodiorite which contains sheets or lenses of a dark hornblendic hornfels. This rock is foliated in the common direction, north 60 degrees west. The sheets are each several feet wide, and they lie in the foliation which has the usual strike of north 60 degrees west and a dip of 60 degrees to the north. Molybdenite fills some of the joints and is locally disseminated for a distance of one-half inch from the mineralized joints. One well-mineralized joint was seen which possessed a northeasterly strike and a southeasterly dip of 45 degrees. Molybdenite disseminations were also observed locally near joints for a distance of 80 feet to the north of the trench, in outcrops of a sheeted assemblage of rocks which include shale, hornfels, and aplite. Comb-textured quartz veins follow the foliation of these rocks and are a few millimetres wide. They contain no molybdenite and are cut by pyrrhotite veins. The creek adjoining this showing follows a lineament directed north 25 degrees east, which may mark a fault.



NORTH CENTRAL BRITISH COLUMBIA SHOWING PROPERTIES REFERRED TO IN TEXT

1. Northwest	2. Serb Creek	3. Glacier Gulch	4. Lucky Ship	5. Huber
6. Silver Queen	7. Endako	8. Calex	9. Pinchi	10. Takla Mercury

Figure 17. Investigation of mercury dispersion halos. Index map.

NATION LAKES

Lead-Zinc-Copper-Silver-Gold

Wit, Wag (Noranda Exploration Company, Limited)*

(55° 124° S.E.) Company office, 1050 Davie Street, Vancouver 5; field office, Smithers. This group of 36 mineral claims was optioned by Noranda Exploration Company, Limited. The property is on the north shore of Chuchi Lake 6 miles west of the Nation Lakes camp. Access is by the Manson Creek road from Fort St. James to Chuchi Lake and thence by boat to the property. Geological, geophysical, and geochemical surveys were made. Some trenching and overburden stripping was done by hand. There was 650 feet of diamond drilling done in five holes. Four company and four contractor employees worked for 2½ months under the supervision of G. C. Camsell and W. Botel, geologists. The option was terminated at the end of the year. The property was not visited.

* By W. G. Clarke.

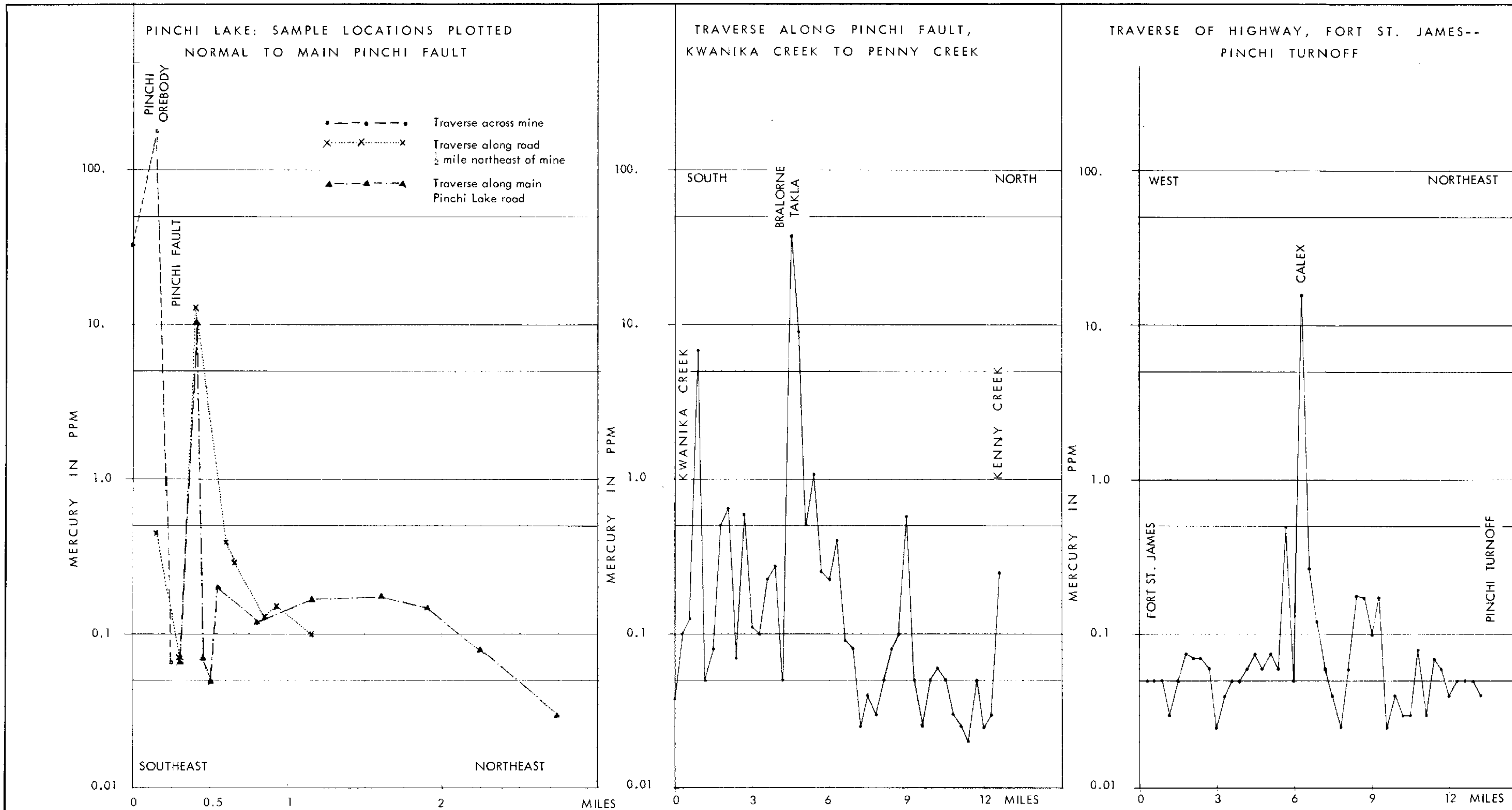


Figure 18. MERCURY PROFILES AT MERCURY DEPOSITS

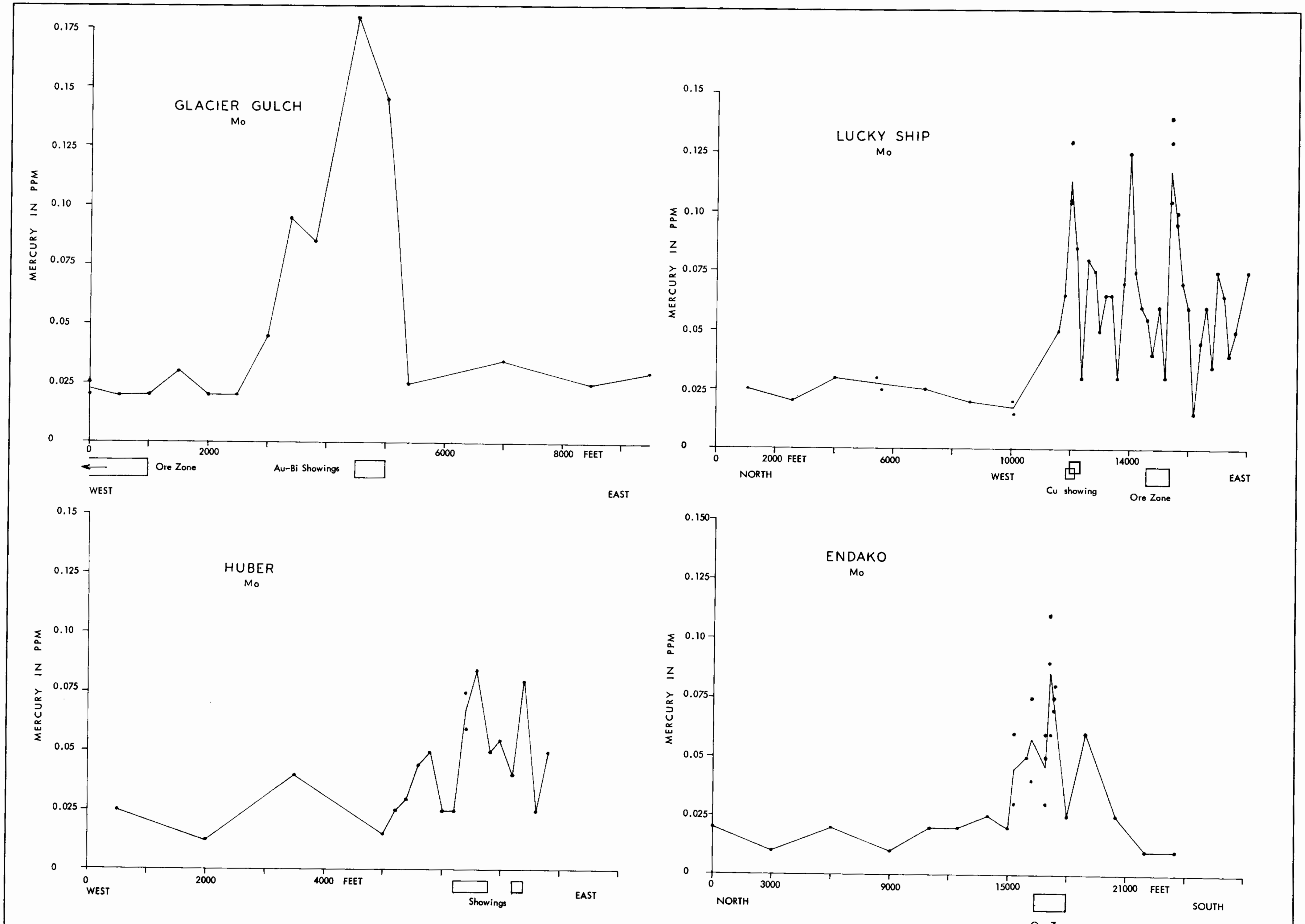


Figure 19. MERCURY PROFILES AT MOLYBDENUM DEPOSITS

PINCHI LAKE

Investigation of Mercury Dispersion Halos*

Mercury dispersion halos in soils surrounding ore deposits have been increasingly studied in the search not only for mercury deposits, but for other base- and precious-metal deposits. An extensive literature on this geochemical method already exists, a selection of which is indicated in the references. During the course of examination of a number of mineral deposits in north central British Columbia, the writer conducted some profiles over known mines and prospects. These were anlaysed by Lemaire S1 detector in the field, and selected samples were checked in the analytical and assay laboratory in Victoria. The results are in general agreement, and the values shown in the accompanying graphs are those recorded in the field.

The deposits examined were chiefly mercury or molybdenum deposits (*see* Fig. 17 showing localities). These are believed to represent extreme types at which halos might be expected, the one type being low temperature and mercury rich, the other one high temperature and mercury poor. The mercury profiles are from localities along the Pinchi fault zone from Fort St. James to Kwanika Creek (*see* Fig. 18). The background ranges from 0.02 p.p.m. to about 0.08 p.p.m., rarely to 0.2 p.p.m., and the anomalous peaks range from 1 p.p.m. to about 200 p.p.m. The preferred materials sampled were tills or outwash sands and coarse silts, or rarely residual regolith, but near Pinchi Lake glacial-lake clays and fine silts were common. The results suggest that true clays may be fairly impervious to mercury vapour, as the highest value recorded in clay samples was 0.45 p.p.m. Contamination from the surface near the Pinchi and Bralorne Takla mines was judged to be relatively slight and fairly local as samples collected at 2- and 1-foot depths showed no consistent difference.

The molybdenum profiles include the Endako, Glacier Gulch, Lucky Ship, and Huber properties (*see* Fig. 19, A to D). Except at Glacier Gulch, all samples

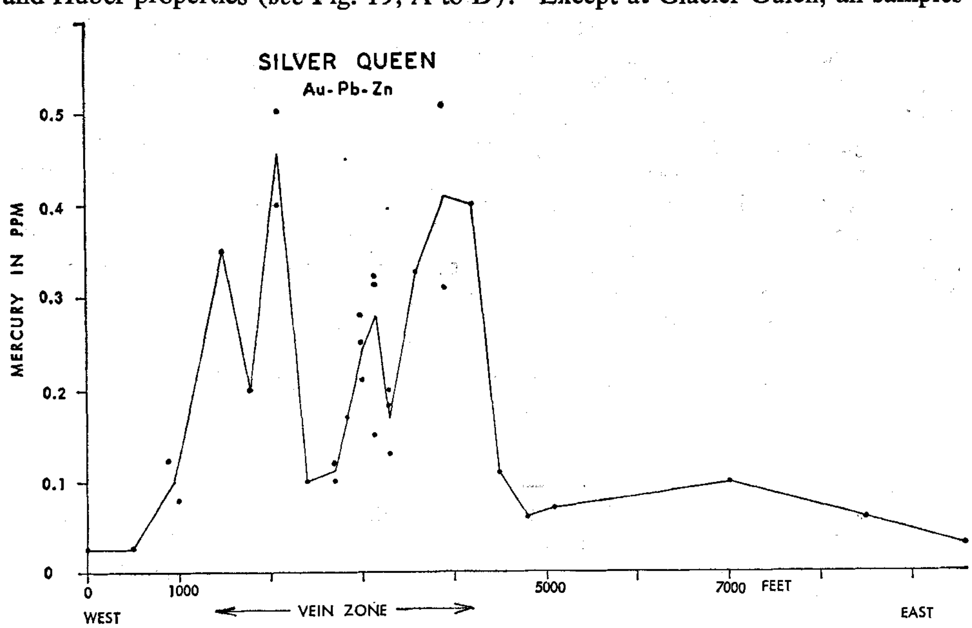


Figure 20. Mercury profile at a silver-lead-zinc property.

* By A. Sutherland Brown.

were collected from till or regolithic till. At Glacier Gulch the only material available was talus, a material that is not ideal. At Serb Creek (not shown) all materials were recent open talus or highly organic, and although some anomalus readings were recorded in non-organic samples in the ore zone, good results were insufficient to give a clear profile. Background in granitic and hornsfelsic volcanic rocks ranged from 0.01 to 0.025 p.p.m., rarely to 0.04 p.p.m., whereas peaks ranged from 0.085 to 0.175. In several molybdenum properties the mercury halo may be annular. At the Lucky Ship the profile is near the margin of the ore zone but shows two peaks symmetrical to it. At the Glacier Gulch the mercury concentration in the fine talus is low over the ore zone, but a significant peak occurs near the gold-bismuth showings which are contained in the same vein system as the molybdenum mineralization.

Silver, lead, zinc, and copper properties might be expected to range between these two extremes of mercury and molybdenum, and published examples tend to substantiate this. The only silver-lead-zinc property the writer examined was the Silver Queen at Owen Lake (*see* Fig. 20), where a vein zone was clearly outlined with background from 0.025 to possibly 0.1 p.p.m., and anomaly peaks of about 0.45 p.p.m. The only copper property examined was the Northwest group (not shown), where background ranged from 0.025 to 0.06 p.p.m. and peaks ran to 0.175. A 2-mile traverse did not extend beyond the area of scattered mineralization, so the profile is incomplete.

Conclusions

The study of mercury halos represents a most valuable addition to the techniques of prospecting. It should not be expected to be infallible. Certain areas with organic soils are unlikely to yield meaningful results with low-cost equipment; in others with clay soils the order of magnitude of anomalies may be greatly reduced. Also, the anomalies of major molybdenum deposits would scarcely be noticed in a mercury belt. Figure 21 shows the background variation and and the anomaly peaks for mercury, gold-silver, lead-zinc, copper, and molybdenum deposits listed in Figure 17 and examples from the literature in which results are shown in absolute values. In most localities, background ranges from 0.01 to 0.1 p.p.m. but in some others is much higher, although the profiles may not have extended in each case far enough from the ore zone to truly record background. However, in still others background over whole regions may be so high (for example, the Crimean Highlands—Bulkin, 1962) that molybdenum peaks would not be noticed. Finally there may be a relation between the maximum concentration or the over-all size of the anomaly for any one type of deposit and the general size and value of the deposit, but this has yet to be demonstrated. Judgment and a complete geological appraisal will be needed to assess the meaning of mercury dispersion anomalies.

List of Mineral Occurrences Shown in Figure 21

Mercury

1. Nivloc, Nev.
2. Cerro Gordo, Calif.
3. Cordero, Calif.
4. Karaotek, U.S.S.R.
5. Pinchi, B.C.
6. Bralorne Takla, B.C.
7. Calex, B.C.

Gold-Silver

8. Comstock, Nev.
9. Dixie Comstock, Nev.

Lead-Zinc

10. Bawdwin, Burma.
11. ———, Eire.
12. Gregory, Derb., U.K.
13. Silver Queen, B.C.

Copper

14. Ruenzori.
15. Baluba.
16. Northwest, B.C.

Molybdenum

17. Endako, B.C.
18. Lucky Ship, B.C.
19. Glacier Gulch, B.C.
20. Huber, B.C.
21. Serb Creek, B.C.

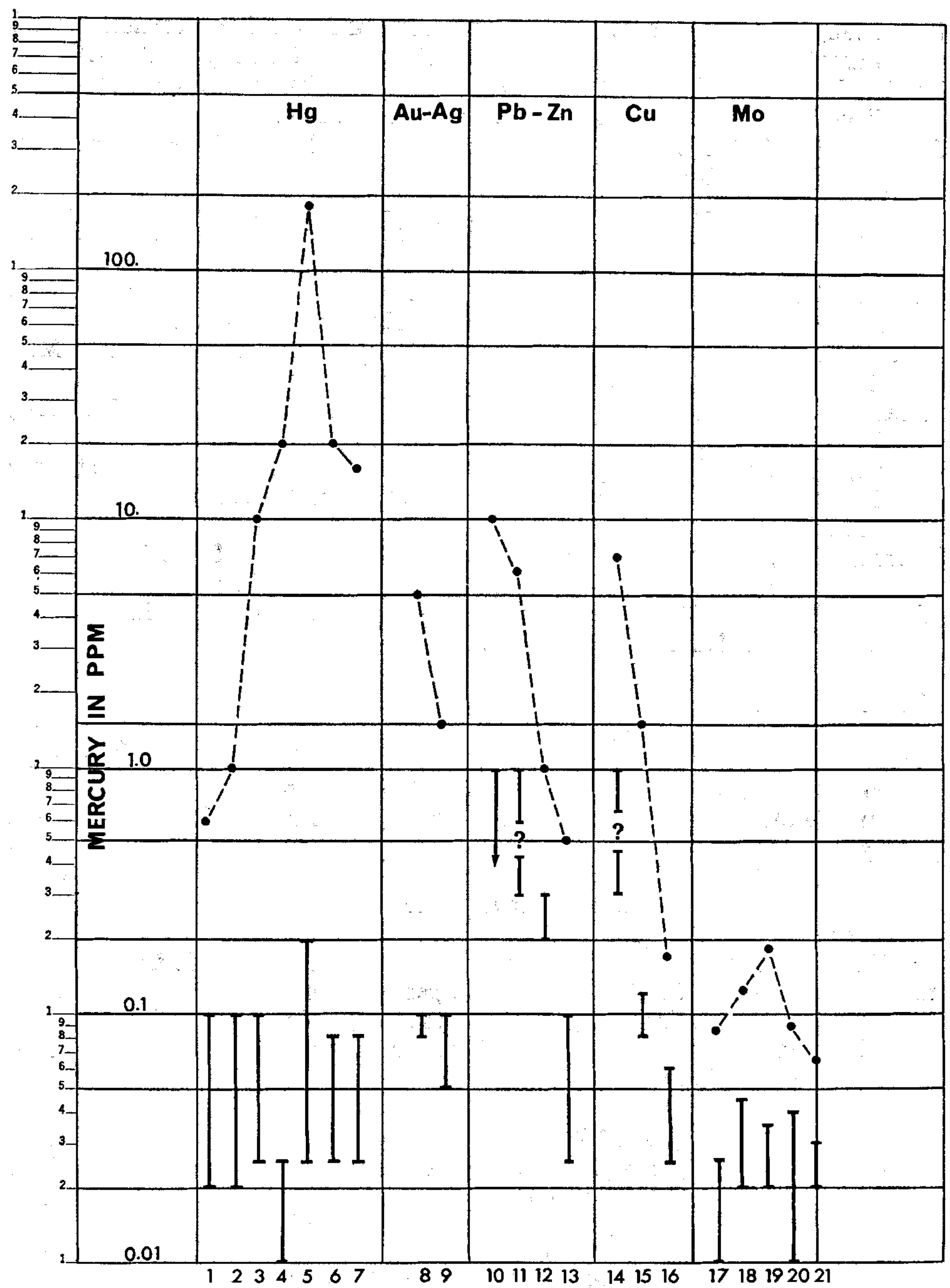


Figure 21. Mercury dispersion peaks and backgrounds.
British Columbia mineral deposits and others.

References

Bulkin, G. A. (1962): The Geochemistry of Mercury in the Crimean Highlands, English Translation, *Geochem.*, No. 12, pp. 1219–1230.

Clews, D. R., and Walker, J. L. (1964): Recent Trends in Geochemical Prospecting, *Northern Miner*, 1964 Annual Review Number, Nov. 26, pp. 18–23.

Fedorchuk, V. P. (1961): Formation of Aureoles of Direct Ore Indicators around Mercury Deposits, English Translation, *Geochem.*, No. 10, pp. 1010–1020.
Hawkes, H. E., and Williston, S. H. (1962): Mercury Vapour as a Guide to Lead-Zinc-Silver Deposits, *Min. Cong. Jour.*, Dec., pp. 30–32.
James, C. H. (1964): The Potential Role of Mercury in Modern Geochemical Prospecting, *Min. Mag.*, July, pp. 23–32.
James, C. H., and Webb, J. S. (1964): Sensitive Mercury Vapour Meter for Use in Geochemical Prospecting, *Inst. Min. & Met.*, Trans., Vol. 73, Pt. 9, pp. 633–641.
Ozerova, N. A. (1959): The Use of Primary Dispersion Halos of Mercury in the Search for Lead-Zinc Deposits, *Geochem.*, No. 7, pp. 793–802.
Saukov, A. A. (1946): Geochemistry of Mercury, *Akad. Nauk U.S.S.R.*, Min. Geochem. Series No. 17, Russian text.
Sutherland Brown, A. (1966): Some Mercury Soil Profiles in British Columbia, *Western Miner*, Feb., 1966, pp. 39–44.
Vaughn, W. W., and McCarthy, J. H. (1964): An Instrumental Technique for the Determination of Submicrogram Concentrations of Mercury in Soils, Rocks, and Gas, *Soc. Min. Eng.*, Preprint No. 64L327.
Warren, H. V.; Delavault, R. E.; and Barakso, J. (in press): Some Observations on the Geochemistry of Mercury as Applied to Prospecting.
Williston, S. H. (1964): The Mercury Halo Method of Exploration, *Eng. & Min. Jour.*, Vol. 165, No. 5, pp. 98–101.

Mercury

Pinchi Lake (The Consolidated Mining and Smelting Company of Canada, Limited)*

(54° 124° N.E.) Exploration office, 1150 Bay Avenue, Trail. This group, consisting of 169 mineral claims, is on the north shore of Pinchi Lake, 20 miles from Fort St. James and connected by a good gravel road. The property was developed during the Second World War and produced mercury from mid-1940 until July, 1944. In 1943 some 450 men were employed in the mine and plant. After the war all the equipment and buildings were removed.

The deposit consists of hydrothermal cinnabar mineralization in fractured Permian rocks along the Pinchi fault. In 1965 geochemical surveys were made under the direction of L. M. Azzaria, geologist. The collar of the old haulage adit was cleaned out and timbered. A crew of three men worked for 3½ months. (*See* Annual Reports, 1940 to 1944.)

Calex (Darbar Explorations Ltd.)†

(54° 124° S.E.) This property is 6 miles east of Fort St. James on the road to Manson Creek. It was first named the D.A. and has commonly been called the Centennial showing. During 1956, 10 diamond-drill holes were drilled by Canex Aerial Exploration Ltd. and their former subsidiary, Centennial Mines Ltd. It is now held by a private company, Darbar Explorations Ltd., Fort St. James, with 21 recorded claims in several groups. The known showings are on the Calex Nos. 1 and 2. During 1965 extensive bulldozer trenching and stripping was carried out along the highway and up to 800 feet south.

The area is underlain by basic volcanic rocks with minor shale and limestone of the Takla Group, intruded by ultramafic rock. This intrusion, judging by Federal-British Columbia aeromagnetic maps 1581-G and 1582-G, is not the same as that

* By W. G. Clarke.
† By A. Sutherland Brown.

of Murray Ridge, but a separate one lying south and west. The Calex showings are on the northern contact of this mass. The peridotites and the basic volcanic rocks are carbonatized to a varying degree to, ultimately, a rusty-weathering buff-coloured massive ferrodolomite. Less-altered rocks show remnants of their origin with even some asbestos-form veinlets in the peridotites or serpentines.

The area is highly imbricated by faults, and all rocks have been subject to intense shearing—most prior to alteration but some after. Most faults strike slightly north of east and many dip northward at shallow angles of 15 to 25 degrees. Others, including the larger ones, dip steeply northward. The most important fault parallels the highway and dips north at about 75 degrees. Some of the fault zones include much dark-grey graphitic schist, probably originally carbonaceous shale. The massive ferrodolomites have been shattered in some exposures and contain an erratic stockwork of quartz veinlets with minor cinnabar. The best showings exposed at the time of the writer's visit were along the road at the discovery locality. Here the ferrodolomite along the fault zone was not only shattered and veined, but widely replaced by cinnabar. Traces of malachite were also widespread. A mercury anomaly related to these showings was detected in soil-sampling along the Pinchi Road (*see* Fig. 18). (*See* Annual Report, 1956, pp. 29–30.)

Sunshine*

(54° 124° N.E.) The property is 6 miles east of Fort St. James, just north of the Calex group on the Manson Creek road. It is held by Eugene and Frank Larsson and J. H. Henry by recorded claims and may be reached by a road that turns off the highway at the Calex (Centennial) showing. During 1965 about 700 feet of bulldozer trenching was done to expose bedrock. Four large east-west trenches are situated about three-quarters of a mile north of the highway. These expose geology which in most respects is similar to that of the Calex group: ferrodolomitized peridotite and serpentine with some green and grey schist. However, the main faults strike north 60 degrees west and dip about 90 degrees, and show some shallowly north-plunging striae. The rocks are shattered and are finely veined with a stockwork of quartz with some cinnabar. Some slivers of relatively unaltered chert pebble conglomerate occur adjacent to the faults. The exposed mercury mineralization occurs along the quartz stockwork and veins but may, where it is most intense, extend as disseminations through the rock.

CIN (Mastodon-Highland Bell Mines Limited)†

(55° 124° N.E.) Company office, 502, 1200 West Pender Street, Vancouver 1. This property, which is owned by Mastodon-Highland Bell Mines Limited, consists of 80 mineral claims located on the north shore of Pinchi Lake. It is accessible by good road from Fort St. James, a distance of 30 miles. Topographic mapping was done on 57 of the claims by air survey. In addition, 40 miles of line was cut on a grid pattern and soil-sampling was carried out over an area of 2,850 acres. Four men were employed for 10 weeks under the supervision of W. R. Bacon, exploration manager. The property was not visited.

* By A. Sutherland Brown.
† By W. G. Clarke.

ENDAKO

Table of Contents

The Geology of the Endako Area*

1. *Introduction.*—The mapped area (Fig. 22) covers about 250 square miles and lies about 100 miles west of Prince George. It extends both northward and eastward from the east end of Francois Lake and is more or less centred at Endako, which is a divisional point of the Canadian National Railway and is on Highway No. 16. Numerous other roads, mostly logging or mine roads, give reasonably good access for four-wheel-drive vehicles to all but the extreme northern part of the area. The Endako open-pit molybdenum mine began operating in 1964 at a rated capacity of 10,000 tons per day, and this mine supports a new community at Fraser Lake townsite. A number of resorts are established on the north shore of Francois Lake.

* By J. M. Carr.

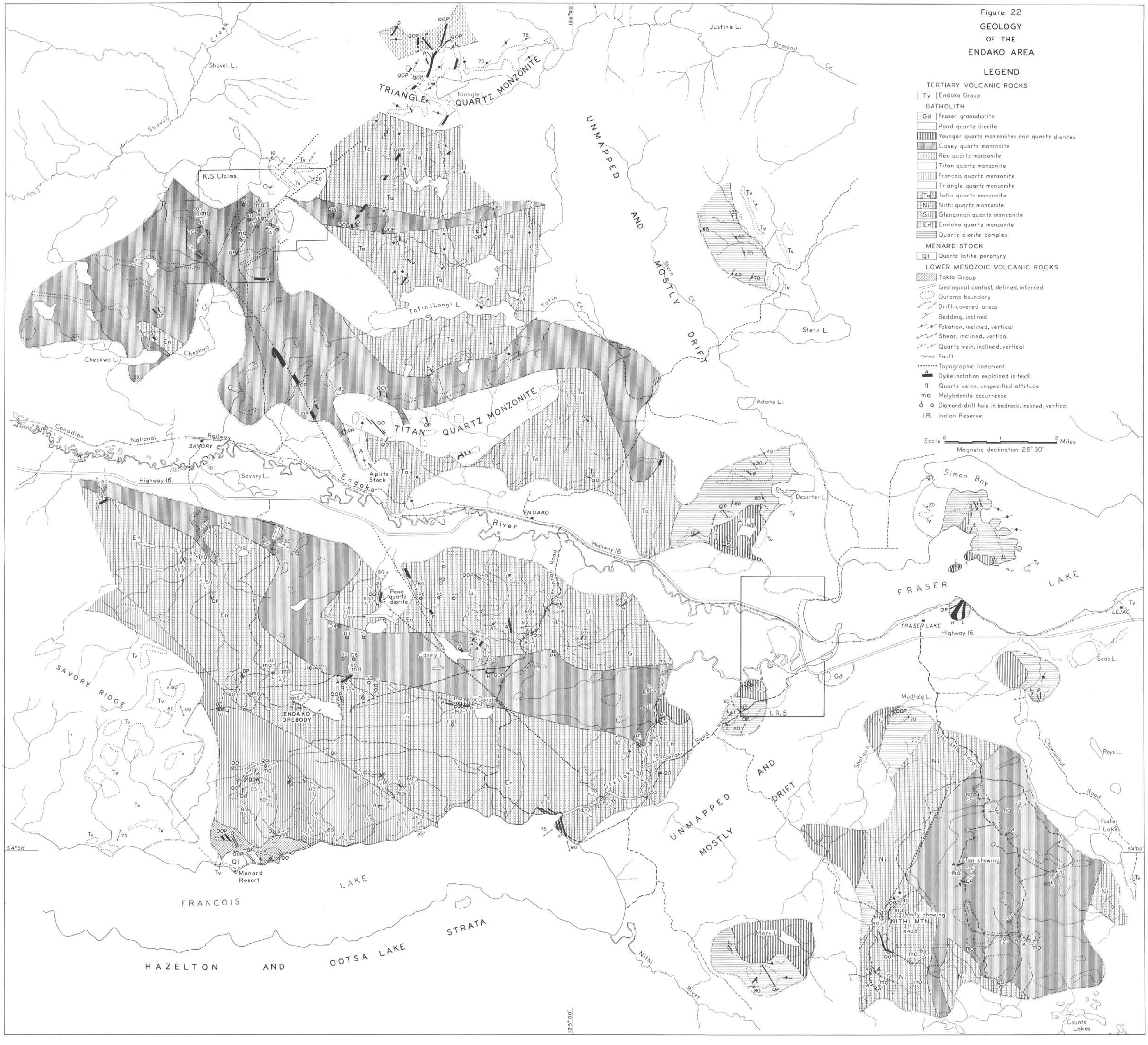


Figure 22
GEOLOGY OF THE ENDAKO AREA

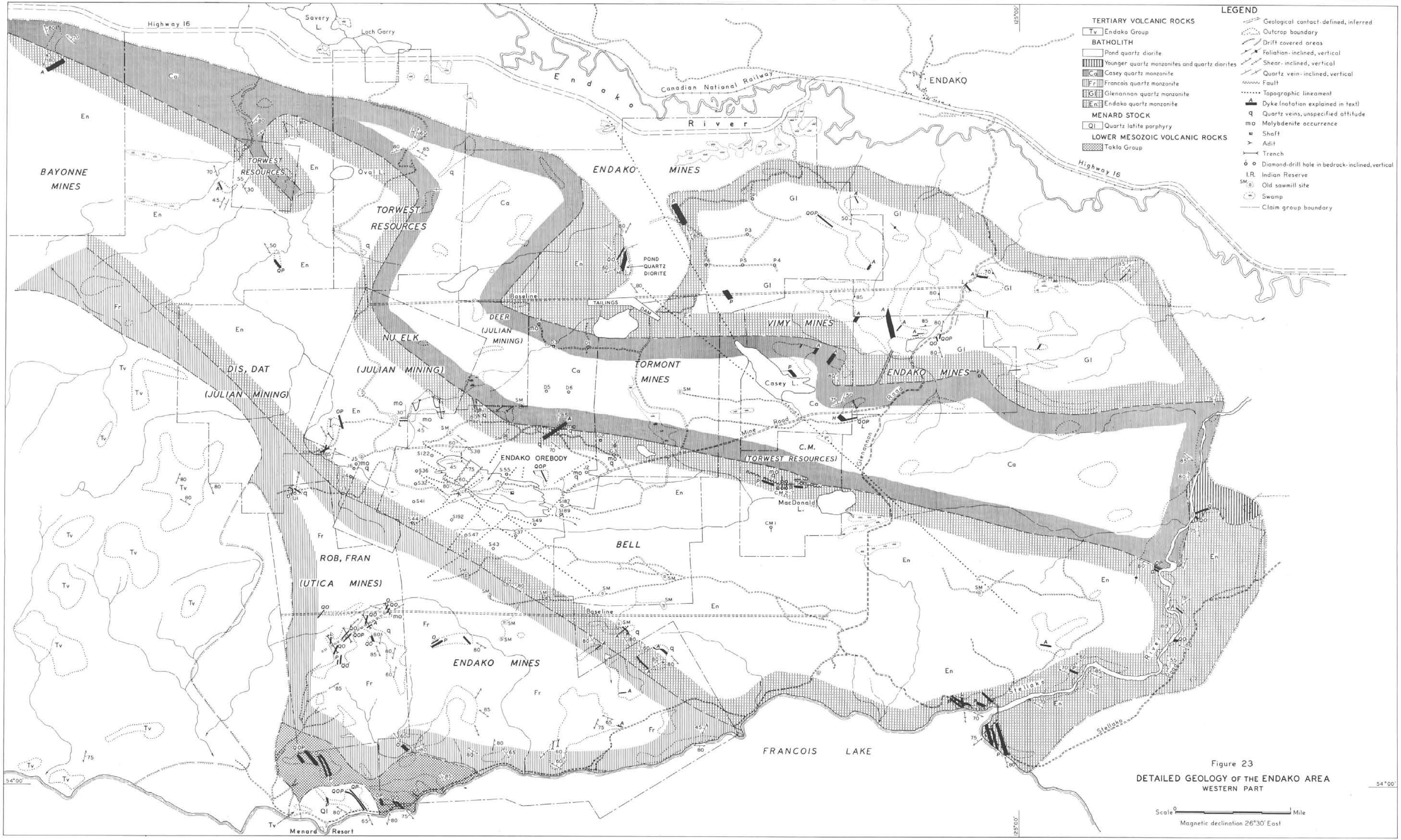


Figure 23
DETAILED GEOLOGY OF THE ENDAKO AREA
WESTERN PART

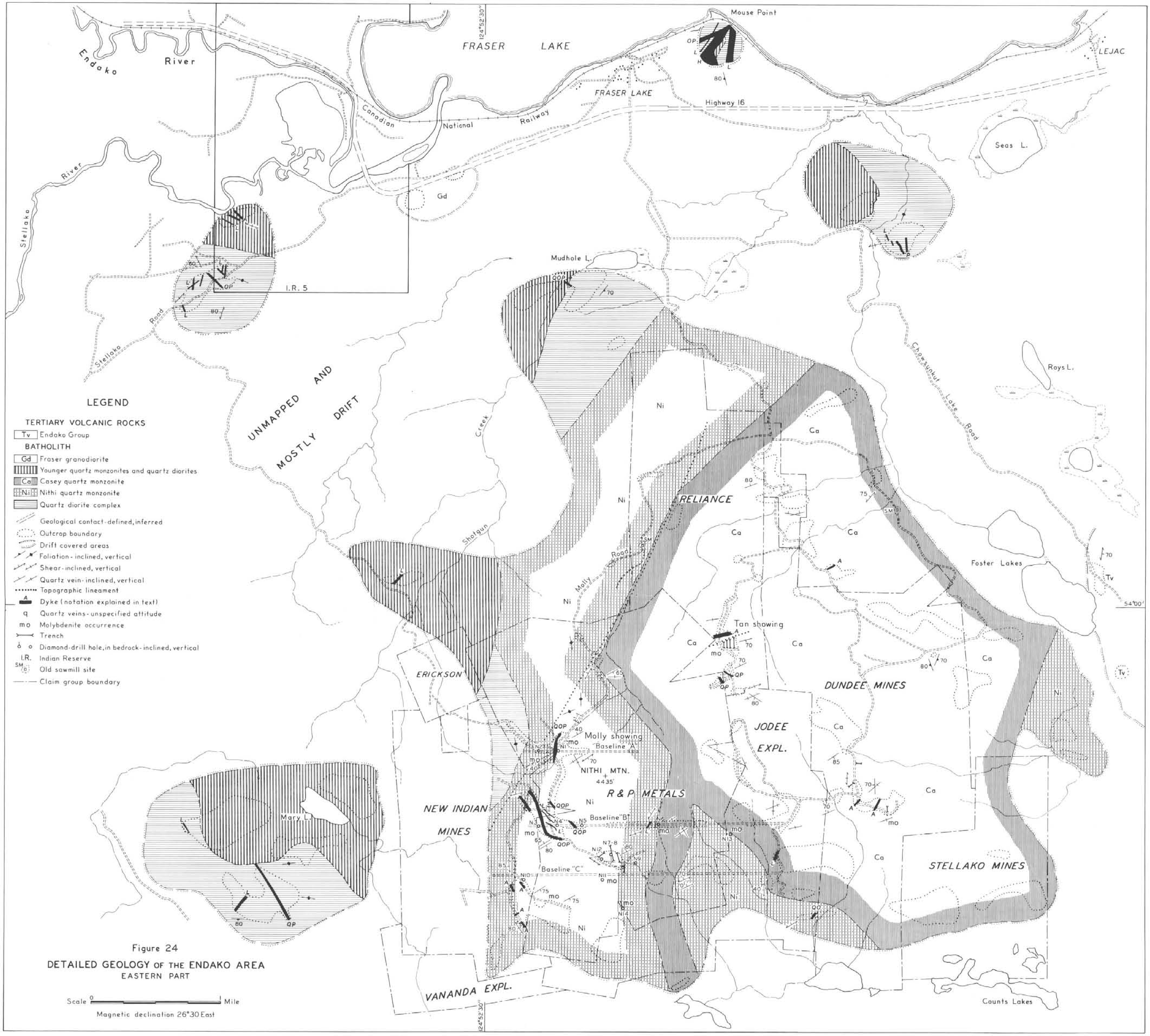


Figure 24

DETAILED GEOLOGY OF THE ENDAKO AREA

EASTERN PART

Near the Nithi River in the southeastern part of the area there are several farms. The area possesses a climate which is moderately severe in winter but pleasant at other times of the year.

Field work was done in June, 1964, and mostly from June to September, 1965, when the northern part of the area, lying north of the Endako River, was mapped mainly by T. A. Richards and the southern part, which contains the Endako mine and the mineralized area of Nithi Mountain, was mapped in greater detail mainly by E. G. Bright. The geology of the southern part (Figs. 23 and 24) is shown separately in two sheets at a scale twice as detailed as that of Figure 22. Boundaries of mining properties are shown on the maps more or less as they existed in 1964. Grateful acknowledgment is made of the co-operation of companies in providing maps and other information. Excellent field work by the graduate assistants, Messrs. Richards and Bright, contributed largely to the material of this report. Also assisting in the field work were F. M. Boas, T. Hoy, and T. A. S. Gore.

2. *Topography and Glaciation.*—The area is a dissected part of the Nechako Plateau. The least and greatest elevations are at Fraser Lake (2,197 feet) and Nithi Mountain (4,435 feet) respectively. The terrain consists of broken upland ridges and wide major valleys, and exhibits a predominant easterly grain. Although greatly accentuated by the prevailing easterly movement of Pleistocene ice, this grain appears to have originated prior to glaciation, and the topography of the area is broadly expressive of bedrock structure, notably joint and fault systems. Glacial till and fluvioglacial gravels mantle much of the area, reaching thicknesses of as much as 40 feet on the higher ground and probably excessive thicknesses in the major valleys. The proportion of bedrock exposed in the area is estimated as about 3 per cent. Residual patches of glacial-lake silts and gravels rest on bedrock at low elevations along the shore of Francois Lake, which in late glacial times was dammed by stagnant ice at the southern foot of Nithi Mountain and emptied into Fraser Lake through a rock cut canyon in its present spillway, the Stellako River.

3. *Regional Geology.*—The area is mostly underlain by part of a batholith comprising numerous members of the Topley Intrusions, and by overlying Tertiary volcanic rocks of the Endako Group. The Topley Intrusions lie in a belt extending northwestward and southeastward for distances of 80 miles on either side of the area. On published maps they are shown as emplaced into rocks of the Cache Creek and Takla Groups and as partly overlain by strata of the Hazelton and younger groups. On stratigraphic evidence they have been considered to be Lower Jurassic in age, but published radiometric dates on biotites from the intrusions, partly obtained within or close to this area, give ages of emplacement ranging from Lower Jurassic to Paleocene (Baadsgaard *et al.,* 1961; Tipper, 1963).

Only one small occurrence of rocks assigned to the Takla Group lies within the area. It apparently marks the position of the southwestern edge of the batholith, whose contacts are otherwise unknown and are largely hidden beneath covering rocks.

On Geological Survey of Canada Map No. 1131A, a major northeasterly fault system is shown on the south side of Francois Lake, striking toward the Endako mine area. The fault system is shown as affecting rocks of both the Takla and Hazelton Groups and as separating these rocks from those of the younger Ootsa Lake Group, which lie to the east. Reconnaissance mapping done in conjunction with the present work suggests that the published geology on the south side of the lake is not altogether correct. No Takla rocks could be identified, and the older rocks on the south side, which apparently comprise only Hazelton rocks, appear to strike in general northwestward with dips which may be chiefly southwesterly. Many of the mapped faults do not produce recognizable offsets within the Hazelton succession, which involves dark porphyritic andesite lavas and clastic sediments that include andesite and chert pebble conglomerates. The Hazelton rocks are overlain by rather flat-lying volcanic rocks of the Ootsa Lake Group, and these extend eastward, as shown on map No. 1131A, as far as the Nithi River, where they locally overlie the batholith just south of the present mapped area. Some of the Ootsa Lake Group volcanics are similar lithologically to light-grey andesites that occur in southern British Columbia, as part of the Kingsvale Group in the vicinity of the Craigmont mine. All the above-mentioned rocks on the south side of Francois Lake contain numerous minor intrusions, of which the acid ones are quite different in appearance to those in the batholith and are variously dacite rhyolite dykes, sill-like bodies, and agglomeratic necks. All the rocks are in places fractured and faulted and locally show chloritic and argillic alteration. Mineralization is apparently restricted to specular hematite and pyrite, which occur sparsely disseminated and on fractures.

Seven miles south of the east end of Francois Lake, to the north of Cabin Lake, diorite and quartz monzonite of the Cabin Lake stock are exposed beneath the Ootsa Lake Group volcanics. Although dissimilar to units of the batholith as known in the mapped area, the Cabin Lake stock is doubtless a part of the Topley Intrusions. Nearby Takla greenstone tuffs are poorly exposed and are much dissected by acid dykes and necks similar to those occurring in the adjacent younger volcanics. Copper-lead-zinc mineralization with silver values occurs locally on northerly shears in the Cabin Lake quartz monzonite and has recently been explored by A. Robertson and associates.

4. *Takla Group.*—Rocks assigned to this group are restricted to a single locality which adjoins the batholith on the north shore of Francois Lake. They are porphyritic dacite and quartz latite lavas, tuffs, and breccias whose attitude is not discernible. A precise contact with the batholith is not exposed. The rocks are grey-green to purple in colour, and they contain small phenocrysts of quartz and larger ones variously of biotite, white or pink plagioclase, and, in places, pink orthoclase. The matrix is aphanitic and the rocks are not converted to hornfels or otherwise noticeably affected by contact metamorphism. They are fractured and hydrothermally altered, with the production of epidote, chlorite, pyrite, specularite, and possibly tourmaline. The rocks are cut by the Menard porphyry stock and by a variety of dykes, which mostly strike northwestward.

5. *Endako Group.*—Tertiary basic volcanic rocks occupy three separate parts of the mapped area and are assigned to the Endako Group, generally considered to be Oligocene or younger. Whether all the lavas included in this group are as young as this is uncertain; a radiometric date on biotite from a rock of this group 3 miles west of the area, toward Priestly, is 48 million years and is therefore Eocene (*see* " Geological History of Western Canada," p. 193). The rocks in the southwestern part of the area, on Savory Ridge and the north shore of Francois Lake, are dark-coloured glassy andesite or basalt flows which form a crude scarp and dip-slope topography and appear to dip westward at low angles. They are reddish due to hematite resulting from weathering, and are partly porphyritic rocks with conspicuous phenocrysts of plagioclase and others of pyroxene. Where vesicular the rocks may contain agate, with or without calcite and chlorite. A flow about 25 feet thick which was examined west of the area consisted of a blockily jointed lower part, a rubbly vesicular middle part, and a highly vesicular and scoriaceous upper part. The southeastermost outcrop of the Savory Ridge rocks is near Menard's resort and is a green volcanic breccia entirely similar to that of the intrusive necks occurring widely on the south side of Francois Lake. The rocks in the northeastern part of the area are generally similar to the above-described ones but are not so commonly

porphyritic. They dip mainly northeastward at low angles. The rocks in the northern part of the area, near Owl Lake, differ from the foregoing in mainly being non-vesicular, rather fissile, light-grey biotite andesites which show a well-developed flow banding that is generally more or less horizontal but may locally be contorted and even steeply inclined. The rocks in all three parts of the area show no more than slight alteration involving partial argillization of feldspars or of groundmass. The rocks are not mineralized but are in places fractured and are veined by calcite.

6. *Topley Intrusions*

A. *The Batholith.*—This incompletely mapped body is represented by more than a dozen units in contact with one another, some occurring as individual intrusions. Because of poor exposures the nature of most contacts has to be inferred, and the units are described in the order of their known or conceived ages, which are by no means assured. Rocks of different units are distinguished by their field appearances. They range in composition from gabbro to granite and are mostly quartz monzonites, which in previous reports have been called granite. Rock naming in this report follows the present usage of the Geological Survey of Canada, whereby granite contains mainly potash feldspar (orthoclase or microcline), quartz monzonite has more or less equal amounts of both feldspars, and granodiorite and quartz diorite have mainly plagioclase feldspar. The two last-named rocks differ only in the composition of their plagioclase and cannot be separated in the field.

Certain petrographic and structural features are common to some units and are therefore mentioned here. Large phenocrysts, principally of orthoclase, are universally present in the rocks of some units and erratically present in those of others. They occur also in certain of the dykes which followed emplacement of the batholith. The phenocrysts provide a link of some kind between those rocks possessing them and are best explained as having originated in a parental magma chamber, from which the material of successive units arose. The phenocrysts deeply enclose minute crystals of all the minerals which comprise the rocks and whose growth thus also began at an early stage, at depth.

The rocks of several units show a perceptible weak foliation whose attitudes are recorded and which is due to the preferred alignment of crystals and locally of rock inclusions. In most units the direction of foliation is contrary to the mapped trend of the unit, which suggests that the foliation may be of secondary origin and perhaps imposed by tectonic stress on the rocks after their emplacement and before their final consolidation. Some rocks which exhibit two directions of foliation, one displayed by phenocrysts and the other displayed by smaller platy crystals, may have experienced more than one stress pattern during that interval.

(i) *Quartz Diorite Complex.*—This unit, which is probably one of the oldest in the batholith, is exposed as isolated masses which form an irregular northerly chain in the eastern part of the area. In the north the complex is partly overlain by volcanic rocks of the Endako Group and in the south is divided by later intrusions. A former continuity of the complex, structurally if not physically, is suggested by the direction of foliation of its rocks, which is generally toward the adjacent mass on the chain.

The complex consists largely of foliated, rather dark rocks having a mixed or hybrid appearance and composed partly of alternating bands, or lenses, which range in width from inches to hundreds of feet and differ either in composition, in grain size, or both. The rocks are mostly greenish, fine- or medium-grained, equigranular quartz diorites consisting of moderate amounts of quartz and orthoclase, or microcline, and abundant plagioclase, biotite, and hornblende. Quartz is interstitial and wedge shaped; orthoclase is in small discrete crystals; plagioclase is andesine and lacks oscillatory zoning; hornblende partly forms anhedral crystals of above average size; and biotite is commonly poikilitic or, in the mafic bands, in laminated masses which contribute strongly to the foliation of the rock. Accessories include magnetite, sphene, and pyrite. Locally there are gabbros, which are quartz-free and contain labradorite plagioclase, diopside, and hornblende. In places the rocks enclose coarse-grained lenses of quartz diorite composition. Inclusions are common and are mainly angular, although in the well-foliated rocks some are lenticular. The inclusions are of dark fine-grained rock which is probably hornfels. In places, notably near Simon Bay, the complex is traversed in several directions by fine-grained light-coloured quartz monzonite dykes at whose margins the host rocks are feldspathized. Aplite dykes were also noted. Although generally fresh, the rocks of the complex are in places strongly sheared and altered, with production of actinolite, chlorite, epidote, pyrite, magnetite, and locally scapolite. This hydrothermal alteration also affects certain sheared greenstone dykes in the rocks but is less apparent in other, later, dykes, which include both acid porphyries and diabase dykes. Shearing in the complex is in various directions, some of which are transverse to the foliation of the rocks.

Foliation in the complex is steeply inclined, except in the north part of the northern belt, where it dips eastward at moderate angles. It strikes variously about north, except near Simon Bay and in the two southwesternmost bodies, where it strikes mainly eastward.

(ii) *The Endako Quartz Monzonite.*—This unit outcrops mainly in a belt containing the Endako mine and extending from the Stellako River west-northwestward for at least 9 miles. The nature of its apparent termination near the Stellako River is unknown. The sides of the belt are formed largely by younger intrusions —namely, the Francois quartz monzonite on the south and the Casey quartz monzonite and a quartz diorite on the north. A small isolated body of the Endako quartz monzonite is recognized within the Casey quartz monzonite near Cheskwa Lake, at a distance of 3 miles northward from the main belt, and is sheared and strongly altered.

The fresh Endako quartz monzonite is pinkish-grey and appears medium grained, although it is in fact porphyritic. Red phenocrysts of perthitic orthoclase constitute almost one-third of the rock and reach 1 centimetre in length, although most are about one-half centimetre long. They are accompanied by a few pale-coloured phenocrysts of plagioclase and others of quartz. The quartz phenocrysts are in the form of granular aggregates, probably due to inversion and recrystallization during cooling. The remainder of the rock has a granular-interstitial texture and consists of smaller crystals, mainly between 1 and 2 millimetres in size, of the above-mentioned minerals together with biotite and lesser hornblende. These two dark minerals make up about 5 per cent of the rock. The biotite occurs as six-sided small plates and thin books, which are partly clustered together. Accessory minerals include magnetite, apatite, and sphene.

Commonly the rock contains scattered dark inclusions with rounded, resorbed outlines approximately an inch in diameter. The inclusions are of fine-grained quartz diorite rich in biotite, and their origin is unknown.

In the extreme southern part of the belt, the rock adjoining the Francois quartz monzonite differs from the described type by lacking large phenocrysts and by possessing biotite that is partly poikilitic, or sieve-like, and quartz grains with feldspar inclusions.

(iii) *The Glenannan Quartz Monzonite.*—This unit comprises a body known in outcrop and drill-holes on either side of the Glenannan road to the south of the Endako River valley. Contacts with units to the north and east are hidden.

On the south the body adjoins the Casey quartz monzonite, which is probably a later intrusion, and also a small body of the Endako quartz monzonite. A decrease in the grain size of the Glenannan quartz monzonite in its southwesternmost outcrops, immediately east of Casey Lake, suggests that chilling occurred at the margin of the body, presumably at an intrusive contact with the Endako quartz monzonite, which may therefore be the earlier of the two units.

The Glenannan quartz monzonite is mostly a pink, rather coarse-grained and conspicuously porphyritic rock that is similar in modal composition and general appearance to the Endako quartz monzonite but differs from it in the following respects: (*a*) The phenocrysts are larger, with orthoclase as much as 2 centimetres long, quartz more commonly one-half centimetre in size, and the plagioclase approaching three-quarters of a centimetre; (*b*) quartz phenocrysts have well-defined rounded margins; (*c*) biotite is in thicker plates or books and is more evenly distributed; (*d*) hornblende is more prominent; (*e*) as seen under the microscope, the plagioclase contains oscillatory zones which are lacking in the Endako quartz monzonite.

Small dark inclusions occur in fewer numbers than similar ones in the Endako quartz monzonite. A foliation due to alignment of phenocrysts is perceptible in some outcrops, and it strikes mainly between north and northwest with steep dips. Like foliations in other units, to be described, it is of primary origin and related to stresses imposed on the crystals during emplacement and consolidation of the intrusions.

(iv) *The Nithi Quartz Monzonite.*—This unit occupies the summit and parts of the northern and eastern slopes of Nithi Mountain and is divided into several outcrop areas by a large later intrusion of the Casey quartz monzonite. West of the summit the unit is in exposed sheared contact with the quartz diorite complex, which it probably intrudes and against which it appears somewhat chilled. Contacts with quartz monzonites assumed to be younger are entirely hidden. The unit consists of quartz monzonites which, although differing in appearance, are probably intergradational and which occur alternately without a definable pattern. The difference in these rocks results from a variation in the content of light-coloured phenocrysts and medium-sized crystals, which are mostly of orthoclase but also of plagioclase and quartz. The rocks contain occasional small dark inclusions like those in previously described units, some of the inclusions being angular and little resorbed. On the Molly road a weak foliation due to feldspar alignment is steep and strikes variously northeast and northwest.

The least porphyritic variety of the Nithi quartz monzonite is a uniform medium-grained pinkish-grey rock with abundant biotite and a granular texture. Crystals as much as one-half centimetre in size are rare, and the majority are between one-half millimetre and 2 millimetres. The estimated modal composition of the rock is: Quartz, 35 per cent; orthoclase, 21 per cent; plagioclase, 35 per cent; biotite, 7 per cent; hornblende, 1 per cent; other minerals, including magnetite, sphene, and apatite, 1 per cent. Although quartz, orthoclase, and biotite may be locally interstitial, the over-all texture is controlled by closely packed subhedral crystals. Orthoclase is perthitic and locally has microcline twinning. Plagioclase shows strongly developed oscillatory zoning and wide rims of more albitic composition. Quartz grains are aggregates of closely packed individuals, formed perhaps by recrystallization during cooling and inversion. Biotite mainly forms small thick plates.

The strongly porphyritic variety is a lighter-coloured, generally pink rock of somewhat coarser grain size and with phenocrysts mainly of perthitic orthoclase and aggregated quartz but also of plagioclase that together amount to nearly one-third of the rock. The estimated modal composition of a specimen is: Quartz, 40 per cent; orthoclase, 30 per cent; plagioclase, 23 per cent; biotite, minor hornblende, and accessory minerals, 7 per cent. The rock, which looks not unlike the Glenannan quartz monzonite, differs from the preceding variety only in the presence of phenocrysts and medium-sized crystals, of which those of orthoclase and plagioclase reach lengths of 2 centimetres and one-half centimetre respectively, and those of quartz a diameter of three-quarters of a centimetre. The orthoclase phenocrysts deeply enclose small crystals of other minerals and are intergrown at their margins with neighbouring crystals. The quartz phenocrysts contain inclusions mainly of feldspar and are ovoid to irregular in shape, with well-defined partly rounded margins.

Rocks occur which are intermediate in character between these two described varieties and which superficially resemble the Endako quartz monzonite and have abundant phenocrysts of sizes generally not exceeding one-half centimetre. Unlike the Endako quartz monzonite, these rocks contain oscillatory zoned plagioclase, which requires identification under the microscope.

(v) *The Tatin Quartz Monzonite.*—This extensive unit may be identical with the Glenannan quartz monzonite, from which it is separated to the south by the drift-filled Endako River valley. It extends northward to an apparently gradational contact with the Triangle quartz monzonite and is interrupted farther south by later bodies of the Titan and Casey quartz monzonites respectively.

The rock commonly resembles closely the Glenannan quartz monzonite and is a mesocratic pinkish-grey medium-grained porphyritic quartz monzonite that contains conspicuous pink or flesh-coloured phenocrysts of orthoclase. The phenocrysts generally form between 1 and 5 per cent of the rock but locally occur in much increased amount, forming elongate pods or clusters as much as 2 feet wide. The orthoclase phenocrysts reach lengths of 4 centimetres but are mostly 1 or 2 centimetres long. They are accompanied by less conspicuous phenocrysts of aggregated quartz, and rarer ones of plagioclase and prismatic hornblende, all of which seldom exceed 1 centimetre in length. These minerals together with abundant biotite also form crystals of lesser size, mostly about 2 or 3 millimetres but as small as 1 millimetre. The biotite is mainly in well-formed plates and slender books but is locally shaped around other minerals. Hornblende occurs as readily seen needles. The over-all texture is granular-interstitial. Under the microscope the plagioclase is seen to be oscillatory zoned and to be locally rimmed by micropegmatite, and the orthoclase commonly shows microcline twinning and perthite veins. Accessories include sphene, allanite(?), magnetite, and apatite. The mode of the rock varies with the content of large orthoclase phenocrysts; where these are least in number, the rock approaches quartz diorite in composition. A specimen with a quartz monzonite composition possessed a mode estimated as follows: Quartz, 35 per cent; orthoclase, 26 per cent; plagioclase, 30 per cent; biotite, 5 per cent; hornblende, 2 per cent; accessories, 2 per cent.

Numerous inclusions of fine-grained quartz diorite are similar to those in the Glenannan and other quartz monzonites and are at various stages of resorption, some being darker than others. They are mainly rounded or elongate, with lengths up to a few feet, and tend to lie with the foliation of the host rock. A weak foliation, evidenced by a preferred alignment of phenocrysts, is not uncommon in the quartz monzonite and is generally steep. It mostly strikes northward in the southern part of the unit and eastward in the northern part, where in places pods and clusters of the phenocrysts are similarly orientated.

(vi) *The Triangle Quartz Monzonite.*—This unit is mapped near Triangle Lake as an incomplete east-trending belt extending for about 3 miles with a width of as much as 1½ miles. Its northern and southern boundaries adjoin the Rex and the Tatin quartz monzonites respectively, although the contacts are not precisely exposed. None of the three units undergoes any marked decrease in grain size to indicate chilling at the contacts, and their relative ages are unknown. The Triangle and Tatin quartz monzonites are, however, sufficiently similar in general appearance to suggest that they are closely related and may therefore be in gradational contact. The Triangle quartz monzonite is similar to the Tatin quartz monzonite, except in the following respects: (*a*) It is finer grained, the average crystal size being about 2 millimetres, the orthoclase phenocrysts not greater than 2 centimetres, and the other phenocrysts seldom exceeding one-half centimetre in size; (*b*) biotite partly occurs in books of thickness far exceeding their widths; (*c*) orthoclase is mostly free of microcline twinning; (*d*) micropegmatite is not present. The range in modal composition is similar to that of the Tatin quartz monzonite, and in some specimens the mode approaches that of quartz diorite.

Inclusions in this unit are more numerous and more varied in type than in the Tatin quartz monzonite. They are partly of fine-grained, dark, somewhat porphyritic rocks and partly of a foliated quartz diorite. Some of them show changes toward a lighter colour outwards, due to progressive reaction and assimilation by the host material. Although some are angular, others are highly elongate and lie parallel to the foliation. They occur partly in swarms of closely spaced inclusions within quartz monzonite that is crowded with phenocrysts, and the swarms trend parallel to the foliation. Foliation in the unit is well developed, the phenocrysts lying mainly steeply and trending northwesterly in the southwestern part of the belt and northeasterly throughout the remainder.

(vii) *The Francois Quartz Monzonite.*—This unit forms the southwestern margin of the batholith, where is occupies a belt as much as 1¾ miles wide that is mapped west-northwestward from Francois Lake for 7 miles and is partly overlain by Tertiary volcanic rocks. An intrusive contact with Takla rocks on the south is poorly exposed; toward this contact the quartz monzonite becomes fine grained and has the character of a porphyry. On the north side of the belt, as seen in drill-hole No. J3, the quartz monzonite becomes somewhat fine grained and is apparently intrusive in the Endako quartz monzonite.

The unit consists principally of a red quartz monzonite which is distinguished from other rocks by its colour and a combination of other features—namely, small phenocrystic quartz grains with feldspar inclusions, a dappled texture due to the juxtaposition and partial intergrowth of quartz and pink feldspar, a lack of phenocrysts exceeding one-half centimetre in size, and an absence or near absence of hornblende. The rock is fine-medium to medium grained and inconspicuously porphyritic; it lacks an appreciable foliation and contains rare inclusions, which are of a type more often seen in the Endako quartz monzonite. The red colour of the rock is due to a high content of orthoclase feldspar, which exceeds the amount of plagioclase locally to the extent that the rock is a granite. The chief components form crystals mainly of sizes between 1 and 4 millimetres. Quartz is partly granular and partly interstitial and is commonly intergrown with orthoclase, which forms subhedral crystals as well as smaller shapeless intergrowths. Plagioclase is subhedral and is either grey or variously white, yellow, and greenish due to alteration. Some of the biotite forms well-shaped plates which are mostly small. Under the microscope, orthoclase is seen to be perthitic, and plagioclase shows a faint oscillatory zoning as well as the strong marginal zoning which is common to most rocks in the batholith. The estimated modal composition of a typical specimen of the red quartz monzonite is: Quartz, 30 per cent; orthoclase, 35 per cent; plagioclase, 29 per cent; biotite, 5 per cent; magnetite, sphene, and other accessories, 1 per cent.

(viii) *The Titan Quartz Monzonite.*—This unit is confined to an area north of Endako, where it forms an east-trending body as much as 3 miles long and 1 mile wide. It is bounded to the north and east by the Casey quartz monzonite and in other directions by the Tatin quartz monzonite, the former being a later intrusion and the latter probably an earlier one. Near its contacts with the Tatin quartz monzonite the Titan rocks show an increased content of biotite and hornblende, and in one place they form unchilled apophyses and narrow dykes within the Tatin quartz monzonite. The contacts generally are not well exposed, and that with the Tatin unit is partly sheared.

The Titan quartz monzonite varies to some extent in appearance, and it generally resembles the Nithi quartz monzonite, of the less porphyritic variety. It differs in appearance from the adjoining Tatin quartz monzonite mainly in its finer grain, more granular texture, and common absence of large phenocrysts. It is typically a pinkish-grey inconspicuously porphyritic rock whose average grain size is about 2 millimetres but in which the range of crystal size is between one-quarter millimetre and one-half centimetre. The larger crystals, or phenocrysts, are similar to those in the rocks of previously described units and are variously of aggregated quartz, pink orthoclase, plagioclase, and hornblende. The mode of a typical specimen was estimated as follows: Quartz, 35 per cent; orthoclase, 30 per cent; plagioclase, 30 per cent; biotite, 3 per cent; hornblende and accessory minerals, 2 per cent. Other rocks show increases in the amounts of plagioclase and hornblende. The texture of the rocks is typically granular, although both orthoclase and quartz become locally poikilitic and enclose parts of other crystals. Orthoclase rarely shows microcline twinning. Plagioclase, determined as oligoclase-andesine, has well-developed oscillatory zoning, which is seen under the microscope, and in the smaller size range of crystals it generally well exceeds orthoclase in volume. It is locally rimmed with micropegmatite. Hornblende is in slender prisms, and biotite occurs mainly in thin plates not exceeding 2 millimetres in diameter. Accessory minerals in the rocks include sphene, allanite(?), apatite, and magnetite.

Unlike the Tatin quartz monzonite, this unit rarely contains inclusions of other rocks. Foliation is not readily visible, and its attitude has been measured at only one locality, where it is steep and north trending.

A light-coloured fine- to medium-grained non-porphyritic quartz monzonite is mapped locally within the unit near its southern border and at its eastern limit, but is probably a separate phase. The rock lacks hornblende and outwardly resembles the Casey quartz monzonite, but it is distinguished from the latter by possessing a strong oscillatory zoning of plagioclase which is seen only under the microscope.

(ix) *The Rex Quartz Monzonite.*—This northernmost mapped unit is in poorly exposed contact with the Triangle quartz monzonite, relative to which its age is unknown. Typically light grey in colour, the rock is rather fine grained and markedly porphyritic, and it differs from others principally in having a texture involving wedge-shaped quartz. The average grain size of its crystal components is under 2 millimetres. Pale-coloured phenocrysts of orthoclase occur in varied amounts and have rounded corners and lengths of as much as 1½ centimetres. Other phenocrysts, which are less than one-half centimetre in size, include some of plagioclase, others of quartz in rounded aggregate form, prismatic green hornblendes, and thick biotite books. Under the microscope the texture of the rock is seen to be granular-interstitial, with both quartz and orthoclase partly poikilitic and the quartz recrystallized. Plagioclase exhibits a strong oscillatory zoning. The estimated modal composition of a specimen is: Quartz, 35 per cent; orthoclase, 24 per cent;

plagioclase, 32 per cent; biotite, 6 per cent; hornblende, 2 per cent; accessory minerals, 1 per cent.

Inclusions as much as 1 foot in length of porphyritic quartz diorite and other dark rocks are common in this unit, which exhibits a generally weak foliation that is steep and is directed eastward, more or less parallel to the southern edge of the body.

(x) *The Casey Quartz Monzonite.*—This unit mainly forms two large bodies which are intrusive into older units which include the Endako, Glenannan, Nithi, Tatin, and Titan quartz monzonites. The Francois quartz monzonite is also an older unit because it is cut by a Casey dyke at a point 1 mile south of the Endako mine. One of the large Casey bodies is a stock near Shovel Creek which extends two arms eastward, one on either side of Tatin Lake, and a third arm east-southeastward as far as the Stellako River. The arm lying south of Tatin Lake is shown as turning southward to include isolated outcrops in two places adjoining the Stern Lake road, northeast of Endako village. The second large body underlies the eastern flanks of Nithi Mountain and is an arcuate mass that is concave eastward and extends to the limits of mapping.

The unit comprises light-coloured rocks, many of which locally have been called alaskite. They are mostly quartz monzonites, although some fine-grained varieties are granites. Although varying in appearance due to their differing grain size and porphyritic development, all are characterized by an absence of hornblende, a low biotite content, and an inequigranular texture.

Fine-grained rocks occupy parts of the margins of the main bodies and also form dykes and offshoots of the latter. They are pink, more or less porphyritic rocks which resemble aplites and have an average grain size of about one-half millimetre. Orthoclase and quartz phenocrysts are 3 millimetres in size in some rocks and are as large as one-half centimetre in others. Under the microscope the quartz phenocrysts appear as aggregated grains, and the rocks are found to contain micropegmatite. The estimated mode of a specimen of these rocks is: Quartz, 33 per cent; orthoclase, 40 per cent; plagioclase, 25 per cent; biotite, 2 per cent.

The remaining rocks are somewhat coarser grained, with average grain sizes ranging up to 2 millimetres; they are pink or white quartz monzonites that weather either white or brownish. The coarser of these rocks are found mainly in the stock and its northernmost arm, and in the northern part of the Nithi Mountain body. The absence of fine-grained rocks along parts of the contacts with the older units, and in some dykes which cut these units, shows that the degree of chilling of the intrusions was slight. In some places the adjoining older rocks were apparently sheared prior to emplacement of the Casey intrusion; for example, the Tatin quartz monzonite at a contact north of Tatin Lake. In the stock, rapid fluctuations of grain size occur and locally there are lenses of granite pegmatite and separate pod-like concentrations of biotite. In many places the rocks contain small irregular cavities partly filled with well-crystallized quartz, orthoclase and biotite, and chlorite. A foliation is recorded only in rocks north and south of the east end of Tatin Lake, where it is directed northward across the assumed strike of both bodies. Inclusions of foreign rocks are virtually absent in the unit.

The coarser-grained rocks contain phenocrysts of orthoclase and quartz which increase in size and number roughly with increasing grain size of the rock. They may be as large as 1 centimetre and constitute as much as 30 per cent of the rock. The phenocrysts are relatively inconspicuous because of the irregularity of their margins, which are poikilitic to smaller crystals. With increasing coarseness the rocks adopt a less granular, more interstitial texture, in which both quartz and orthoclase partly surround other crystals and form interstitial wedges. Plagioclase is generally in small crystals, and in some of the rocks it exceeds orthoclase in amount. Biotite forms small scarce books and plates and is slightly more plentiful than in the fine-grained rocks. Under the microscope some interstitial orthoclase is seen to possess microcline twinning, and plagioclase crystals show wide marginal zones and only the faintest indication of oscillatory zoning. Local graphic intergrowths of quartz and orthoclase occur but not in the coarsest-grained rocks. The estimated mode of a typical coarser-grained rock is: Quartz, 36 per cent; orthoclase, 30 per cent; plagioclase, 30 per cent; biotite, 3 per cent; accessories, 1 per cent.

(xi) *Younger Quartz Monzonites and Quartz Diorites.*—These varied rocks comprise intrusions which are mainly within the quartz diorite complex or locally in the Endako quartz monzonite. They occur in the eastern part of the area, but are also known outside the area to the west, on Sam Ross Creek. The intrusions generally have sharp, somewhat chilled contacts with their host rocks, and on the peninsula near Simon Bay they locally form intrusion breccias in the older complex.

The quartz monzonites are rather fine-grained or medium-grained grey-pink rocks which mostly contain a few orthoclase phenocrysts of one-half centimetre size and in some cases quartz crystals of equal size. Biotite exceeds hornblende, and together they form about 7 per cent or less of the rock. Textures are more or less granular and foliated, but some quartz is interstitial. Under the microscope, plagioclase generally shows only a weak zoning, rarely with oscillations.

The quartz diorites are greyer inconspicuously porphyritic rocks with a somewhat higher mafic content than the quartz monzonites. Biotite generally forms abundant small flakes and hornblende small prismatic crystals. Feldspar crystals range in size to one-half centimetre, and the rocks have inequigranular textures and some degree of foliation. Plagioclase crystals are strongly zoned with oscillations, and the orthoclase partly has microcline twinning.

Near Alf Lake a quartz monzonite with abundant large orthoclase crystals is cut and altered by a quartz diorite porphyry with crowded aligned laths of plagioclase and hornblende, and the two rocks together form a multiple intrusion whose full extent is unknown. The estimated mode of the quartz monzonite is: Quartz, 30 per cent; orthoclase, 35 per cent; plagioclase, 29 per cent; hornblende, 2 per cent; biotite, 3 per cent; accessories, 1 per cent. That of the quartz diorite porphyry is: Quartz, 20 per cent; orthoclase, 20 per cent; plagioclase, 46 per cent; hornblende and biotite, each 6 per cent; magnetite and other accessories, 2 per cent.

Quartz monzonite that is exposed on the island and the west side of the peninsula in Fraser Lake corresponds lithologically to the generally described type and recurs locally on the east side of the peninsula as an intrusion breccia of quartz monzonite with crowded amphibolite and quartz diorite fragments. On nearby Mouse Point and to the southeast across Shotgun Creek, further unchilled quartz monzonite or quartz diorite intrudes the older complex and is probably a part of the same younger body. The estimated mode of a specimen from the southeastern outcrops is: Quartz, 35 per cent; orthoclase, 20 per cent; plagioclase, 37 per cent; biotite, 6 per cent; accessories, 2 per cent.

Westward as far as the Stellako River there are isolated outcrops of rocks which probably belong to one or more other bodies. Immediately west of Mudhole Lake a strongly porphyritic, medium-grained pink quartz monzonite decreases in grain size toward its contact with the older complex, and the resulting chilled rock contains local segregations of granite pegmatite. The estimated mode of the medium-grained quartz monzonite is: Quarz, 35 per cent; orthoclase, 40 per cent; plagioclase, 20 per cent; biotite and hornblende, etc., 5 per cent. At the Stellako River, on Indian Reserve No. 5, an inconspicuously porphyritic quartz diorite of rather fine grain size occurs which is neither a part of the older complex nor similar to other younger quartz diorites in the vicinity. It is a grey somewhat altered rock with quartz that is partly interstitial and with rare plagioclase phenocrysts three-quarters of a centimetre in size. Its estimated mode is: Quartz, 30 per cent; orthoclase, 15 per cent; plagioclase, 46 per cent; biotite, 6 per cent; hornblende, 2 per cent; accessories, 1 per cent. Farther upstream to the southwest, fresh quartz diorite of differing appearance intrudes the Endako quartz monzonite and adjoins the Casey quartz monzonite at a shear zone wherein diabase dykes have apparently been sheared, altered, dismembered, and mechanically incorporated in crushed quartz diorite. The unaltered quartz diorite corresponds to the generalized description, except that it lacks hornblende. Its estimated mode is: Quartz, 20 per cent; orthoclase, 25 per cent; plagioclase, 45 per cent; biotite, 8 per cent; accessories, 2 per cent.

Near Mary Lake a medium-grained somewhat porphyritic quartz monzonite outcrops widely and is emplaced in the older complex, the contact more or less paralleling the direction of steep foliation in the latter. At the margin of the body the quartz monzonite is rather fine grained and resembles in a general way the rock on Indian Reserve No. 5.

(xii) *The Pond Quartz Diorite.*—This unit is exposed in a single isolated outcrop near the tailings-pond dam to the north of the Endako mine. It probably forms a stock whose size and relationships are unknown, except to the west, where it is in disturbed and probably intrusive contact with the Endako quartz monzonite. At this contact the two rocks are separated partly by northwesterly shears and partly by a northeasterly dyke.

The quartz diorite is a pinkish-grey fairly fresh rock which appears to be equigranular and medium grained but on close inspection is seen to have a crowded porphyritic texture. The rock is largely composed of closely packed crystals, mainly about 2 and 3 millimetres in size, of quartz, pink orthoclase, zoned plagioclase, booky or platy biotite, and squat hornblende, which occur in a subordinate granular matrix of much smaller quartz and feldspar crystals. Under the microscope, orthoclase appears clear and non-perthitic, and plagioclase is strongly oscillatory zoned and too weakly twinned to allow determination of its composition. Quartz and orthoclase are partly intergrown in the granular matrix, whose average grain size is less than one-half millimetre. The estimated mode of the rock is: Quartz, 35 per cent; orthoclase, 20 per cent; plagioclase, 50 per cent; biotite, 3 per cent; hornblende, 1 per cent; accessory sphene and magnetite, 1 per cent.

(xiii) *The Fraser Granodiorite.*—Exposures of this unit are confined to two adjacent outcrops on the highway near the west end of Fraser Lake. The outcrops are in an area of contrasting low magnetic susceptibility, which is shown on the aeromagnetic map as extending east-southeastward as far as Mudhole Lake, and having a width of as much as 2 miles. The unit therefore probably forms a stock which underlies this area, extends an unknown distance to the northwest, and may transect adjacent units. Of the two outcrops, the western one is of finer-grained rock and is probably close to the edge of the stock. Both outcrops contain partly rounded inclusions of fine-grained pink and grey rocks whose origin is unknown.

In the eastern outcrop the granodiorite is a moderately fresh, pink rock of medium-grained appearance. It consists of crystals mainly between 1 and 3 millimetres in size, which are crowded together in a pink finer-grained groundmass. The dappled texture and visible intergrowths of quartz and orthoclase in the groundmass, and the presence of occasional larger quartz grains containing feldspar inclusions, give the rock a similarity to the Francois quartz monzonite, from which it differs mainly in having few orthoclase crystals larger than 3 millimetres, abundant plagioclase crystals as much as three-quarters of a centimetre in size, and easily seen hornblende prisms. Under the microscope, orthoclase is turbid and non-perthitic, micropegmatite is visible in the groundmass, and plagioclase has a complex oscillatory zoning and also a sodic composition that identifies the rock as a granodiorite. The estimated mode of the rock is: Quartz, 15 per cent; orthoclase, 30 per cent; plagioclase, 50 per cent; biotite, 3 per cent; hornblende, 2 per cent; accessories, 1 per cent.

B. *Minor Intrusions.*—Small intrusions in the batholith and the adjoining Takla rocks include numerous dykes and two stock-like bodies. They have various compositions and may range widely in age. A porphyry stock that is confined to the Takla rocks may pre-date the batholith, and unchilled bodies variously of aplite, pegmatite, and quartz diorite may relate to the cooling stage of the batholith. The remaining intrusions are chilled dykes which wholly post-date the batholith and were successively emplaced prior to deposition of the Endako Group.

(i) *Aplite and Pegmatite.*—These rocks of granitic composition (marked A on the maps) are restricted to the batholith and are apparently the oldest minor intrusions within it. Pegmatite is uncommon and occurs mostly with aplite, in which it forms lenses possessing either a sharp or gradational contact. In the quartz monzonites of the northern part of the area, however, pegmatite lenses occur alone or with a central quartz vein. Pegmatite mostly has a crystal size of about 1 inch at most and consists of quartz, perthitic orthoclase, and minor plagioclase and biotite. Where gradational to aplite it may contain a coarse aplite groundmass throughout. The largest body found is a 30-foot-wide dyke occurring alongside an aplite dyke about three-quarters of a mile northeast of Casey Lake.

Aplite includes porphyritic and non-porphyritic varieties and is very widespread in the batholith as dykes of varied attitude. Porphyritic aplite forms some of the widest dykes, which measure as much as 30 feet, and it also forms an elongate stock-like body of northerly trend that occurs with unexposed contacts 3 miles west of Endako. Aplite is a pink rock of uniform appearance and with an average grain size of about one-half millimetre. Its mineralogical composition is much like pegmatite, and porphyritic varieties have scattered small phenocrysts of biotite and others, as large as one-half centimetre, which are variously of quartz, orthoclase, and rarely plagioclase. Irregular small cavities occurring sparsely in the rocks are partly filled by projecting crystals and were formed by the local concentration of volatile fluids. Contacts of aplite with host rocks are sharp, show no chilling, and in places enclose irregular wisps of the host. Very commonly the aplite bodies contain clear, impersistent veins of quartz, which are mostly less than one-half inch wide and in places contain small amounts of orthoclase.

Aplites are generally rare in the Tatin quartz monzonite and, by contrast, they are abundant in the Casey quartz monzonite. In places they occur in swarms of dykes of individual widths ranging from a few inches to 20 feet. At the Endako mine, dykes of non-porphyritic aplite possess varied attitudes where exposed and appear from drill-holes to be confined largely to zones or swarms whose trends are unknown.

(ii) *The Menard Quartz Latite Porphyry.*—This rock underlies an area of about 100 acres adjoining Francois Lake near Menard's resort, and is equivalent in composition to a quartz monzonite. It shows no evidence of being a flow and is probably a small stock or plug emplaced in the Takla volcanic rocks under near-surface conditions. Its age is unknown, but its altered condition suggests it to be a comparatively old intrusion which may pre-date the batholith. The porphyry is a brown or grey weathering, generally altered rock, of which about 40 per cent is phenocrysts and the remainder a red or purple fine-grained groundmass containing small crystals and epidote and chlorite patches. The phenocrysts are disoriented, and they range in size up to one-half centimetre, being mostly smaller. In order of abundance they are plagioclase, biotite, quartz, augite, and hornblende. Plagioclase phenocrysts are white or flesh coloured; biotite phenocrysts form chloritized plates or extremely thick books; quartz phenocrysts are small and rounded or kidney shaped; and augite and hornblende phenocrysts, if present, are long black prisms. Except for some visible quartz, the groundmass is aphanitic and in places has a granular appearance due to closely packed, crude radial growths of orthoclase, or sanidine.

(iii) *Quartz Diorite and Quartz Monzonite Dykes.*—A few dykes of holocrystalline, generally non-porphyritic rock cut the batholith and are distinct from the porphyries described below. The dykes possess mainly northeasterly strikes, and in some cases reach thicknesses of as much as 100 feet.

One type (marked D on the maps) is a fine-grained hornblende-biotite quartz diorite which usually possesses only moderate amounts of quartz and has mostly a felted texture. Dykes of this type occur generally in or near larger bodies of quartz diorite, against which there may be little or no chilling. Individual dykes occur west of the summit of Nithi Mountain, west of Alf Lake, at the western edge of the area south of the highway (close to a body of quartz diorite farther west on Sam Ross Creek), and northwest of Triangle Lake.

Other distinctive dykes (marked H on the maps) are of pink or grey, rather fine-grained rock that is characterized by a criss-cross texture of fresh black hornblende or augite needles 1 to 3 millimetres in length. The rock is variously quartz diorite and quartz monzonite and contains, in addition, plagioclase, biotite, and micropegmatite. The dykes are poorly chilled and are emplaced on the contact between the quartz diorite complex and younger rocks at Mouse Point on Fraser Lake, in the Endako quartz monzonite on the Endako mine road, and between the Endako quartz monzonite and the Pond quartz diorite to the north of the tailings dam.

(iv) *Porphyry Dykes.*—These dykes, which cut the batholith and older rocks profusely, have chilled edges and mainly steep attitudes. They are mapped and described in several groups according to the presence of light-coloured phenocrysts, which are variously quartz (Q), orthoclase (O), and plagioclase (P). Each group contains a variety of dykes whose distribution and relative ages, if sufficiently well known, would be of great interest in construing the history and structure of the batholith. The majority of the dykes are variously rhyolite, quartz latite, and dacite, but some are latite or andesite. A few felsite and andesite dykes which occur without phenocrysts are not specifically distinguished on the maps. With some evident exceptions, the porphyry dykes are apparently pre-mineral in age.

(*a*) *QOP Porphyry.*—Dykes with all three phenocrysts are common. Some contain large orthoclase phenocrysts whose sizes range from one-half centimetre to 2 centimetres. In the southern part of the area, these include northwesterly dykes of pink quartz monzonite porphyry which cut the Takla rocks and the Menard porphyry stock and are later than some QO porphyry dykes. Southwest of Endako a 50-foot-wide dyke trends northwestward in the Glenannan quartz monzonite and contains large pale orthoclase phenocrysts in addition to quartz, plagioclase, and biotite. A porphyry also in this category is known only as float and forms large blocks that are strewn along the highway 2 miles east of Endako. It is an aplitic textured quartz monzonite porphyry with large phenocrysts of quartz, orthoclase, and plagioclase and smaller ones of biotite and hornblende. In the northern part of the area, dykes with large phenocrysts possess northwesterly strikes north of Cheskwa Lake and also form a north-northeasterly system some 4 miles long near Triangle

Lake. Dykes of this system are as much as 300 feet wide, and they contain hornblende and biotite in addition to light-coloured components. They are emplaced in previously sheared rocks and make ridge-like outcrops.

Dykes referred to in the Annual Report for 1964 as rhyolites are important because they are found only in the Endako mine area and near mineralized showings on Nithi Mountain. They are aphanitic pale to buff-coloured rocks which contain small and scattered rounded or kidney-shaped quartz phenocrysts that are partly recrystallized, and other phenocrysts of perthitic orthoclase and in some cases of plagioclase. Biotite forms rare small plates and is generally chloritized. The groundmass of the rock contains quartz and orthoclase, partly as micropegmatite, and also plagioclase. The dykes at the mine are numerous, mineralized, and as much as 40 feet wide, with strikes that range from northeast to northwest. Several narrow darker-coloured dykes which strike northeastward in the Endako quartz monzonite north of the tailings dam may be related to them. The dykes on Nithi Mountain curve northward to the Molly showing and are partly strongly sheared and altered. Near the showing a large dyke is locally 100 feet wide and contains secondary uranium minerals in fractures.

West of the Endako mine, on the Nu-Elk claims, dykes whose phenocrysts include pink orthoclase mantled by white plagioclase possess in some cases north-northeast strikes and contain biotite in an aphanitic groundmass which contains micropegmatite. Other dykes lack the mantled phenocrysts and have a pink aplitic groundmass. Elsewhere in the area, pink or grey dykes occur whose strikes are mainly between north and east in the southern part and are north-northwesterly in the northern part. Those in the northern part generally contain conspicuous biotite.

(*b*) *QO Porphyry.*—Dykes with quartz and orthoclase phenocrysts are fairly numerous and widespread in the southern part of the area but are apparently uncommon in the northern part, where they are represented by a few altered grey felsitic dykes with small pale phenocrysts, for example, northwest of Endako village. The dykes in this group have predominantly a northwesterly strike, although some on the baseline 1 mile southwest of the Endako mine have a northeasterly strike. They are mostly rhyolites, but some have plagioclase in the groundmass and are quartz latites. Their colour is pinkish-grey or greenish, and they partly contain hornblende in addition to biotite. Southwest of the mine as far as the lake-shore these dykes occur with similar appearing orthoclase (O) porphyries and orthoclase plagioclase (OP) porphyries and in places are offset by faults and mineralized with specular hematite and pyrite. Along the Stellako River and yet farther to the east, the dykes locally contain quartz veins. In drill-holes on the C.M. group to the east of the Endako mine, chilled brown porphyry is present as vestiges of dykes which have largely been obliterated by faulting and later dyke intrusion.

(*c*) *QP Porphyry.*—Dykes having quartz and plagioclase phenocrysts are not very numerous and occur scattered throughout the area. They mostly possess a northwesterly strike and are dacites, although some are quartz latites and contain micropegmatite in the groundmass of the rock. The dykes are varied in appearance, being mostly either light or dark grey, and some are pink. Some dykes have crowded plagioclase phenocrysts and inconspicuous ones of quartz; others have prominent quartz phenocrysts. Biotite is generally present and may form thick books or conspicuous plates; it may, however, be absent in favour of hornblende, which may be in prominent crystals. Several of the dykes contain conspicuous amounts of epidote and are rather severely chloritized. Some are of later age than dykes of quartz monzonite porphyry and QO porphyry.

(*d*) *OP Porphyry.*—Pink, grey, or greenish dykes with orthoclase and plagioclase phenocrysts are variously latites and quartz latites. Those in the southern part of the area are frequently sheared, fractured, altered, and mineralized mostly with pyrite. Brown dykes at the Endako mine are unique and were named either dacite or quartz latite in the Annual Report for 1964; they are apparently neither as thick nor as numerous as the accompanying, probably later QOP porphyry dykes, and their strike is northeasterly where observable. The brown porphyry has relatively abundant small biotite flakes and equally small orthoclase and plagioclase phenocrysts. It contains quartz partly in aggregates not large enough to be considered as phenocrysts, and the remainder of the rock is a crystalline fine-grained material, mainly quartz and orthoclase which partly form micropegmatite.

Other dykes in the southern part of the area strike variously northeastward and northwestward. A wide one at Mouse Point closely resembles another on the Stellako road and contains plagioclase mantled by pink orthoclase, separate orthoclase phenocrysts as large as one-half centimetre, and thick biotite books. Except in their phenocryst assemblage, dykes in trenches and a drill-hole on the Rob group, 1 mile west of the Endako mine, resemble adjacent QO and O porphyry dykes and are wholly similar to northwesterly dykes in the northern part of the area, located variously northwest of Endako village, north of Tatin Lake, and east of Triangle Lake.

Elsewhere in the northern part, OP porphyry dykes extend along a north-northwesterly lineament for a distance of as much as 3 miles from north of the highway to the head of Cheskwa Creek. The principal dyke is 150 feet wide and consists of a grey aphanitic rock with biotite and, rarely, quartz amongst the phenocrysts. Comparable dykes occur also to the north of Cheskwa Lake.

(*e*) *O Porphyry*.—Dykes containing orthoclase phenocrysts alone are uncommon, except to the west and southwest of the Endako mine as far south as the lakeshore. These dykes contain fine-grained plagioclase and quartz and are probably quartz latite; in most respects they are similar to QO porphyry and OP porphyry dykes, with which they are associated. A similar dyke at the Stellako River more or less follows the contact of the Endako and Casey quartz monzonites.

(*f*) *P Porphyry*.—Dykes having plagioclase as the only light-coloured phenocrysts are of several types and ages. Grey or brown dykes which occur in the eastern part of the area possess northerly and northwesterly strikes and are quartz latites, with hornblende present in an aphanitic, slightly pinkish groundmass. Those near Seas Lake are fresh, but others near Deserter and Stern Lakes are partly altered and contain epidote and pyrite. Darker, strongly porphyritic dykes with the composition of andesite and quartz andesite are apparently unmineralized and are later than various other dykes. They occur with northeasterly and northwesterly strikes to the south and southwest of the Endako mine and at the Stellako River.

The remaining dykes are probably all of post-mineral age and are of two kinds. A few are grey augite-andesites, which are widely distributed, occurring variously at the head of Stellako River, south of the east end of Tatin Lake, south of Owl Lake, and north of Triangle Lake. They strike either northward or northwestward, possess slender plagioclase phenocrysts, and show a mild degree of alteration involving epidote and chlorite. More numerous are other grey dykes with the composition of quartz andesite, or possibly dacite, which occur chiefly in faults and are themselves commonly faulted and sheared. In drill-holes near MacDonald Lake, molybdenite and pyrite are present in the adjacent rocks but not in the dykes, which are evidently post-mineral. So far as known, the dykes are confined to a north-northwesterly line extending from the head of the Stellako River, through the MacDonald and Casey Lakes area, to the north side of the highway. From Casey Lake northward this line is a topographic lineament and is partly followed by previously described OP porphyry dykes. South of Casey Lake the dykes apparently follow various faults, which are east striking near MacDonald Lake. The dykes have pinkish chilled edges, and they exhibit conspicuous phenocrysts of biotite and plagioclase and rare quartz phenocrysts in an aphanitic groundmass which contains plagioclase, quartz, and biotite. Where sheared, the dykes are partly argillized, biotite is incipiently chloritized, and the rock is ramified by pink or white zeolite veins and calcite.

(v) *Lamprophyre Dykes.*—These fine-grained dark-green dykes (marked L on the maps) are probably not all of the same age and include the youngest intrusions known in the area. They occur throughout the area and are especially numerous in certain places, notably at the Endako mine, along the Stellako River, on the west side of Nithi Mountain summit, and on the peninsula in Fraser Lake. The dykes occur mainly in fractured rock or fault zones and are commonly sheared and partly altered to calcite and chlorite. Most are devoid of mineralization, but some contain disseminated pyrite. They are generally narrow and tend to swell, pinch, and change direction abruptly. Some fresh dykes contain small phenocrysts of plagioclase and augite, or hornblende, in a felted groundmass mainly of plagioclase and hornblende. More altered ones contain small patches of pink calcite and consist in varying proportions mainly of plagioclase, actinolitic hornblende, biotite, and chlorite. Quartz may be present in small amount.

7. *Structure.*—Evidence is insufficient to describe the structure of the batholith in detail, and only a few generalizations can be attempted. Faulting has probably been important at all stages of the structural evolution of this area. Repeated conditions of tension were necessary to allow the successive emplacement of intrusions, which are mostly tabular and steeply inclined, and rocks such as the Casey and Rex quartz monzonites possess unevenly granular textures suggestive of crushing and milling of still mushy material. Primary foliations in many of the batholithic rocks are apparently due more to external stress than to flow. These considerations suggest that faults were active during emplacement of the batholith and that some of the intrusions may be aligned with old faults. In the western part of the area most contacts trend mainly west or west-northwest, but those of the Casey unit may turn locally to other directions; for example, to the northeast near the Endako mine. In the eastern part of the area the contacts follow various directions, including north and northwest, and no clear pattern is evident. Dykes of both pre- and post-mineralization age in the area possess various strikes, of which northeast and northwest are the most common.

Evidence of widespread faulting is seen in the sheared, fractured, and altered condition of many rock outcrops. Strong chloritic faults are mapped in the Endako open pit and farther east on the C.M. group; numerous other faults are intersected in drill-holes at the mine or on Nithi Mountain but cannot be mapped because their directions are unknown. Various topographic lineaments thought to coincide more or less with faults are mapped. There are many other lineaments visible on air photographs of the area, those of easterly trend being of doubtful structural significance because they follow the direction of glacial movement. The most common lineament direction is west-northwest, other common directions being northeast and north.

Some important faults may underlie younger stratified rocks which adjoin or rest upon the batholith. Tertiary volcanic rocks beyond the western edge of the area at Shovel Creek are in a broad northeasterly belt which is probably a fault-controlled graben, and Hazelton rocks south of Francois Lake may occupy a structural basin near the southern edge of the batholith.

8. *Rock Alteration and Mineralization.*—Alteration and mineralization at the Endako mine and on Nithi Mountain have previously been described (*see* Annual Report, 1964, pp. 58–64). Showings near Owl Lake, presently being explored by

United Buffadison Mines Limited, are described subsequently in this report. Other known occurrences of molybdenum mineralization in the area are few in number, and no important new ones were located in the course of mapping. One or two prospects lie short distances outside the area and are briefly mentioned below. Exploration to date has not been intense throughout the area and, considering the general suitability of the area for molybdenite mineralization, there seems a good chance that eventually other deposits will be found in spite of the lack of outcrop. Pyrite and specular hematite occur partly with quartz veins in sheared and fractured rock in numerous places, and chalcopyrite was occasionally found in very minor amounts. Types of wallrock alteration peculiar to the known molybdenite deposits were elsewhere hardly seen, but other types, including chloritic alteration, were observed quite widely and are generally accompanied by pyrite or specularite.

First hinted at in 1927 by the finding of mineralized float, the Endako orebody was mainly covered by glacial till, gravel, and mud to depths of as much as 40 feet. As now outlined, the orebody strikes west-northwest, is over 5,000 feet long and about 1,000 feet wide, and extends to a depth of at least 500 feet. The host rock is the Endako quartz monzonite, which is dissected by pre-mineral dykes of aplite and porphyry and by faults and post-mineral dykes. At the time of examination the orebody was exposed only in the western part, which is essentially a system of parallel mineralized quartz veins in a stockwork of lesser veins and fractures. The parallel veins mostly strike north of east and dip southward at about 45 degrees; individually these are several hundred feet long, with widths ranging from a few inches to as much as 5 feet. These veins enclose dark-grey mylonite and silicified wallrock, are ribboned in appearance, and are locally displaced either in complex fashion on hair-line fractures or by simple offset on small transverse faults. Across porphyry dykes the veins commonly shrink and regain width on the far side. The numerous connecting quartz veins are mostly very narrow and are apparently of more than one age. Molybdenite is virtually restricted to veins and fractures and occurs variously as coarse platings, dense fine-grained seams, and fine disseminations. Pyrite accompanies it and extends beyond the orebody as disseminations and fracture fillings. Magnetite and specularite occur locally in the veins and so rarely does chalcopyrite, which may be restricted to the vicinity of small offsetting faults.

Wide chloritic faults occur and also numerous smaller ones, some of which are sericitic and partly follow the vein walls. A wide south-dipping fault strikes west-northwest and forms a southern limit to the ore in the vicinity of the adit, with low-grade mineralization extending to the south of it; other faults cross the orebody in northeasterly directions and possess dips variously to the east or west. There is much evidence of post-mineral movement on these and other faults, but there is also evidence that the faults exerted control on the mineralization and preceded it. In the pit a high-grade vein lies in a west-dipping fault for some distance and is virtually undisturbed by later movements. In addition, drill-core assays commonly show an increase near the large faults.

Rock alteration has produced the following minerals in veins or along fractures: Quartz, orthoclase, biotite, sericite, calcite, minor chlorite, and possibly kaolin. One and sometimes both of the walls of wide faults are altered extensively to a bleached rock which crumbles on exposure. Elsewhere in the orebody, rock alteration mostly leaves the orthoclase and biotite fresh but changes the plagioclase to a greasy greenish colour, which is probably due mainly to a combination of incipient sericitization, chloritization, and possibly kaolinization. Surface weathering is accompanied by some leaching of molybdenum and extends to depths of a few feet.

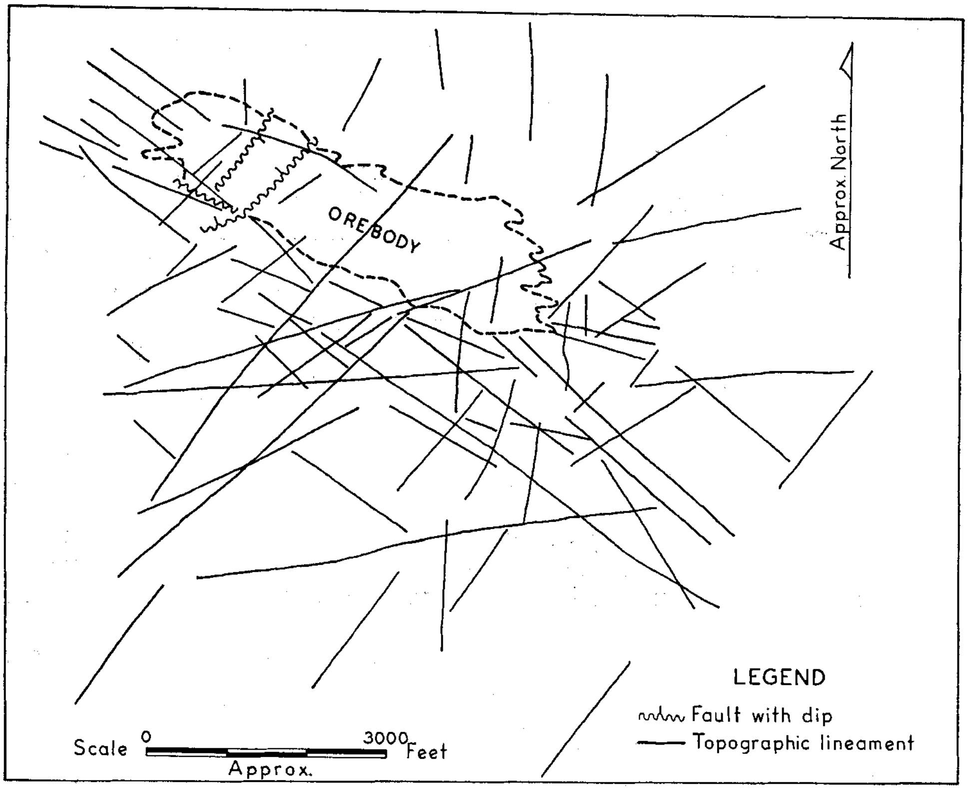


Figure 25. Sketch map of lineaments near the Endako orebody. From an air photograph.

If known, ore controls at the mine would explain why the shear veins have strikes different from that of the orebody and probably would involve a full understanding of the fault pattern. Figure 25 is a sketch map, not to true scale, showing the outline of the orebody, mapped faults in the open pit, and lineaments visible on air photographs. The faults coincide closely with lineaments and give weight to the belief that other lineaments are also faults. The pattern apparently includes one or more faults which follow the southern edge of the orebody and are offset by later faults which strike northeastward. Faults of this pattern would be an adequate cause of the various structural features of the orebody.

Apparently the orebody lies in a part of the area which has been particularly susceptible to intense and continued fracturing. It is in one of the oldest units, hemmed in by younger intrusions and containing a concentration of dykes. Moreover, the shape of the Casey contact north of the mine probably was controlled by early northeasterly fracturing in the older quartz monzonites.

Near the top of Nithi Mountain and south of Owl Lake in the northwestern part of the area, molybdenite occurs widely, mainly in narrow quartz veins and fractures that form large diffuse stockworks. Systems of wider parallel veins are generally missing, although on Nithi Mountain there are short lenses of mineralized banded quartz which reach thicknesses of 2 feet and lengths measurable in tens of feet, which strike mostly northeastward with dips in some places to the north and in others to the south. At both Nithi Mountain and Owl Lake a widespread rock alteration is partly strongly sericitic, partly weakly chloritic, and partly of a type like that at the Endako mine, which results in green plagioclase and the introduction of some biotite and orthoclase. Pyrite disseminations and fracture fillings occur widely in both places. Molybdenite is known either in trenches or drill-holes variously west, southwest, south, and east of the Nithi Mountain summit and rarely farther east than the location of drill-hole No. N13, and is in a geological setting which resembles that of the Endako mine in the following respects: (*a*) It is in an older medium-grained quartz monzonite adjacent to a younger Casey intrusion; (*b*) porphyry dykes are the same as one of the types at the mine; (*c*) strong chloritic faults occur near the showings, for example, in drill-hole No. N2.

A showing on the northern slope of Nithi Mountain, on the Tan claims, was explored in 1964 by Fort Reliance Minerals Limited (Annual Report, 1964, p. 64) and is a pod of high-grade partly oxidized molybdenite mineralization in locally argillic quartz monzonite. It is located at a multiple intersection of joints about 75 feet to the south of a creek bed trending north 70 degrees east, which probably marks a fault. Recent stripping shows that pyrite and a little molybdenite, partly in narrow quartz veins, occur for as much as 120 feet farther to the west.

Molybdenite occurs in drill-holes to northwest and southeast of the Endako mine. In addition, small amounts of molybdenite were intersected 2 miles east of the mine on the C.M. claims, where in 1963 Torwest Resources (1962) Limited explored an east-trending electromagnetic anomaly by drilling. In the drill-holes, quartz monzonite, which is fractured and sheared but not otherwise greatly altered, locally contains narrow quartz veins with pyrite and a little molybdenite. Other molybdenite occurs locally as a varnish on shear surfaces in strong chloritic faults, which contain later dykes that are unmineralized.

Three-quarters of a mile south-southwest of the mine, on or near the Fran 40 claim, a showing is exposed on a baseline trending east across the Utica property and is of pyrite, and very small amounts of molybdenite occurring on fractures about 40 feet east of a northeasterly gully which may mark a fault. No quartz veins are evident, and the quartz monzonite has chloritized biotite, although to the east where not mineralized, it is altered differently and has green plagioclase with fresh biotite and orthoclase.

Apart from the above-described deposits, two small molybdenite occurrences are shown on the maps, one being on the Nithi Mountain road west of Foster Lake and the other west of Oval Lake, about 3 miles northwest of the Endako mine. A piece of molybdenite-bearing Casey quartz monzonite was found as float 2 miles north of the east end of Tatin Lake, in a part of the area otherwise lacking evidence of mineralization; it contained quartz stringers with pyrite and molybdenite and may have been transported from much farther west.

A short distance west of the area, a showing on Sam Ross Creek may contain small amounts of molybdenite with more abundant pyrite and specular hematite. South of the area, a showing on the former Bat claims, held in 1964 by Julian Mining Co. Ltd., lies above the east bank of the Nithi River, 5 miles by road from the east end of Francois Lake. At this showing the northernmost of three trenches exposes narrow quartz veins containing molybdenite and magnetite over a width of a few feet in porphyritic quartz monzonite that contains disseminated pyrite and is argillized and chloritized. A number of wide faults occur elsewhere in the trenches, one of them striking north-northeast.

Occurrences of ore minerals other than molybdenite are restricted to one of secondary uranium minerals which occur on joints in porphyry immediately south of the molybdenite showing on the Molly 1 claim on the west side of Nithi Mountain near the summit.

[References: *Geol. Surv., Canada,* Mem. 252, Fort St. James Map-area, 1949; Mem. 324, Nechako River Map-area, 1963; Maps 630A and 631A, Fort Fraser, 1941; Tipper, H. W., Paper 62-17, Age Determinations and Geological Studies, 1963, pp. 134–136; *Minister of Mines, B.C.,* Ann. Repts., 1963, pp. 30–38; 1964, pp. 58-64; Aeromagnetic Maps 1589-G, Hallett Lake and 1590-G, Fraser Lake, 1963; Baadsgaard, H., Folinsbee, R. E., and Lipson, J., *Geol. Soc. Am.,* Bull. Vol. 72, 1961, pp. 689–702; Geological History of Western Canada, *Alta. Soc. Pet. Geol.,* 1964.]

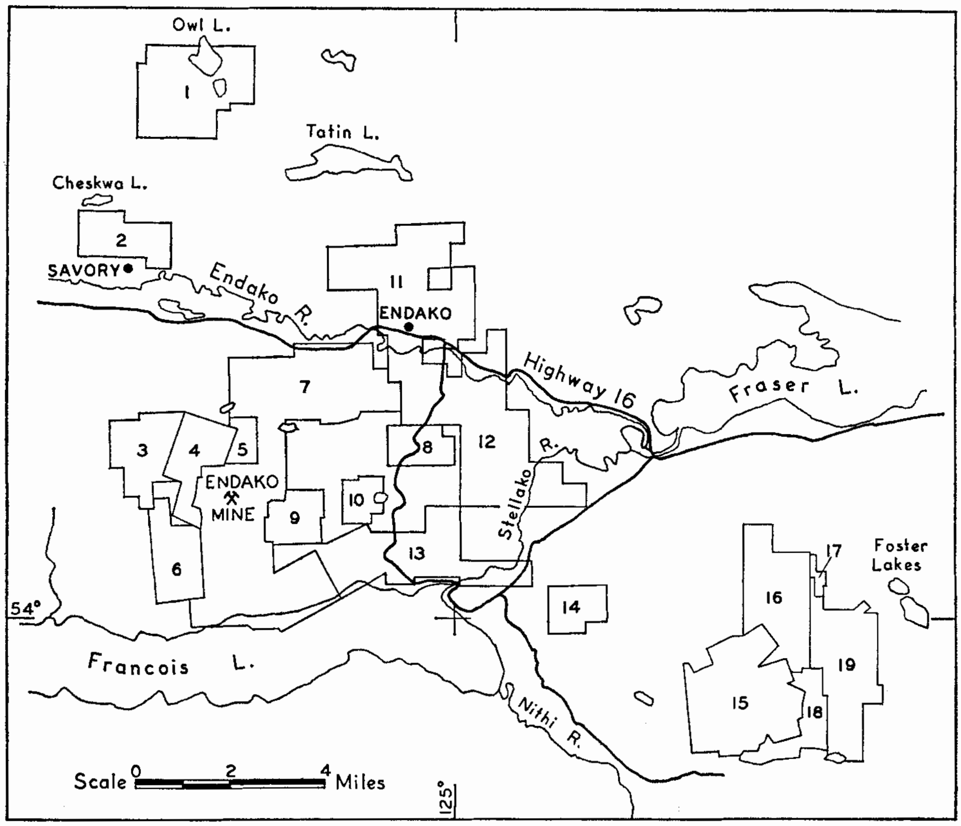


Figure 26. Index map showing approximate property boundaries, Endako area.

Figure 26 is an index map showing the approximate positions and outlines of the following properties in the Endako area:—

1. K, S groups (United Buffadison Mines Limited).
2. Aly group (National Explorations Limited).
3. Dis, Dat groups (Julian Mining Co. Ltd.).
4. Nu, Elk groups (Julian Mining Co. Ltd.).
5. Deer group (Julian Mining Co. Ltd.).
6. Rob group (Utica Mines Ltd.).
7. Endako Mines Ltd.
8. Endako Mines Ltd.
9. Bell group.
10. C.M. group (Torwest Resources (1962) Ltd.).
11. Joe, DI, Ex groups (Copper Ridge Mines Limited).
12. Nurd, Dave, Vera groups (Copper Ridge Mines Limited).

13. Rac, Bingo, Pal, O1, Tab groups (Copper Ridge Mines Limited).
14. KO group (Julian Mining Co. Ltd.).
15. Andy, Scott, Enco, Molly groups (R & P Metals Corporation Ltd. and New Indian Mines Ltd.).
16. Tip, Tan groups (Fort Reliance Minerals Limited).
17. MJM group (Scope Development Ltd.).
18. Jen, Beaver groups (Jodee Explorations Limited).
19. Nithi group (Dundee Mines Ltd.).

Molybdenum

K, S (United Buffadison Mines Limited) (1)*

(54° 125° S.E.) Company office, 305, 100 Adelaide Street West, Toronto 5, Ont. L. Lahman, president; C. J. Cryderman, property supervisor. This company holds about 70 claims in the K and S groups, which are 3 miles north of Savory and are reached by road from Highway 16. The property is mainly west of Owl Lake and two smaller lakes to the south, and is at elevations ranging from 2,500 to 3,500 feet. Work in the year included road-building, stripping and trenching, soil-sampling, and 6,000 feet of wire-line diamond drilling in 12 holes. A winter camp was constructed.

The main showing was discovered in May or June and is northeast of another showing found earlier by C. L. Erickson and also trenched. The main showing is on the K claims about 800 feet west of the middle lake and consisted originally of one or more narrow quartz and molybdenite veins in rusty Casey quartz monzonite. An area extending 400 feet farther southeast was trenched and stripped, exposing further scattered molybdenite, mainly in or near narrow quartz veins which mostly trend eastward and dip northward. Three holes, each 480 feet or more in length, were then drilled, of which two were inclined under the showing from the northeast and southwest respectively, and the third was drilled vertically from the northeastern set-up. High molybdenite assays were reported from the first hole, but reassaying of this core and the results from later holes showed the mineralization to be far below ore grade. The best mineralization in the first hole extended for a length of about 250 feet from the collar. The core of the first two holes revealed numerous quartz veins rarely as much as one-quarter inch wide, some of which contain molybdenite which is mostly very finely disseminated. Fractures, which are mostly chloritic, are in some cases smeared with molybdenite. Pyrite is sparsely disseminated and also occurs on fractures. The quartz monzonite is cut by aplite dykes and is variously altered, being partly both bleached and chloritized and partly containing fresh biotite and orthoclase, which are accompanied by greenish or yellow altered plagioclase. One or more faults which occur in these two holes appear to strike eastward and are partly followed by unmineralized dykes variously of latite and andesite.

Other holes were drilled vertically at wide spacing, mostly to the west and northwest of the showing in an area devoid of outcrops. Mostly non-commercial amounts of molybdenite were intersected, partly in holes northwest of the showing at distances of as much as 2,300 feet.

* By J. M. Carr.

Aly (National Explorations Limited) (2)* (54° 125° S.E.) Company office, 509, 25 Adelaide Street West, Toronto, Ont. This group of mineral claims is 4 miles west of Endako. A soil-sampling survey of all the claims was made by Sulmac Exploration Services. Nine men worked for 2½ months under the direction of E. Amendolagine, geologist. The property was not visited.

Rob (Utica Mines Ltd.) (6)† (54° 125° S.E.) Company office, 1030 West Georgia Street, Vancouver 5. G. L. Mill, president. This company holds 28 claims, mainly in the Rob group west of the Endako mine. Work in 1965 was supervised by R. C. Coutts and included several surface diamond-drill holes totalling about 3,000 feet. No significant molybdenite mineralization was intersected.

Hole No. U1 was inclined north-northeastward from a trench situated at the north boundary of the claim group, about 1 mile west of the Endako orebody. In this hole, the only one for which details are available, the Francois quartz monzonite is cut by sheared dykes variously of orthoclase-plagioclase porphyry and lamprophyre and by post-mineral faults. Pyrite occurs abundantly as fracture-fillings, and there are occasional slender quartz veins which enclose specular hematite. A single quartz vein was seen that contained molybdenite. The quartz monzonite is partly chloritized and locally contains seams of breccia and grey siliceous mylonite. (*See* Annual Report, 1964, p. 61.)

Nu, Elk (Julian Mining Co. Ltd.) (4)* (54° 125° S.E.) Company office, Britannia Beach; field office, 122, 744 West Hastings Street, Vancouver 1. R. S. Adamson, chief geologist. This property, owned by Julian Mining Co. Ltd., consists of 63 claims adjoining the western boundary of the property of Endako Mines Ltd. Some geological mapping and seismic work was done, and eight trenches of a total length of 1,600 feet were made by bulldozer. Two men were employed for one month under the supervision of D. B. Petersen, geologist. The property was not visited.

Endako Mines Ltd. (7, 8)* (54° 125° S.E.) Company office, 1218, 1030 West Georgia Street, Vancouver 5; mine office, Endako. T. H. McClelland, president; H. J. Matheson, manager. This company, which is controlled and managed by Canadian Exploration Limited, holds 244 mineral claims and fractions, of which 13 are held under mineral lease. The property lies north of the east end of Francois Lake, 115 miles west of Prince George.

The mine was officially opened on June 8, 1965. Limited development work had commenced in the West pit early in the year, and by the end of May some 110,000 tons of ore had been hauled to the crusher, 313,500 tons of ore had been stockpiled, and 512,500 tons of waste had been removed. The mill started in the middle of May, so that by the opening date the plant was in running order.

By the end of 1965, 2,287,000 tons had been milled, producing 4,895 tons of molybdenum concentrate and 749 tons of molybdenum trioxide. These contained a total of 5,460,676 pounds of molybdenum. Nearly a third of the concentrate is sold to Japan. The remainder is shipped to France, Italy, Holland, West Germany, and England. Very small quantities remain in Canada.

* By W. G. Clarke.
† By J. M. Carr.

Stripping of the overburden on the West pit was completed in the spring, when stripping the East pit started. By the end of 1965, 2,474,612 cubic yards of overburden had been removed. An additional 131,400 cubic yards was excavated from the plant area.

The mine crew consists of 74 hourly rated employees and nine staff. There are 18 mining shifts per week. Pit equipment includes: Two shovels, with 5-cubic-yard dippers; thirteen trucks, 35-ton capacity; two rotary drills, to drill 9-inch holes; one air-track drill; one tractair drill; one compressor, 600 c.f.m.; three tractors, Caterpillar D-8; two graders; one ammonium nitrate truck; one water and sand truck; five pick-up trucks; one 1¾-ton flat-bed truck; one bus, 25 passengers; one lubrication truck; one 25-ton truck crane; two flat-bed trucks with 3-ton cranes; one front-end loader, 2½-cubic-yard bucket; one dump truck; one ambulance; one fork lift; one road sander.

The pit is being developed in 33-foot benches. Waste dumps and low-grade-ore stockpiles are distributed around the pit outside the final perimeter. Most of the blasting is done with AN/FO; slurry is used in wet holes. At present the haulage distance to the crusher is 4,000 feet.

At the end of December the concentrating plant was treating between 12,000 and 13,000 tons of ore daily, seven days a week. The primary crusher is a 42- to 65-inch gyratory. Minus ¾-inch material from the crusher goes to the fine-ore storage bins, and the remainder goes to a 20,000-ton-capacity stockpile. From this the ore goes to a 17- to 84-inch hydrocone secondary crusher, and the minus ¾-inch again goes to the fine-ore storage. The remainder is fed to two 5- to 84-inch hydrocone tertiary crushers and then to the fine-ore bins, which have a live capacity of 21,000 tons.

There are three sections in the grinding plant, each of which consists of one rod mill and one ball mill, all 12½ feet in diameter by 15 feet long and all driven by 1,250-horsepower motors. Mill discharge is classified in Dorrclones. The pulp, 40 per cent minus 200 mesh, is pumped to one of three rougher circuits, each consisting of four banks of eighteen 48-inch Agitair cells. The rougher concentrate is put through a cyclone, and the underflow is pumped to the first stage of regrinding in closed circuit with a second cyclone. The combined overflow from the two cyclones is pumped to the first stage of cleaner flotation. Four stages of cleaning are employed, with regrinding prior to the first, second, and third stages. After flotation the concentrate is pumped into a 20-foot thickener, from which the underflow goes to a 10- by 10-foot stock tank. It is then filtered by a 6- by 4-foot disk filter and carried by screw conveyor to a drier, a 10-foot four-hearth furnace. Concentrate is taken from the drier to a 90-ton sulphide storage bin by screw conveyor and bucket elevator. That to be shipped as sulphide goes by inclined conveyor to an automatic auger packer for loading into 500-pound drums. That to be shipped as oxide is fed by a variable-speed screw conveyor to a 16-foot 10-hearth oil-fired furnace.

The plant includes an administration building, a warehouse, a dry, a laboratory, and a shop containing eleven 20-foot bays. Water is pumped from Francois Lake. The tailings line is a 22-inch wood-stave pipe 10,000 feet long. Reclaimed water is returned to the mill from the tailings pond.

Exploration continued in 1965, with some geological mapping, and 24,181 feet of diamond drilling, on the West and East pits and the Al, Deer, and Pat claims.

At the end of the year 329 men were employed, 236 on the hourly payroll and 93 on staff. Most of the contractor's work was completed by the end of June. At one time 355 men were employed on plant construction.

Fraser Lake, the townsite for the mine, was built in 1965 and consists of 81 houses, a 48-unit motel, and 36 apartments built by the company. Private interests erected a shopping centre.

Copper Ridge Mines Limited (11, 12, 13)*

(54° 125° S.E.) Company office, 74 East Pender Street, Vancouver 4. This property consists of about 300 mineral claims owned by Copper Ridge Mines Limited. The key groups are named Joe, DI, Dave, Ex, Nurd, Vera, Rac, Ol, Pal, Tab, and Bingo. The property extends from Endako to the shore of Francois Lake and adjoins Endako Mines Ltd. on the south, north, and east sides. Access is from Endako village on Highway 16. A crew of four men worked for four months during the summer. In this period a geochemical survey was made of the 12 claims in the Rac group and seven claims in the Bingo group. Some 30,000 square feet of stripping was done on 72 claims in the Ex, Joe, Pal, Rac, and Bingo groups. Some trenching by bulldozer was done, and pits were dug to a depth of 3½ feet. Work was carried out under the direction of S. J. Hunter, consulting mining engineer. The property was not visited.

Copper-Molybdenum

KO (Julian Mining Co. Ltd.) (14)*

(54° 124° S.W.) Company office, Britannia Beach; field office, 744 West Hastings Street, Vancouver 1. R. S. Adamson, chief geologist. This property, owned by Julian Mining Co. Ltd., consists of 20 claims on a disseminated copper-molybdenum deposit about 8 miles southeast of Endako village. It is accessible by a 5-mile road from Stellako. Previous work on the property consisted of geological mapping and geophysical and geochemical surveying. Further geophysical surveying was done in 1965. A crew of five men worked for one month under the supervision of D. B. Petersen, geologist. The property was not visited.

Molybdenum

Andy, Scott, Enco, Molly (R. & P. Metals Corporation Ltd.) (15)*

(53° 124° N.W.) Company office, 25 Adelaide Street West, Toronto, Ont.; western office, 605 Burrard Building, Vancouver 1. This group of 122 mineral claims, owned and optioned by the company, is on Nithi Mountain 6 miles south of the village of Fraser Lake, and is connected to Highway 16 by a gravel and dirt road. Molybdenite and pyrite are found in fracture fillings in Topley granitic rocks, which have been intruded by porphyry and basic dykes. A soil-sampling survey was done on the central group, over an area of 2,000 acres. Some trenching and stripping was done by bulldozer. Two access roads were built, one 2 miles long to the Scott group and one 4 miles long to the Andy group. This company worked on the property in 1963 and 1964. There were four men employed for three months in 1965, under the direction of R. C. Coutts, engineer. The property was not visited. (*See* Annual Report, 1964, pp. 62–63.)

Jen, Beaver, Pete (Jodee Explorations Limited) (18)*

(53° 124° N.W.) Company office, 404, 510 West Hastings Street, Vancouver 2. There are 37 claims in the group, which is 10 miles southwest of the village of Fraser Lake. Access is by jeep-road from Highway 16. The claims were optioned to Canex Aerial Exploration Ltd., who made an

*By W. G. Clarke.

air-photo survey and did some bulldozer stripping. Mineralization is low-grade disseminated molybdenite. Two men worked for one week under the supervision of J. Knox. The property was not visited.

GISCOME

Gold-Silver-Lead-Zinc

Samson, JHG (Vanco Explorations Limited)* (54° 122° S.E.) Company office, 935, 470 Granville Street, Vancouver 2. The Gerlitzki group of 32 claims, the JHG 1 to 10 and Samson 1 to 22, were held under option. The deposit is a replacement in limestone. Access is by forestry road from Giscome, a distance of 2 miles. Geochemical work was done in 1964, and some geological mapping was done in 1965 by T. Lisle, geologist. It is reported that in 1959 geophysical surveys were made and four holes were diamond drilled on the same ground. Vanco Explorations Limited has terminated its option. The property was not visited.

Copper

Fubar (Noranda Exploration Company, Limited)* (53° 122° N.E.) Company office, 1050 Davie Street, Vancouver 5. This property is east of Wansa Creek, approximately 20 miles east of Prince George by road. There are 16 mineral claims in the group, which is owned by the company. Geological, geophysical, and geochemical surveys were made. Four men were employed for one month under the supervision of A. Burton, geologist. The property was not visited.

CARIBOO

Wells-Barkerville (53° 121° S.W.)

Gold

Aurum (The Cariboo Gold Quartz Mining Company Limited)† Company office, 617 West Pender Street, Vancouver 2; mine office, Wells. J. R. Morris, president; Marcel Guiguet, mine manager. The mine is on the east side of Island Mountain, at Wells. The Cariboo Gold Quartz Mining Company Limited acquired the property in 1954 from Island Mountain Mines Company Limited, who had worked the mine for 20 years. Ore is trucked from the mine across the valley to the Cariboo Gold Quartz mill on Cow Mountain, which is the location of the original mine, now depleted. The offices, warehouse, shops, and power-house are at the millsite.

Most of the work done in 1965 was in the Burnett-Mosquito area. Development consisted of 4,274 feet of drifting and crosscutting and 834 feet of raising. In October a drift was started on the 4000 level to provide access to the Burnett area. A total of 15,439 feet of diamond drilling was done, and 7,558 feet of test-holes was drilled with percussion drills.

In 1965, 28,862 tons of ore was milled, from which was recovered 18,491 ounces of gold and 3,236 ounces of silver. An average crew of 108 included a doctor and five hospital employees.

* By W. G. Clarke.
† By W. C. Robinson.

QUESNEL RIVER

Silver-Copper

B.I. (Coast Silver Mines Ltd.)*

(52° 122° N.E.) This group of 36 recorded claims is on Gerimi Creek, 15 miles southeast of Quesnel on the ridge between the Quesnel and Swift Rivers. It is held by Coast Silver Mines Ltd. (Orvin Baker, president), 1316, 510 West Hastings Street, Vancouver 2. During the year, line-cutting, bulldozer stripping, and geomagnetic surveying were the principal activities. Diamond drilling consisted of 200 feet of EX core. The area of the showings is a moderately compressed syncline of purplish pyroxene andesite flows and pyroclastics overlying limestone of late Triassic or early Jurassic age. Some of these rocks contain areas of minor malachite stain, as do some ankeritic fault zones, but the chief interest was in narrow veinlets of calcite with silver-rich tetrahedrite.

Copper

BJ*

(52° 121° N.W.) This property comprises 130 recorded claims extending on either side of Bootjack Lake to Polley Lake on the east and Trio Lake on the west. Bootjack Lake is about 6 miles southwest of Likely. The claims were located and explored by Mastodon-Highland Bell Mines Limited, 1200 West Pender Street, Vancouver 1 (K. J. Springer, president), but in January, 1966, a new company, Cariboo-Bell Copper Mines Limited, was formed to continue the work. Attention was drawn to the area by magnetic anomalies on the Hydraulic sheet (1533-G, 93-A-12) of the Federal-British Columbia aeromagnetic survey. The property was located after preliminary examination in the summer of 1964, and reconnaissance geochemical and magnetometer surveys were run that fall. In 1965 the following work was performed: An induced polarization survey of the most favourable area east of Bootjack Lake, a detailed soil survey, and 20 bulldozer trenches totalling 25,000 feet.

The showings are in a strip between Horsefly and the Quesnel River at Moorehead Creek in which the outcrop, although scarce, is almost entirely of Lower Jurassic purple to green andesitic pyroclastic and flow rocks (Campbell, 1961). However, at Mount Polley and Bootjack Mountain on either side of Bootjack Lake the volcanic rocks are intruded by stocks ranging from syenite to diorite. At present the most interesting areas are believed to be east of Bootjack Lake in the Mount Polley stock, the outlines of which are not fully known because of relatively poor exposure, but which has a diameter of at least 2 miles. This stock is composed of a number of phases ranging from grey monzonite to pink or grey syenite and rarely to diorite. The phases appear largely gradational, but some intrude others. The borders are irregular and interpenetrating with a northerly oriented grain. Some of the variation between phases is the result of variable potassic alteration, which may occur pervasively, in replacement veinlets, or in intrusive dykelets of syenite. Certain areas show a stockwork of shattering and a related reticulate pattern of alteration.

Microscopically all these rocks are seen to be porphyritic, with phenocrysts of augite, sodic plagioclase, and some orthoclase. The orthoclase either mantles the plagioclase or occurs as separate middling-sized phenocrysts in a fine feldspathic matrix that is fairly potassic. Phenocrysts form about 40 per cent of the rock. The augite phenocrysts everywhere form 10 to 15 per cent, and the feldspars 25 to 30 per cent, but the relative proportion of plagioclase to potash feldspar is quite variable. The plagioclase is commonly highly sericitized and may be replaced by orthoclase

*By A. Sutherland Brown.

or clinozoisite. The orthoclase is highly clouded, but the augite is commonly fresh. Opaque minerals form up to 5 per cent and are magnetite, pyrite, and chalcopyrite. Accessory minerals include apatite, sphene, and zircon. In some specimens, apatite forms rare phenocrysts up to 1 millimetre long. Veinlets of potash feldspar, clinozoisite, and pyrite and chalcopyrite are common.

The Mount Polley monzonites and syenites are cut by some wide dykes of augite diorite, which is younger than the potassic alteration and the mineralization. Oscillatory zoned augite phenocrysts form 30 per cent of this rock, and the matrix is formed of serially graded, lathy, altered plagioclase with minor interstices filled with potash feldspar. Magnetite forms about 5 per cent and is randomly distributed in middle- to small-sized grains.

Sulphide minerals (chalcopyrite and pyrite) are widely distributed throughout the stock in small amounts, disseminated and along hair-line fractures. The induced polarization survey revealed three main northerly trending anomalies, which show a crude relationship to copper soil anomalies but not to magnetic highs. Trenching has shown copper mineralization of low grade to be very widely distributed.

[References: Campbell, R. B., *Geol. Surv., Canada,* Map 3-1961, Quesnel Lake, West Half.]

QUESNEL LAKE

Copper

KE, LO* (52° 121° S.E.) Helicon Explorations Ltd., North Vancouver, owned the KE group and held by option agreement the LO group. The two groups comprise 212 mineral claims on the south side of Quesnel Lake and north of Hen Ingram Lake. The showings are reported to consist of pyrrhotite, pyrite, and chalcopyrite mainly in fracture fillings. During 1965 five BXW holes were diamond drilled a total length of 1,500 feet and two 4½-inch-diameter diamond-drill holes were drilled a total length of 306 feet. Other work included geological mapping, geophysical surveying, trenching, and stripping with a bulldozer. A crew of 12 men was employed for seven months under the direction of G. M. Hurd. Access to the property was by road from Horsefly. The property was transferred to Pegasus Explorations Ltd. when the work terminated. The property was not visited.

LAC LA HACHE

Big Timothy (Takomkane) Mountain (52° 120° S.W.)

Molybdenum

Boss Mountain (Brynnor Mines Limited, Boss Mountain Division)* British Columbia office, 1050 Davie Street, Vancouver 5; mine office, Box 247, 100 Mile House. L. R. Redford, manager; K. G. Collins, mine superintendent; J. Austin, mill superintendent; A. Ozols, plant superintendent; R. C. Heim, geologist. The property comprises 11 Crown-granted and 83 recorded claims. The mine is on the east slope of Big Timothy (Takomkane) Mountain, about 35 air miles northeast of 100 Mile House, from which it is reached by 57 miles of road via Forest Grove and Canim Lake. The geology of the mine is described in the Annual Report for 1964.

The ore mineral is molybdenite, which occurs as pockets and veinlets in two quartz breccia zones, as seams in slips in quartz diorite, and as seams, pockets, and veinlets in various quartz veins. The Main quartz breccia orebody approximates a vertical prism 70 feet thick, 300 feet long, and more than 500 feet deep. The South

*By W. C. Robinson.

quartz breccia orebody is known only from diamond drilling. The Fracture orebody is a block of unbrecciated quartz diorite in which slips and quartz veins are sufficiently closely spaced and sufficiently well mineralized with molybdenite to make the block of ore grade. The Fracture orebody is about half as large as the Main breccia orebody. The High Grade vein is exposed for a length of 90 feet on the 5045 level and comprises quartz and molybdenite in a sheared lamprophyre.

The workings include a main haulage adit-crosscut at 5,045 feet elevation, driven 5,600 feet almost due west from the portal to the vicinity of the orebodies. It curves into a main drift which passes along the northeast side of the Main breccia and Fracture orebodies and continues beyond them to the northwest. The southerly of two raises leads to the 5085 sublevel in the Main breccia orebody. The northerly raise, in the Fracture orebody, leads to the 5280 level drift. A vertical raise from this drift leads to surface at 5,488 feet elevation. The ore is mined by vertical long-hole blasting and is drawn off at mucking-machine draw points, where it is loaded directly into cars and hauled to surface by trolley locomotive. The following is a summary of mining and development in 1965:—

	Ft.
Drifting and crosscutting	6,287
Raising	1,619
Diamond drilling (underground)	23,491
Diamond drilling (surface)	11,692
Blast-hole drilling	225,304

During 1965 a townsite was completed adjacent to the south end of Hendrix Lake, about 6 miles distant from the mine. Thirty houses, a school, a recreation hall, and a curling rink were erected. Construction was completed of a 1,000-tons-per-day mill just below the portal and other mine buildings. Milling commenced on February 17th, but work was suspended between March 8th and May 11th due to an industrial dispute. In 1965 a total of 224,299 tons of ore was milled to produce 1,429 tons of concentrate containing 1,615,223 pounds of molybdenum. An average crew of 200 men was employed. (*See* Annual Report, 1964, pp. 65–80; *see also* Bull. 9, 1940, pp. 34–47.)

TASEKO LAKE

Copper-Molybdenum

MM (Phelps Dodge Corporation of Canada, Limited)* (51° 123° S.E.) Company office, 55 Yonge Street, Toronto 1, Ont.; Vancouver office, 404, 1112 West Pender Street, Vancouver 1. This company holds 43 recorded mineral claims near the confluence of Taseko River and Griswold Creek. Work in 1965 consisted of geochemical sampling. Two men were employed for one month under the direction of W. Meyer. Access was from Vancouver by fixed-wing aircraft and helicopter. The property was not visited.

KH (Mesa Mines Limited)* (51° 123° S.E.) Company office, c/o Phelps Dodge Corporation of Canada, Limited, 55 Yonge Street, Toronto 1, Ont.; Vancouver office, 404, 1112 West Pender Street, Vancouver 1. This company owns 120 mineral claims approximately 8 miles southeast of Taseko Lake. Work in 1965 was carried out by a crew of eight men employed for three months under the supervision of W. Meyer. Seven diamond-drill holes totalling 3,182 feet were drilled from surface with AX wire-line equipment. Other work included geological mapping. It has been re-

* By W. C. Robinson.

ported that the mineralization consists of chalcopyrite with minor molybdenite disseminated in quartz diorite. Access was from Vancouver by fixed-wing aircraft and helicopter. The property was not visited.

Zen (Noranda Exploration Company, Limited)* (51° 124° S.W.) Vancouver office, 1050 Davie Street, Vancouver 5. This company held, by option agreement, 24 mineral claims in the Zen, On, and Zenon groups, approximately 8 miles southwest of Taseko Lake. During 1965 work was carried out by a crew of seven men under the direction of W. Botel. Work included geological mapping, trenching, stripping, and sampling. Subsequently the option was dropped. It has been reported that the mineralization consists of chalcopyrite, pyrite, and molybdenite in porphyry dykes within granodiorite. Access was by aircraft from Vancouver. The property was not visited.

TATLAYOKO LAKE

Gold-Silver

Hom* (51° 124° S.W.) Falconbridge Nickel Mines Limited, 1112 West Pender Street, Vancouver 1, holds 30 mineral claims by record southwest of Tatlayoko Lake. The mineralization is reported to consist of arsenopyrite, pyrite, and chalcopyrite in fissure veins. During 1965 work included stripping and trenching. A crew of three men was employed for two months under the supervision of J. J. McDougall. Access was by helicopter from Tatlayoko Lake. The property was not visited.

LILLOOET

Bridge River (50° 122° N.W.)

Gold-Antimony

Ace Mining Company Limited* Company office, 546 Howe Street, Vancouver 1. This company holds 53 mineral claims lying for the most part north of Carpenter Lake and extending west of Gun Creek. During 1965, 124 feet of crosscutting was done in the old Congress mine. Other work included 1,943 feet of surface diamond drilling, 2,531 feet of underground diamond drilling, and mapping. Eleven men were employed for three months under the direction of A. R. Bullis.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1948, pp. 106–112; Cairnes, C. E., *Geol. Surv., Canada,* Mem. 213, 1937, pp. 102–104.]

Gold

Bralorne Pioneer Mines Limited* Company office, 355 Burrard Street, Vancouver 1; mine office, Bralorne. G. H. Davenport, president; W. E. Field, resident manager; D. B. Cameron, mine superintendent; E. H. Hall, mill superintendent; M. J. Mitchell, plant superintendent. The company operates the Bralorne mine on Cadwallader Creek. It is reached by 51 miles of road from Shalalth or 75 miles from Lillooet, both stations on the Pacific Great Eastern Railway. Development of the surface showings began about 1898, and production has been continuous since 1931. The property is described in some detail in the 1958 Annual Report.

The workings are approached by a main haulage adit on No. 8 level. There are three internal shafts: the Crown shaft, approximately 2,600 feet deep from No. 8 to No. 26 level; the Empire shaft, approximately 3,280 feet deep from No. 3 to

* By W. C. Robinson.

No. 26 level; the Queen shaft, 2,640 feet deep from No. 26 to No. 43 level. Most of the present production is mined by the cut-and-fill method. Most of the stopes are sand-filled with mill tailings, which are piped into the mine. The ore is hoisted in the Queen shaft to No. 26 level and is then hauled by battery locomotive to the Crown shaft, hoisted to No. 8 level, the main haulage level of the mine, and hauled by trolley locomotive to the mill. The ore is treated in a 600-ton cyanide mill. In 1965, 115,731 tons of ore was milled, yielding 54,589 ounces of gold.

A summary of development work done in 1965 is given below:—

	Ft.
Drifting	709
Crosscutting	781
Raising	162
Sinking	373
Diamond drilling	11,611

During July and August, production from the mine was curtailed while the Queen shaft was deepened 373 feet from No. 41 to No. 43 level. A station was cut on No. 39 level and a crosscut driven to the 77 vein, on which 700 feet of drifting was done. A station was partially cut on No. 42 level, and a station was cut on No. 43 level in preparation for crosscutting to the 77 vein on this level.

The number of employees was 261, of whom 189 were underground.

HURLEY RIVER (50° 122° N.W.)

Copper

Cap (Mining Corporation of Canada (1964) Limited)*

Company office, 1800, 44 King Street, Toronto, Ont.; Vancouver office, 514, 402 West Pender Street. This company owns 18 mineral claims at an elevation of 5,500 feet on the east side of Donelly Creek, a tributary of Hurley River. It has been reported that the mineralization consists of disseminated pyrite with minor chalcopyrite. Work in 1965 was carried out by a crew of seven men for four months under the supervision of W. Rainboth. One AX diamond-drill hole was drilled 370 feet. Other work included geological mapping, geophysical surveying, trenching, and stripping. The property is accessible by 23 miles of jeep-road from Bralorne. It was not visited.

TYAUGHTON CREEK (51° 122° S.W.)

Mercury

Dot, Silverquick, Etc. (Silverquick Development Company (B.C.) Ltd.)*

Company office, 325, 1155 West Georgia Street, Vancouver 5; mine address, Gold Bridge. Robert E. Woods, president. This company holds a group of claims that straddles Tyaughton Creek just west of Relay Creek. The main showing on the property, a zone of cinnabar mineralization, is at 5,475 feet elevation, 1 mile up a small creek that flows north into Tyaughton Creek 2 miles west of its junction with Relay Creek. In the early part of the summer of 1965 a small retort was operated at the mine. High-grade ore was mined from the main vein, crushed, and fed into the retort in 600-pound charges. During the period of operation 20 flasks of mercury were produced.

In 1965 Canex Aerial Exploration Ltd. obtained an option agreement on the property. Work, which was carried out by an average crew of six men under the direction of W. S. Pentland, commenced in September and was suspended in November. The work included geochemical surveying of an area 2,000 feet wide and

* By W. C. Robinson.

4,000 feet long. Other work included 3,400 feet of bulldozer trenching and 1,425 feet of diamond drilling in two holes. Access is by road from the Bridge River road.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1964, pp. 81–83; *Geol. Surv., Canada*, Paper 43-15.]

TEXAS CREEK (50° 122° N.E.)

Molybdenum

Index* Texas Creek Mines Limited, 569 Howe Street, Vancouver 1, holds 13 Crown-granted claims and 23 recorded claims. The property is on the summit between the north fork of Texas Creek and Phair Creek and is at an elevation of 7,300 to 8,500 feet. Access is by jeep-road via Texas Creek, which flows into the Fraser River from the west about 13 miles south of Lillooet. It has been reported that the mineralization consists of molybdenite, with minor pyrite and pyrrhotite, in shears and fractures in a granite stock. Work in 1965 was carried out by a crew of four men, which was employed for six months under the supervision of W. Inverarity. The work included trenching, stripping, and 78 feet of diamond drilling. The property was not visited. (*See* Annual Report, 1949, pp. 113–114.)

LYTTON

Copper

Tetra, Jean* (50° 121° S.W.) This property consists of 30 recorded mineral claims, of which 20 are in the Tetra group and 10 in the Jean group. These claims are held by Bernard Dupuis, of Petrolia, Ont., and associates. The property is on the east side of the Fraser River about 10 miles north of Lytton and between 1,000 and 2,500 feet elevation. Access is by approximately 1½ miles of road from the Lytton–Lillooet highway. Low-grade azurite and malachite mineralization, with minor tetrahedrite, occurs along a shear zone in impure limestone. The mineralized zone ranges from 8 inches to 10 feet wide and is exposed by shallow open cuts for a distance of 680 feet. A test sample, taken from the mineralized zone, indicated the presence of mercury. Widespread azurite and malachite mineralization occur in minor quantities away from the shear zone.

During 1965 construction of approximately 1½ miles of road was completed to the showings. Other work included trenching and sampling.

HIGHLAND VALLEY

Copper-Molybdenum

Krain (North Pacific Mines Ltd.)† (50° 121° N.E.) Company office, 408, 409 Granville Street, Vancouver 2. This company owns 32 recorded mineral claims in the Krain and D. W. groups. The claims lie on the east side of Forge Mountain about 6 miles north of the Bethlehem mine. Access is by jeep-road from the Trojan mine. This is the former Keystone property. Former work done consisted of geological mapping, induced polarization surveys, magnetometer surveys, geochemical surveys, and approximately 10,800 feet of diamond drilling. In early 1965 work done consisted of some road-building; eight diamond-drill holes totalling 7,707 feet, and seventeen 3-inch percussion holes totalling 2,645 feet. A crew of three company men and a diamond-drill crew of 10 men were employed under the direction of A. Fustos. The claims were optioned late in 1965 by Canex Aerial Exploration Ltd. A winter

* By W. C. Robinson.
† By David Smith.

camp was established, short access roads were built, and 2,645 feet of diamond drilling was done in 14 holes under the direction of C. E. Dunn. (*See* Annual Reports, 1956, p. 43; 1957, p. 24; 1958, p. 21.)

Lux, Forge (Canzac Mines Ltd.)*

(50° 120° N.W.) Company office, 418, 510 West Hastings Street, Vancouver 2. This property lies on Bose Hill about 8 miles north of the Bethlehem mine and consists of 84 claims in the Lux and Forge groups. Access has been by jeep-road from the Trojan camp. In 1965 an induced polarization survey was carried out. Other work consisted of trenching and road-building. Eight diamond-drill holes totalling 4,200 feet were drilled. A crew of eight men was employed under the supervision of W. McLaren.

Dansey (North Pacific Mines Ltd.)*

(50° 120° N.W.) Company office, 408, 409 Granville Street, Vancouver 2. This company holds under option 92 claims consisting of the key groups, Tom, JB, Bill, AB, and Mike. The claims include the Dansey property and lie in the northeastern area of the Highland Valley about 2 miles northeast of Bethlehem. Access is by 7 miles of jeep-road which leaves the Witches Brook road about 1 mile east of the airfield.

In 1965 geological mapping, soil-sampling, and an induced polarization geophysical survey on part of JB and Tom groups were carried out. Ten trenches totalling 5,000 feet were bulldozed. A crew of 11 men was employed under the direction of A. Fustos. (*See* Annual Report, 1964, p. 88.)

Bethlehem Copper Corporation Ltd.*

(50° 120° S.W.) Company office, 1825, 355 Burrard Street, Vancouver 1; mine office, Box 520, Ashcroft. H. H. Huestis, president; D. W. Pringle, manager; J. Stitt, general superintendent; R. G. Blundell, mill superintendent. Access to the property is by about 30 miles of paved road from Ashcroft. This company holds 56 Crown-granted and 146 recorded claims and fractions immediately east of Quiltanton (Divide) Lake. A dirt-surface airstrip 2,400 feet long has been built approximately 6 miles by road from the mine-site.

In 1965 the mill capacity reached 6,000 tons per day. A decision was made in February, 1965, to expand the capacity to 10,000 tons per day. Additions to the crushing plant, increasing capacity to 1,100 tons per hour, included a 7-foot short head crusher, screens, conveyors, and feeders. Additions to the new extension of the concentrator building included two 12½- by 15-foot rod and ball mills, cyclones, an electrical control room, one 90-foot deep air cell, six No. 30 cleaner cells, twelve No. 30 D-R flotation cells, and, to the west of the concentrator, two 200-foot thickener tanks. An interesting feature of the Bethlehem operation is the reclaimed water system, which is now capable of supplying the mill with 3,400 gallons of water per minute. Fresh water is obtained from a deep well on Shula Flats that supplies water at the rate of 1,200 gallons per minute.

In May, 1965, the tailings dam failed, but it has since been replaced by a rock dam built of mine waste. Concentrates are hauled by truck to the Vancouver Wharves in North Vancouver for shipment to Japan. Copper concentrate produced in 1965 totalled 32,132 tons. Molybdenum concentrate totalled 55 tons.

Mining was carried out under contract. In February, 1965, production was discontinued from the East Jersey zone. It is planned to recover any ore left in the bottom of this pit in future operations. In 1965 production from the East

* By David Smith.

Jersey pit was 155,653 tons of waste, 6,016 tons of marginal ore, and 167,046 tons of ore. Production from the Jersey zone pit was 3,144,094 tons of waste, 1,060,722 tons of marginal ore, and 1,834,634 tons of ore.

Additional equipment placed in service in the pit in 1965 included nine Haulpak trucks, one rubber-mounted pushdozer, and one D-8 Caterpillar tractor.

No work was done underground.

In 1965 the number of persons employed was 166, of whom 98 were employed by the company and 68 by the contractors. No housing is provided at the property; the employees commute to Ashcroft.

Other work done on the property in 1965 consisted of further exploration on known ore zones—the Iona, White, "D," Fault, Spud Lake, and Hank. A total of 7,137 feet of diamond drilling was done—5,942 feet on the Iona, 459 feet on the Jersey, and 700 feet on the White. Approximately 1,000 feet of trenching was done on the Hank.

Copper

Eden, Ezra, Job (New Indian Mines Ltd.)*

(50° 120° N.W.) Company office, 661 Hornby Street, Vancouver 1; field office, 616, 850 West Hastings Street, Vancouver 1. This group of 57 recorded mineral claims is owned jointly by New Indian Mines Ltd. and by Vananda Exploration Ltd. Access is by jeep-road to the property 3 miles north of Indian Reserve No. 15. In 1965 work consisted of some trenching, road construction, and a geochemical survey. An average crew of five was employed, including the contract crew. Work was under the supervision of F. J. Hemsworth.

Copper-Molybdenum

Jericho Mines Ltd.*

(50° 120° S.W.) Company office, 71, 553 Granville Street, Vancouver 2. This company holds a large group of claims south of Witches Brook, about 7 miles east of Quiltanton (Divide) Lake. Work in 1965 was supervised by Alrae Exploration Ltd. The lower adit, which was started in 1964, was driven to intersect the predicted ore zone at 2,500 feet from the portal. At 1,725 feet a mineralized zone (1725 zone) was intersected and crosscut for approximately 30 feet. Drifts were driven to the right and left on this zone, and the faces were still mineralized when work was suspended. On the target zone, about 2,250 feet from the portal, drifts were also driven to right and left. The main adit has been timber-supported for most of its length. A raise was started to explore the target zone to surface, but only 30 feet was completed when work was suspended. Six diamond-drill holes were drilled from underground in the vicinity of the 1725 drifts to explore the ore zones to a depth of 500 feet below the drifts. Including contractors, a crew of 14 men was employed. (*See* Annual Report, 1964, pp. 89–90.)

W.D.R., Huestis, Outrider, Toketic, Bethsaida, Buttle Lake (Valley Copper Mines Limited)*

(50° 120° N.W., S.W. and 50° 121° S.E.) Exploration office, 1150 Bay Avenue, Trail. This company, which is under the management of The Consolidated Mining and Smelting Company of Canada, Limited, holds under agreement 442 mineral claims in the Highland Valley area. Access to the properties is by 24 miles of road from Ashcroft. In 1965 geological surveys were continued, an induced polarization survey was carried out on the Huestis and B.X. groups, and

* By David Smith.

a magnetometer survey on the Huestis, B.X., and Buttle Lake groups. A geochemical survey was carried out over the W.D.R., Huestis, Outrider, Buttle Lake, and Bethsaida groups. Stripping and trenching was done on the Buttle Lake group. Seven diamond-drill holes totalling 3,000 feet were drilled. A crew of seven men was employed under the supervision of J. M. Allen. (*See* Annual Report, 1964, p. 85.)

JAC, RAF, TAM, MER (Cleveland Mining & Smelting Co. Ltd.)*

(50° 121° N.W.) Company office, 615, 850 West Hastings Street, Vancouver 1. This company holds by record 102 claims, consisting of the key groups RAF, TAM, MER, and JAC. The property is on the south side of Highland Valley 4 miles west of Quiltanton (Divide) Lake. In 1965 work consisted of trenching and road-building. Using a percussion drill, sixteen 3-inch holes were drilled totalling 2,000 feet. An average crew of five including contractors was employed. Work was under the supervision of F. J. Hemsworth.

Sheba, Highmont, Minex, B.X. (Anaconda American Brass Limited)*

(50° 120° S.W.) Company office, Britannia Beach. This company held 174 claims by option on Gnawed Mountain, on the south side of Highland Valley about 5 miles south of the Bethlehem mine. Access was by jeep-road from the Divide Lake turn-off. Work in 1965 consisted of trenching, road-building, an induced polarization survey, and six diamond-drill holes totalling 2,355 feet. A crew of 13 men was employed under the supervision of P. A. Lindberg. (*See* Annual Report, 1964, p. 89.)

Lornex Mining Corporation Ltd.*

(50° 121° S.E.) Company office, 558 Howe Street, Vancouver 1; mine office, Box 658, Ashcroft. E. H. Lorntzsen, president; A. C. Skerl, consulting geologist; J. W. Scott, mine manager. This company holds 150 recorded mineral claims to the south of Quiltanton (Divide) Lake, and the camp is accessible by 5 miles of road which branches off about 2 miles east of the end of the paved road from Ashcroft. The key groups are the AM, the Award, and the Iris. Late in 1964 interesting copper mineralization was uncovered by bulldozer trenching on the AM No. 42 claim and Lornex No. 1 fractional claim. The showing is on or close to the contact of younger quartz diorite and the later Bethsaida granodiorite stock and consists of chalcopyrite and copper carbonates in quartz veins and in the fractured rock. In 1965 an extensive trenching programme has been carried out; 18,000 feet of trenching was completed. Geological mapping continued under the direction of Dr. Skerl. An extensive grid was laid out with lines running east-west, and has been used to correlate the geological mapping, trenching, induced polarization surveys, and the drilling which is still being carried out. In 1965 a total of 3,123 feet of diamond drilling was done. It is of interest that one hole was cased to 400 feet and was subsequently drilled over 1,000 feet. Holes totalling 36,500 feet have been drilled with an Atlas Copco overburden drill mounted on a truck (*see* photo). These have been 300-foot vertical holes, drilled to conform to the grid pattern. The holes have been drilled wet and extend below the water-table. A sample-splitter was used at the discharge stream from the drill, and an assay office was set up on the property. Results using the overburden drill have been up to expectation. An average crew of 20 men has been employed.

In 1965 an option agreement was entered into by Lornex Mining Corporation Ltd. with Rio Algom Mines Limited. Management has been retained to date by Lornex Mining Corporation Ltd.

* By David Smith.

MAMIT LAKE

Copper

MLM (Mamit Lake Mining Ltd.)*

(50° 120° S.W.) Company office, 61, 1091 Broughton Street, Vancouver 5. This property consists of the MLM group of 95 recorded mineral claims lying along the west side of Mamit Lake. Access is by gravel road 20 miles from Merritt. Work in 1965 consisted of induced polarization surveys, a geochemical survey, and a magnetometer survey. Some trenching was done with a bulldozer. Seven diamond-drill holes totalling 1,800 feet were drilled. A crew of nine men was employed under the supervision of G. J. Saarse.

Fiddler (Consolidated Skeena Mines Ltd.)*

(50° 120° S.W.) Company office, 716, 602 West Hastings Street, Vancouver 2. This property consists of 12 mineral claims held by option 3 miles northwest of Mamit Lake. Access is by 30 miles of road from Merritt. In 1965 work consisted of a geochemical survey and six X-ray diamond-drill holes totalling 600 feet. A crew of four men was employed under the supervision of W. M. Sharp. The option was dropped.

Chataway Exploration Co. Ltd.†

(50° 120° S.W.) Company office, 1926 Ogden Avenue, Vancouver 9. S. W. Wright, president and managing director. The property consists of 359 recorded claims about 12 miles north of Lower Nicola. Access is by jeep-road from the Guichon Creek road near the Aberdeen mine, or by a recently completed extension of the Skuhun Creek road from the Merritt–Spences Bridge highway. The Chataway camp is on the west shore of Dot Lake. Present work is being done chiefly on a block of 128 claims in the southeasterly part of the property which is under option to Bralorne Pioneer Mines Limited. (*See* Annual Reports, 1962, p. 50; 1963, p. 48; 1964, p. 90.)

The property is underlain by the Guichon batholith and related rocks. Exploration is directed to the investigation of a number of sulphide-bearing faults in a reddish medium-grained quartzose rock resembling quartz monzonite of a younger phase of the batholith. The faults strike about north-south. Two showings on the Wiz 21 mineral claim, about 1,000 feet apart, were examined.

The northerly showing is a shear 19 feet wide, striking north 10 degrees east and dipping 70 degrees westward. Sulphides with minor quartz and carbonate lie in a band up to about 8 inches wide crossing the shear on a strike of north 45 degrees east and a dip of 45 degrees northwest. The principal sulphide is chalcocite; it is massive over much of the 8 inches. Blebs of chalcopyrite occur in the chalcocite. Other smaller and parallel sulphide veins occur in the shear; at this place they are not very numerous. The southerly showing is less well exposed; in it a shear of comparable width to that of the northerly showing strikes north 10 degrees west and dips 60 degrees westward. It is mineralized by quartz which carries coarse chalcopyrite. This exposure is considerably weathered. The relationship of the exposures to one another is not known.

Work done during 1965 included a geological survey by Chataway Exploration, geochemical surveys by both Chataway Exploration and Bralorne Pioneer on the southeastern part of the property, and by Chataway in other parts of the property.

* By David Smith.
† By N. D. McKechnie.

Physical work on the whole property included over 19,000 feet of trenching, 91,600 square feet of stripping, and 9,500 feet of diamond drilling.

Zinc-Copper

Lee, Sunshine, Lo (Vastlode Mining Company Limited)*

(50° 120° S.W.) Head office, Merritt. Andrew D. Gavelin, president; Sherwin F. Kelly, director and consulting geologist. The property consists of 67 claims held by record as the Lee, Sunshine, and Lo groups. It is situated at the headwaters of Steffens and Tolman Creeks, west of Sophia Lake and on the westerly slope of Swakum Mountain at elevations of 4,000 and 5,500 feet. Access is by a dirt road through the Lazy L Ranch which leaves the Mamit Lake road about 7½ miles from its junction with the Merritt–Spences Bridge highway.

The work in progress at the time of the writer's visit in July consisted of open cuts on Sunshine No. 8 mineral claim and trenching and diamond drilling near the boundary between Sunshine No. 11 and No. 13.

On the Sunshine No. 8 mineral claim, open cuts at about 5,200 feet elevation expose in andesitic tuff a shear about 25 feet wide striking north 85 degrees east and dipping 65 degrees north. A cut on the footwall side of the shear exposes a number of quartz stringers dipping about 75 degrees north. These stringers coalesce downward into a vein 1 to 2 feet wide in the bottom of the cut. The quartz is fractured, in places brecciated, and the fractures are mineralized with dark sphalerite and minor galena. About 25 feet to the south a second open cut exposes the hangingwall of the shear. Near the hangingwall a quartz vein 2 feet wide is exposed, also carrying sphalerite and minor galena. This cut exposes the shear for a width of about 10 feet. No work has been done to explore the shear along strike. The mineralization exposed is sparse.

At the Sunshine Nos. 11 and 13 boundary, at about 5,350 feet elevation, four short cross-trenches lie on a line bearing north 65 degrees east for a distance of 150 feet. The rocks exposed are andesitic tuffs. Starting from the northeast end, the first trench is 26 feet long on a bearing of north 60 degrees west. It exposes brecciated tuffs mineralized by quartz, sphalerite, pyrite, chalcopyrite, and galena. No definite strike or dip of the breccia can be seen. A strong set of joints striking north 65 degrees east and dipping 80 degrees southeast cut the mineralized breccia. At the southeast end of this trench two unmineralized faults are exposed; one strikes north 20 degrees west and dips 80 degrees northeastward, the other strikes north 80 degrees east and dips 40 degrees northward. There is no evidence as to magnitude or direction of movement. At a second trench 48 feet southwest and 10 feet long quartz stringers and sulphides lie in two principal directions, striking east-west and dipping 75 degrees north, striking north 45 degrees east and dipping 80 degrees southeast. Unmineralized joints strike north 75 degrees east and dip 70 degrees southeastward, and north 45 degrees west, 85 degrees northeast. A small rock cut 33 feet farther to the southwest exposes what appears to be a contact between brecciated and massive unmineralized tuff. The contact strikes north 50 degrees east and dips 45 degrees northwest.

More work on the surface is required before the nature, extent, or direction of the brecciated zone can be known. The cores from six diamond-drill holes near the trenching area showed little indication of the brecciated mineralized tuff, but without more reliable data this may or may not be significant. Assays on split core samples from the first two holes, made available to the writer by the company, showed fractions of 1 per cent in zinc, copper, and lead with two exceptions, which

* By N. D. McKechnie.

were 4 per cent zinc over 9 feet in hole No. 1 and 1.91 per cent zinc over 10 feet in hole No. 2. Assays in gold and silver are negligible.

Work done in 1965 included road-building, trenching, stripping, and the drilling of 12 holes totalling 3,000 feet.

SKUHUN CREEK

Copper-Molybdenum

Cris (General Resources Ltd.)*

(50° 121° S.E.) Company office, 213, 678 Howe Street, Vancouver 1; field office, Box 892, Merritt. The Cris group of six recorded mineral claims is reached from a turn-off at Mile 14 on Highway 8, by 14 miles on the Skuhun Creek road and 6 miles up the Skuhost Creek jeep-road, which was built in 1965. In 1965 work done consisted of road-building, 21 trenches totalling 3,100 feet, and three diamond-drill holes totalling 900 feet. A crew of eight men was employed under the direction of R. B. Stokes.

BO, LF (Benson Mines Ltd.)*

(50° 120° S.W.) Company office, 207 Rogers Building, 470 Granville Street, Vancouver 2. This property includes 40 recorded mineral claims in the BO and LF groups lying east of Pimainus Lake at the head of Skuhost Creek. Access is by the Lornex or Skuhun Creek roads. In 1965 a magnetometer survey was carried out. About 2,500 feet of trenching was done with a bulldozer, and two diamond-drill holes totalling 425 feet were drilled. A crew of five men was employed under the supervision of H. Cohen Engineering Ltd.

Copper

Yubet (Stellako Mining Co. Ltd.)†

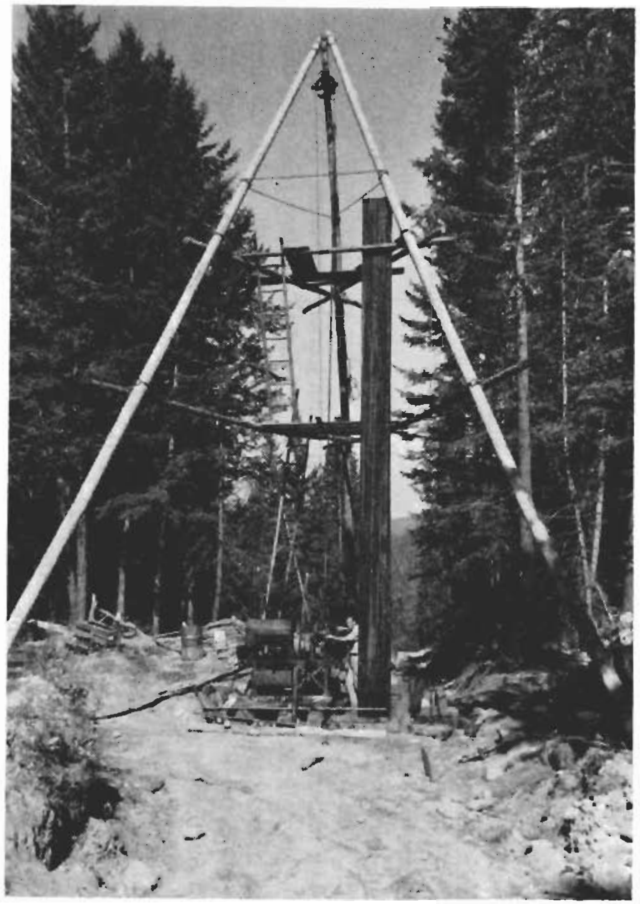
(50° 120° S.W.) Company office, 716, 602 West Hastings Street, Vancouver 2. M. F. Maxwell, president; J. R. Trepanier, general manager. The company controls the Yubet group of eight claims recorded in the name of Estey Enterprises, 404, 510 West Hastings Street, Vancouver 2. The group is situated at the southeast end of Roscoe Lake, which is about 6 miles due west of Mamit Lake. Access is from the Guichon Creek road via Dot Lake over the Chataway road, or by the Skuhun Creek road, which leaves the Merritt–Spences Bridge highway about 25 miles northwest of Merritt.

In mid-July discovery was made of copper-bearing sulphides in a bulldozer trench. The writer made a short examination of this showing.

The mineralization, exposed in a north-south trench measuring 50 by 110 feet, is in highly silicified granitic rock. It consists of bornite, chalcopyrite, and chalcocite in quartz stringers and small veins striking predominantly north 25 degrees east and dipping 80 degrees southeastward. Some sulphides were seen in the highly silicified granitic rock. The trench was not well cleaned, so the proportion and width of quartz-sulphide mineralization were not clearly evident. A quartz-sulphide boulder of about 30 inches diameter lay in the bottom of the trench, indicating the existence of veins much larger than the 6-inch width, which was the largest exposed in place. The secondary copper carbonates, azurite and malachite, were prominent in the bottom of the trench. The occurrence is about 5 miles northwest of the Chataway showing, to which it bears some similarity.

An extension of the Chataway road was built and a camp was installed at the south end of Roscoe Lake. Later in 1965 an induced polarization survey was made. Diamond drilling was done to test the area of the surface showings.

* By David Smith.
† By N. D. McKechnie.


Diamond-drill rig on Betty Lou property.


Truck-mounted percussion drill on Lornex property.

Cal (General Resources Ltd.)*

(50° 120° S.W.) Company office, 213, 678 Howe Street, Vancouver 1. The Cal group of 12 recorded mineral claims north of Roscoe Lake is reached from a turn-off at Mile 14 on Highway 8, by 23 miles up the Skuhun Creek road. Work in 1965 consisted of 3,500 feet of bulldozer trenching. A crew of two men was employed under the direction of R. B. Stokes.

Rain (Vanmetals Exploration Limited)*

(50° 120° S.W.) Company office, 213, 678 Howe Street, Vancouver 1. The Rain group of 16 recorded mineral claims lies 3 miles southwest of Chataway Lake and is accessible by the Skuhun Creek road. In 1965, 1,800 feet of trenching was done and magnetometer and induced polarization surveys were made. A crew of two men was employed under the direction of R. B. Stokes.

MERRITT

Copper-Iron

Craigmont Mines Limited*

(50° 120° S.W.) Company office, 700, 1030 West Georgia Street, Vancouver 5; mine office, Box 3000, Merritt. J. D. Simpson, president; R. E. Hallbauer, mine manager. This company holds 106 mineral claims and fractions, of which 22 claims and fractions are held in 10 separate leases. The Craigmont orebodies are in the Merrell Nos. 7 and 8 claims and the McLeod Nos. 5 and 6 claims and are between the forks of Birkett Creek at original surface elevations between 3,800 and 4,200 feet. Access to the property is by road north from Lower Nicola on No. 8 highway, 5 miles west of Merritt.

Mining and milling were not continuous in 1965. There was no production in the months of October, November, and December due to a work strike. Production was from the open pit and from the underground operation. The copper concentrate was shipped by Canadian Pacific Railway and was loaded at the Coyle siding. Most of the concentrate was shipped to Japan, and the remainder was shipped to the smelter at Tacoma, Wash. The iron content of the ore was impounded with the tailings. A part of the tailings was deslimed and returned to underground as backfill. In 1965 material moved in the open pit by contractors measured 341,733 cubic yards, including glacial till and waste rock. An additional 11,051,882 tons of material, including glacial till, waste rock, and stockpiled ore, was moved by the company, which also mined 735,402 tons of open-pit ore. From the stockpile, 320,635 tons of ore was taken to the primary crusher. Underground work was continued on all levels and is summarized as follows:—

Development—	Ft.
Lateral development	7,441
Raising	2,618
Borehole (48 inches)	177
Shaft-sinking	20
Ore production—	Tons
Cut-and-fill stopes	130,299
Blast-hole stopes	114,503
Development	25,272

Diamond drilling was continued underground and on the surface. The cut-and-fill system of mining, using tailings as backfill material, has been tried underground. On the 3000 level, a system of long-hole drilling has been used, in which

* By David Smith.

the ore drops to a series of mucking-machine draw points. In 1965 a new method of placing cement as a ground support was tried. The machine places a very dry mix, brought together at the nozzle or gun held by the operator, placed to a depth of several inches as desired on the back and walls.

In 1965 the number of persons employed was 528. No housing is provided on the property, and the crews commute from Merritt, a distance of approximately 8 miles. (*See* Annual Reports, 1960, pp. 35–40; 1961, pp. 31–37.)

Copper

Cinderella (Peel Resources Limited)*

(50° 120° S.W.) Company office, 501, 535 Thurlow Street, Vancouver 5. J. S. St. Mars, managing director. The company owns 62 recorded mineral claims in the Cinderella and Nola groups on the hillside 2 miles northeast of Merritt. In 1965 an agreement was reached with Nippon Mining Company Ltd. of Japan to explore the property. Work began in August with geological, geophysical, and geochemical surveys. Twenty trenches totalling 4,000 feet were made, and 10 NX holes totalling 5,000 feet and two BX holes totalling 250 feet were diamond drilled. The work was supervised by Ruben Fast. The property was not visited.

Kan, Tin (Canex Aerial Exploration Ltd.)†

(49° 120° N.W.) Company office, 700, 1030 West Georgia Street, Vancouver 5. The company holds by agreement 28 recorded mineral claims under the Kan and Tin groups, southeast of Iron Mountain. Access is by 10 miles of road south of Merritt. In 1965 work consisted of soil-sampling and four holes were diamond drilled totalling 1,939 feet. A crew of five men was employed under the supervision of W. Pentland.

Selish (Torwest Resources (1962) Ltd.)†

(49° 120° N.W.) Company office, 702, 850 West Hastings Street, Vancouver 1. This property lies on Selish Mountain 8 miles south of Merritt and is accessible by 14 miles of road from Merritt. The company owns the Selish group of 72 recorded mineral claims. In 1965 work consisted of extensive trenching using a bulldozer. A crew of seven was employed under the supervision of W. G. Hainsworth.

CANFORD

Copper

Wade (General Resources Ltd.)†

(50° 120° S.W.) Company office, 213, 678 Howe Street, Vancouver 1. This company holds claims in the Wade, the Major, and the General groups on the southwestern slopes of Promontory Hills immediately north of Highway 8. In 1965 work was confined to geological mapping. One diamond-drill hole totalling 850 feet was drilled. A crew of six men was employed under the direction of R. B. Stokes.

Betty Lou (Canex Aerial Exploration Ltd.)†

(50° 120° S.W.) Company office, 700, 1030 West Georgia Street, Vancouver 5. The company owns 29 recorded mineral claims in the Betty Lou, the Lou, and the Loo groups adjoining the Craigmont property. Access is by 10 miles of road from Merritt. In 1965 two AX holes were diamond drilled totalling 1,596 feet. A crew of five men was employed under the supervision of W. Pentland.

* By M. S. Hedley.
† By David Smith.

Copper Canyon (Hurley River Mines Ltd.)* (50° 121° S.E.) Company office, 535 Howe Street, Vancouver 1. This property lies northwest of Merritt and consists of 52 mineral claims grouped as the Copper Canyon, P.J.H., Eagle, and Tent groups. Access is by good road 18 miles from Merritt. In 1965 a geological survey and a geochemical survey were carried out. Ten diamond-drill holes were drilled totalling 3,310 feet. A crew of seven men was employed. Supervision of the property was carried out by Alrae Exploration Ltd.

NICOLA

Copper-Tungsten

Last Chance (Torwest Resources (1962) Ltd.)* (50° 120° S.W.) Company office, 702, 850 West Hastings Street, Vancouver 1. This property is at the summit of Swakum Mountain, 12 miles north of Nicola, and is accessible by road on Clapperton and Shuta Creeks. It consists of three mineral leases and six claims held by record. The property includes several old showings such as the Lucky Mike and the Last Chance, on which work has been recorded as far back as 1916. In 1965 work consisted of the diamond drilling of nine holes totalling 1,719 feet. A crew of nine men was employed under the supervision of W. G. Hainsworth. (*See* Annual Report, 1959, pp. 36–38.)

Copper

Mab (Noranda Exploration Company, Limited)* (50° 121° S.W.) Company office, 1050 Davie Street, Vancouver 5. This company owns the Mab group of 25 recorded mining claims. The property is on Clapperton Creek, east of Swakum Mountain and west of Mab Lake. In 1965 a magnetometer survey and a geochemical survey were carried out. A crew of four men was employed under the supervision of A. Burton.

Quilchena (Quilchena Mining & Development Co. Ltd.)† (49° 120° N.W.) Head office, c/o Paul Schutz, 815 West Hastings Street, Vancouver 1. The company controls 73 mineral claims, holding 54 by record, 12 under mineral lease, and 7 Crown-granted claims by lease agreement with Guichon Mines Limited. The property is mainly along the west side of the Quilchena Creek valley south of Nicola Lake. The present working area is 2 miles south of the Kamloops–Merritt highway. It is reached by a dirt road which leaves the highway about half a mile southwest of Quilchena.

[References: *Geol. Surv., Canada,* Mem. 249, p. 131; *Ann. Repts.,* 1949, pp. 120–124; 1962, pp. 56–59.]

The rocks are andesitic and basaltic volcanic flows and breccias of the Nicola Group, intruded by dykes of feldspar porphyry.

The area presently under investigation is part of that tested in 1962 and extends from the northern side of the Camperdown Crown grant southwestward to the northwest corner of Mineral Lease 13, a distance of about three-quarters of a mile. At the time of the writer's visit, rock cuts were being made in a hillside on the Camperdown. The rocks here are chiefly basaltic, and mineralization is extremely sparse, consisting of occasional grains of bornite and some malachite stain.

* By David Smith.
† By N. D. McKechnie.

Two places in the present rock trenches were shown the writer as examples of better-grade mineralization. The first, at 3,300 feet elevation, consists of a zone some 5 feet wide of irregular and discontinuous fractures in a reddish andesite. Along the fractures the rock is extensively altered to epidote and quartz. The epidotized rock contains grains and small stringers of bornite. The strike of the zone appears to be about north-south and the dip is very steep to the east. The second showing, in a trench at 3,050 feet elevation, is a small exposure of bornite in a medium-grained quartz gabbro. In thin-section the rock is seen to have undergone some fracturing and crushing, but not enough to be apparent in hand specimen. Grains and threads of bornite lie in the crushed zones and in fractured silicate grains. Neither of these sulphide occurrences is of more than academic interest.

The other mineral occurrences on the property are as described in the 1949 and 1962 Annual Reports.

ASPEN GROVE

Copper

Lou, Halo (Friday Mines Limited)*

(49° 120° N.W.) Company office, 501, 535 Thurlow Street, Vancouver 5. The Lou and Halo groups of 60 recorded mineral claims lie 2 miles northeast of Aspen Grove. The ground includes the former Big Sioux showings. A total of 1,600 feet of trenching was done with bulldozer and rippers under the supervision of Ruben Fast. The property was not visited.

Pay (Payco Mines Ltd.)†

(49° 120° N.W.) Company office, 2117 West Fourth Avenue, Vancouver 9. This company holds by record the Pay group of 40 mineral claims in the vicinity of Alleyne Lake, 3 miles southeast of Aspen Grove. The property is reached by a narrow road that turns north from the Kentucky Lake road about 2½ miles east of the Princeton–Merritt highway. A permanent camp has been established at the north end of Alleyne Lake. In 1965 work consisted of some trenching and surface drilling under contract. A crew of eight men was employed. (*See* Annual Report, 1963, pp. 55–56.)

Pyramid (Pyramid Mining Co. Ltd.)‡

(49° 120° N.W.) Company office, 202, 678 Howe Street, Vancouver 1. A. H. Lenec, president; H. L. Hill and Associates, consulting engineers. The property includes 50 claims held by record, all or parts of the June, Saw, Six, Key, Bunny, Sin, and Final groups, and 3 Crown-granted mineral claims, the Tom Cat, Covington, and Vicksburg. The claims are west and south of Kentucky Lake and about 4 miles southeast of the settlement of Aspen Grove. The working area is reached by a jeep-road southward from the Kentucky Lake road about 1½ miles from the highway. (*See* Annual Reports, 1963, p. 56; 1964, p. 96.)

The 1965 work done was chiefly diamond drilling on the Tom Cat mineral claim, at 4,000 feet elevation, which by mid-July amounted to 3,417 feet in 13 holes. The writer was able to ascertain the location, angle, and direction of only one of these holes.

The rock tested is a band of rubbly weathering basaltic flow breccia striking south-southeast and exposed in outcrops for a strike length of about 600 feet. The width on surface varies from 100 to 200 feet. The angle and direction of dip are uncertain; two dip readings on surface were near 60 degrees eastward, but in the

* By M. S. Hedley.
† By David Smith.
‡ By N. D. McKechnie.

one hole for which position and direction are known the core indicates a flatter dip and westward. The rocks to the north and east of the band are massive basaltic flows; those to the south and west are red and green andesitic breccias.

In thin-section the basalt breccia shows considerable fracturing, which does not as a rule show in hand specimens. Alteration consists principally of chloritization of olivine, with some talc, and, to a lesser degree, of pyroxene; feldspars are more or less sericitized.

The basalt breccia is erratically mineralized with chalcopyrite, bornite, and possibly chalcocite. Grab samples of split cores, representative pieces taken at 5-foot intervals, yielded the following assays:—

Hole No.	Core Interval	Copper (Per Cent)
1	0– 50	0.41
1	100–150	0.22
4	110–147	0.25
4	147–187	0.09
10	87–155	0.33

Par (Tormont Mines Limited)*

(49° 120° N.W.) Company office, 509, 25 Adelaide Street West, Toronto, Ont.; field office, 605, 1030 West Georgia Street, Vancouver 5. The Par group of 40 recorded mineral claims lies west of the Merritt–Princeton highway, 7 miles south of Aspen Grove. It is crossed by the Otter Creek road. Eight diamond-drill holes totalling 4,159 feet were drilled on the Par 3, 5, and 33 claims. A crew of seven men was employed under the supervision of B.A. Nekrasov.

Primer†

(49° 120° N.E.) This group of 52 recorded claims is held by record in the name of Primer Group Minerals Ltd., 1111 Venable Street, Vancouver 6. It is situated east of the south end of Missezula Lake, 21 miles north of Princeton. A jeep-road connects the showings with the Missezula Lake road, which leaves the Princeton–Merritt highway at the sawmill 6 miles north of Princeton.

The showings were described in the 1963 Annual Report, page 57.

Some stripping in isolated areas has been done by the owners since 1963. One of these strippings, some 200 feet eastward from the previous work on the Primer No. 21 mineral claim, exposed altered monzonite porphyry containing finely disseminated chalcopyrite. The rock is sericitized, and fresh secondary orthoclase also is present. The chalcopyrite is associated chiefly with patches of epidote, which appears to have been derived from an altered amphibole. The exposure is a small one, a few tens of feet; it is worth enlarging.

STUMP LAKE

Gold-Silver-Lead

Planet (Stump Mines Ltd.)†

(50° 120° S.E.) Head office, 800, 789 West Pender Street, Vancouver 1. L. F. LaPrairie, vice-president and managing director. Present work is financed, under an option agreement, by New York Oils Ltd., 300, 444 Seventh Avenue Southwest, Calgary, Alta. Stump Mines Ltd. owns 117 claims, of which 54 are Crown-granted. The claims are on Mineral Hill, on the eastern side of the southwest end of Stump Lake, which is 1,000 feet east of the Merritt–Kamloops highway. At 28 miles from Merritt a dirt road leads 2 miles north from the highway to the old Planet buildings on the shore of the lake.

* By David Smith.
† By N. D. McKechnie.

Discovered in 1882, the deposit has been mentioned in various Annual Reports from 1885; the geology is described in detail in the Annual Report for 1936, pages D 14–21. A detailed description is contained also in Geological Survey of Canada Memoir 249, 1948, pages 45–57; a full bibliography accompanies this report. The last work prior to the present operation was done in 1944.

The object of the current work is to explore a horizontal gap of about 900 feet on the projection of the King William vein, one of six known on the property, between the King William shaft and the Enterprise workings. At the time of the writer's visit, the work consisted of trenching on the No Surrender Crown-granted mineral claim.

The rocks underlying the Planet property are Nicola volcanic rocks. On the No Surrender mineral claim the principal type is an olive-green finely granular tuff. Northward, some 2,000 feet, agglomerate is exposed near the Joshua shaft.

The main line of trenches, extending some 400 feet on a bearing of north 20 degrees west, expose the King William vein and shear along the strike. The shear here is 4 to 5 feet wide; it is well defined in some places and much less so in others, so that the actual width is not always easily seen. The shear is mineralized with milky quartz, which occurs as stringers along the shear and as veins up to 1 foot wide subparallel to the shear. The quartz carries pyrite, chalcopyrite, bornite, and galena in fractures. Minor disseminated pyrite and chalcopyrite occur for a short distance into the wallrocks. A narrow vein of vuggy dolomite occurs commonly along the hangingwall of the quartz; it contains similar sulphides, but sparsely.

The shear in the trenches strikes from north-south to north 20 degrees west and dips 80 to 85 degrees eastward. Strikes and dips of quartz veins within but not parallel to the shearing are north 5 degrees east, dip 70 degrees eastward, and north 45 degrees east, dip 80 degrees eastward.

Some 300 feet west of the above northwesterly set of trenches, two veins are exposed striking north 5 to 10 degrees east and dipping 70 degrees east. One is a vein of glassy quartz about 1 foot wide and carrying sparse galena; the other is a shear some 2½ feet wide carrying varying amounts of milky quartz mineralized with galena, chalcopyrite, pyrite, and chalcocite(?). A few inches of vuggy dolomite lie along the hangingwall.

It may be of interest to note that plans in the 1936 Annual Report and in Memoir 249 show that in the Enterprise workings the King William vein dips about 20 degrees flatter than it does in the present trenches. The vein in these workings is described in the memoir as the Enterprise vein, striking north 5 degrees east, and its branch, the King William vein, striking north 40 degrees east. These strikes correspond to those of quartz veins within the King William shear as exposed in the trenching. The only sustained production from the property came from the Enterprise vein: 78,601 tons yielded in concentrates 8,186 ounces of gold, 249,932 ounces of silver, 109,266 pounds of copper, 2,292,592 pounds of lead, and 517,709 pounds of zinc.

KAMLOOPS

Copper

Vanco Explorations Limited*

(50° 120° N.E., N.W.) Vanco Explorations Limited, 935, 470 Granville Street, Vancouver 2, is jointly owned and financed by Steep Rock Iron Mines Ltd. and Labrador Mining and Exploration Co. Ltd. On September 10, 1965, this company reached an agreement with nine companies in the Kamloops area to take over their properties and explore them, with a substantial capital outlay over a three-

* By M. S. Hedley and David Smith.

year period. The nine companies were to retain their autonomy and be free to acquire or to conduct exploration on other ground. A total of about 600 mineral claims was reported to be involved at the end of 1965, including 13 claims held by Vanco. The ground extends south and west of Kamloops, from Knutsford to beyond the Iron Mask mine. It is a mineralized belt along the eastern part of the Iron Mask batholith that has long been known to be copper bearing, and has had a considerable amount of work done on it since before 1900.

The deal was engineered by Murray Pezim and E. A. Glick, of Toronto, who gained control of Kamloops Copper Consolidated Ltd., Makaoo Development Company Limited, Galaxy Copper Ltd., and Western Beaver Lodge Mines Ltd. Through Consolidated Negus Mines Ltd., Continental Potash Corporation Ltd., and the newly formed Rolling Hills Copper Mines Limited, Comet Mining Corporation Ltd., and Bata Resources Limited, more ground was acquired in an almost solid block.

Work was carried out before September 10, 1965, by Sulmac Exploration Services Limited from a field headquarters in Kamloops. This included geological, geophysical, and geochemical surveys and some diamond drilling, the latter on the Galaxy property. Work was continued by Vanco, including the diamond drilling of seven holes totalling 2,100 feet, under the direction of D. H. Nicholson, exploration geologist. (*See* Annual Report, 1956, pp. 47–69, for the best published description of the area and the various properties.)

MO (Mineral Mountain Mining Co. Ltd.)*

(50° 120° N.E.) Company office, 789 West Pender Street, Vancouver 1. This property consists of the MO group of 20 recorded mineral claims. The claims lie 5 miles by road south of Knutsford. The claims on which work was done are: Bee No. 2, No. 5; MO No. 1, No. 3. In 1965 a magnetometer survey and an electromagnetic survey were carried out. A crew of two men was employed under the supervision of Ron Granger.

NORTH THOMPSON

Barriere Lake (51° 119° S.W.)

Copper-Lead-Zinc

Barriere Lake Mines Ltd.†

Company office, 2010 Rattenbury Place, Victoria. This company holds about 100 claims, in three groups, in the vicinity of North and East Barriere Lakes. In 1965 work included diamond drilling 19 holes totalling 2,422 feet. Other work included road construction, magnetometer surveying, and stripping. A crew of three men was employed for about nine months. Access to the property is by road from Barriere. The property was not visited.

Little Fort (51° 120° N.E.)

Copper-Molybdenum

SO, RO (Anaconda American Brass Limited)†

Company office, Britannia Beach. This company holds 177 recorded claims in the vicinity of Friendly Lake, approximately 14 miles northeast of Bridge Lake. Access is by jeep-road from the Bridge Lake–Little Fort road. The showings are reported to consist of disseminated chalcopyrite, bornite,

* By David Smith.
† By W. C. Robinson.

and pyrite in fracture filling. Work in 1965 included geological mapping, geochemical sampling, and induced polarization surveying. About 9 miles of road was constructed. A crew of nine men was employed for three months under the direction of P. E. Hirst. The property was not visited.

Molybdenum

Mo (Rio Tinto Canadian Exploration Limited)*

Western district exploration office, 818, 736 Granville Street, Vancouver. This company holds by option 52 recorded claims. The property, formerly known as the Anti-Climax, is in the vicinity of Taweel Lake, about 17½ miles northwest of Little Fort. The property has been described in Department of Mines Bulletin No. 9, 1940, Molybdenum Deposits of British Columbia. Work done in 1965 included geological mapping, soil-sampling, and induced polarization surveying. Other work included trenching and stripping with bulldozers. A crew of seven men was employed for five months under the supervision of G. T. Warren.

ADAMS LAKE

Silver-Lead-Zinc

Helen, S. B. (Aetna Investment Corporation Limited)*

(50° 119° N.W.) Company office, 1690 West Broadway, Vancouver 9. This company, formerly Sheep Creek Mines Limited, holds by option agreement 24 mineral claims about 6 miles westerly from the south end of Adams Lake. The property is accessible by 11 miles of logging-road from Holdings sawmill. It has been reported that mineralization on the property consists of galena, sphalerite, and pyrite. During 1965 four AX diamond-drill holes, totalling 386 feet, were completed. Other work included geological mapping and road-building. A crew of three men was employed for one month under the direction of R. H. Beaton. The property was not visited.

COQUIHALLA

Lead-Zinc-Silver

Hope (Anaconda American Brass Limited)†

(49° 121° N.E.) Company office, Britannia Beach. This group of six mineral claims held by option is located 1 mile by road north of Mile 14 on the Kettle Valley Railway, midway between Coquihalla station and Juliet. It was formerly known as the Keystone group. In 1965 the old adit, 1,000 feet long, was remapped and an induced polarization survey was carried out. A crew of six men was employed under the supervision of P. A. Lindberg. (*See* Annual Reports, 1936, pp. 31–32; 1954, p. 113.)

Copper-Molybdenum

Independence (Bethex Explorations Ltd.)†

(49° 120° N.W.) Company office, 1821, 355 Burrard Street, Vancouver 1. This property of 103 claims consists of 99 recorded mineral claims in the groups Low, FRM, and Ponoka, and four Crown-granted claims. Access is by road 37 miles from Merritt. In 1965 an induced polarization survey was carried out. Six trenches were bulldozed and four diamond-drill holes totalling 1,804 feet were drilled. A crew of eight men was employed under the supervision of C. J. Coveney.

* By W. C. Robinson.
† By David Smith.

TULAMEEN

Copper

David, PR (Bethex Explorations Ltd.)*

(49° 121° S.E.) Company office, 1821, 355 Burrard Street, Vancouver 1. This property consists of 50 mineral claims in the David and PR groups. Access is by 12 miles on the Summit road and by 5 miles of jeep-road northwest to the head of Kelley Creek. In 1965 an access road was built to the claims and eight trenches were bulldozed under contract. A crew of three men was employed under the supervision of R. P. Chilcott.

Lode (Copper Mountain Consolidated Limited)*

(49° 120° N.W.) Company office, 625, 925 West Georgia Street, Vancouver 1. This company holds by record the 15 Lode mineral claims. Access is by 2½ miles of road northwest of Tulameen. Work up to and including 1964 consisted of trenching in the vicinity of the old workings and five diamond-drill holes totalling 1,250 feet. In 1965 surface exploration was continued. A crew of two men was employed under the supervision of R. Collishaw. The property was not visited.

Iron

Imperial Metals and Power Ltd.*

(49° 120° S.E.) Company office, 230 West Broadway, Vancouver 10. N. H. McDiarmid, president. This company owns a large group of claims encompassing the area of Lodestone and Olivine Mountains and Tanglewood Hill. The property lies about 15 miles due west of Princeton and is accessible by logging-roads from the community of Tulameen. The area has been explored, some of it in detail, in past years. In 1965, 45 tons of magnetite ore and 10 tons of Coalmont coal were reportedly shipped to the Lurgi Corporation in Frankfurt, Germany, for testing. Results of tests are not available. (*See* Annual Report, 1959, pp. 39–53.)

SIMILKAMEEN RIVER

Copper

Ilk, Elk, Ni (The Hanna Mining Company)*

(49° 120° S.W.) Company office, 100 Erieview Plaza, Cleveland, Ohio; field office, 200A, 1200 West Pender Street, Vancouver 1. The property consists of 25 mineral claims and fractions of the Elk, Ilk, and Ni groups held by option. It is part of the old Wheeler property in the vicinity of Friday Creek, on the west side of the Similkameen River about 10 miles south of Princeton. Access is by means of a 3-mile road leaving the Hope–Princeton highway at a point approximately 5 miles south of Whipsaw Creek. In 1965 a geological survey and an induced polarization survey were carried out. A crew of six men was employed under the supervision of A. G. Jones. (*See* Annual Report, 1963, pp. 59–61.)

PRINCETON

Regal (The Granby Mining Company Limited)*

(49° 120° S.E.) Company office, 507, 1111 West Georgia Street, Vancouver 5; field office, Allenby. This company holds under agreement the GE group of 72 mineral claims. The property is situated on the east side of Allison Creek valley 2½ miles northeast of Princeton. In 1965 a percus-

* By David Smith.

sion drill was used on the property; 41 holes totalling 5,880 feet were drilled under contract. A crew of three men was employed under the supervision of K. C. Fahrni, chief geologist. (*See* Annual Report, 1963, pp. 63–64.)

Voight Camp (Cumont Mines Limited)*

(49° 120° S.E.) Company office, 302, 550 Burrard Street, Vancouver; field office, Box 405, Princeton. This property consists of 81 mineral claims including 46 Crown-granted and 35 recorded claims. Access is by the Copper Mountain highway 10 miles from Princeton. Geophysical and geochemical surveys have been conducted, and in 1965 work consisted of surface exploration by trenching with a bulldozer. A crew of five men was employed under the supervision of M. MacKnight and P. E. Dumont. (*See* Annual Report, 1964, p. 101.)

KEREMEOS

Gold-Silver

Horn Silver (Utica Mines Ltd.)†

(49° 119° S.W.) Company office, 904, 510 West Hastings Street, Vancouver 2; mine office, Box 47, Keremeos. Isaac Shulman, president; R. E. C. Richards, mine manager. The property comprises 2 Crown-granted and 41 recorded mineral claims situated on the western slope of Richter Mountain 16 miles south and east of Keremeos and 4 miles north of the International Boundary. Access to the mine plant at 2,622 feet elevation is by a 2½-mile road which leaves the Keremeos-Richter Pass highway at the foot of Mount Richter.

[References: Annual Reports, 1915–30, 1933, 1958–60, 1963, 1964; *Geol. Surv., Canada,* Sum. Rept., 1927, Pt. A, p. 47; Map 341A, Keremeos.]

The deposit is opened by adits on four levels designated 2400, 2600, 2800, and 3000 from their respective elevations of 2,422, 2,622, 2,742, and 3,010 feet. The 2600 is the main operating level and is the most extensive working. The 2800 is an old adit at the western end of the structure that recently has been reopened. The 3000 adit is at the eastern end of the structure at the site of the mineralization known as the " Bromley showing."

Work in 1965 consisted principally of the preparation of existing underground workings for production and of exploration by sublevel drifting of possible ore zones indicated by diamond drilling. A ventilation raise was driven by use of a raise climber. Ore produced by development is being stockpiled. The following is a summary of underground work on all levels:—

	Ft.
Drifting and crosscutting	4,838
Raising	1,826
Subdrifting	3,449
Diamond drilling	5,414

There was no new construction in 1965. At the year-end a crew of 34 men was employed.

The structure of the deposit was described in the 1960 Annual Report. The mineralization is in discontinuous quartz bodies within a weakly developed 80-foot-wide shear zone striking north 85 degrees west and dipping 40 degrees south. The quartz bodies are displaced by fractures striking north-south and northeastward. A post-mineral syenite dyke has been recognized.

Since the 1960 Report, the 2600 level has been extended eastward by a line-drive some 700 feet long. This brought it under the Bromley surface showing (1964 Report). The drive started near the footwall of the shear zone, the limits

* By David Smith.
† By N. D. McKechnie and D. Smith.

of which are hard to recognize, and continued in the footwall to the present face. At about 1,000 feet east of the entry crosscut, and at about 150 feet from the face of the line-drive, a working was driven southeastward which crossed, at about 40 feet from the drive, a fracture striking south 75 degrees east and dipping 27 degrees southwestward. The fracture contains only rare grains of pyrite. It truncates two quartz bodies, one of which is exposed at the northwestern side of the working in the hangingwall of the fracture, and the other at the southeastern side in the footwall of the fracture. The hangingwall quartz body is white with greyish bands, shows a platy structure due to shearing, and is very sparsely mineralized with fine-grained pyrite. The footwall quartz body is badly crushed and is heavily mineralized with sulphides, some of which are sheared, and wire silver. Both quartz bodies strike about north 85 degrees east and dip about 30 degrees southward. The true width in each case is under 2 feet.

Sublevel drifting from raises above the line-drive shows the presence of mineralized quartz in the main shear zone. Near the start of the line-drive a quartz vein in a sublevel was mapped to see whether correlation could be made with nearby quartz exposures in the 2600 drift. The quartz in the sublevel has a true width of up to 1 foot and is exposed for a strike length of nearly 80 feet. Both here and on the 2600 level the quartz is offset along frequent crosscutting fractures. Whether due to the offsetting fractures or to the original structure, no obvious correlations could be made on the basis of dips and strikes. The difference in elevation is about 40 feet.

On the 2400 level a drift was extended eastward some 500 feet on what appears to be the projection of the shear zone downward from the 2600 level. No quartz bodies were exposed. Raising toward diamond-drill intersections below the 2600 is in progress. The fracture system described in the 1960 Report indicates a plunge of some 10 degrees westward. This may explain the lack of quartz on the 2400 level.

On the 3000 level the entry crosscut extends 100 feet to a working driven a little south of east in monzonite. This working is about 250 feet in the hangingwall of the shear zone. From the west end of this working, near the entry crosscut, a sinuous working leads in a generally northeasterly direction and turns at about 300 feet straight-line distance to a direction south of east. Quartz exposed in the face strikes north 5 degrees east and dips 40 degrees eastward. This is the only quartz seen by the writer on this level; it is subparallel to one of the quartz directions at the surface Bromley showing.

In the now considerable strike length of about 1,900 feet exposed on the 2600 level, the quartz bodies appear consistently to lie along and within the limits of the weakly developed shear zone described in the 1960 Report.

BRENDA LAKE

Copper-Molybdenum

North Brenda (Noranda Exploration Company, Limited)*

(49° 120° N.E.) Company office, 1050 Davie Street, Vancouver 5. This company holds 80 claims including the Coulee and Jefs groups near Brenda Lake. Access is by forestry road 28 miles from Peachland. In 1965 work carried out consisted of an induced polarization survey, a magnetometer survey, and a geochemical survey. Trenching was done using a bulldozer, and six pits were opened by drilling and blasting. A crew of 12 men was employed under the direction of A. Burton.

* By David Smith.

WESTWOLD

Molybdenum

Jim (Bralorne Pioneer Mines Limited)*

(50° 119° S.W.) Company office, 320, 355 Burrard Street, Vancouver 1. This property, held by option, consisted of 35 recorded mineral claims in the Jim group. The claims lie on Adelphi Creek 5 miles by gravel road south of Westwold. Mineralization occurs as a dissemination in granite and is associated with quartz veinlets. In 1965 work consisted of a geological survey, soil-sampling, and trenching with a bulldozer. A crew of four men was under the supervision of D. H. James. The option has been dropped.

Copper-Molybdenum

Brenda Mines Ltd.†

(49° 119° N.W.) Company office, 1030 West Georgia Street, Vancouver 5; field office, 44 Padmore Street West, Penticton. B. O. Brynelsen, president. The company controls 63 recorded mineral claims on the plateau surface 14 miles northwest of Peachland and 1 mile east of Brenda Lake. The property is reached by about 20 miles of good logging-road extending up Peachland Creek.

The central Brenda claims were located in 1954 by Robert Bechtel and Eric S. Hill, of Penticton. They were optioned in 1955 to Noranda Exploration Company, Limited, who diamond drilled three EX holes in 1956. In 1957 Northwestern Explorations, Limited (now Kennco), mapped the geology, made a magnetic survey, and diamond drilled about 70 holes with an aggregate length of 1,585 feet. The central claims reverted to the locators but were reacquired by Noranda Exploration in 1963. They later passed to Northlands Explorations Ltd., whose name was changed in December, 1965, to Brenda Mines Ltd.

Work began in the spring of 1965 to investigate further the grade of copper and molybdenum known to be widespread but indicated by the 1956–57 work to be very low in grade. An induced polarization survey was made, 2,000 feet of bulldozer trenching was done, and about 60 shallow pits were blasted in bedrock. Percussion drilling was tried in one 50-foot hole and then diamond drilling totalling 950 feet was done in three H holes and two BQ holes. A camp was built and a new access road was put in. The work was supervised by Chapman, Wood, and Griswold under a management contract.

Metallurgical testing was done, and an indicated grade of 0.26 per cent copper and 0.07 per cent molybdenum was calculated by checking the results of all drilling. This grade was deemed satisfactory in a year-end report, the findings of which were made public, and as a result the company in early 1966 made an offering to raise the sum of $700,000 for further exploration of the property. The response by the public was most enthusiastic.

The mineralization is in an extensive mass of granodiorite close to the east end of a large re-entrant of Nicola volcanic and sedimentary rocks. It is not apparently related to the actual contact. Chalcopyrite and molybdenite occur principally along steep fractures, of which there are three sets—north 0 to 20 degrees east, north 55 to 75 degrees east, and north 45 to 55 degrees west. The three sets are well enough developed in places to give to the rock a columnar structure, with the columns pitching steeply to the southeast. The northeast set is the dominant one and shows evidence of movement and vein filling on some fractures. What is probably the original showing on which work was done consists of a zone about

* By David Smith.
† By M. S. Hedley.

8 feet wide along northeast fractures that has a copper and molybdenum content about 10 times that indicated for the general area.

In a seven-month period there was an average of five company and 10 contractor employees.

MABEL LAKE

Copper-Zinc

Elk and Dakota (Dakota Silver Mines Ltd.)* (50° 118° N.W.) Head office, 3104—31st Avenue, Vernon. A. F. Pederson, president. The Elk and Dakota groups include 28 mineral claims, held by record, on the middle fork of Kingfisher Creek about 8 miles upstream from its confluence with the Shuswap River just west of Mabel Lake. Access is from the Enderby–Mabel Lake road by a logging-road which leads from a point about 4 miles west of Mabel Lake northeastward 4½ miles to a bridge across Kingfisher Creek. From there northward along the creek about 3 miles a narrow road branches to the west and leads a half mile to the Dakota Silver camp at elevation 2,350 feet.

The general geology is shown on Geological Survey of Canada Map 1059A, Vernon. The claim area is within the Shuswap terrane and is underlain by metasediments of the Monashee Group.

No one was at the property and no work was in progress at the time of the writer's visit in August.

On the Elk No. 3 claim between barometer elevations of 2,820 and 2,980 feet there were several trenches and, at the lower elevation, a diamond-drill site at which two holes had been drilled. No core was found. The holes, at inclinations of 45 and 68 degrees, were drilled toward the trenched area on a bearing of north 20 degrees west.

At 40 feet higher in elevation than the drill-site a band of quartzites exposed in trenches strikes north 20 degrees east and dips 70 degrees southeastward. Within the quartzites is a 6- to 8-inch band of gneiss containing pyrite.

At 70 feet higher in elevation than the drill-site a small stripped area exposes quartzitic rocks striking north-south and dipping 37 degrees east. These are in irregular contact with a highly altered dyke. This latter rock is well mineralized with pyrrhotite, which favours the ferromagnesian patches, chalcopyrite, and black sphalerite. The exposure is not large enough to indicate the extent nor the shape of the dyke rock.

OLIVER

Gold

Smuggler† (49° 119° S.W.) Mine office, Box 106, Okanagan Falls. This property, of eight recorded claims and the leased Powis Crown-granted claim, lies just west of the golf course, about 4 miles southwest of Oliver. In 1965 trenching was continued on the exposed vein on the Powis lease. Two men were employed under the direction of the owner, K. G. Ewers.

OSOYOOS

Silver

White Knight* (49° 119° S.W.) The White Knight Crown-granted mineral claim is situated on the International Boundary 4½ miles west of Osoyoos Lake. The claim was Crown granted in 1901, lapsed in 1947, and now is held as Mineral Lease M39 by K. A. Butler, R.R. 1, Osoyoos. Access to the workings, consisting of a single adit, is from the

* By N. D. McKechnie.
† By David Smith.

Submarine claim on the United States side of the boundary. A good gravel road westward from Oroville, Wash., along the Similkameen River is connected by about 1 mile of jeep-road to the portal of the adit at 2,750 feet elevation.

The geology of the area is shown on Geological Survey of Canada Map 341A, Keremeos.

The White Knight is in the Kruger syenite near its eastern contact with Kobau sediments. At and near the deposit the syenite forms a complex of dykes cutting basic rock which resembles the Richter Mountain hornblendite exposed in the Similkameen Valley 8 or 9 miles to the northwest. The areal extent of the hornblendite here is not known. The syenite dykes lie in two principal planes, striking north 30 degrees west and dipping 85 degrees northeast, and striking east-west and dipping 70 degrees north. There are numerous other dyke directions in the immediate vicinity of the deposit, which suggest the presence of a shattered zone in the hornblendite.

The deposit consists of a series of connected quartz veins in syenite. The veins are exposed in the 600-foot-long adit, which is essentially a curving crosscut that starts on bearing north 55 degrees west for the first 100 feet then curves northward. The veins all have flat dips; the greatest true width appears to be less than 15 feet. In the first 100 feet the adit crosses three succeeding quartz veins of true widths of about 6 inches, 5 feet, and 12 feet respectively, all striking north 5 degrees east and dipping 15 degrees eastward. A quartz vein about 2 feet wide exposed in the footwall of the 12-foot vein strikes north 15 degrees east and dips 35 degrees eastward. This vein merges to the northeast with a 10-foot-wide quartz vein striking north 40 degrees west and dipping 5 degrees northeastward, which in turn joins one of similar width striking north 65 degrees west and dipping 20 degrees southward. There is no evidence at their junctions that any of these veins cut any of the others, so they are assumed to be contemporary. The north 65 degrees west vein disappears up dip into the back of the adit at about 25 feet from the face. There is no evidence to indicate which of the vein directions would prove most persistent.

The quartz is erratically mineralized with pyrite, chalcopyrite, galena, and argentite. At the time of the writer's visit in August no recent work had been done.

BEAVERDELL

Silver-Lead-Zinc

Highland-Bell (Mastodon-Highland Bell Mines Limited)*

(49° 119° S.E.) Company office, 502, 1200 West Pender Street, Vancouver 1; mine office, Beaverdell. K. J. Springer, president; O. S. Perry, manager; A. Zelmer, mine superintendent. The property consists of 32 Crown-granted and 14 recorded mineral claims on Wallace Mountain. Production for 1965 was obtained from the 2850, 2900, and 3000 levels; the main haulage is the 2900 adit. Development work underground has been continued on all levels and included 1,195 feet of drifting on No. 7 level to establish diamond-drill stations and to improve the emergency exit route. In 1965 the production of the mill was maintained at 95 tons per day, of which a small tonnage is discarded as waste by hand sorting. This is done by means of a washing and picking belt in the crusher-room.

The following is a summary of operations for 1965: Drifting and crosscutting, 3,800 feet; raising, 545 feet; and diamond drilling, 23,291 feet. The lead and zinc concentrates were shipped to Trail. An average crew of 46 men was employed, of whom 26 worked underground.

* By David Smith.

Silver-Lead

Bounty, Etc. (Ruby Silver Mines Ltd.)*

(49° 119° S.E.) Company office, 509, 602 West Hastings Street, Vancouver 2. The property consists of 27 mineral claims including the Tiger, Bounty, Wellington, and other Crown-granted claims, which lie on Wallace Mountain directly to the east of the Highland-Bell mine. Access is by 5 miles of forestry road. In 1965 work carried out consisted of a geomagnetic survey and some bulldozer trenching. A crew of four men was employed under the direction of D. L. Hings.

Silver-Lead-Zinc

Rocco Plata (Red Rock Mines Ltd.)*

(49° 119° S.E.) Company office, 310, 850 West Hastings Street, Vancouver 1. This property, formerly called the Nepannee, lies on Wallace Mountain and consists of 16 mineral claims in the Rocco Plata group. In 1965 diamond drilling was carried out, and five holes were drilled totalling 1,063 feet. A crew of two men was employed under the supervision of J. A. Hallberg.

Highland Silver (Bethex Explorations Ltd.)*

(49° 119° S.E.) Company office, 1821, 355 Burrard Street, Vancouver 1. This old property, consisting of nine Crown-granted mineral claims, lies on Wallace Mountain about 2 miles southeast of Beaverdell. A preliminary geological survey was carried out. A crew of two men was employed under the supervision of R. P. Chilcott.

Molybdenum

MO (Amax Exploration, Inc.)*

(49° 119° S.E.) Company office, 601, 535 Thurlow Street, Vancouver 5. This company holds by record the MO group of 18 mineral claims. Access is by 9 miles of jeep-road from Beaverdell. Formerly known as the Matt group, work was performed on this group in 1961 by Kennco Explorations, (Western) Limited. In 1965 work consisted of a geochemical survey and three drill-holes totalling 188 feet. A crew of three was employed. Work was under the supervision of J. M. Patterson.

GREENWOOD

Silver-Lead

Spotted Horse†

(49° 118° S.W.) The Spotted Horse Crown-granted mineral claim is on the west side of Boundary Creek, on the edge of Greenwood. Work was done on a quartz vein containing lenses of galena and pyrite mineralization. Sorted ore from drifting and stoping was shipped to the Trail smelter, but the operation was found uneconomical. Two shipments totalling 58 tons were made during May and June, after which the operation was shut down. Work was done by two men under the direction of D. C. Wing.

Silver-Lead-Zinc

Skomac (Skomac Mines Limited)†

(49° 118° S.W.) Company office, 405, 25 Adelaide Street West, Toronto, Ont.; mine office, Greenwood. The mine is 2½ miles north of the Greenwood–Midway highway where it crosses Boundary Creek. A quartz vein carrying scattered bunches of galena mineralization has been developed by several levels, and some ore has been stoped and shipped from areas around No. 4 and No. 5 levels. In 1965 a

* By David Smith.
† By P. E. Olson.

crosscut was driven 88 feet into the hangingwall of the vein on No. 5 level to provide a diamond-drill site. Subsequently, several down-holes were diamond drilled from this site. Diamond drilling, including some surface drilling, amounted to 3,500 feet of EX core. Work was directed by A. Edwards and E. Strong.

Copper

Iva Lenore (Crown Silver Development Company Limited)*

(49° 118° S.W.) Company office, 511, 602 West Hastings Street, Vancouver 2. The property consists of 40 mineral claims 2 miles west of Greenwood. It is reached by the Haas Creek road, which leads southward from the Greenwood–Deadwood road at about 1 mile northwest of Greenwood. Key claims on the property are the Iva Lenore and Salamanca Crown-granted mineral claims.

Diamond drilling and surface stripping were carried out on a follow-up basis from the 1964 exploration programme. Eight miles of new road was constructed and geochemical prospecting was done on the drainage crossing the claims. Work was directed by R. E. Renshaw.

Boundary Creek (Scurry-Rainbow Oil Limited)*

(49° 118° S.W.) Company office, 539 Eighth Avenue Southwest, Calgary, Alta.; field office, Greenwood. This group of mineral claims is situated on Boundary Creek about 5 miles north of Greenwood. Airborne magnetic and induced polarization surveys were followed by geochemical work on the ground. Four anomalies were diamond drilled, but no significant concentrations of copper were found.

Gem (Noranda Exploration Company, Limited)*

(49° 118° S.W.) Company office, 1050 Davie Street, Vancouver 5. The property is in the vicinity of the abandoned town of Deadwood, about 1 mile west of Greenwood, and includes the Greyhound and Gem Crown-granted mineral claims. Geophysical surveys and geochemical sampling were carried out and the ground mapped on a scale of 1 inch to 400 feet. Four rotary-percussion drill-holes, totalling 1,000 feet, were put down on anomalies. These holes were 6½ inches in diameter, and drill cuttings were collected systematically. The investigation was directed by A. Burton and employed nine men for two months.

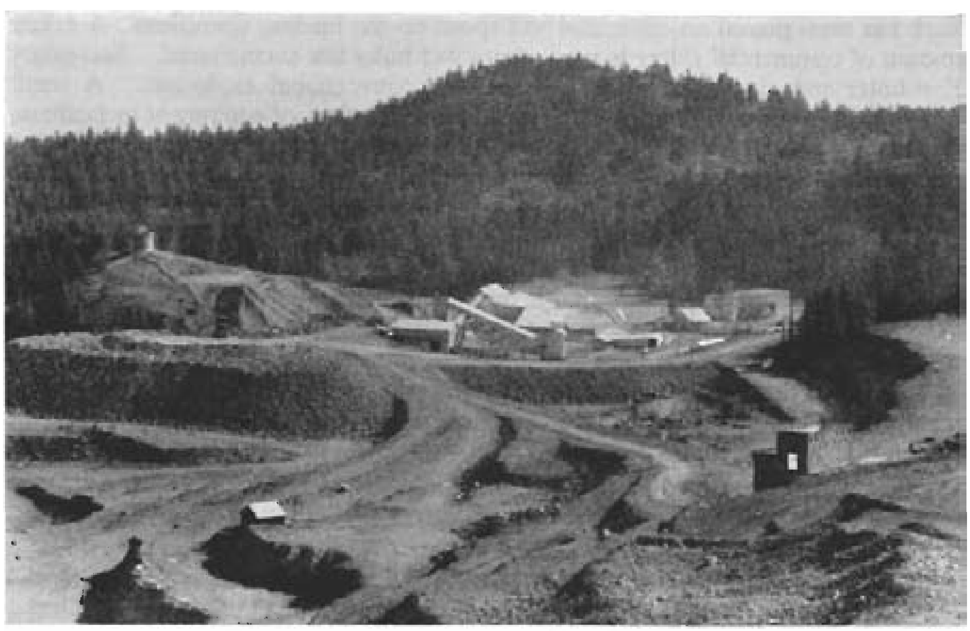
PP (Value Line Mining Ltd. and Scurry-Rainbow Oil Limited)†

(49° 118° S.W.) Head office, 475 Howe Street, Vancouver 1; mine office, Greenwood. William Quinn, project manager; E. F. Elstone, consulting engineer. Value Line Mining Ltd. holds by record some 400 mineral claims lying east and west of Boundary Creek, from about 4 miles north of Greenwood. An unsurfaced road along Boundary Creek passes through the claim group. The general geology is shown on Geological Survey of Canada Map 6-1957, Kettle River East Half. The rocks underlying the property are chiefly Nelson granodiorite and quartz diorite with included Permian and earlier metasediments and volcanics. Small intrusions of Coryell pulaskite cut the Nelson rocks.

The work done in 1965 consisted of geological, geophysical, and geochemical surveys and exploratory diamond drilling.

* By P. E. Olson.
† By N. D. McKechnie.

Phoenix Copper Company Limited. Old Ironsides open pit, August 30, 1965.
(P. R. Matthew photo.)



Phoenix mill from headwall of Old Ironsides open pit, July, 1965. Note pump-house at collar of Victoria shaft, lower left, also old substation building, lower right. These are relics of original Granby operation, 1900–19.

One inclined diamond-drill hole, on the PP 299 mineral claim, had been drilled to a depth of 591 feet at the time of the writer's visit. The rocks were quartz diorite to 242 feet and greenstones from there to the end of the hole. Occasional sparse pyrite was seen and, in a 1-foot length near the bottom of the hole, a very little disseminated chalcopyrite.

PHOENIX

Copper-Gold-Silver

Phoenix Copper Company Limited* (49° 118° S.W.) Company office, 1111 West Georgia Street, Vancouver 5; mine office, P.O. Box 490, Grand Forks. L. T. Postle, president; P. R. Matthew, manager; J. S. Kermeen, mine superintendent; G. Hingley, mill superintendent. The property consists of 192 mineral claims, an increase of 85 since 1964. There are 121 recorded and 55 Crown-granted mineral claims. Sixteen claims are held under six leases. All ore and waste mined came from the Old Ironsides open pit and amounted to 768,722 tons of ore and 2,707,920 tons of waste. The waste figure includes a considerable tonnage of low-grade ore which has been stockpiled and eventually may be milled. The mill treated 703,420 tons grading 0.81 per cent copper.

The Old Ironsides pit was deepened two benches, leaving eight benches before the pit reaches the planned depth. Pit expansion was started about the middle of 1964, and the pit will eventually be enlarged to the south and east to make it possible to mine ore found in that area. This expansion will increase the potential life of the pit.

Blast-holes are drilled with three Ingersoll-Rand drillmasters, one of which was added in 1965. Blasting is done with AN/FO, which is mixed in the vicinity of the holes being loaded, in a home-made hand-rotated mixer. A special explosives truck has been placed on order and will speed up the loading operations. A minor amount of commercial slurry is used where wet holes are encountered. Secondary blast-holes and air-trac holes are loaded with conventional explosives. A small mobile compressor and plugger unit was added to the fleet of equipment to facilitate secondary blasting. Where the pit encounters caved stopes dating back to the original underground mining at Phoenix, a serious amount of secondary blasting occurs.

At the mill a new drier was installed and a larger concentrate-storage shed was constructed. Concentrates are shipped by truck to Vancouver and by Japanese freighters to smelters in Japan. A large machine-shop of post and beam construction was erected, capable of handling any repair or fabricating job anticipated at the operation.

Diamond drilling amounting to 5,574 feet was carried out in the Old Ironsides pit and the Stemwinder claim. The company employed an average of 126 men, 19 of whom were on staff.

The company entered a mine-rescue team in the West Kootenay Mine Rescue Competition, which was held in Nelson.

B.C. (Phoenix Copper Company Limited)* (49° 118° S.W.) The B.C. mine is situated 4 miles northeast of Phoenix on the north side of the Greenwood–Grand Forks highway. The Phoenix Copper Company Limited has purchased, on an option basis, three Crown-granted mineral claims, the London No. 2 Fraction, Mountainview, and B.C. Two diamond-drill holes were completed in 1965.

* By P. E. Olson.

Copyright

Oro Denoro (West-Coast Resources Ltd.)*

(49° 118° S.W.) Company office, 104, 569 Howe Street, Vancouver 1. John Luttin, president; W. E. McArthur, Jr., project manager; J. P. Elwell, consulting geologist. The Oro Denoro, Crown granted in 1897, is part of a group held in the name of Guaranty Trust Company of Canada, 624 Howe Street, Vancouver 1. The property is 1½ miles south of Eholt, a stop on the Kettle Valley line of the Canadian Pacific Railway about 7 miles by road east of Greenwood. A jeep-road leaves the Greenwood–Grand Forks highway 1½ miles north of its junction with the Phoenix cut-off.

[References: Annual Reports 1896–1911, 1916, 1917; *Geol. Surv., Canada,* Map 828; *Geol. Surv., Canada,* Map 6-1957; Assessment Reports Nos. 67, 117, 178.]

The Oro Denoro and its neighbours formed the Summit Camp of the Boundary copper district. The Summit Camp produced some 632,000 tons of ore, of which 136,477 tons is recorded as having come from the Oro Denoro.

The writer's examination comprised a cursory surface inspection and the logging of some 5,500 feet of core drilled by West-Coast Resources; the cores from earlier drilling by Noranda Exploration Company, Limited, about 1957, were not available. A map showing the distribution of both Noranda Exploration and West-Coast Resources holes and showing the principal mineralized sections was made available.

The Oro Denoro is underlain by Triassic sharpstone conglomerate, tuffaceous sediments, minor limestone, and fine-grained volcanic breccias intruded by a succession of granitic rocks ranging in age from that of the Lower Cretaceous Nelson intrusions to the Paleocene Coryell intrusions. There is an extensive development of skarn, chiefly epidote-garnet-calcite, which appears to have been derived both from the tuffaceous rocks and from the older intrusive rocks.

The mineralization is chalcopyrite and pyrite. Predominantly it is associated with skarn. Magnetite and pyrrhotite are reported in ores produced from different sections of the property but neither was recognized in the West-Coast Resources cores.

The area drilled is about 600 by 800 feet in the southeast part of the claim and just south of the old open-pit workings. The principal zone of mineralization is one indicated by four of the Noranda Exploration holes and one West-Coast Resources hole. The core in the latter, the only one in the zone seen by the writer, was skarn, in part garnetite, with scattered grains of chalcopyrite. Nothing is known of the geological control of the zone. Geometrically, the intersections indicate a strike of north 70 degrees west and a northerly dip between 76 and 82 degrees. The present indicated length is about 250 feet and the width is from 20 to 50 feet. Assays for the five holes, supplied by West-Coast Resources, range from 0.8 to 1.89 per cent copper over these widths. The geometric strike is about parallel to the trend of the more southerly of the two open pits, but a drill-hole under this pit cuts skarn and mineralization with a dip of about 80 degrees southward. Holes drilled across the strike of the zone 200 to 300 feet eastward were almost entirely in sharpstone conglomerate and diorite; the zone does not show in these holes. To the west there is no information about the zone.

The kind and amount of intrusive rocks encountered seem to have some bearing here on the possibility of finding ore. Some relationships noticed in the cores will be discussed. The Coryell pulaskite dykes and the basaltic dykes which cut

* By N. D. McKechnie.

them appear to be post-skarn and post-mineralization. The older intrusives are divided on the basis of hand specimens into granodiorite, diorite porphyry, and granite. The granodiorite, which is a light-grey equigranular hornblendic rock, appears to be the oldest and is extensively altered to skarn. All gradations between skarn and granodiorite are observable in the core. The diorite porphyry, which is dark grey and porphyritic, with prominent dark pyroxene, is younger than the granodiorite and in part younger than skarn. It is locally altered to skarn but, in comparison to the alteration of granodiorite, to a minor degree. In one core, granodiorite was observed to have a chilled edge against the diorite, but this younger granodiorite had also inclusions of skarn. The granite, recognized in only two holes, is light grey and quartzose; it is younger than the diorite porphyry, and skarn alteration is confined to a little epidote along fine fractures.

Diorite porphyry is prominent in all of the West-Coast Resources holes. It appears to be younger than the main skarn bodies, which are the host rocks for most of the mineralization. If the presently indicated zone could be traced away from the diluting effect of the diorite porphyry, its prospects might well improve.

Diamond drilling was in progress in August.

GRAND FORKS

Copper

July Creek (Scurry-Rainbow Oil Limited)*

(49° 118° S.W.) Company office, 539 Eighth Avenue Southwest, Calgary, Alta.; field office, Greenwood. The July Creek group of mineral claims embraces July Creek, 5 miles northwest of Grand Forks. Three anomalous areas were located by geochemical and geophysical surveys. Diamond drilling on these anomalies disclosed no significant amounts of copper mineralization.

FRANKLIN CAMP

Gold-Silver-Copper

Maple Leaf (Franklin Mines Ltd.)†

(49° 118° N.E.) Head office, 1824, 355 Burrard Street, Vancouver 1. H. H. Huestis, president; Gene Stonehocker, project manager. The company owns 125 mineral claims by record, 8 mineral leases, and 7 Crown-granted mineral claims at Mount Franklin, 45 miles north of Grand Forks. The claims comprise most of the area known as Franklin Camp. Access is by a fair gravel road following Granby River and Burrell Creek to the site of the old Union mine where the present tent camp is situated.

The geology of Franklin Camp is described by C. W. Drysdale in Geological Survey of Canada Memoir 56, 1915, and it is included in Geological Survey of Canada Map 6-1957, Kettle River East, by E. W. Little. In brief summary, Franklin Camp is underlain by clastic sediments and volcanic rocks of the Permian(?) Anarchist Group, in which is included a crystalline limestone mapped separately by Drysdale as the Gloucester Formation. The Anarchist rocks are intruded by Lower Cretaceous(?) Nelson granodiorites and monzonites, and these in turn are intruded by Paleocene Coryell syenites and shonkinite. Overlying all these rocks are Paleocene and Eocene clastic and volcanic rocks of the Phoenix Group. Mineralization as described by Drysdale can be grouped into two main divisions: that associated with the Mesozoic rocks and best developed in the rocks of the Anarchist Group, and that associated with the Tertiary shonkinite. The principal sulphides in each

* By P. E. Olson.
† By N. D. McKechnie.

case are pyrite, galena, sphalerite, and chalcopyrite, the proportions varying in individual occurrences. Drysdale reports molybdenite in the Gloucester showing, now part of Mineral Lease 150, in Anarchist (Franklin) greenstone at its contact with Nelson granodiorite. The only serious production from the camp was 188,680 tons from the Union mine, nearly all between 1927 and 1934, in which the principal assays were in gold and silver. The mine was in Anarchist greenstones.

The Maple Leaf showings are among those associated with the Tertiary shonkinite. The original Maple Leaf mineral claim has lapsed, and the showings now are on the Par claim, which adjoints the Union Fraction Crown-granted claim on the north. Two kinds of mineralization were found on the Maple Leaf. As described by Drysdale, they are a "Black Lead" type, which contain chalcopyrite, pyrite, and a little bornite and is associated with shonkinite, and a "contact metamorphic type" containing chalcopyrite, pyrite, sphalerite, and galena in altered Anarchist rocks at their contact with augite syenite and shonkinite. The "Black Lead" mineralization contains platinum (Ann. Rept., 1918, p. 206).

At the old Maple Leaf shaft, in the northwest quarter of the Par claim, shonkinite is in contact with a grey, siliceous, finely crystalline rock which in thin-section is seen to be composed chiefly of anhedral potassic and sodic feldspars, some nepheline, a pyroxene now almost wholly altered to uralite and carbonate, and biotite. This rock is in the area mapped as "augite syenite" by Drysdale, but the trachytoid structure mentioned as characteristic was not recognized by the writer. The shonkinite, and to a markedly lesser degree the augite syenite, is mineralized by chalcopyrite and pyrite. At the south face of the open cut in which the shaft is situated an unmineralized fault is exposed striking north 20 degrees east and dipping 75 degrees eastward; the crushed zone is 2 to 3 feet wide. At some 800 feet southeastward, near the portal of an old adit, two diamond-drill holes were drilled northward. The cores were chiefly augite syenite with minor lengths of volcanic rocks. Shonkinite was present but in minor quantity. Chalcopyrite and pyrite were present sparsely in the augite syenite; the core of one hole cut 1 foot of near massive chalcopyrite and pyrite in augite syenite near the collar.

According to the accounts in the Annual Reports (1918–1922, 1927, 1932, 1934), two adits were driven but neither exposed appreciable mineralization. The shaft also is stated to have lost the mineralization at some 20 feet down. Drysdale mapped the shonkinite as older than, and therefore included in, the augite syenite. If this is the correct relationship, then the Maple Leaf shonkinite bodies may not persist to any great distance from exposures. The "Black Lead" mineralization is found only in the shonkinite bodies.

McRAE CREEK

Lead-Zinc-Copper

Ajax (Christina Lake Mines Ltd.)*

(49° 118° S.E.) Company office, 325, 1155 West Georgia Street, Vancouver 5. The property is about 1 mile southwest of the Paulson bridge on the Christina Lake–Kinnaird highway. A new road was built from the main highway immediately west of the Paulson bridge. A field office was built on the property, from which a diamond-drilling and stripping programme was directed. Work was stopped about mid-year following a staking dispute.

* By P. E. Olson.

ROSSLAND

Copper-Gold

Velvet (Rayrock Mines Limited)*

(49° 117° S.W.) Company office, 1011, 2200 Yonge Street, Toronto 12, Ont. This company optioned the Velvet from Mid-West Mines Limited and carried out a detailed mapping programme of the underground workings which entailed considerable washing of drifts and raises. The property is on the east side of Big Sheep Creek on the old highway from Rossland to Christina Lake.

Gold

Midnight*

(49° 117° S.W.) The Midnight Crown-granted mineral claim is 2 miles west of Rossland and below the Cascade highway. Three men worked for three months on the property and rehabilitated the portal of the old workings. A new building and dump area were put up to facilitate ore-handling. No mining was done.

Molybdenum

Grey (Trojan Consolidated Mines Ltd.)*

(49° 117° S.W.) Company office, 844 West Hastings Street, Vancouver 1. The property consists of the St. Louis, Green Mountain, Jersey, and Anaconda Crown-granted mineral claims and the Grey Nos. 3 to 7 recorded mineral claims situated about 2 miles northwest of Rossland. Electromagnetic and geochemical surveys were carried out over the eastern part of the property under the direction of L. Telfer. The company dropped its option upon completion of the programme.

Gold-Silica

I.X.L.*

(49° 117° S.W.) The I.X.L. Crown-granted mineral claim is under lease to J. A. Ruelle and associates, of Rossland, from the John S. Baker Investment Company, of Tacoma, Wash. Drifting and raising on the 350 level amounted to 20 and 45 feet respectively. Shipments to the Trail smelter amounted to 30 tons of ore, which assayed: Gold, 2.27 ounces per ton; silver, 1.05 ounces per ton.

ROSSLAND AREA†

The revival of interest in the Rossland area has centred mainly on the occurrence of molybdenite, principally on the Coxey, Golden Queen, St. Elmo, Novelty, and Giant Crown-granted claims. These claims are on the east side of Jumbo Creek (between elevations of 3,500 and 5,200 feet) and on the south and southwest slopes of Red Mountain.

The molybdenite mineralization occurs very largely in metasiltstones of the Mount Roberts Formation.

The Mount Roberts Formation occupies a gently west-dipping panel that is exposed on the south and west slopes of Red Mountain above a 45-degree west-dipping sill of augite porphyry. This panel of Mount Roberts is close to and lies between the Coryell batholith on the west and the smaller Trail batholith on the east.

The Mount Roberts Formation, as exposed on the southwest slopes of Red Mountain, comprises light-grey quartzite; grey-green thinly laminated quartzose metasiltstones, which, with increasing amounts of epidote, grade into epidote horn-

* By P. E. Olson.
† By Stuart S. Holland.

fels; skarn with varying amounts of garnet and magnetite; and black quartzite and argillite. The black quartzite and argillite with associated grey quartzite constitute a recognizable member about 150 feet thick that outcrops on the Ophir, on the northern part of the Giant, and on the eastern part of the Golden Queen claims. This member also underlies the known molybdenite mineralization on the Coxey, Golden Queen, and St. Elmo claims.

On the east sides of the Golden Queen and St. Elmo claims the Mount Roberts rocks are intruded by a sill of augite porphyry dipping about 45 degrees west. The sill was intersected at a depth of 560 feet in hole N22 drilled by McKinney Gold Mines Ltd. on the Golden Queen claim. In addition, the Mount Roberts is intruded by numerous sills and dykes of several varieties of diorite, both porphyritic and even grained. These diorites have been encountered in the exploratory diamond drilling on the Coxey claim and tend to be poorly mineralized with molybdenite, if mineralized at all.

On the east side of the Coxey the rocks are intruded by granodiorite which is exposed in an area 200 feet long and 40 feet wide. Granodiorite also occurs as a 15- to 20-foot dyke which extends from the Coxey 500 feet northeastward onto the Golden Queen. This dyke is strongly brecciated, as is part of the larger granodiorite intrusion.

Breccia is exposed in northerly trending zones on the Giant and Novelty claims and is recorded in company logs of exploratory drill-holes on the Coxey, Golden Queen, and other claims. In some instances, breccia is localized along north-trending faults. The brecciated rocks include granodiorite, metasiltstone and skarn of the Mount Roberts Formation, and the diorite of some sills and dykes. It is possible that the distribution and structural relationships of the seemingly widespread breccias might be important factors in localizing mineralization.

The sedimentary rocks of the Mount Roberts Formation occupy a gently west-dipping panel extending eastward from Jumbo Creek as far as the augite porphyry sill which borders the Mount Roberts in the east. This relation is shown diagram-

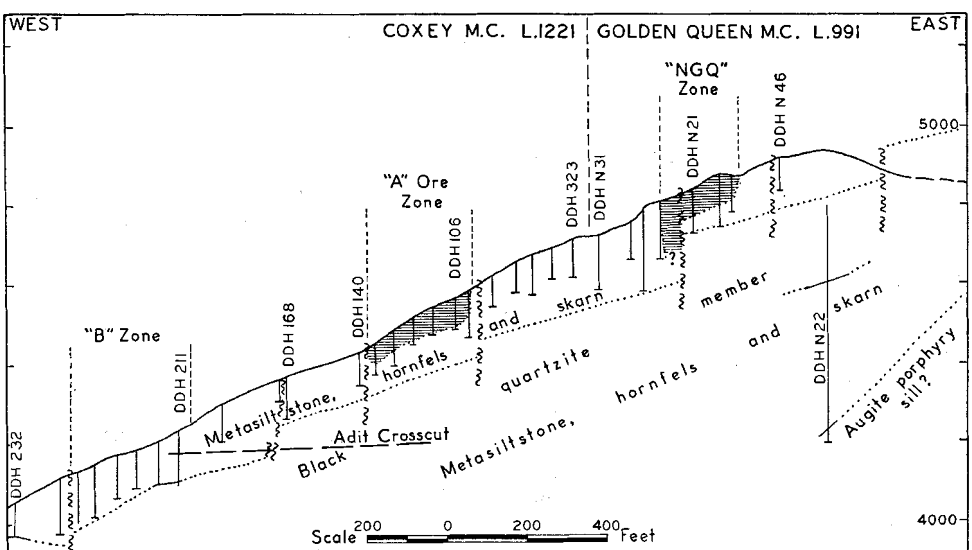


Figure 27. Diagrammatic cross-section through the Coxey and Golden Queen mineral claims.

matically in Figure 27, which is a cross-section running east from drill-hole 232 on the Coxey claim through drill-hole N21 on the Golden Queen claim. This structural interpretation is based on partial mapping of the black quartzites in outcrop and in drill-holes on the Coxey, Giant, and Golden Queen claims. The rocks are thought to be cut by steep northerly striking faults along which the relative movement has been west block down.

Molybdenite mineralization being developed on the Coxey, Golden Queen, and St. Elmo claims occurs in metasiltstone and hornfels of the Mount Roberts Formation lying above the black quartzite member. No deep drilling has been done to penetrate the black quartzite and to explore the siltstones lying at depth beneath the ore zone on the Coxey, despite the fact that on the adjoining Giant claim molybdenite and gold-bearing arsenopyrite mineralization occurs in breccia zones in siltstone and skarn beneath the black quartzite.

Molybdenum

Coxey, Mountain View, Nevada (Red Mountain Mines Limited)*

(49° 117° S.W.) The company holds the Coxey, Ophir, Jumbo, Nevada, Mountain View, High Ore, Peak, Sam Hayes, Good Friday, and Ontario Crown-granted claims, two mineral leases, and eight recorded claims and fractions, mostly on the west and south slopes of Red Mountain just northwest of Rossland. Red Mountain Mines Limited is a company jointly owned by Torwest Resources (1962) Ltd., 60 per cent; Metal Mines Limited, 20 per cent; and Canadian Nickel Co. Ltd., 20 per cent, and was formed to exploit the molybdenum orebody discovered by the Torwest company on the Coxey claim. Brian Fillingham is resident manager.

By mid-November, 1964, when the change-over from Torwest to Red Mountain Mines took place, the Torwest company had drilled 18,776 feet in 89 holes and had indicated about 340,000 tons of ore grading 0.57 per cent molybdenite. This is the "A" ore zone on the Coxey claim. In 1965, 13,558 feet of diamond drilling in 109 holes was done by the present company to substantiate the tonnage and grade of the orebody previouslly drilled by Torwest and also to explore for further mineralization on the Coxey claim. Once the ore tonnage had been confirmed the company went ahead with plans to bring the mine into production. Surface preparations were made for open-pit mining of the orebody, a 3,000-foot road was built northward to the mill-site on the Good Hope claim, and mill construction was begun. Initial production of molybdenite is expected in April, 1966.

The occurrence of molybdenite, chalcopyrite, pyrrhotite, and pyrite mineralization on the Coxey claim has been known since the early days of the Rossland camp. Surface trenches, a shallow shaft, and two adits totalling about 1,050 feet, mostly done before 1900, explored mineralization across narrow widths in a northerly striking fracture zone. Early in 1964, sampling of the old surface cuts and short packsack drill-holes in their immediate vicinity confirmed the presence of molybdenite over a considerable area and led to the initiation of diamond drilling that eventually outlined the "A" orebody.

Vertical and south-dipping holes were first drilled on a rectangular grid pattern at 100-foot intervals by the Torwest company. Subsequent fill-in drilling by Red Mountain Mines Limited has been with vertical holes at 50-foot intervals. This drilling has outlined ore-grade molybdenite mineralization in a block 400 feet long in a northerly direction, 200 feet wide, and to a depth of from 50 to 80 feet below the surface.

* By Stuart S. Holland.

The molybdenite mineralization explored to date on the Coxey is in grey to grey-green metasiltstones lying above black quartzite. Molybdenite, sparse pyrite and pyrrhotite, and rare chalcopyrite occur as disseminations of fine grains; as films along faint, rather unsystematic discontinuous fractures; as veinlets along steep, northerly striking fractures; and in the matrix of some breccias. The mineralized rock commonly is biotitized to the extent that it has a purplish-brown cast. The dioritic sills and dykes are only very sparsely mineralized.

There is some indication that the "A" orebody may be limited on its east and west sides by faults. No reason is apparent for its northern and southern terminations.

Drilling on the Coxey disclosed two other areas of molybdenite mineralization downhill from the "A" orebody. These two, called the " B " and " Upper B," are of somewhat lower grade.

Golden Queen, St. Elmo, Gertrude, and Surprise (McKinney Gold Mines Limited)*

(49° 117° S.W.) McKinney Gold Mines Limited holds the Golden Queen, St. Elmo, Gertrude, and Surprise Crown-granted claims. They are in a group on the south slope of Red Mountain and adjoin the Coxey and the Giant on the east. Geophysical and geochemical work was started late in 1964 by the company. The geochemical survey of the Golden Queen and St. Elmo claims was continued in 1965 when 1,000 soil samples were taken and analysed for molybdenum. Some prospecting and stripping were done with a D-6 bulldozer, and numerous surface showings were sampled. In addition, 47 vertical drill-holes totalling 4,826 feet were drilled in the northwestern part of the Golden Queen and western part of the St. Elmo claims. J. F. Schaefle was in charge of the work.

The black quartzite member which crosses the Coxey and Giant claims is exposed on the St. Elmo south of the television towers and in a nearby adit and was intersected in several drill-holes. It is evident that the mineralization explored by the diamond drilling is in grey laminated metasiltstones—part of a succession of hornfels, metasiltstones, and skarn that lies stratigraphically above the black quartzite member.

Surface stripping and diamond drilling between elevations of 4,830 and 4,970 feet on the northwest corner of the Golden Queen claim, and about 500 feet east of the "A" orebody on the Coxey, delimited a Y-shaped body of mineralization in the metasiltstones. This is the NGQ zone with an indicated 68,000 tons grading 0.24 per cent molybdenite. The mineralization possibly is localized in the vicinity of the intersection of a granodiorite breccia dyke and a northerly trending fault.

Scattered mineralization may be seen on surface near the western boundary of the St. Elmo claim on the east side of a ridge between elevations of 5,070 and 5,120 feet. In a northeasterly trending zone about 400 feet long and 100 feet wide there is disseminated molybdenite as well as chalcopyrite, pyrite, sphalerite, and galena in narrow east-striking veinlets. Toward the south end of the zone, and near the local television towers, an L-shaped adit 130 feet long is driven northwestward and then southwestward in the mineralized zone. The average of 12 samples taken by the company was 0.55 per cent molybdenite. Some scheelite and chalcopyrite are also present. This mineralization constitutes the NSE zone, which, to a depth of about 75 feet, contains about 73,000 tons grading 0.33 per cent molybdenite.

* By Stuart S. Holland.

Molybdenum-Gold

Giant, Gold King, Little Darling, Evening (Cascade Molybdenum Mines Ltd.)*

(49° 117° S.W.) The company holds, by ownership or agreement, the Victor, Giant, Gold King, Evening, Little Darling, Northern Belle, Crowe Hunter, Harkoff Fraction, Vernon Fraction, and Hardor Fraction claims on the south and west slopes of Red Mountain on the outskirts of Rossland. Elevations range from 3,550 feet on the lowest point on the Evening to 4,500 feet on the Giant. In 1965 the company explored several zones of mineralization by 30 diamond-drill holes totalling 8,610 feet on the Giant, by 15 holes totalling 3,803 feet on the Evening, by 7 holes totalling 3,020 feet on the Gold King, and by 3 holes totalling 968 feet on the Little Darling. W. H. Patmore was in charge of the work.

The work on the Giant was localized in two zones. The first is at about 4,250 feet elevation, in the vicinity of the upper Giant adit and open stope in the centre of the claim. From these workings prior to 1903 some 4,344 tons of ore averaging 0.90 ounce gold per ton and 0.1 per cent copper was shipped to the smelter at Trail. The ore mineralization consisted of pyrite, pyrrhotite, arsenopyrite, chalcopyrite, and molybdenite. It occupied a steep east-dipping, northerly striking fracture in skarn.

The second zone on the Giant claim is to the northeast of the first, at 4,450 feet elevation, where brecciated metasiltstone along a northerly trending fault is mineralized with arsenopyrite and molybdenite. The company has reported that drill intersections have assayed as high as 0.97 ounce gold per ton and 0.69 per cent molybdenite. Cobalt and bismuth are also present.

Both these zones occupy northerly striking fractures in rocks stratigraphically below the black quartzite member that lies beneath the ore zone on the Coxey.

Consolidated St. Elmo (Northwood Mining Limited)†

(49° 117° S.W.) Company office, 506, 540 Burrard Street, Vancouver 1; field office, Rossland Motel, Rossland. The property consists of the Consolidated St. Elmo and Cliff Crown-granted mineral claims on Red Mountain about 1 mile northwest of Rossland. Detailed geological mapping, followed by soil-sampling, was done by J. F. Schaefle, a geologist in the employ of Northwood Mining Limited.

Gold-Silver

Mayflower (Northwood Mining Limited)†

(49° 117° S.W.) Company office, 506, 540 Burrard Street, Vancouver 1; field office, Rossland Motel, Rossland. The property consists of the Mayflower, Bluebird, Homestake, and Gopher Crown-granted mineral claims about 1 mile south of Rossland. Geological mapping and detailed soil-sampling were done by J. F. Schaefle, the company geologist. Most of this work was done in the vicinity of the Bluebird and Mayflower workings.

TRAIL

Gold

W.D. (Columbia River Mines Ltd.)‡

(49° 117° S.W.) Company office, 410, 470 Granville Street, Vancouver 2. J. G. Donnelly, president; James A. Farrell, manager; A. Pompu, mine foreman. The property consists of 24 recorded mineral claims situated on the eastern

* By Stuart S. Holland.
† By P. E. Olson.
‡ By N. D. McKechnie.

slope of Lookout Mountain and on the northwestern side of Casino Creek, about 5 miles by road southeast of Trail. First developed in 1951, the deposit has produced, to the end of 1964, 5,871 tons of ore, from which has been obtained 2,461 ounces of gold, 737 ounces of silver, 12,836 pounds of lead, and 12,634 pounds of zinc.

The regional geology is shown on Geological Survey of Canada Map 7-1962 which accompanies Paper 62-5. Brief descriptions are given in the Annual Reports for 1951 (as Casino Red Cap) and for 1957 to 1964, inclusive.

The deposit consists of a number of small quartz bodies lying in a zone of weak fractures in monzonite, at and near the contact of the monzonite with thin-bedded, siliceous sediments of the Lower Rossland Group.

Locally the fracture zone is very variable both in dip and strike, and anastomosing fractures are common. In general the strike is about north 55 degrees east and the dip about 65 degrees northwestward. This is subparallel to the general strike and dip of the sediments in the mine area, which strike north 65 to 75 degrees east and dip 45 to 60 degrees northwestward. The fracture zone is slightly offset by occasional north-south striking fractures which commonly contain calcite.

The sediments and monzonite are cut by dykes of gabbro and granite porphyry. Both are younger than the fracture zone. The gabbro ranges from medium-grained and porphyritic to a fine-grained massive dark biotitic rock, and occupies fractures striking north 55 degrees west and dipping 75 degrees southwestward and striking north 10 degrees west and dipping 85 degrees westward. In a sublevel a north 10-degree west dyke truncates the fracture zone; the drift continues for 40 feet beyond the dyke with no sign of the zone. The granite porphyry is a grey siliceous porphyritic rock with a fine-grained matrix; the prominent ferromagnesian is hornblende. On surface the granite porphyry cuts a gabbro dyke, and at a number of places underground the fracture zone is cut by these dykes. They occupy three main sets of fractures: strike north-south, dip 80 degrees east to 80 degrees west; strike north 45 degrees east, dip 45 degrees northwest; strike north 80 degrees west, dip 70 degrees northward.

The quartz bodies range in size from scattered blebs to lengths of about 150 feet and widths of about 5 feet. There is no information on the plunge, but the impression given by the small stopes is that of a steep plunge to the southwest. Mr. Pompu states that the steep parts of the fracture zone carry the ore. The quartz is mineralized rather sparingly with pyrite, sphalerite, galena, and arsenopyrite. The latter is considered an indicator of gold.

A programme of drifting, raising, and diamond drilling was carried out during the first half of 1965. Sections of ore which were encountered were stoped out, and 207 tons was shipped directly to the Trail smelter. Smelter charges were offset by the high silica content of the ore.

A new compressor building was erected near the portal and additional equipment was purchased. This machinery was left at the property when work stopped.

NELSON

Gold-Silver-Copper

Silver King (New Cronin Babine Mines Limited)*

(49° 117° S.E.) Company office, 844 West Hastings Street, Vancouver 1. The company holds a large interest in the old Silver King mine, situated on Toad Mountain 9 miles southwest of Nelson. The property consists of 22 Crown-granted and 8 recorded mineral claims and fractions. Surface dia-

* By P. E. Olson.

mond drilling amounted to 6,596 feet in 28 holes. This drilling has indicated an extension of the Silver King structure. A temporary camp was installed at the mine, and No. 4 and No. 5 levels were rehabilitated to permit an examination of the old workings. Some stripping and road-building were done in the vicinity of the mine. Work was being continued at the year-end under the direction of M. K. Lorimer.

HALL CREEK

Gold

Fern (Weland Mining Ltd.)*

(49° 117° S.E.) Company office, 1316, 510 West Hastings Street, Vancouver 1. This company has an option on the Fern Crown-granted mineral claim on the south side of Hall Creek, about 2 miles from the Nelson–Salmo highway. Mike Cannon, of Ymir, directed a small crew in repairing the Fern No. 4 adit, and in relocating the road to the mine. Preparations were made to ship about 700 tons of dump rock at the No. 4 level portal. John Gilroy, of Vancouver, is mining consultant for the company.

YMIR

Gold-Silver

Ronoke*

(49° 117° S.E.) The Ronoke Crown-granted mineral claim is on Wildhorse Creek, about 5 miles by road from Ymir. L. de Kock and partner stripped a vein along the edge of the creek and prepared several tons of material for shipment before closing down the operation.

Zinc

Jack Pot, Oxide, Last Chance (New Jersey Zinc Exploration Company (Canada) Ltd.)*

(49° 117° S.E.) Company office, 905, 525 Seymour Street, Vancouver 2. R. C. Macdonald, manager. This company controls a group of 50 mineral claims extending northward from the summit between Hidden and Porcupine Creeks to the summit between Oscar and Ymir Creeks. The Jack Pot group, which is situated on the south side of Porcupine Creek, is reached by jeep-road which leaves the Porcupine Creek road about 3 miles from the Salmo River.

In 1965 two diamond-drill holes were drilled a total of 459 feet. Drilling similar to this has been done nearly every year since a major exploration programme was completed in 1954.

Zinc occurs in dolomitized limestone under conditions similar to those found at the H.B. mine, 7 miles south of the Jack Pot.

Gold-Silver-Lead-Zinc

Yankee Dundee (Cayzor Athabaska Mines Limited)*

(49° 117° S.E.) Company office, 3669 West 35th Avenue, Vancouver 13. The company has an option on the Yankee Dundee holdings on Wildhorse Creek, about 2 miles east of Ymir. Three diamond-drill holes, totalling 1,500 feet, were drilled from the Wildhorse level, which crosscuts to the old workings from Wildhorse Creek.

* By P. E. Olson.

SALMO

Erie Creek (49° 117° S.E.)

Gold

New Arlington* The New Arlington mine is on Rest Creek, a tributary of Erie Creek, about 7 miles by road from Salmo. The property is leased by G. D. Fox, of Trail. The new level started in 1964 on the Directorate Crown-granted mineral claim was extended about 60 feet, but no significant amounts of gold were encountered. Dump rock amounting to 5,406 tons was shipped to the Trail smelter. This rock contained 767 ounces of gold and had a high silica content, the latter having a bonus value at the smelter.

Silver-Lead

Silver Dollar* (49° 117° S.E.) The Silver Dollar Crown-granted mineral claim is immediately west of Salmo on the north side of Erie Creek. This property was leased by Dave Norcross from the owner, L. R. Clubine, of Salmo. Mineralization occurs in a bedded vein which dips about 20 degrees to the east, and which is exposed along a hillside for several hundreds of feet. Galena occurs as scattered lenses in the vein. Mr. Norcross put in two adits on the vein about 60 and 100 feet in elevation higher than the lowest level on the vein. Shipments to the Trail smelter amounted to 154 tons, and drifting amounted to 135 feet.

Sheep Creek (49° 117° S.E.)

Gold-Silica

Gold Belt* The Gold Belt mine is a former producer on Sheep Creek, lying north of the Queen and south of the Reno holdings. A. Endersby and sons, of Fruitvale, stoped 52 tons from a narrow vein which is located immediately above the main haulage level, about 600 feet from the portal. This ore was shipped to the Trail smelter.

Silica

Kootenay Belle* The Kootenay Belle mine is on Sheep Creek, 9 miles by road from Salmo. Bryan's Transfer, of Salmo, hauled 6,085 tons of dump rock to the Trail smelter, using a front-end loader and tandem trucks. The dumps contain silica and minor gold.

Aspen Creek (49° 117° S.E.)

Lead-Zinc

H.B. (The Consolidated Mining and Smelting Company of Canada, Limited)† Company office, Trail; mine office, Salmo. R. R. McMichael, property superintendent; J. B. Burleson, mine superintendent; C. Sedeco, mill superintendent. The H.B. mine is on the west side of Aspen Creek, on the north side of Sheep Creek, 7 miles by road from Salmo. The ore occurs as a galena-sphalerite-pyrite replacement of dolomitic zones within the Reeves Limestone, a formation that contains similar orebodies at the Reeves and Jersey mines to the south. The geology of the mine has been described by Warning (1960) and Fyles and Hewlett (1959, pp. 101–104). A significant development in 1965 has been the beginning of mining in the Garnet zone. This zone lies several hundred feet west of the main orebodies

* By P. E. Olson.

† By P. E. Olson and James T. Fyles.

and is in general above them and relatively close to surface. Where the zone outcrops, an open pit was started, which is to be incorporated with the underground workings in 1966. In the latter part of 1965 the orebody was being prepared for long-hole stoping, and ore is to be transferred from the 3300 level via a raise to the main haulage level (2800).

The No. 1 ore zone, the largest, is steeply dipping, has a lenticular cross-section, and a long axis which plunges gently to the south. It is being mined by long-holes which are drilled from fringe drifts in vertical fans. Several flat zones which are tabular and gently dipping lie immediately west of the No. 1 zone. They are mined by conventional jackleg slashing. Production from the various zones is tabulated below.

	Tons
No. 1 zone	289,658
Flat zones	111,973
Garnet zone (underground)	5,055
Garnet zone (open pit)	17,604

A pillar blast in the No. 1 zone resulted in 72,300 tons of broken ore. Some resultant caving affected the grade of ore from this blast.

The following table gives development advances and drilling footages:—

	Ft.
Raising	3,441
Drifting	336
Sublevels and crosscuts	2,951
Diamond drilling (surface)	5,391
Diamond drilling (underground)	8,089
Long-hole drilling (2⅛-inch)	27,439

Underground diamond drilling was done with a wire-line rig to test the ore-bearing dolomite at considerable depth below the 2800 level.

A new electrical substation was installed on the 3300 level as part of the underground mining installation for the Garnet ore zone. Power from this substation will be used for electric slushers and fans.

Ammonium nitrate and fuel-oil explosives (AN/FO) were used for most of the underground blasting. Prilled AN/FO is used to load development rounds and blast-holes, while pulverized AN/FO is used mainly for bulldozing and sand blasting in scram drifts and raises.

The mill treated 415,290 tons of ore, the concentrates being shipped to the Trail smelter.

The company employed 128 people, 28 of whom were on staff payroll.

[References: Fyles, James T., and Hewlett, C. G., 1959, *B.C. Dept. of Mines* Bull. No. 41; Warning, G. F., 1960, *C.I.M.M.* Trans., Vol. LXIII, pp. 520–523.]

IRON MOUNTAIN (49° 117° S.E.)

Lead-Zinc

Jersey (Canadian Exploration Limited)*

Head office, 700 Burrard Building, Vancouver 1; mine office, Salmo. C. E. Brown, mine manager; J. W. Robinson, mine superintendent; B. Wilson, mill superintendent. This company is a wholly owned subsidiary of Placer Development Limited. The mine, offices, and camp are located on the summit between Sheep Creek and Lost Creek, at an elevation of 4,000 feet. The property is reached by two roads which leave the Salmo–Creston highway 4 and 6

* By P. E. Olson.

miles respectively south of Salmo, the north (Emerald) road being the main access road. The company concentrator is beside the Salmo–Creston highway where the south (Jersey) road leaves the highway. Ore is crushed in the mine and transported to the mill by a series of conveyors.

The lead-zinc ore of the Jersey mine occurs in the base of the Reeves Limestone, and is generally more abundant in the western limbs of two north-trending fold structures which are overturned to the west. In the most westerly of these, the "A" zone, the overturning and subsequent deformation have laid the ore bands relatively flat. The ore bands range in thickness from a few inches to several feet, and have composite thicknesses up to 80 feet. The eastern structure, the Dodger trough, is more complex. Here the ore occurs in a variety of bands, lenses, and sheets which dip from flat to 30 degrees eastward. The mine zone has a gentle dip to the south.

All production came from the Jersey zone. Mining is done with jackleg drills, electric slushers, and trackless loading and haulage. The mill treated 377,124 tons of ore. Lead concentrates were shipped to Kellogg, Idaho (Bunker Hill smelter); 47 per cent of the zinc concentrates went to the Trail smelter and 53 per cent to the Anaconda smelter at Black Eagle, Montana.

Development consisted of 9,058 feet of drifting and crosscutting, 661 feet of raising, 24,630 feet of underground diamond drilling, and 1,717 feet of surface diamond drilling.

Two mine-rescue teams competed in the West Kootenay Mine Rescue Competion. These teams were captained by A. Summers and A. Nord. There are 145 men employed by the company, 86 of whom worked underground. There are about 50 staff members.

NELWAY

Lead-Zinc

Reeves MacDonald Mines Limited* (49° 117° S.E.) Company office, 410, 837 West Hastings Street, Vancouver 1; mine office, Remac. L. M. Kinney, general manager; F. R. Thompson, mine manager; M. B. Wiwchar, chief engineer; J. M. McDearmid, mill superintendent. The Reeves MacDonald mine is on the north side of the Pend d'Oreille River, on the Nelway–Waneta road 4 miles west of Nelway.

The geology of the mine is similar to that of the H.B. and Jersey mines, near Salmo. Lead-zinc mineralization occurs in dolomitized limestone of the Reeves member, which passes through the three mines.

Orebodies have been developed by the 1900 level main haulage and internal shafts, the deepest of which nearly reaches sea-level. Mineralized zones are all steeply dipping and range in width from a few feet to upwards of 100 feet. Most of the ore comes from long-hole stopes, from which it is drawn by gravity into scram drifts. Broken ore is then scraped by electric hoists into ore-passes which terminate at skip loading points for hoisting to pockets on the 1900 level. Where ground conditions are uncertain, finger levels are used for drilling fans of blast-holes, while normal practice calls for parallel blast-holes drilled from slashed-out horizons in the orebodies. Vertical slots are mined out to provide a free face for the long-hole blasting. Pillars, which are left behind during initial stoping, may be removed eventually if ground conditions permit. Blast-hole drilling is shown in the following table:—

* By P. E. Olson.

Hole Size (Diameter)	Feet Drilled
2⅛ inches	60,860
2¾ inches	54,362
3 inches	5,549
6 inches	180

The 6-inch hole was drilled as part of an experiment whereby raising would be done entirely with blast-holes rather than by conventional methods. Tungsten carbide bits were used in all long-hole drilling. The table below shows exploration and development advance:—

	Ft.
Drifting	4,737
Raising	2,435
Test-hole drilling	4,455
Diamond drilling (underground)	13,793
Diamond drilling (surface)	8,104

On the 2350 level, 1,377 feet of prospect drift was driven.

The surface diamond-drilling programme consisted of the pattern drilling of a deep zone of mineralization found on the south side of the Pend d'Oreille River, on company ground. This zone will be explored from within the mine workings on the 240 level, where preparation work was completed during 1965. This level will also explore a faulted segment of the Reeves ore zone about 1,300 feet from the main shaft. Production from the mine was as follows:—

	Tons
O'Donnell zone	21,019
Upper Reeves zone	24,188
Lower Reeves zone	364,297
Total	409,504

The use of heated water has improved milling during winter months. An oil-fired boiler with an output capacity of 6,695,000 B.t.u. per hour raises mill water temperature to 55 degrees centigrade through a heat-exchanger.

The company employs 119 men, 22 of whom are salaried employees. A cook-house is operated at Remac for single employees.

NORTH KOOTENAY LAKE

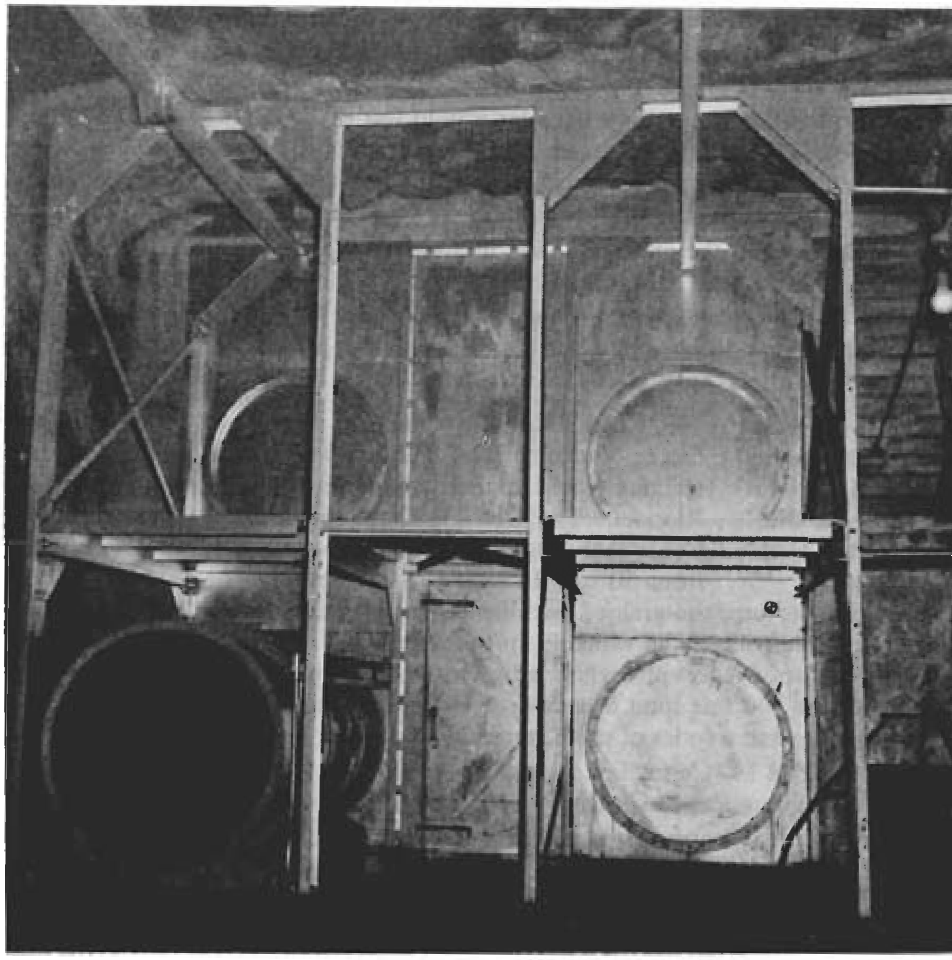
Riondel (49° 116° N.W.)

Silver-Lead-Zinc

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited)*

Company office, Trail; mine office, Riondel. J. B. Donald, property superintendent; A. J. Richardson, mine superintendent; T. F. Walton, mill superintendent. The mine is on a small peninsula in Kootenay Lake, 6 miles by paved road north of Kootenay Bay. The mine is below lake-level and is serviced mainly by the No. 1 shaft, inclined westward at 35 degrees near the footwall of a layer of limestone. The orebodies are replacements of limestone that extend laterally from a series of steeply dipping fractures that cross the formation almost at right angles. Replacement in general is more extensive near the hangingwall of the limestone but has been influenced by a variety of factors. Most of the orebodies have a rake to the west down the formational dip and thin irregularly across the dip toward the footwall of the limestone.

* By P. E. Olson and James T. Fyles.



Fan installation, Kootenay Chief adit, Bluebell mine. First of four 48-inch fans in place, 50,000 c.f.m. capacity each. (Cominco photo.)

The Kootenay Chief ore zone lies south of the shaft. The Bluebell and Comfort ore zones lie to the north of the shaft and are serviced by No. 2 and No. 5 levels The ore is generally fairly irregular and rich, and hence is mined selectively. Mining is done by open-stoping and by cut-and-fill methods employing deslimed tailings. Ore is trammed to No. 1 shaft, hoisted to the surface, then crushed and conveyed to the mill.

Development amounted to 1,500 feet of drifting, 5,400 feet of sublevelling, and 5,200 feet of raising. Production amounted to 256,332 tons of ore, all of which was milled. Concentrates were shipped to the Trail smelter.

The operation continued to encounter thermal conditions in the mine which necessitated special precautions. Carbon dioxide flows into the mine air at a rate of about 2,000 cubic feet per minute. This is diluted by mine ventilation and is exhausted from the mine continuously. Ventilation fans installed at the surface can exhaust upwards of 400,000 cubic feet per minute from the mine workings. The mine intake for ventilation is mainly the No. 1 shaft. Pumping-stations are maintained on No. 5 and No. 8 levels, the latter being the lowest working in the mine. The influent thermal water contains much dissolved solids which tend to precipitate on the walls of the rising mains. A specially converted diamond-drilling rig was prepared which was successful in reaming out the rising mains, more or less without dismantling the line.

An exploration programme is under way to test the area north of the Comfort zone, and No. 8 level is being driven northward from No. 1 shaft to explore below the Bluebell zone. The results of this exploration will reflect in the potential life of the mine.

Employment at the operation is as follows: Staff, 41; surface, 32; mill, 15; underground, 133; total, 221.

Two teams competed in the West Kootenay Mine Rescue Competition held in Nelson. The team captained by Ben Ramage won the competition.

Tam O'Shanter (Pacific Silver Mines & Oils Ltd.)*

(49° 116° N.W.) Company office, 640 West Hastings Street, Vancouver 2. This property consists of 36 mineral claims situated immediately north of the Bluebell property at Riondel. The principal showings on the property are along a vein that ranges in strike from southeast to east and in dip from 50 to 70 degrees to the north. The vein transects a series of fine- to medium-grained hornblende gneisses that locally contain narrow lenses of marble. The vein, which is up to 3 feet wide, contains quartz and calcite and local pods of pyrite, sphalerite, and galena. The workings consist of a drift on the vein about 500 feet long driven eastward many years ago from the beach of Kootenay Lake and a series of small stopes and raises to surface above the drift.

In 1918 and 1921 a total of 94 tons of ore shipped from the mine had a gross content of 1,664 ounces of silver.

The property was promoted and drilled in 1956 and again in 1961. Work in 1965 consisted of cleaning out the old drift, diamond drilling, and a magnetometer survey. The drilling amounted to 2,835 feet in five surface and eight underground holes. This work, like that in 1956 and 1961, was aimed at discovering replacement ore of the Bluebell type associated with the Tam O'Shanter vein. The Bluebell limestone, which contains the only significant replacement ore known in the area, is under the lake, probably half a mile west of the property, and dips to the west.

The work was under the direction of H. H Cohen, who employed an average of six men.

AINSWORTH (49° 116° N.W.)

Silver-Lead-Zinc

Triumph (Blue Star Mines Limited)†

Company office, 400, 837 West Hastings Street, Vancouver 2; mine office, Ainsworth. E. L. Borup, managing director; C. Lind, mine manager. This property is on the south side of Lendrum Creek, about 3 miles by road from the Balfour–Kaslo highway. Stoping was done above No. 6 level, and some underhand stoping was done below No. 6 level. All ore was shipped to the company mill at Ainsworth, amounting to 2,400 tons, including 1964 production (1,300 tons). Four men were employed for four months during the summer and early fall. The mine has been closed.

* By James T. Fyles.
† By P. E. Olson.

The mill at Ainsworth was purchased from Yale Lead & Zinc Mines Limited and put into operation during 1965. Mill production is shown in the following table:—

Source of Ore	Tons Treated	Approximate Grade	
		Lead	Zinc
		Per Cent	Per Cent
Black Fox (Keen Creek)	600	1.0	8.0
Triumph (Lendrum Creek)	2,400	1.5	3.0
Amazon (Woodbury Creek)	260	3.8	2.8

All concentrates were shipped to the Trail smelter. An average crew of three men operated the mill on a one-shift-per-day basis.

Amazon (Blue Star Mines Limited)* (49° 116° N.W.) Company office, 400, 837 West Hastings Street, Vancouver 2; mine office, Ainsworth. E. L. Borup, managing director; C. Lind, mine manager. The property is on Woodbury Creek adjacent to the Kaslo–Balfour highway. The Amazon Crown-granted claim lapsed and was relocated by L. D. Besecker, who leased the property to Blue Star Mines Limited. New drifting and raising amounted to 206 feet, mostly on the south side of Woodbury Creek. A bridge was built across the creek to gain access to old workings on the north wall of Woodbury canyon. Production amounted to 256 tons of ore grading about 6.5 per cent combined lead and zinc. Five men were employed for a period of six months. The operation was shut down in December.

Jewel* (49° 116° N.W.) The Jewel Crown-granted mineral claim is about 1 mile north of Ainsworth. T. Lane and partner, of Ainsworth, stripped several hundred feet along the Jewel showing and commenced shaft-sinking on the vein before closing down the operation for the winter.

Woodbury Creek (49° 117° N.E.)

Gold-Silver-Lead-Zinc

Scranton (Blue Star Mines Limited)* Company office, 400, 837 West Hastings Street, Vancouver 2; mine office, Ainsworth. E. L. Borup, managing director; C. Lind, mine manager. The Scranton mine is near the headwaters of Pontiac Creek, a tributary of Woodbury Creek in Kokanee Glacier Park. The mining-road to the property was repaired and a new tractor-road was constructed on the west side of Pontiac Creek, from the main workings to the 6040 level. Stripping was done in this area along the Scranton vein. Three men were employed for one month.

KEEN CREEK

Silver-Lead-Zinc

Cork Province (London Pride Silver Mines Ltd.)* (49° 117° N.E.) Company office, 611, 850 West Hastings Street, Vancouver 1; mine office, Kaslo. D. C. B. Pitkethly, president; F. J. Hill, secretary-treasurer; L. Olson, mine manager; C. Hartland, mill superintendent. The property consists of 21 mineral claims, 9 of which are Crown granted, on the east side of Keen Creek, 6 miles from the Kaslo–New Denver highway.

* By P. E. Olson.

In 1964 London Pride Silver Mines Ltd. obtained an option from Base Metals Mining Corporation Limited to buy the property on a royalty basis. The property went into production late in 1964 and operated continuously during 1965.

The mine is developed by a vertical shaft with hoisting-gear located underground on No. 3 level, which serves as a main haulage from the shaft to the crushing plant. Although some mining was done on No. 3 level, the main production came from stopes between No. 6 and No. 7 levels. Late in 1965 these areas were shut down and production subsequently came from a stoping area immediately above No. 8 level, the lowest level in the mine. The following table gives mine footages:—

	Ft.
Diamond drilling	1,124
Raising	875
Drifting	942

Production amounted to 26,081 tons of ore, all of which was milled.

Power is produced at the property by diesel-electric units, and compressed air by direct-driven diesel compressors.

Tailings disposal resulted in some spillage into Keen Creek, mainly during the spring months. A new tailings pond, about 1 mile downstream from the camp, has contained tailings since early fall. A new thickener was added to the mill.

Metal production was as follows:—

Lead	1,098,286 lb.
Zinc	3,532,805 lb.
Cadmium	31,305 lb.
Silver	45,797 oz.

The company operates a cook-house, bunk-house, and assay office at the property. Thirty-five men were employed, 10 of whom were on salary.

KOKANEE CREEK

Silver-Lead-Zinc-Copper

Molly Gibson (Homestake Silver Ltd.)*

(49° 117° N.E.) Company office, 1403, 1030 West Georgia Street, Vancouver 5; mine office, P.O. Box 560, Nelson. C. G. Newton, engineer in charge. The property is situated near the headwaters of Kokanee Creek, 12 miles by road from the Nelson–Balfour highway. There are 18 claims in the group centred around the Molly Gibson Crown-granted mineral claim. The property was last worked in 1932 by The Consolidated Mining and Smelting Company of Canada, Limited, from whom the present owners optioned the mineral claims.

The road from No. 3 highway to Gibson Lake was rebuilt at considerable cost, part of which was borne by the Department of Highways since this road will service Kokanee Glacier Park from the south. This road was in excellent condition when work was finished late in 1965. From Gibson Lake, 2 miles of additional road was put in to service the 5880 level of the Molly Gibson mine. This level was rehabilitated and diamond drilling started just before the year-end. Work was under the direction of C. G. Newton, who employed an average of six men during the latter half of 1965.

* By P. E. Olson.

KASLO

Silver-Lead-Zinc

Utica (Continental Consolidated Mines Ltd.)*

(49° 117° N.E.) Company office, 535 Howe Street, Vancouver 1. This company acquired the Utica mine by option and carried out a preliminary geological investigation in the area. Prior to this, Lamint Mining Corporation repaired the mine road to the property and maintained the buildings and machinery. The property is at the head of Twelve Mile Creek, about 15 miles west of Kaslo.

RETALLACK-THREE FORKS

Silver-Lead-Zinc

Doherty (Northlodge Copper Mines Ltd.)*

(50° 117° S.E.) Company office, 1301, 8 King Street East, Toronto, Ont. The company has an option on the Doherty Crown-granted mineral claim on the Kaslo–New Denver highway at the mouth of Lyle Creek. Four holes were diamond drilled from various points along the Kaslo Creek flats to test a structure outcropping along the highway. Overburden was found to be up to 150 feet deep in the middle of the flats. The work was directed by E. Dionne and employed four men for two months.

Charleston (Buchanan Mines Ltd.)*

(50° 117° S.E.) Company office, 15816—112th Avenue, Edmonton, Alta.; mine office, Nelson. The property is situated about 2 miles north of Retallack on the west side of Whitewater Creek. About 200 feet of drifting was done on the lower Keystone adit, and about 100 feet of drifting was done on the upper Keystone adit. In both cases a narrow stringer of ore was followed until it petered out. The mineralization appears to be confined to a streak about 8 to 10 inches wide in a calcareous band of argillite about 5 feet wide.

In December a new adit was collared on the Charleston Crown-granted mineral claim, and it was planned to work throughout the winter on this project.

Shipments of ore totalling 330 tons were made from the Keystone workings to the Carnegie custom mill at Sandon. This was mainly development ore. Levi Siega directed the mine crew of five men.

London, Panama (Vimy Explorations Ltd.)*

(50° 117° S.E.) Company office, 702, 850 West Hastings Street, Vancouver 1. W. G. Hainsworth, consulting geologist. Four diamond-drill holes were drilled from the end of the new level which was driven in 1964, with a view to locating the downward extension of the known ore strand seen in the old workings. According to Mr. Hainsworth, hole No. 4 intersected 18 inches of mineralization grading 60.6 ounces of silver per ton. This hole was inclined at plus 45 degrees and the intersection came at 20 feet.

Access to the property, which is on the south side of London Ridge, is most difficult, and helicopters are used frequently.

Sir Charles*

(50° 117° S.E.) This property is in Jackson Basin, which is 3 miles south of Retallack near the head of Stenson Creek. Several Crown-granted mineral claims, including the Sir Charles, are owned by S. W. Forteath, 301—10th Street, New Westminster. Several short diamond-drill holes were drilled during the summer on a small rich zinc

* By P. E. Olson.

vein striking north 80 degrees west and dipping very steeply. There has been a great deal of trenching, crosscutting, and tunnelling done in this area, mainly in the early 1900's.

Antoine (Antoine Silver Mines Limited)*

(50° 117° S.E.) Company office, 114 West 15th Street, North Vancouver; mine office, New Denver. W. E. Selnes, mine manager. The property consists of the Antoine group of five Crown-granted and three recorded mineral claims and the Soho group of eight Crown-granted mineral claims at the head of McGuigan Creek. The property is reached by 9 miles of good mining-road which leaves the Kaslo–New Denver highway 3 miles east of Three Forks.

The company shipped 500 tons of ore to the Carnegie custom mill at Sandon. Most of this came from old dumps and some was stoped from the Ogema vein above No. 5 level. Drifting on No. 5 level amounted to 40 feet in the vicinity of the Ogema vein, and diamond drilling amounted to 2,000 feet.

In December the camp was moved to the Soho area, where preparations were made to extend the Tom Moore adit to intersect the Ogema vein at a depth of 500 feet below No. 5 level. This will require about 1,400 feet of crosscutting.

Eight men were employed for most of the year. A cook-house is maintained at the mine.

Washington (Red Deer Valley Coal Company, Limited)*

(50° 117° S.E.) Company office, 634 Eighth Avenue Southwest, Calgary, Alta.; mine office, Silverton. L. N. Garland, mine manager; P. Wright, mine superintendent. The company owns the Washington Crown-granted mineral claim on the south side of McGuigan Creek. The Washington mine is developed by Nos. 2, 3, and 4 levels, and stoping has been done in past years above No. 2 and No. 3 levels. The company rehabilitated all levels and commenced stoping where ore had been left by previous operators. Stoping and back-fill removal amounted to 2,649 tons of ore, which was shipped to the company concentrator at Silverton. The operation at the mine was shut down in November due to winter conditions. The Washington ore graded as follows: Silver, 3.6 ounces per ton; lead 1.2 per cent; zinc, 12.0 per cent.

The company purchased milling equipment from New Arlington Mines Ltd., of Salmo, and installed the plant in the Van Roi mill buildings at Silverton. This mill has a daily capacity of 75 tons. Electrical power is supplied by British Columbia Hydro and Power Authority at Whatshan Lake.

SANDON

Silver-Lead-Zinc

Carnegie Mill (Carnegie Mining Corporation Limited)*

(49° 117° N.E.) Company office, 416, 25 Adelaide Street West, Toronto, Ont.; mine office, New Denver. J. C. Black, manager. The Carnegie mill is at Sandon. During the past several years it has operated on a custom basis only, during the late summer and fall. Hydro-electric power is supplied by a company-owned plant at Sandon, with water drawn from Cody and Carpenter Creeks.

* By P. E. Olson.

The following table gives sources and tonnages of custom ores treated at the mill:—

Source	Tons
Antoine	499
Deadman	191
Altoona	272
Keystone-Charleston	330
Victor	253
Rabbitt Paw	85
Total	1,630

Cody Reco Mill (Minoca Mines Ltd.)*

(49° 117° N.E.) Company office, 311, 543 Granville Street, Vancouver 2. The Cody Reco mill is at the old townsite of Cody, 1 mile east of Sandon on Carpenter Creek. The mill has been idle since 1955 and was sold in 1964 to Minoca Mines Ltd. Following the removal of machinery, a clean-up of spilled concentrates was carried out in the mill. Shipments made to the Trail smelter amounted to 8 tons of lead concentrates and 8 tons of zinc concentrates. Diesel generating equipment has been left in the mill, but all other equipment has been taken away.

Rabbitt Paw (Carnegie Mining Corporation Limited)*

(49° 117° N.E.) E. Perepolkin and K. Gordon, of New Denver, leased the Rabbitt Paw section of the Silversmith mine, which is part of the holdings of Carnegie Mining Corporation Limited. They worked mainly in an area between No. 10 and No. 9 levels, where they extracted 85 tons of mill feed, which was treated at the Carnegie mill, and 9.5 tons of crude ore, which was shipped to the Trail smelter.

Silversmith, Richmond-Eureka, Ruth Hope, Etc. (Carnegie Mining Corporation Limited)*

(49° 117° N.E.) Company office, 416, 25 Adelaide Street West, Toronto, Ont.; mine office, New Denver. J. C. Black, manager; S. J. Pedley, geologist. These claims are part of a contiguous group of 54 claims owned by Carnegie Mining Corporation Limited in the Sandon district. Stripping was done on three separate lode strands located on the Slocan Belle, Eureka No. 2, and Ruth Fraction. About 400 square yards of bedrock, which was exposed by stripping, was mapped in detail.

Deadman*

(49° 117° N.E.) L. N. Fried and partner leased the Deadman claim of the Noble Five property near Cody. They shipped 7 tons of crude ore to the Trail smelter and 191 tons of mill feed to the Carnegie mill.

Shady*

(49° 117° N.E.) The Shady recorded mineral claim is on Carpenter Creek about 1 mile east of Cody. N. Sibilleau, of Sandon, stripped overburden with a bulldozer and uncovered 2 tons of galena boulders, which he shipped to the Trail smelter. Overburden is very thick where stripping is being done, and the galena float appears to be distributed vertically. Interest is being shown in locating the source of the lead boulders.

* By P. E. Olson.

Slocan Sovereign*

(49° 117° N.E.) The Slocan Sovereign Crown-granted mineral claim is adjacent to the Reco mine about 1 mile northeast of Cody on the Cody–Reco mine road. P. Leontowicz, of Hills, leased the claim. A kidney of clean lead ore was exposed during the summer but was not mined out. Seventeen tons of milling ore was sold to Johnsby Mines Limited, at Silverton, and 6 tons of crude ore was shipped to the Trail smelter.

Reco (Reco Silver Mines Limited)*

(49° 117° N.E.) Company office, 645 Hornby Street, Vancouver 1. W. S. Ellis, manager. The property consists of 31 Crown-granted and recorded claims immediately northeast of Cody. During the summer months, stripping, mapping, and geochemical sampling were carried out by a crew of three men.

Greenhorn (Hallmac Mining Syndicate)*

(49° 117° N.E.) The Greenhorn Crown-granted mineral claim is about 2 miles east of Cody on the north side of Carpenter Creek. A road was constructed to the property at considerable expense, following which 13 tons of marginal-grade ore was shipped to the Trail smelter. The property was closed in August.

Victor (Violamac Mines Limited)*

(49° 117° N.E.) J. Stewart and E. Anderson, of New Denver, leased in the Victor mine, in an area between No. 3 and No. 4 levels. The lease was dropped early in October and the lessees removed their equipment to New Denver. Thirty-four tons of crude ore was shipped to the Trail smelter, and 253 tons of mill feed was trucked to the Carnegie mill at Sandon. Milling resulted in 23 tons of lead concentrates and 53 tons of zinc concentrates; the latter were shipped to the Trail smelter.

New Springfield*

(49° 117° N.E.) This Crown-granted mineral claim is about 1 mile west of Sandon. Miller Creek passes over the property and is adjacent to the workings. The property is owned by Eugene H. Petersen, of Sandon. The mine consists of three levels, of which the two lower ones are open. A total of 189 tons of ore was shipped from 1897 to 1957. There are over 1,000 feet of workings in the three levels.

During the summer and fall of 1965, Mr. Petersen and helper raised up from No. 3 level about 55 feet, near the north end of the workings, and drifted about 30 feet from this raise along a vein. Ore sorted from this work was stockpiled near the portal of No. 3 level. About 40 tons was sold to Johnsby Mines Limited at Silverton.

Altoona (Hallmac Mining Syndicate)*

(49° 117° N.E.) The Altoona Crown-granted mineral claim is on the old Kaslo and Slocan railway grade about 1 mile northwest of Sandon. The access road to the property is built on the railway grade, and No. 2 level is alongside the grade. No. 1 level, which is 100 feet higher, was rehabilitated and some stoping was done along a previously known mineral zone. All production came from No. 1 level and amounted to about 300 tons, most of which was shipped to the Carnegie mill. Two men were employed under the direction of Norman Sibilleau.

* By P. E. Olson.

SLOCAN LAKE

Silver-Lead-Zinc

Hecla, Mammoth (Johnsby Mines Limited)*

(49° 117° N.E.) Company office, 1011, 2200 Yonge Street, Toronto 12, Ont.; mine office, Silverton. R. C. Phillips, manager; F. D. Carlson and M. Fryters, mine superintendents for the Hecla and Mammoth operations respectively. During the year the company operated its mill at Silverton and mined in the Hecla and Mammoth mines as two fairly distinct operations. The Hecla produced 7,128 tons of ore, grading 16.4 ounces of silver per ton, 3.4 per cent lead, and 4.6 per cent zinc. Drifting, raising, and diamond drilling amounted to 414, 271, and 1,706 feet respectively at this operation. Known ore was fairly well exhausted above the Hecla drive, and sinking was started near the end of 1965.

The Mammoth produced 3,527 tons of ore, grading 7.3 ounces of silver per ton, 4.9 per cent lead, and 4.6 per cent zinc. Drifting, raising, and diamond drilling amounted to 145, 258, and 672 feet respectively. All work on the Mammoth was done between No. 12 level (the main haulage) and No. 9 level.

The company mill operated all year on a one-shift-per-day basis and treated ore as follows:—

	Tons
Hecla	6,915
Mammoth	3,507

The Company also treated custom ore, which was purchased outright. The following table shows sources of ore and tonnages:—

	Tons
Hewitt (J. Kelly)	422
Slocan Sovereign (Leontowicz & Maxinuk)	17
New Springfield (E. Petersen)	42
Beatrice (Dakota Silver Mines Ltd.)	5
Altoona (Hallmac Mining Syndicate)	27
Mountain Chief No. 2 (A. Kesler)	2
Slocan Lake (P. V. Nelson)	1

The 1 ton of ore from Slocan Lake was jig concentrates which had been lost from a Canadian Pacific Railway barge near the Silverton dock. All concentrates were shipped to the Trail smelter. The company employed 30 men, 4 of whom were staff members.

Hewitt*

(49° 117° N.E.) This mine is under lease to Jack Kelly, of Silverton. It is situated on the south side of Silverton Creek about 3 miles east of Silverton. Mr. Kelly and son mined 422 tons of ore on No. 10 level and shipped it to the Johnsby mill at Silverton. Most of this ore came from a drift which was driven on a new ore shoot about 5 feet wide and 100 feet long. Mr. Kelly tried to sell his lease to nearby operating companies but was unable to complete a deal due to the terms of his lease.

Copper-Gold

Rockland (The Consolidated Mining and Smelting Company of Canada, Limited)*

(49° 117° N.E.) Field office, 1150 Bay Avenue, Trail. The Rockland group consists of 17 recorded and Crown-granted mineral claims situated on Aylwin Creek about 5 miles south of Silverton. The property is held under option from Northlode Exploration Ltd. Early work on the Rockland consisted of open-cutting and about 300 feet of cross-cutting on a mineralized shear in what appears to be a roof-

* By P. E. Olson.

pendant in the Nelson Batholith. Pyrite, pyrrhotite, and chalcopyrite mineralization was encountered. The Consolidated company has carried out a mapping and drilling programme over the past two years, mainly on the Rockland and Willa Crown-granted mineral claims. Diamond drilling in 1965 amounted to 975 feet in four holes. Work was diretced by A. B. Mawer.

Silver-Lead-Zinc

Galena Farm (Red Deer Valley Coal Company, Limited)*

(49° 117° N.E.) Company office, 634 Sixth Avenue Southwest, Calgary, Alta.; mine office, Silverton. L. N. Garland, mine manager; F. Mills, mine superintendent. The property is under lease and option to the Red Deer Valley Coal Company, Limited, from Galena Farm Mining and Milling Company of Spokane, Wash. Rehabilitation work was started on No. 1 and No. 2 levels during November, and dump rock was being shipped to the company concentrator at Silverton by late December. The mill treated 90 tons of dump rock, which graded about 1.0 per cent lead and 3.0 per cent zinc. Exploration on No. 2 level was started, but considerable timbering had to be done before blasting and mucking could start. The mine and mill employed about 35 men at the year-end.

ENTERPRISE CREEK

Silver-Lead-Zinc

Enterprise*

(49° 117° N.E.) The Enterprise mine consists of fairly extensive workings on the south side of Enterprise Creek, about 6 miles by road from the Slocan–New Denver highway. The property has been idle since 1952 except for occasional leases. R. T. Avison and J. Nesbitt, of Silverton, took out a lease from Western Exploration Company Limited and rehabilitated the area around No. 6 and No. 7 level adits. A new adit was driven between No. 6 and No. 7 levels, and about 20 tons of ore mined was shipped directly to the Trail smelter. Just before winter set in, a 35-foot raise was put in on No. 6 level. This made a section of ore available for stoping. The Enterprise vein is quite narrow but contains sections of massive ore with high silver values.

Gold-Silver

Jumbo (Timberline Mines Limited)*

(49° 117° N.E.) Company office, 23 Glade View Crescent Southwest, Calgary, Alta; field office, c/o S. Berisoff, Silverton. The Jumbo group of 10 recorded mineral claims is on the south side of Enterprise Creek, 8.3 miles from the Slocan–New Denver highway. Timberline Mines Limited was formed specifically to conduct exploration on the Jumbo. An adit was driven at an elevation of 5,000 feet where previous stripping had disclosed high gold values in a sheer which cuts granite of the Nelson batholith. The adit was driven 100 feet along the shearing before the project was abandoned. Samples taken at regular intervals along the drift gave disappointing results. Mr. Berisoff supervised the work, which employed three men for three months during the early part of the summer. The company dropped its option on the property late in 1965.

* By P. E. Olson.

SPRINGER CREEK

Silver-Lead-Zinc

White Hope (Western Standard Silver Mines Ltd.)* (49° 117° N.E.) Company office, Box 22, Slocan. This is a private company whose managing director is R. Bentley. The White Hope is immediately east of the Slocan–New Denver highway, 4 miles north of Slocan. No. 4 level, the lowest workings on the property, was reopened and advanced about 300 feet to explore downward extensions of mineralized fractures previously explored in the upper levels. About 1,000 feet of diamond drilling was done from this level after drifting and crosscutting were halted. On No. 3 level, which is 150 feet vertically above No. 4 level, about 150 feet of crosscutting and 200 feet of diamond drilling were done. The " G " vein, which is 700 feet southwest of the main workings, was explored with several open cuts.

A mining-road was built from the White Hope to the Colorado vein, which is situated on the White Hope No. 8 recorded mineral claim. From the end of this road a new portal was started, which is intended to explore the Colorado showing 175 feet vertically below the old Colorado adit. This prospect has been described in Geological Survey of Canada Memoir 184 by C. E. Cairnes.

Silver

Ottawa (Slocan Ottawa Mines Ltd.)* (49° 117° N.E.) Company office, 201, 569 Howe Street, Vancouver 1; mine office, Box 75, Slocan. J. L. Wilson, president and managing director; W. W. Tyler, mine manager. The Ottawa mine is on the north side of Springer Creek about 5 miles from Slocan. In 1965 the name of the company was changed from Ottawa Silver Mines Ltd. to Slocan Ottawa Mines Ltd.

The mine is developed by two main adits, No. 8 and No. 9 levels, which have no raise connections. Drifting on No. 9 level amounted to 155 feet following a diamond-drilling programme which gave favourable intersections of silver ore. Some of the No. 9 level development was in ore which was shipped to the Trail smelter with ore mined from above No. 8 level. Shipments to the Trail smelter totalled 999 tons, which graded approximately 70 ounces of silver per ton.

Raising and drifting above No. 8 level amounted to 420 and 210 feet respectively, and 25 feet of raising was done from No. 9 level. Diamond drilling amounted to 1,092 feet, mainly on No. 9 level. The mine operated a full year and employed an average of 12 men.

Myrtle (Silver King Mines Limited)* (49° 117° N.E.) Company office, Slocan. Benjamin Marasek, managing director. The Myrtle property consists of several recorded claims covering ground previously known as the Myrtle mine which was operated between 1901 and 1908. The vein is developed by a shaft and a 450-foot crosscut which provides backs of about 100 feet on the vein. The property is 3½ miles by road north of the Ottawa mine.

Silver King Mines Limited built a good road to the Myrtle and prepared the 450-foot crosscut for modern equipment. Two buildings were put up on the property late in the year.

* By P. E. Olson.

Arlington (Arlington Silver Mines Ltd.)*

(49° 117° N.E.) Company office, 809, 525 Seymour Street, Vancouver 2. B. I. Nesbitt, managing director; G. House, engineer in charge. The property consists of 16 mineral claims on the north side of Springer Creek 6.7 miles by road from Slocan. Considerable drifting and diamond drilling were done on the " B " level horizon. This level was advanced in the hangingwall of previously worked ground, and diamond-drill holes were then driven to test the mineralized zone. High values in silver have been reported by the company as a result of this drilling. A new adit was started about 100 feet vertically below the " B " level and in the hangingwall of the abandoned "A" level. At the end of 1965 there was a crew of seven men on the property.

Silver-Lead-Zinc

Exchange (New Gateway Oils and Minerals Limited).*—(49° 117° N.E.) Company office, Suite 808, Bank of Montreal Building, Edmonton, Alta. The Exchange group of mineral claims is located on Dayton Creek, a tributary of Springer Creek. One thousand feet of diamond drilling was done during the summer.

PINGSTON CREEK

Zinc

Big Ledge (The Consolidated Mining and Smelting Company of Canada, Limited)†

(50° 118° N.E.) The Big Ledge property consists of 44 Crown-granted and 25 recorded mineral claims, situated along the north side of Trout Creek, a tributary from the west of Pingston Creek. The property is owned by The Consolidated Mining and Smelting Company of Canada, Limited, whose exploration office is at 1150 Bay Avenue, Trail. Showings of pyrite, pyrrhotite, and sphalerite occur on the claims along a layer, known as the Ledge, of fine- to medium-grained schists with calcareous lenses that form part of a sequence of metasedimentary rocks of the Shuswap metamorphic complex. Exploration in 1965 was a continuation of that carried out in 1964 (*see* Annual Report, 1964, p. 130) and consisted of diamond drilling 17 holes totalling 8,080 feet and some geological mapping.

Two drills and two tent camps were run concurrently during July, August, and September and were serviced by helicopter. One camp, used also in 1964, is at an elevation of 6,000 feet on Iron Lake at the head of Trout Creek. The second camp was above Paint Lake about a mile to the west.

The holes were drilled to delimit zones of the best zinc mineralization and to discover a basis for predicting the shape of these zones. Some success was obtained, but the grades are low and the mineralized zones are irregular.

Work was supervised by A. de Voogd.

NORTH LARDEAU

Silver-Lead-Zinc

Beatrice (Dakota Silver Mines Ltd.)*

(50° 117° N.W.) Company office, 3104—31st Avenue, Vernon; mine office, Camborne. This company owns a group of 26 mineral claims and fractions at the head of the east fork of Mohawk Creek, at an elevation of 7,000 feet. The property is reached by 7 miles of tractor-road from

* By P. E. Olson.
† By P. E. Olson and James T. Fyles.

Camborne. New mine buildings were installed in a slide-free area near the mine and the road was extended to the portal of No. 2 level. A minor amount of raising was done and an ore bin was installed at the end of the road. John Graham directed the work, which was stopped following the onset of winter.

Teddy Glacier (Teddy Glacier Mines Limited)*

(50° 117° N.W.) Company office, 355 Burrard Street, Vancouver 1. This property, consisting of about 20 claims on the hills northeast of Stephney Creek about 10 miles due north of Beaton, was explored in 1964 by diamond drilling near the old showings (*see* Annual Reports, 1935, p. E 21, and 1964, p. 131). Road work in 1964 disclosed, about 3,000 feet southeast of the old workings, mineralization on the crest of a ridge, locally called Vimy Ridge, which forms the pass between the two main forks of Stephney Creek. In 1965 trenching and prospecting of the showings were done by a small crew during July.

The rocks near the showings are green and grey phyllites with thin lenses of white limestone. On Vimy Ridge several veins well mineralized with galena, sphalerite, and chalcopyrite cut a lens of limestone which is up to a few feet thick. The veins trend northeast and transect folds that plunge at low angles to the southeast. In three of six trenches, sulphide mineralization occurs in the veins up to widths of 10 inches and has spread out from them into the limestone to a maximum distance of about 2 feet from the vein. The trenches extend for about 200 feet along the top of the ridge which trends southeast and is crossed by the veins. Mineralized limestone in two of the trenches is near the crest of a fold.

SOUTH LARDEAU

Lead-Zinc

Vin (The Consolidated Mining and Smelting Company of Canada, Limited)†

(50° 116° S.W.) Field office, 1150 Bay Avenue, Trail. The Vin group of 10 recorded mineral claims lies about 2 miles southeast of Duncan Lake on the slope of Lavina Mountain. During the summer months some geological mapping and diamond drilling were done on the Vin Nos. 7, 8, and 9 mineral claims. The drilling amounted to 1,880 feet in seven holes. A crew of six men, four of whom worked for the drilling contractor, were under the direction of W. P. Armstrong.

CRAWFORD CREEK

Gold-Silver-Copper

United Copper†

(49° 116° N.W.) The United Copper is on the west slope of Cogle Pass, which is near the headwaters of Crawford Creek. The property consists of recorded mineral claims held by W. Cartwright and associates, of Nelson. Mineralization occurs in narrow quartz veins that locally contain massive chalcopyrite and pyrrhotite. The veins strike northward and dip westward at 30 to 40 degrees. Wallrock is mainly chlorite schist with local talc development.

A tractor-road was constructed during the early summer, and several short diamond-drill holes were put down on the best showing with an X-ray drill.

* By James T. Fyles.
† By P. E. Olson.

CRESTON

Silver-Lead-Zinc

Liz B (Aspen Grove Mines Ltd.)*

(49° 116° S.W.) Company office, 826, 510 West Pender Street, Vancouver 2. The property is located on Wildes Creek 2 miles north of Wynndel. A D-6 bulldozer was used to build roads, strip the main showing, and level diamond-drill sites. The mineralized zone, which parallels Wildes Creek, was surveyed and sampled, and later several diamond-drill holes were put down to test the mineralization about 150 feet down-dip. The Liz B has been drilled twice before, in 1954 and in 1962. Work was carried out under the direction of Henry Tysseland.

KITCHENER

Silver-Lead-Zinc

Star*

(49° 116° S.E.) The Star mineral claims are on the east side of Goat River about 3 miles north of Kitchener. The property is owned and operated by F. Brady, of Creston. A narrow quartz vein containing bunches of galena and minor sphalerite is developed by a drift about 200 feet long. The wallrock is quartzite. One ton of selected ore was shipped to the Trail smelter on a trial basis.

MOYIE

Gold-Silver

Midway (Calix Gold Mines Ltd.)†

(49° 115° S.W.) Registered office, 645 Hornby Street, Vancouver 1. This property is adjacent to the No. 3 highway 6 miles southwest of Moyie. It comprises 16 mineral claims which were optioned by the present company in 1963 for exploration. A detailed description of the property is given in the 1933 and 1934 Annual Reports. Most work in the past was done in 1933, and a total of 1,053 tons of ore containing 253 ounces of gold, 1,934 ounces of silver, 4,056 pounds of lead, and 2,634 pounds of zinc was shipped, chiefly by lessees.

A quartz vein with an average north-south strike and a west dip ranging between 30 and 50 degrees crosses quartzitic sedimentary rocks of the Aldridge Formation dipping 20 to 30 degrees to the north and northeast. The vein ranges in width from a crack to several feet of shattered quartz. Oreshoots appear to consist of concentrations of pyrite with more restricted galena and sphalerite.

An upper adit, about 1,250 feet long, is caved at 500 feet from the portal. Maps indicate five small stopes, the largest seen being 40 feet long and about 40 feet on the dip. The lower adit is approximately 70 feet below the upper. Most of the exploration in 1965 was confined to the lower adit. Portions of the drift were slashed and widened, and the drift itself extended 600 feet to a total length of 1,050 feet. A narrow mineralized vein was followed 715 feet from the portal but was lost when the drift was driven into the hangingwall due to poor ground conditions. A number of short holes were drilled from the side of the drift in search of the vein but failed to locate it, and further exploration was suspended. The work was done by contract. There were six men employed under R. Ernewin.

* By P. E. Olson.
† By D. R. Morgan and M. S. Hedley.

St. Eugene, St. Eugene Extension, Aurora*

(49° 115° N.W.) This property is south of Moyie and is adjacent to the No. 3 highway. It comprises 23 Crown-granted claims owned by The Consolidated Mining and Smelting Company of Canada, Limited, and 81 Crown-granted claims owned by St. Eugene Mining Corporation. The property is astride lower Moyie Lake and includes the old St. Eugene mine area. By joint agreement Falconbridge Nickel Mines Limited conducted an exploration programme in 1965. Ten diamond-drill holes were completed, totalling 2,320 feet. A bulldozer was used for trenching and for constructing 1½ miles of road, and in addition geophysical and geochemical surveys were carried out. A contract seismic and hydrosonde (" sparker ") survey was completed on the shore and surface of lower Moyie Lake to investigate geological structure beneath the lake.

An average crew of six men was employed from May 1st to September 1st. The work was under the direction of A. Burgoyne, geologist.

GALLOWAY

Copper

Empire, Strathcona (Altamont Exploration Company Ltd.)*

(49° 115° S.E.) Registered office, 543 Granville Street, Vancouver 2. Ross Stanfield, president. This property is on Sand Creek, approximately 4 miles north of Galloway and 26 miles southwest of Fernie. The property consists of the Empire and Strathcona Crown-granted claims and 150 mineral claims held by record. They are situated at elevations ranging from 4,000 to 5,000 feet, and can be reached by means of a road leading from No. 3 highway at Galloway. A detailed description of the property is given in the 1930 Annual Report.

Several adits were reopened in 1965 for examination, and a crew of 10 men drilled five diamond-drill holes, totalling 1,200 feet, at various points on the surface to explore the continuation of the orebody. A number of open cuts were made by bulldozer, and approximately 10 miles of access roads were made to the drill-sites. The crew started working on June 1st, and continued during the winter months. A well-constructed camp, comprising an office, cook-house, and bunk-house, was built to accommodate the workmen. The work was under the direction of Ross Stanfield.

FORT STEELE

Lead-Zinc

M.J.P. (Northern Pacific Corporation Limited)*

(49° 115° N.W.) Registered office, Guaranty Trust Building, Edmonton, Alta. M. J. Pritchard, president. This property is near the confluence of the Wildhorse River and Fisher Creek, 5 miles northeast of Fort Steele. It comprises 20 mineral claims recorded by M. J. Pritchard, of Edmonton, in December, 1964. Commencing May 15, 1965, a crew of two men drilled three BX wire-line holes totalling 869 feet on the east side of the Wildhorse River. The ground was heavily fractured and a great deal of difficulty was experienced in recovering the core. Further drilling was suspended on June 20th. The property was inactive for the remainder of 1965.

* By D. R. Morgan.

KIMBERLEY

Silver-Lead-Zinc

Sullivan (The Consolidated Mining and Smelting Company of Canada, Limited)*

(49° 115° N.W.) Company office, Box 1510, Station B, Montreal 2, Que.; W. S Kirkpatrick, chairman and president; D. D. Morris, vice-president, operations. Western headquarters, Trail; J. H. Salter, vice-president, Western region. Sullivan mine office, Kimberley; R. M. Porter, manager, Kimberley operations; O. E. Weightman, superintendent, Sullivan mine; H. J. Chalmers, superintendent, Sullivan concentrator. The Sullivan mine is on Mark Creek, 2 miles north of Kimberley, and the concentrator is at Chapman Camp, 2 miles south of Kimberley. The holdings include 678 Crown-granted claims and fractions and 30 recorded claims. The following report, prepared by the management, is a synopsis of the operations:—

" During 1965, about 2,300,000 tons of Sullivan ore were treated at the Concentrator. In addition, the Mill treated some ore from Pine Point Mines, Limited, as capacity was available. The Concentrator operated 265 days during 1965.

" Development driven totalled approximately 20,000 feet and core-hole diamond drilling about 4,000 feet Backfill totalled 563,000 cubic yards of float rock, cave and development waste.

" The ventilation system handled approximately 950,000 c.f.m. of air which equals about 4.5 tons of air per ton of production.

" Revisions were required to part of the major ventilation circuit so as to keep clear of hanging wall subsidence. This included two new ventilation airways to surface, one at the south end of the mine (No. 41) and one on the west end of the mine (No. 42).

" No. 42 airway will have the largest capacity of the mine airways. Its rated range is 400,000–450,000 c.f.m. exhausting through a 15-foot diameter, concrete-lined shaft 430 feet deep. Twin fans in parallel, each having an 87-inch diameter rotor and a 300 h.p. motor, were being installed at the year-end.

" Construction of the first intake heating plant at the Sullivan was nearing completion. Located at the collar of No. 41 airway, it will consist of an indirect type heating plant fired by natural gas and rated at 16 million B.T.U. per hour.

" Ground control in relation to safety and mine planning was studied by a recently established Rock Mechanics Department. Equipment includes a Tinius-Olsen, 200,000 lb. testing machine, a photoelastic polariscope with a 12-inch field, portable SR4 BLH strain indicators and Griswold-type overcoring borehole gauges. Various laboratory and underground instruments were tested with the object of developing techniques for determining the magnitude and direction of rock stresses in situ.

" Technical developments relating to health and safety included the local manufacture of pulverized NCN for secondary blasting. It is less sensitive and cheaper than dynamite. Noise suppression devices were developed for the various types of rock drills.

" Other technical subjects under development related to improved drilling techniques and the sharpening of tungsten carbide bits by spark erosion.

" In 1965, the Sullivan mine had 9 lost-time accidents; there were 4 at the Concentrator. No fatalities were suffered at either the mine or the mill. Accident frequency per 1,000,000 man-hours was 6.98 at the mine, and 8.89 at the concentrator. The severity rate per 1,000,000 man-hours worked was 1,577.2 calendar days at the mine and 417.9 at the concentrator.

* By D. R. Morgan.

" Fourteen Sullivan Mine and Concentrator employees obtained or renewed their Industrial First-aid certificates, and 110 employees passed their St. John's first-aid examinations.

"A team from the Sullivan Mine won the Provincial Mines Department mine-rescue trophy after winning the East Kootenay Mine Safety Association competition. Thirteen Sullivan employees obtained their mine-rescue certificates, making a total of 328 since training first started at the mine in 1929.

" Employees at the year-end totalled 687 at the Mine and 293 at the Concentrator."

Lead-Zinc

Western Exploration (Reeves MacDonald Mines Limited)*

(49° 115° N.W.) Head office, 410 Metropolitan Building, 836 West Hastings Street, Vancouver 1; mine office, Remac. L. M. Kinney, Metaline Falls, Wash., general manager; F. R. Thompson, superintendent. This property is located between the headwaters of the east fork of Mark Creek and Mather Creek. It is 10 miles north of Kimberley, and can be reached by means of an old forestry road leading from the open-pit area of the Sullivan mine. The property comprises 110 Crown-granted claims, optioned from Western Exploration Company Limited of Silverton, and six mineral claims held by record. The latter claims are on the north end of the group.

A crew of four men drilled four BXWL holes, totalling 2,465 feet, during a four-month period in the summer of 1965, the deepest hole being 890 feet. Drilling was done under contract, and the work was supervised by D. C. Plecash, geologist. The men stayed in a temporary camp on the property.

HELLROARING CREEK (49° 116° N.E.)

Silver-Lead-Zinc

Boy Scout (Wescan Development Ltd.)*

Registered office, 233 Canyon Road, Creston. John Wolfe, president. This property is on the west fork of Hellroaring Creek, and is approximately 10 miles southwest of Kimberley. It can be reached by road leading from Marysville The property comprises four Crown-granted claims, optioned from Harold Bennett, of Cranbrook, and 12 mineral claims held by record. It also includes the Warhorse mine that was last operated in 1955. A crew of three men rebuilt a bridge leading to the property during the summer of 1965, restored the ventilation at the mine, and constructed 2 miles of road to the upper tunnels. The men were employed for a period of 10 weeks. The work was under the direction of John Wolfe.

CANAL FLATS

Silver-Lead-Zinc

St. Anthony (Northern Pacific Mining Corporation Limited)*

(50° 116° S.E.) Registered office, Guaranty Trust Building, Edmonton, Alta. M. J. Pritchard, president. This property is on Doctor Creek, 12 miles southwest of Canal Flats. It comprises 19 mineral claims which the present company optioned from the Blake family at Skookumchuk in 1965 for exploration. A crew of two men drilled five holes totalling 1,801 feet during the period June 20th to August 18th, following which further exploration was suspended. The work was directed by M. J. Pritchard.

* By D. R. Morgan.

WINDERMERE

TOBY CREEK (50° 116° S.E.)

Silver-Lead-Zinc

Mineral King (Aetna Investment Corporation Limited)*

Company office, 1690 West Broadway, Vancouver 9. J. S. McIntosh, vice-president and director of mining operations; J. B. Magee, resident manager. This mine is at Toby Creek, 28 miles southwest of Athalmer. It is reached by a good road leading from near Wilmer. The workings are in a mountain ridge between Toby and Jumbo Creeks. They are entered by four levels, Nos. 2, 3, and 7 being driven from the Toby Creek side and No. 9, the lowest at present, from the Jumbo Creek side, the latter two levels being used for main haulage. The mine is operated by the open-stope method, and the workings are in four irregular-shaped orebodies known as the " A," " B," " C," and " D " zones. Detailed descriptions of the property are given in the 1959 and 1962 Annual Reports.

The mine produced 145,196 tons of lead-zinc ore in 1965, most of the ore being mined from the stopes in the upper levels and the remainder by development of the lower levels. A new inclined shaft was sunk below No. 9 level. The shaft is 728 feet long and will extend the workings to the 4,000-foot elevation, and enable three levels to be developed in the orebody disclosed by drilling in 1964. At the year-end, hoisting equipment, electrical installation, and pumps were in operation, and the three new shaft stations in progress of construction. The total development at the mine in 1965 included 1,304 feet of drifting and crosscutting, 615 feet of raising, and 23,905 feet of diamond drilling. There was no production of barite.

The mine is ventilated by mechanical and natural means. Approximately 36,000 cubic feet of air per minute is exhausted from the workings, and of this quantity 23,000 cubic feet per minute is supplied by a 15-horsepower electrically driven fan located in the No. 2 level. The ventilation in the lower workings is also boosted by a small auxiliary fan on the No. 9 level. These quantities were found to be sufficient for the present requirements of the workings.

The concentrator operated throughout the year and produced 2,473 tons of lead concentrates grading 65.2 per cent lead and 9,127 tons of zinc concentrates grading 54.0 per cent zinc. The concentrates were trucked to Invermere for shipment by rail. The average number of men employed was 95, of whom 54 were employed underground.

Copper

O.K. (Aetna Investment Corporation Limited)*

(50° 116° S.E.) Company office, 1690 West Broadway, Vancouver. J. S. McIntosh, vice-president and director of mining operations; J. B. Magee, resident manager. This property is on the north side of the Toby Creek valley, 16 miles southwest of Athalmer, and can be reached by a 1-mile trail leading from the Toby Creek road. It is at an elevation of 5,300 feet, and consists of four mineral claims formerly known as the Dragon group. The property covers a showing of pyrite and chalcopyrite appearing in a narrow quartz vein in a faulted and crumpled zone of argillites. The present company optioned the property in 1965 for examination. A reconnaissance survey was made of the surface, and a crew of two men drilled four X-ray holes, totalling 212 feet, during one of the summer months. The option was later relinquished. The work was under the direction of W. W. Cummings, geologist.

* By D. R. Morgan.

BRISCO

Copper-Lead-Zinc-Silver

Jersey (The Consolidated Mining and Smelting Company of Canada, Limited)*

(50° 116° N.E.) Company office, Trail. This property is near the foot of Steamboat Mountain, 10 miles southwest of Brisco, and can be reached by logging-road leading from Brisco. It is at an elevation of 3,800 feet and consists of seven mineral claims formerly known as the Myras group, and were examined by New Jersey Zinc company in 1954. The property covers a showing of disseminated chalcopyrite with minor galena and pyrite in a brecciated dolomite zone adjacent to a large fault. The present company optioned the property in 1965 for examination. A reconnaissance survey was made, and a crew of three men drilled two AX and EX holes totalling 443 feet. The men were employed for two months, and the drilling was done under contract. The work was under the direction of G. L. Webber, senior geological technician.

PARSON

Lead-Zinc-Silver-Gold

Ruth (Columbia River Mines Ltd.)*

(50° 116° N.W.) Registered office, 410, 470 Granville Street, Vancouver 2. This property, also known as the Ruth Vermont, is on Vermont Creek 25 miles southwest of Golden. It comprises 11 Crown-granted and 35 recorded mineral claims, which are situated at elevations ranging from 6,000 to 6,500 feet, and can be reached by a 35-mile road leading from Parson. The Crown-granted claims were acquired by the present company in 1965, and the additional claims were recorded the same year. The property has been previously worked, and detailed descriptions are included in the 1930 and 1936 Annual Reports.

The main activities in 1965 were directed to the Old Timers level, which is at an elevation of 6,000 feet, and is being driven on the footwall of a slaty limestone containing mineralization. The level was extended 900 feet, and an additional 180 feet was driven back to a new portal to straighten the old level. Two raises were also driven from the level. A number of drill-sites were established on the level and in the raises, and 47 diamond-drill holes totalling 6,100 feet were drilled. Appreciable values in silver, lead, and zinc are reported to have been found as a result of the drilling, and preparations were being made at the year-end to drive a crosscut into the mineralized zone. The exploration started in July, 1965, and continued during the winter months. There were 22 men employed, and the work was under the direction of T. E. Swanson, consulting engineer. The men stayed in a camp near the creek level.

Silver-Lead-Zinc-Copper

Alpha (Bonanza Explorations Ltd.)*

(50° 117° N.E.) Company office, 711, 543 Granville Street, Vancouver 2. This property is between the headwaters of Bobby Burns and Bennison Creeks, on the Spillimacheen Range of the Purcell Mountains, 30 miles southwest of Golden. It comprises eight Crown-granted and seven recorded mineral claims which are located at elevations ranging from 7,500 to 8,500 feet. Transportation at present is by helicopter from Golden. The present company acquired the

* By D. R. Morgan.

property in 1965, and a crew of three men started rehabilitating the old Kimpton adit, which is at an elevation of 8,200 feet, in November. The work was under the direction of G. R. Hilchey, consulting engineer.

REVELSTOKE

Gold-Silver-Lead-Zinc

J & L (Westairs Mines Limited)*

(51° 118° S.E.) Company office, P.O. Box 520, Bathurst, N.B.; mine office, P.O. Box 1318, Revelstoke. Ivan C. Stairs, president; T. W. Roynon, resident engineer. This company holds, by option agreement, the J & L property, consisting of 9 Crown-granted and 48 recorded mineral claims. The property is on the southern side of the east fork of Carnes Creek, half a mile above its junction with the main creek. Carnes Creek joins the Columbia River at a point about 24 miles north of Revelstoke.

The property has been described in previous Annual Reports. The J & L vein lies between a limestone footwall and a sericite schist hangingwall. The strike is northwesterly and the dip from 40 to 50 degrees to the northeast. Mineralization consists of arsenopyrite, pyrite, galena, sphalerite, and minor chalcopyrite.

Work in 1965 commenced on September 1st and continued for the remainder of the year. The old camp was rehabilitated. An adit was collared on the south side of the east fork of Carnes Creek and was driven 103 feet on the vein. In addition, 101 feet of crosscutting was done. Other work included road construction. Approximately 1 mile of a proposed 8-mile road from the Big Bend Highway to the property had been completed at the year-end.

Transportation was by helicopter. An average crew of 13 men was employed. (*See* Annual Reports, 1922, pp. 215–217, and 1946, pp. 174–175.)

Lead-Zinc

King Fissure, S.B., C.R., and Deby*

(51° 118° S.E.) This property, also known as the River Jordan, consists of 16 Crown-granted claims held under option agreement and 41 claims held by record by Bralorne Pioneer Mines Limited. The company office is 320, 355 Burrard Street, Vancouver 1. The property is on the upper northern slope of Mount Copeland, about 12 miles northwest of Revelstoke. Mineralization consists of an aggregate of fine-grained pyrite, pyrrhotite, galena, and sphalerite disseminated in a single layer of metamorphosed sedimentary rock in a sequence of schists and gneisses. The mineralized layer is folded isoclinally; two limbs are exposed which strike eastward and dip at moderate angles to the south. The property has been described by C. Riley in Transactions of the Canadian Institute of Mining and Metallurgy for 1961, pages 268 to 272.

The mineralization is well exposed in cliffs and outcrops between elevations of 5,800 and 7,500 feet. Exploratory work since about 1950 has been mapping, trenching, sampling, and diamond drilling. Work in 1965 consisted of mapping and diamond drilling. Two holes were drilled, totalling 2,966 feet. An average crew of six men was employed for three months under the supervision of D. H. James. Transportation was by helicopter from Revelstoke. The property was not visited.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1956, p. 114; 1958, p. 53; *C.I.M.M.*, Trans., Vol. LXIV, 1961, pp. 268–272.]

* By W. C. Robinson.

Molybdenum

Joan*

(51° 118° S.E.) A group of claims covering the ridge west of Mount Copeland some 15 miles northwest of Revelstoke was located in 1964 by E. H. Ewar and associates, of Peachland, and optioned in 1965 to King Resources Ltd., of Calgary. The claims cover showings of molybdenite in syenite and lime silicate gneisses adjacent to a thick layer of nepheline syenite. The principal showings are at an elevation of 7,200 feet on the north slope of the ridge about 2 miles west of the summit of Mount Copeland. They are on a rock bench at the lower edge of a small glacier and occur intermittently along the strike of the formations for about half a mile.

Rocks in the area are part of the Shuswap metamorphic complex and include fine-, medium-, and coarse-grained lime silicate gneiss, biotite hornblende gneiss, and dolomite in layers and lenses up to a few tens of feet thick. They strike north 70 degrees west and dip at moderate angles to the south beneath the nepheline syenite. Irregular sill-like sheets and lenses of fine- and coarse-grained syenite which appear to be related to the nepheline syenite are present in the metamorphic rocks.

Molybdenite occurs as clusters or as scattered grains or thin stringers in lime silicate gneiss, in biotite hornblende gneiss, and in the lenses of syenite. Scattered showings form a discontinuous zone trending parallel to the formations but not restricted to any one rock type or clearly defined structure. It is estimated that grades of 5 per cent molybdenite over widths of a few feet could be obtained from several of the showings but that the average grade across 15 to 20 feet would be a fraction of 1 per cent. Pyrrhotite, which is widely scattered and locally abundant, is the only other sulphide recognized. Magnetite is common, and in some places causes strong local magnetic attraction. Work in July and August consisted of geological mapping, prospecting, and sampling. In late August and early September five diamond-drill holes, totalling 1,037 feet, were drilled on showings at the eastern end of the zone. The property was serviced by helicopter. Ten men were employed for six weeks under the direction of George A. Wilson, consulting geologist.

SICAMOUS

Copper-Lead

Annis, Dawn, and Lakeview (Annis Mines Ltd.)†

(50° 119° N.E.) Company office, 1413 Tranquille Road, Brocklehurst, Kamloops. J. S. McKechnie, president; S. F. Kelly, consultant. The claim group includes the Annis, Dawn, and Lakeview groups totalling 38 claims, all held by record. It is situated between Mara Lake and the Salmon Arm of Shuswap Lake; a dirt road leads eastward a quarter-mile from the Trans-Canada Highway about 5 miles southwest of Sicamous.

The general geology is shown on Geological Survey of Canada Map 1059A, Vernon. The area of the claim group is underlain by the Mara Formation of uncertain age.

The showings, in pits and trenches adjoining a jeep-road, are at elevations (barometer) between 2,600 and 2,750 feet on the westerly slope of the hill. The rocks are mica schists and quartzose gneisses striking north 30 degrees west and dipping 70 degrees northeastward. The beds are cut by one or more mineralized fractures striking nearly east-west and dipping 35 degrees to 65 degrees north. Mineralization is chiefly pyrite with chalcopyrite and galena. Locally pyrrhotite is

*By James T. Fyles.
† By N. D. McKechnie.

prominent. It is possible that only one mineralized fracture is involved, but correlations between pits are uncertain. The greatest width observed was 4 feet, at 2,750 feet elevation.

An adit at 2,630 feet elevation driven 125 feet on a bearing of south 74 degrees east exposes a quartz vein striking east-west to north 80 degrees west and dipping 35 degrees north. It is sparsely mineralized with pyrrhotite and galena and has a maximum width of about 1 foot.

At about 50 feet north of the adit portal and 30 feet lower in elevation, a fracture 1 foot wide is exposed striking north 65 degrees west and dipping 40 degrees northeastward. The fracture is mineralized with quartz carrying minor pyrite, chalcopyrite, and galena. It is cut off by a fault striking north 10 degrees west and dipping 65 degrees east.

All of the mineralization is on the footwall side of a fault zone at least 50 feet wide striking north 55 degrees east and dipping 35 degrees northwestward. The fault is not mineralized.

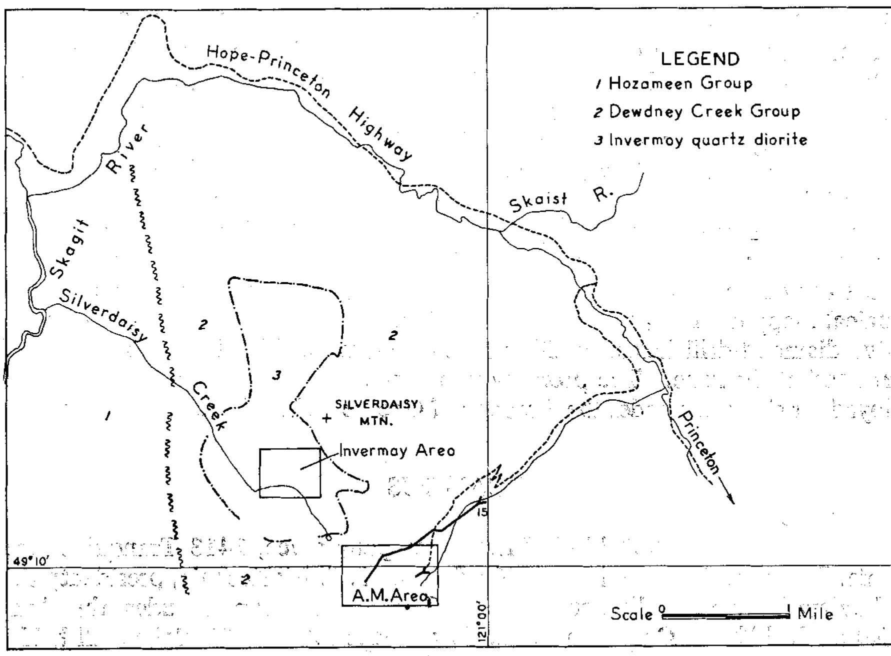


Figure 28. Index map, A.M. and Invermay mines.

SKAGIT RIVER

Copper

A.M. and Invermay (Giant Explorations Limited)*

(49° 121° S.W.) Company office, 1825, 355 Burrard Street, Vancouver 1. W. Clarke Gibson, president; L. P. Starck, general manager. This company is a subsidiary of Giant Mascot Mines Limited, which has an option agreement with Canam Copper Company, Ltd., to explore and develop Canam's property astride the west boundary of Manning Park. The property consists of the A.M. group of 8 Crown-granted claims and some 45 recorded claims. The A.M. workings are in a basin on the east slope of the mountain ridge between the upper and lower sections of the Skagit River (*see* Fig 28), and the Invermay workings are in the valley of Silverdaisy Creek on the west slope of the ridge. Access

* By G. E. P. Eastwood.

is by a good dirt road which leaves the Hope–Princeton highway about a half-mile above the mouth of the Skaist River and rises to the main camp at 4,300 feet elevation. From the main camp near No. 15 portal a jeep-road climbs to the upper A.M. workings and to a pass in the ridge at 5,900 feet elevation. A jeep-road from this pass down to the old Invermay camp was barely passable in 1965.

From 1930 to 1938 The Consolidated Mining and Smelting Company of Canada, Limited, explored the A.M. property and drove six adits aggregating nearly 2,500 feet. After 1944 the property was acquired by Canam Amalgamated Mines Limited and its successor, Canam Mining Corporation. Canam Copper Company, Ltd., was formed as a wholly owned subsidiary, and in 1951 received the property in exchange for shares. Large numbers of additional shares were sold to finance development, and Canam Mining Corporation is now a minority shareholder. No. 7 and No. 10 adits were driven in 1952–53. In 1954 the property was explored under option by American Metal Company, Limited. Management was provided by Mogul Mining Co. in 1955–57, and No. 15 adit was driven 4,400 feet. In 1958–59 the property was explored under option by The Consolidated Mining and Smelting Company of Canada, Limited. The remaining 2,300 feet of No. 15 adit was driven in 1960–61. To the end of 1963 about 18,000 feet of diamond drilling had been done on the A.M. property by or for Canam Mining Corporation, Canam Copper Company, Ltd., and the optionees.

The Invermay showings were discovered in 1933 and covered by claims of the Norwegian group. These claims adjoined the Invermay claim, and were owned by Invermay Annex Mining Company, Ltd. In time the covering claims came to be known as the Invermay group. Between 1933 and 1938 five short adits were driven, an aerial tramway was built to a point near the Skagit River north of the mouth of Silverdaisy Creek, and 21 tons of ore was shipped to the Trail smelter. From 1945 to 1947 the property was operated by the Skagit River Development Co. Ltd., and by the latter year two additional adits had been driven and nine holes diamond drilled. J. F. Bailey shipped 4 tons of ore to the Trail smelter in 1947. By 1949 the Invermay group had been acquired by Canam Mining Corporation. Canam Copper Company, Ltd., diamond drilled an additional 460 feet in 1955–56.

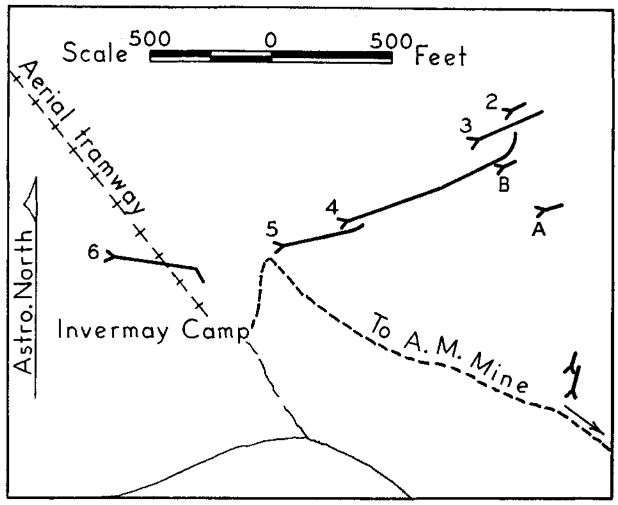
In 1964 an option agreement was concluded with Giant Mascot Mines Limited, which then proceeded to further explore the A.M. group, principally by diamond drilling.

During 1965 five holes were diamond drilled from the surface, totalling 1,249 feet, and 53 holes were diamond drilled from underground, totalling 8,724 feet. Other work included stripping, with a bulldozer, and mapping. A crew of 15 men was employed under the supervision of E. R. Gayfer. Work continued at the year-end.

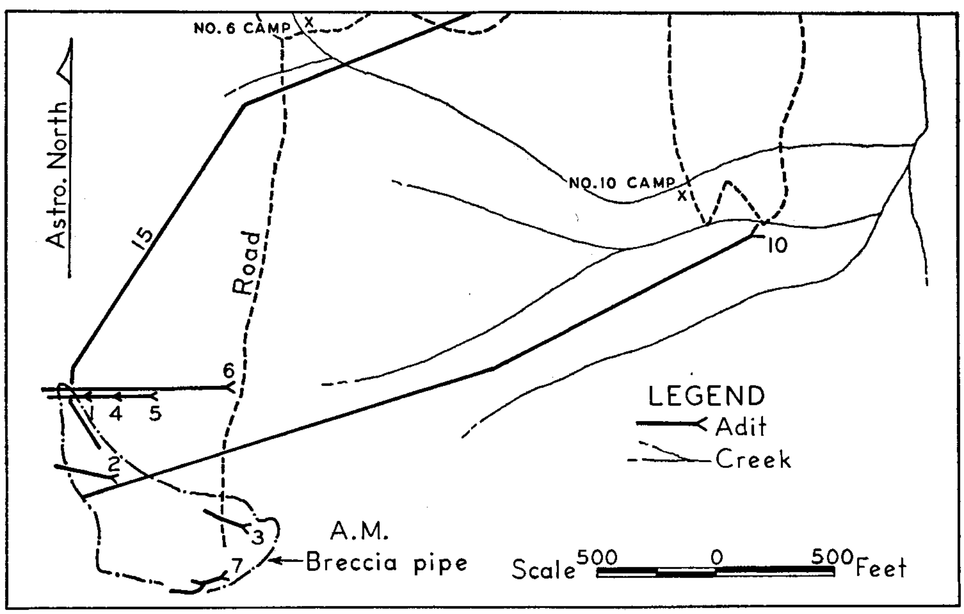
Mine Workings

The A.M. mineralization has been explored by various open cuts and by nine adits, which are designated Nos. 1 to 7, No. 10, and No. 15. The crosscut portions of the first eight are shown in Figure 29, together with a part of No. 15. The remainder of No. 15 is shown in Figure 28. In round figures, the elevation of No. 1 adit is 5,820 feet, of No. 6 is 5,470 feet, of No. 10 is 4,870 feet, and of No. 15 is 4,300 feet. The workings are unconnected.

On the Invermay group nine short adits have been driven, at elevations ranging from 5,970 to 5,080 feet (*see* Fig. 29). Five adits numbered from 2 to 6 are approximately in line down the hillside. Two others, designated A and B, lie to the south of the numbered adits, and the remaining two lie farther to the southeast, on the former July group.



Invermay Workings.



A.M. Workings.

Figure 29. A.M. and Invermay workings.

General Geology

The regional geology was mapped by Charles Camsell for the Geological Survey in 1911. The A.M. mine was studied briefly by geologists of the Department of Mines in 1938, 1949, 1954, and 1959 and the Invermay in 1938. A series of detailed geological maps of parts of the property have been made by the owners and the optionees. The most comprehensive mapping was done by A. de Voogd for The Consolidated Mining and Smelting Company of Canada, Limited, and covered a strip 2,000 feet wide and 6,500 feet long extending north from the A.M. orebody. The present report derives from a six-day reconnaissance, which included one day on the A.M. No. 15 level and five days on surface.

The three principal rock units on the property are indicated in Figure 28. The fault boundary between the Hozameen and Dewdney Creek Groups is sketched from the Hope sheet of the Geological Survey, and the outline of the Invermay stock is sketched from Canam Copper maps. The Invermay mineralization is in the stock, and the A.M. mineralization is in brecciated sediments of the Dewdney Creek Group.

As exposed on the property, the Dewdney Creek Group comprises thin-bedded sediments, which are white to light grey or rusty on the weathered surface and range from cream through buff to various shades of grey on the fresh surface. Nearly all the beds are fine grained or dense, but a few are medium grained or gritty, and some of these show graded bedding. The lighter-coloured beds are highly siliceous, and some of the dense ones resemble chert. The darker beds are more or less argillaceous. In natural exposures they are much less common than the lighter, more siliceous beds, but road cuts expose a much higher proportion of dark beds, therefore their apparent scarcity may be due in large measure to differential erosion of somewhat softer beds. Sediments of the various shades and textures are interbedded, and well-defined rock units are not apparent. However, the preliminary observations suggest that there may be some thick sections that are predominantly light coloured, some other sections of unknown thickness that are predominantly grey in colour, and some thin sections that are markedly banded, consisting of alternating beds that are distinctly light and distinctly dark. The sediments are commonly said to be tuffaceous, but this is not apparent in outcrop or hand specimen.

Bedding is demonstrated by banding, and is simulated by parallel fractures in those sediments that weather to a uniform colour. Examination of fresh surfaces indicates that for the most part these fractures follow bedding surfaces, but that they tend to cut across beds in the noses of folds. As outlined by colour differences or by bedding-surface fractures, the beds are from one-half to 1 inch thick.

The sediments have been intruded by a great many small sills and dykes of mafic and ultramafic rocks, by scattered dykes and sills of quartz diorite, and by the Invermay quartz diorite stock. Most of the mafic and ultramafic rocks are medium to dark green in colour; actinolite is conspicuous. The quartz diorite is normally coarse grained, light grey in colour, and massive. Part of the Invermay stock near the A and B adits is banded and heavily tourmalinized. Parts of two bodies of quartz diorite in the A.M. No. 15 adit contain almost no dark minerals and are white or pale green, depending on the colour of the feldspar; part of one body is strongly gneissic. Chilled contacts were not seen.

Regional metamorphism appears to have been of a low grade, but large quantities of tourmaline have been introduced into the sediments and quartz diorite over a wide area.

Structural Geology

For the most part the beds strike northward and dip steeply. Departures from this attitude appear, mainly, where the beds pass around fold noses. A number of folds are indicated on the various geoloigcal maps of the property, but the pattern of folding remains unclear. A relatively large syncline in predominantly dense, light-coloured sediments in the southeast end of Silverdaisy Mountain was found to be symmetrical and concentric in form, with an almost vertical axial plane and an axial plunge of about 35 degrees to the north. At the base of exposure the beds curve gently through the trough of the fold, but at higher elevations the curvature is increasingly tight. Near the top of good exposure the axial zone has been intruded by a mafic dyke, on both sides of which the adjacent beds are parallel.

An array of discordant strikes west and northwest of the A.M. orebody has been interpreted in the past as a multiple, vertically plunging dragfold. Time did not permit a proper study of this structure, but on the west limb of the presumed major dragfold a small dragfold was found, discordant in plunge and opposite in sense. The axes of the small dragfold are approximately parallel to the axis of the concentric syncline. On admittedly skimp evidence, it seems likely that the structure represented by the discordant strikes is not part of the general fold pattern.

Ruptures of only small size are apparent on surface on and near the A.M. group; they include the sheeting or fracture cleavage that generally follows bedding surfaces, some joints, and some fractures representing faults with displacements of a few inches. The rocks in the A.M. workings, however, are traversed by a profusion of gouge zones and soft shear zones. Some of the gouge zones on No. 15 level are 20 feet and more wide. The amount of movement on them was not determined. They traverse all rock types and the breccia. One gouge zone traversing the breccia contains lenses of massive sulphides, but generally these structures are not well mineralized in the A.M. mine. On the Invermay group, however, a considerable part of the mineralization is in shear zones which range in width from 1 or 2 inches to several feet.

The A.M. orebody is in the northwest tip of a body of brecciated sediments (*see* Fig. 29). In the southeast part of No. 15 level drift the breccia consists of oblong fragments of red-stained cherty rock in a scanty dark-grey matrix. Under the hand-lens, tourmaline, quartz, and small cherty fragments can be identified in this dark-grey matrix, and it probably consisted originally of comminuted siliceous sediments. To the northwest, over a distance of 40 feet, the matrix grades to black argillite and the light-coloured fragments thin out and disappear. Much of the argillite is apparently formless, but here and there black fragments can be identified in the black matrix. At one place in the transition zone, light-coloured fragments are closely spaced in a band in the argillite and are separated from other fragments by several feet of argillite. They clearly represent a single disrupted bed; they have been rotated in various directions, but have been translated less than an inch. It seems reasonably clear that the rock that was broken up to form the breccia body was bedded and consisted of a siliceous member and an argillite member, with interbedding at the contact between them.

This argillite member has not been found on surface near the breccia body, and apparently was not brecciated on the upper levels. Previous descriptions indicate that the breccia on the upper level is essentially the same as in the southeast part of No. 15 level.

The breccia body appears to be pipe-like in form. The walls are generally sharp, and around the northwest tip at least they are essentially vertical. Sharpness of walls has been reported from the upper levels, and is indicated on surface by proximity of outcrops of breccia and non-breccia. This relationship could not be checked on No. 15 level due to the difficulty of identifying argillite fragments in argillite matrix. The walls around the larger part of the breccia body have not been outlined at the lower levels, and their attitude is unknown. Around the northwest tip, however, the walls have been exposed over a vertical range of more than 1,500 feet. In longitudinal projection the boundary would appear strictly vertical, but in cross-section the walls dip steeply southwest from surface down to No. 6 level and steeply northeast from No. 6 down to No. 15.

Several different modes of origin have been suggested for the breccia pipe, but it is difficult to reconcile any of them with the body of facts that has now accumulated. The breccia pipe is clearly not a sharpstone conglomerate or fossil talus slide. It probably was not produced by slumping during compaction, for such a hypothesis encounters most of the objections to a fold-related origin and the sharply defined fragments would indicate that the beds were already lithified when brecciated.

It has been suggested that brecciation was related to folding, and specifically to formation of a vertically plunging, multiple dragfold that was deduced from an array of discordant strikes west and northwest of the tip of the breccia body. There are several objections to this interpretation:—

(1) As indicated above, the presumed dragfold probably is not part of the general fold pattern. Hence it is a local fold structure which itself needs explanation.

(2) The area of discordant strikes is smaller than the breccia body, and it is likely that the brecciation caused the folding, rather than the other way round.

(3) The apparent pipe-like form of the breccia is difficult to reconcile with any known type of folding.

(4) The breccia pipe apparently transgresses the contact between argillite and siliceous sediments, for argillite is apparently not brecciated on the upper levels and is not exposed near it on surface. These relationships might perhaps be the result of a prefolding fault that is now horizontal or gently dipping, but there is no positive indication that such a fault exists. Previous reports have noted conformability of the breccia walls with bedding in enclosing sediments at several places in the upper workings, but it would seem at least possible that the beds are locally twisted into conformability with the walls.

The probability of a fault-related origin cannot be properly assessed on the basis of the present information. However, the breccia pipe is of such a shape as to virtually preclude its being a breccia zone along a single fault. Brecciation caused by up-wedging or block caving, induced by movement on an array of intersecting faults, is theoretically possible, but although it is perhaps of little significance that the relevant faults have not been recognized, it does seem that such a process would have been fortuitous. The younger faults also intersect, both within and outside the breccia pipe, but they have produced breccia only in zones along the individual faults themselves.

It would appear that other possible origins of the breccia need to be considered, and evidence for them sought. An alternative theory of origin cannot be proposed on the basis of the facts now available, but diapirism and explosive evolution of gas can be mentioned as examples of other possible mechanisms.

Company maps indicate three other areas of breccia and several outcrops containing scattered fragments. Two of these areas are in sediments; they were not examined, but, as far as is known, no appreciable mineralization has been found in them. The scattered fragments were not recognized in one outcrop that was studied;

presumably they are rather subtle and can be recognized only after considerable experience with the sediments. The third additional area of breccia is indicated to lie within the Invermay stock and to be host to much of the Invermay mineralization. Several of the outcrops were examined but, except for a small area around A and B adits, no breccia could be recognized. The rock appeared to be normal massive quartz diorite. Around the A and B adits the rock is effectively banded light and dark, and some of the light bands have been separated into sections which have been rotated a few degrees. These sections may perhaps be regarded as breccia fragments, though they are hardly typical. They are more than 20 times as long as they are thick, they have been rotated only a few degrees, and they have not been individually translated.

Mineralization

The whole area appears to be sparsely mineralized. Many outcrops of the sediments are distinctly rusty, and almost every piece of sedimentary rock broken contains a speck of pyrite or arsenopyrite. Chalcopyrite is also widespread, but is identifiable in only about 20 per cent of the pieces broken. These sulphides also occur in the intrusive rocks, but less commonly. In places the sulphides are slightly concentrated along small fractures and in widely scattered quartz veinlets.

Significant concentrations of sulphides have been found in the A.M. breccia pipe and in and around the Invermay workings. Judging from the rusty outcrops, all of the breccia pipe is more mineralized than the surrounding sediments, but weakly so except near the southeast end and the northwest tip. The mineralization near the southeast end has been partly tested in two adits and by diamond drilling. An orebody does not appear to have been indicated.

The A.M. orebody is in the northwest tip of the pipe. It is crescentic in plan, approximately following the breccia wall around the tip, with both horns pinching out to the southeast. It plunges with the breccia; that is, steeply southwest down to No. 6 level then steeply northeast down to No. 15. Pyrrhotite, chalcopyrite, and less pyrite occur as pockets in the matrix adjacent to fragments, and subordinately as veinlets cutting both matrix and fragments. One gouge zone traversing the breccia contains lenses of massive arsenopyrite, pyrite, and chalcopyrite which appear to have undergone considerable movement. Molybdenite, magnetite, uraninite, scheelite, sphalerite, and galena have been reported from the mine. Two pieces of mafic dyke rock containing pockets of massive molybdenite were found on one of the dumps.

Two different types of mineralization occur on the Invermay group: lenses in shear zones, and scattered grains and pockets in dark bands of the banded rock at the A and B adits. Several shear zones are apparent in outcrop, and it has been reported that many more are exposed in adits Nos. 2 to 5. Little of the mineralization can now be seen in pits or outcrops. Underground, the mineralization has been described as consisting of lenses and bands of quartz, sphalerite, and galena and occurring mainly along the walls of the shear zones. Minor jamesonite, pyrite, arsenopyrite, and chalcopyrite were reported to occur in the banded ore. Virtually no sulphides were seen on No. 6 dump.

The mineralized banded rock is exposed in two groups of outcrops extending, respectively, north from adit A and east from adit B. It is sharply bounded on the east by a shear zone 2 to 4 feet wide, the rock east of the shear zone being massive quartz diorite. This shear zone is exposed on surface and in adit A, 25 feet from the portal, and strikes toward a subparallel shear zone in an outcrop 100 feet east of the portal of No. 2 adit. To the north, west, and south the extent of the banded rock is unknown. Its minimum surface area is about 15,000 square feet, but its actual area is probably much larger. It is possible, also, that the shear zone may represent a fault which has displaced the east part of the banded rock to the south, where it is covered.

The light bands consist of feldspar, quartz, and minor tourmaline. The dark bands consist largely of tourmaline with some quartz. Both light and dark bands are vuggy. Pyrite and less chalcopyrite occur as scattered grains and as pockets in some of the dark bands. A sample taken in 1938 across 18 inches normal to the banding assayed: Gold, 0.02 ounce per ton; silver, 1 ounce per ton; copper, 0.25 per cent.

The two adits shown on Figure 29 to the southeast of the Invermay workings, as reproduced from company maps, are presumably the July workings described in the 1938 Annual Report. They were not visited in 1965. In the 1938 report they are described as following an irregular shear zone, along the walls of which there are lenses of quartz, sphalerite, arsenopyrite, and chalcopyrite.

[References: *Geol. Surv., Canada,* Sum. Rept. 1911, pp. 115–120; Map 737A, Hope, 1944; *Minister of Mines, B.C.,* Ann. Repts., 1938, Pt. F, pp. 10–13 and 23–27; 1949, pp. 210–213; 1954, pp. 152–159; 1959, pp. 122–124; 1964, p. 136.]

HOPE

Nickel

Mammoth (Foundation Mines Limited)*

(49° 121° S.E.) Company office, 202, 736 Granville Street, Vancouver 2. N. Mussallem, president; R. J. MacKinnon, general manager; Joseph T. Mandy, consulting engineer. The company holds by record 32 claims astride the Hope–Princeton highway 20 miles east of Hope. A steep pack-trail leads northward about one-quarter of a mile from and 700 feet above the highway to the working area on the Mammoth No. 2 mineral claim. (*See* Annual Report, 1964, p. 137.)

The general geology is shown on Geological Survey of Canada Map 737A, Hope. The claims are underlain by cherty sediments of the Pennsylvanian(?) Hozameen Group.

On the Mammoth No. 2 claim the cherty sediments are intruded by green pyroxenite dykes. At the working area three dykes are exposed: striking north 25 degrees east and dipping 35 degrees southeast; striking north 30 degrees east and dipping 75 degrees northwestward; striking north-south and dipping 60 degrees west. The third dyke connects the other two. The dykes are up to 10 feet wide.

The pyroxenite is mineralized with disseminated pyrrhotite, black sphalerite which in places can be seen to enclose the pyrrhotite, and chalcopyrite. Pyrrhotite is predominant. The cherty sediments contain sparsely disseminated pyrite with rare grains of chalcopyrite.

One diamond drill in operation at the time of the writer's visit had not reached the pyroxenite section and no other core was available at the property.

Nickel-Copper

Pride of Emory (Giant Mascot Mines Limited)†

(49° 121° S.W.) Company office, 1825, 355 Burrard Street, Vancouver 1; mine office, P.O. Box 820, Hope. W. Clarke Gibson, president; L. P. Starck, vice-president and general manager; F. Holland, resident manager; K. Dahlke, mine superintendent; G. D. Bosnich, mill superintendent; O. C.

* By N. D. McKechnie.
† By G. E. P. Eastwood and W. C. Robinson.

Gilroy, plant superintendent. The property is at the head of Stulkawhits (Texas) Creek, which flows eastward into the Fraser River about 6 miles north of Hope. From a point on the Trans-Canada Highway 8 miles north of Hope, a good gravel road 5.1 miles long leads up Stulkawhits Creek valley to the mill and surface buildings at the 2600 adit portal. The ore occurs in a number of separate orebodies, the principal ones being the Pride of Emory, the Brunswick Nos. 1, 2, and 10, the 1900, 1600, 1500, 1400, 600, and 512. The mine is developed from two adit levels—the 3550 level, with portals on both the west and east side of the mine, and the 2600 level, which is the main haulage level. Levels are designated by nominal elevation above sea-level. An ore-pass and an internal inclined shaft join the two adit levels. Three other levels at 3,400, 3,250, and 2,950 feet elevation respectively have been developed from the inclined shaft. Workings above the 3550 level are reached by various raises. The ore is mined by horizontal and vertical long-hole blasting. The long blast-holes are usually loaded with a commercial form of AN/FO. The bulk of the ore from the stopes is loaded into cars at mucking-machine draw points. At the 2600 level the ore is loaded from the ore-pass into 6-ton Granby cars and hauled to the mill by trolley locomotive.

The following is a summary of mining and development in 1965:—

	Ft.
Drifting and crosscutting	2,738
Raising	4,912
Diamond drilling	45,365
Blast-hole drilling	200,605

Principal development work done in 1965 was as follows:—

(1) A raise was driven through to surface at 4,040 feet elevation. Exploratory diamond drilling from this raise is planned.

(2) Further development was done on the 1400 orebody above the 3550 level. A drill raise to 3,840 feet elevation and an access raise to 3,775 feet elevation were completed.

(3) The 1500 orebody above the 3550 level was fully developed to 3,740 feet elevation and brought into production.

(4) Further development was done on the 512 orebody above the 3550 level and approximately 800 feet of raising was completed.

(5) Mining of the Pride of Emory " B " zone was continued above 3,750 feet elevation and the pillar under 3840 No. 2 scraper drift was removed.

(6) A raise, following a high-grade shoot, was continued up from the top of the Pride of Emory " D " zone at 3,550 feet elevation. This raise is planned to connect with the service manway at 3,760 feet elevation.

(7) On the 3250 level the 1900, 1500, and 600 orebodies were fully developed and brought into production.

(8) The Brunswick No. 10 orebody was developed to 3,450 feet elevation. Development was done on the Brunswick No. 1 orebody between 3250 and 3400 levels.

(9) Diamond drilling below the 3250 level has indicated the downward continuation of the 1500 orebody to 2,900 feet elevation. A crosscut was driven 175 feet on the 2600 level toward the orebody and a raise from it was driven 302 feet.

(10) Another crosscut on the 2600 level was driven 331 feet, past the 2000 orebody and toward the 2200 orebody. A raise was started in the 2000 orebody.

The mill continued to produce a bulk nickel-copper concentrate, which is supplied to the Sumitomo Metal Mining Company Ltd. The concentrates are trucked from the property to Vancouver Wharves Ltd. bulk-loading plant in North Vancouver by truck-trailer units. In 1965 a total of 330,954 dry tons of ore was milled. A total of 18,800 tons of bulk concentrate was shipped, containing 3,775,000 pounds of nickel and 2,000,000 pounds of copper. The crew in December comprised 153 men (including staff), of whom 90 were employed underground.

Geology

The geology of the mine is outlined in the Annual Report for 1964. Geological studies were continued for 2½ months in 1965, in the hope of learning more about the controls of the orebodies and establishing additional guides to ore. The useful results have been disappointingly meagre. A considerable mass of data was collected, yielding a more detailed picture of the rocks and their structures but, even though thin-section studies have not been completed, it is clearly of limited value to the exploration for new orebodies. It is hoped that the detailed results, together with the more theoretical considerations and some comparative information on other ultramafic stocks in the Hope area, can subsequently be published. Meanwhile those features that appear to bear on the localization of ore are described below.

The mine exposes a complex array of rocks which may be grouped under three headings: relict metasedimentary and metavolcanic rocks, ultramafic intrusive rocks, and norite and diorite. The fine-grained diorite and hornblendite referred to in the 1964 report are now believed to be remnants of metavolcanic rocks. Metasedimentary rocks appear to be more widespread in the mine than was formerly thought. Locally they are recognizable as fine-grained hornfels, but generally they are so recrystallized that their original nature is revealed only by the presence of pink garnets. Both the metasedimentary and metavolcanic rocks grade to diorite, with which they have previously been included.

The ultramafic rocks are of two kinds: a complex ranging from peridotite to pyroxenic hornblendite, and successive younger intrusions of fine-grained and coarse-grained to pegmatitic hornblendite. These younger hornblendites have no demonstrable relation to ore, and are not considered further. The complex consists mainly of three intergrading rock types: fine-grained peridotite, poikilitic rock, and coarse-grained hornblende-pyroxene rock. The poikilitic rock consists of large host crystals of hornblende containing few to many inclusions of pyroxene and olivine. In places the inclusions are so crowded together that the host crystal is merely a ragged skeleton or shell. Most of the poikilitic rock appears to contain olivine, although some apparently does not. The hornblende-pyroxene rock varies considerably in the proportions of the two minerals, even over short distances, and includes some considerable blocks of hornblende-free pyroxenite, but pyroxene-free hornblendite has not been found within the complex. Here and there the hornblende-pyroxene rock contains a few blebs or small lenses of white feldspar.

The coarser feldspathic rocks are conveniently called norite if they contain appreciable pyroxene, and diorite if they do not. The norite typically consists of medium-sized grains of brown pyroxene and aggregates of fine-grained feldspar; some of it also contains hornblende. It commonly has a somewhat gneissic appearance, due to the feldspar tending to form lenses and ragged bands aligned in parallel. The diorite consists mainly of hornblende and feldspar, and shows a broad range of textures. At one extreme it resembles the norite in containing aggregates of fine-grained feldspar and tending to show a gneissic structure. At the other extreme it is massive and granitoid, the feldspar crystals being as large or larger than the hornblende crystals and isolated from each other by the hornblende. Most of the diorite can be designated as either foliated or massive according as it tends toward one extreme or the other. A few small bodies of massive fine-grained brown rock occur here and there in the foliated norite, and are probably massive norite.

The norite and diorite form relatively small stock-like bodies within the ultramafic complex and a much larger mass enclosing it. The over-all pattern suggests that they intrude the complex. In detail, clear-cut intrusive relationships are lacking, but some minor features and some indirect evidence tend to indicate that the norite and diorite formed after the complex was emplaced. Two of the stock-like bodies are included within the area studied. The northwest body has a core of massive diorite which grades north and east to foliated norite, and south to foliated diorite. The foliated norite is in contact with the ultramafic complex, and the foliated diorite is in contact with relict metavolcanic rock. The southeast body consists of fairly uniform foliated norite where intersected by the 3550 level adit-crosscut, but is highly variable in character and irregular in shape on the 3250 level. On this level an appreciable fraction of the body is metasedimentary rock, which in places can be seen to be intruded by the ultramafic complex. Another considerable part of the body on this level is low feldspar norite. The contacts between this low feldspar norite and the complex are arbitrary and highly irregular; in the mapping they were placed where feldspar was no longer visible. The rest of the rock in the southeast body exposed on the 3250 level consists of more typical foliated norite and some foliated diorite.

It seems probable that the foliated norite and diorite in the northwest body represent broad contact zones, produced both by assimilation of wallrock by intrusive diorite and by introduction of feldspar into the wallrock. In the southeast body almost no massive diorite is exposed, and the rock that is not simply recrystallized sediment was probably formed through introduction of feldspar into metasediments and ultramafic rocks.

The rocks are broken by many fractures, slips, shear zones, and gouge and breccia zones. The shear zones are of two types. One type comprises sharply defined narrow zones 1 to 6 inches thick developed in all rock types. The other type consists of broad zones of pervasive shearing several tens of feet across, with gradational margins, developed principally if not entirely in the poikilitic rock. Along strike these zones pass into zones of parallel fractures or slips. The sheared rock spalls readily, and has been called " crumbly alteration."

The orebodies are pipe-like sections of the ultramafic complex containing lenses, blebs, and intergranular laceworks of pyrrhotite and chalcopyrite. A few are more or less cylindrical, but most are elliptical or irregular in section, and one is crescentic. They are from 30 to 100 feet across, and the longest extends 1,100 feet down from surface. They plunge steeply in various directions.

Most of the orebodies lie close to contacts with feldspathic rocks, but some of these contacts have more associated orebodies than others. The 1900 orebody is adjacent to a broad zone of foliated norite. The 1600 orebody is adjacent to a zone of foliated norite which is narrow on the 3550 level but fairly broad on the 3250 level. The 1400 orebody is adjacent to a broad area of foliated norite on the 3550 level, but only feldspathized metasediments have been found near it on the 3250 level. The feldspathic rock near the 600 orebody is poorly known. No feldspathic rock has been found near the 1500 orebody on the 3550 level, although a tongue of low feldspar norite occurs within 60 feet on the 3250 level.

Clearly, some other factor or factors must have operated to localize the sulphide concentrations in pipe-like sections of the ultramafic complex. It seemed likely that these factors might be ruptures, and a large number were mapped in the section of the workings that was studied. E. R. Gayfer, chief mining engineer of the company, made a geometrical analysis of the shapes of horizontal sections of most of the orebodies and concluded that the shape of each orebody could be related to three, or in some cases four, intersecting planes. Some of the deduced planes of several orebodies were approximately parallel.

In only three places, however, were orebodies found to be related to ruptures. On the 3550 level, at least part of the 1600 orebody is in sheared poikilitic rock, and most of the sheared rock apart from the ore is more mineralized than the average ultramafic rock in the mine. Although this sheared poikilitic rock was not identified on the 3250 level, where much of the rock adjacent to the orebody has been altered to talc, core from a vertical diamond-drill hole indicated that the poikilitic rock extends most of the way down to the lower level beside the orebody, and that much of it is probably sheared. The 600 orebody on the 3250 level lies partly in sheared poikilitic rock and partly along the steep fractures into which the shearing passes to the north. The highest concentrations of sulphides in the orebody occur along these steep fractures.

Elsewhere in the part of the mine that was studied, sheared poikilitic rock appears to be neither a necessary nor a sufficient condition for the formation of an orebody. A considerable mass of poikilitic rock is included in the 1900 orebody, but only a small part, on the 3550 level, is pervasively sheared. The 1500 and 1400 orebodies have no sheared poikilitic rock associated with them. On the other hand, a crosscut north from the 1900 orebody on the 3550 level passed through a long section of strongly sheared poikilitic rock without encountering appreciable sulphides.

The 1900 orebody particularly was scrutinized for structures corresponding to the planes deduced by Gayfer. On the 3550 level the search was fruitless, but on the 3250 level a set of parallel narrow shear zones passes through the orebody, striking north 60 degrees west and dipping 23 degrees northeastward. Diamond-drill holes nearby intersected many slips and narrow shear zones, and the most probable correlation of many of the intersections indicated strikes parallel to that of the set. This set of shear zones thus appears to persist for an appreciable distance on this level, and it might have helped to localize the mineralization. The north 60 degree west strike is the same as that of Gayfer's dominant plane for this orebody. Possibly Gayfer's other planes, for this and other orebodies, represent structures which have been obliterated during the formation of the orebody.

Apart from these two instances of association with broad shear zones in poikilitic rock and one instance of association with a set of narrow shear zones, the orebodies show no apparent relation to any of the numerous ruptures of various kinds that can be seen in the mine. (*See* Annual Report, 1964, pp. 137–142.)

Copper

Bea (Impad Holdings Ltd.)*

(49° 121° S.E.) This group of 70 claims, held by record, is controlled by Impad Holdings Ltd., 3004 West 13th Avenue, Vancouver 8. The claims lie north and south of American Creek, which nearly bisects the group. The working area is on the north side of Schkam Lake, which lies on the west side of the Trans-Canada Highway 3 miles north of Hope. Access is by road through the Cariboo Road Auto Court, which is on the highway about one-half mile north of Schkam Lake.

The geology of the region is shown on Geological Survey of Canada Map 737A, Hope. The rocks in the vicinity of Schkam Lake are Chilliwack sediments of Late

* By N. D. McKechnie.

Palæozoic age, save for a north-striking band, about one-quarter mile wide, of Lower Cretaceous sediments of the Jackass Mountain Group, which underlies the west end of the lake. West of the Jackass Mountain band the rocks are granitic intrusions mapped as Jurassic(?) and later.

Limited surface work, including one diamond-drill hole, has been done on the Bea No. 3 mineral claim about 200 feet north of the lake-shore. The rock has been exposed in a number of cuts made, apparently, in the course of constructing the road. The road is blocked to automobiles at the drill-site, but continues for about another half-mile westward and northward where it is succeeded by a poor foot-trail which soon disappears in the brush. No other workings were found. The drill-hole, on a bearing of north 30 degrees west and inclined at 54 degrees, is about 500 feet west of the east boundary of the Bea Group.

The rocks exposed at intervals along the road are little-disturbed Jackass Mountain shale and siltstones to the west of the drill-hole. Some conglomerate is found in detritus on the road, but none was seen in place. Eastward from the drill-hole are argillaceous rocks, with some greenstone, of the Chilliwack Group. All of the rocks are fractured and disturbed in what appears to be a wide zone of faulting. At the drill-hole two principal fault planes strike north 35 degrees east and dip 80 degrees northwestward, and strike north 25 degrees east and dip 50 degrees southeastward. Near the east claim boundary a serpentinized amygdaloidal rock in contorted sediments is exposed for a width of about 30 feet. The rock is medium grained and appears to be composed chiefly of greenish feldspar and serpentinized pyroxene. Its contacts with the sediments are much disturbed, so that its attitude was not determined.

Disseminated pyrite and chalcopyrite occur sparingly in the serpentinized rock. No sulphides were seen in the fault planes at the drill-hole, or elsewhere in the disturbed zone.

Silver-Copper

Murphy (Union Bar Mines Ltd.)*

(49° 121° S.E.) Head office, 209, 615 West Pender Street, Vancouver 2. P. J. McDonald, manager. The property comprises 26 mineral claims held by record in the names of P. J. McDonald, Miller W. Graham, and Frank W. Johnson, all of Vancouver. Management control is exercised by Union Bar Mines Ltd. The claims lie west of the Fraser River at the old placer-mining site of Union Bar, about 2 miles north of Hope. The property is nearly bisected by the Trans-Canada Highway; the workings are reached by a dirt road which leads one-half mile southeast of the highway from a point just north of Schkam Lake.

The Murphy mine is the oldest lode prospect on the mainland and was the site of the first discovery of a silver-bearing lode in British Columbia. The Annual Report for 1874, recounting silver discoveries in the Province up to that year, refers to what undoubtedly was the Murphy mine. " Silver ore was first discovered on the banks of the Fraser, near Hope, and a lead was opened, by a tunnel, at a considerable outlay, but nothing of any importance resulted." The lode was discovered by the Murphy Bros., who had placer workings on Union Bar, and in 1858 they sank the " Greenwood Shaft " to a reported depth of 24 feet. The " tunnel " of the 1874 Report, an adit collared just below the level of the Canadian Pacific Railway tracks, was driven to a stated length of 850 feet by 1901.

References to the deposit under Murphy Bros. and McKay-Murphy are in Annual Reports from 1878 to 1901 and under Murphy mine to 1924. The principal references are 1902, page 196, and 1915, page 259.

* By N. D. McKechnie.

The area of the claim group is shown by Geological Survey of Canada Map 737A, Hope, to be underlain by Chilliwack Group sediments.

The principal surface showing is a quartz vein exposed in a trench northeast of the site of the Greenwood shaft. The vein here is about 25 feet wide; it strikes north 30 degrees east, dips 65 degrees northwest, and is enclosed between a light-grey fine-grained granite hangingwall and a serpentine footwall. A few feet to the southwest the vein is displaced about 20 feet to the northeast by a fault striking north 65 degrees east and dipping 65 degrees southeastward. The quartz is well fractured, and the fractures are mineralized with pyrite, chalcopyrite, pyrrhotite, and very sparse galena. Though the line of the old trench can be seen to extend over 200 feet to the site of the shaft, the mineralization is well exposed only for some 30 to 40 feet on strike at this one place.

The adit, driven to crosscut the vein structure at a depth of about 300 feet below the outcrop, passes under the Canadian Pacific Railway tracks between Mile 37 and Mile 38. The length was not measured by the writer, but it is at least 800 feet. The last 100 to 150 feet is blocked by caved ground and water. The rocks are quartzose Chilliwack sediments cut by narrow dykes of grey granite. For the whole length of the adit the rocks are much disturbed by faulting; the faults are not mineralized. At about 600 feet from the portal a 2- to 3-foot quartz vein is exposed striking north 5 degrees east and having a near vertical rolling dip. It is sparsely mineralized with sulphides and scheelite. At this point the western contact of the quartz is with a narrow granite dyke. The relationship of this quartz vein to that exposed at surface is not known.

In view of the abundant unmineralized faults there is reason to question the possibility of adequate continuity of the mineralization. More extensive surface exposures are needed to resolve this question.

Copper

Lucky Four (Rico Copper Mines Limited)*

(49° 121° S.W.) Company office, 2, 851 West Pender Street, Vancouver 1. The company holds a total of 44 claims, including the Lucky Four group situated on the summit of the Cheam Range at the head of Wahleach Creek, about 15 miles from Laidlaw. The showings, which occur at elevations of 5,450 to 6,250 feet, include chalcopyrite mineralization in a zone of altered sediments adjacent to an intrusive contact between the sediments and a large body of granodiorite. Intermittent work has been done on the property since it was discovered in 1915 although the work has probably been limited by the exceptionally rugged terrain.

In 1965 it is reported that work was done on the Lucky Four Nos. 5 and 6 claims. This included one trench 30 feet long, two 4-foot test pits, and an adit which was driven 40 feet. Two men were employed for two months under the direction of H. D. Forman. (*See* Annual Report, 1949, pp. 214–216.)

HARRISON LAKE

Molybdenum

Meg (Gem Explorations Limited)†

(49° 121° N.W.) Company office, 1272 West Pender Street, Vancouver 1. R. W. Caskey, president; J. A. McAskill, managing director. The property consists of 80 mineral claims, the Meg and Baily groups, held by record

* By A. R. C. James.
† By N. D. McKechnie.

near the crest of the Lillooet Range at the head of Clear Creek, a tributary of Big Silver Creek. A series of logging-roads along the east side of Harrison Lake give access to the property for four-wheel-drive vehicles. The camp on Clear Creek is at about 2,500 feet elevation. Exploration is in the charge of Utah Construction & Mining Co. by agreement. Utah Construction owns the adjoining Sash group of 18 mineral claims. (*See* Annual Report, 1963, p. 91 (Gem).)

Recent work, including 4,300 feet of diamond drilling in six holes, has been done mostly between Canyon Creek and Ore Creek, southeastward-flowing tributaries of Clear Creek which enter it about one-half mile west of the height of land. Mapping by the company in this area has shown the presence of a quartz monzonite breccia pipe surrounded by a granite-aplite-pegmatite complex which in turn is surrounded by granodiorite. At the granite-granodiorite contact there are local occurrences of granite breccia. The granodiorite is more or less gneissic and in the 1963 report was termed " gneissic biotite granite." The quartz monzonite breccia has a dark-grey fine-grained porphyritic matrix, in which the feldspars are rounded and embayed. Fragments are up to several inches across and include those of gneissic granodiorite as well as those of the contiguous granite complex.

Molybdenite occurs with quartz threads and stringers in the rocks peripheral to the monzonite pipe and in the metamorphic rocks, chiefly gneisses, which these rocks intrude. Commonly the molybdenite is found in small vugs in the granitic rocks, and some good crystals have been seen. Very small amounts of chalcopyrite, pyrite, scheelite, powellite, sphalerite, and, doubtfully, galena have been recognized with the molybdenite. Magnetite also occurs in minor amounts but appears to bear no relationship to the molybdenite.

Copper-Molybdenum

Empress (Noranda Exploration Company, Limited)*

(49° 121° S.W.) Company office, 1050 Davie Street, Vancouver 5. B. O. Brynelsen, manager. The Empress group comprises three claims situated at an elevation of 600 feet on the south slope of Bear Mountain approximately 3½ miles north of Agassiz. It is reported that chalcopyrite and molybdenite mineralization occurs in altered limestone adjacent to a contact with granitic rocks. Some mapping and soil-testing was done, and 10 holes were diamond drilled, totalling 643 feet. A crew of four men was employed for a month under the supervision of W. Botel. It was reported that the mineralization did not prove to be of very large extent.

HOWE SOUND

Copper-Zinc

Britannia (The Anaconda Company (Canada) Ltd.)*

(49° 123° N.E.) Registered office, 1600, 409 Granville Street, Vancouver 2; mine office, Britannia Beach. J. Van Der Ploeg, president; J. D. Knaebel, general manager; B. B. Greenlee, manager, Britannia operations; L. Pollish, general superintendent; J. C. S. Moore, mine superintendent; W. Stern, mill superintendent. The property is on the east side of Howe Sound, 40 miles by road from Vancouver.

The mine was reopened in March about five months after closure of the property by The Anaconda Company (Canada) Ltd. following failure to reach agreement in wage negotiations with the International Union of Mine, Mill, and Smelter Workers. Production of ore and concentrates began again in May.

* By A. R. C. James.

The main haulage tunnel of the mine is on the 4100 level, with the main portal at Britannia Beach. This now extends for approximately 4 miles along the Britannia shear structure. Orebodies are at present being mined in the Victoria, Bluff, and No. 8 sections of the mine. The Victoria section is serviced by the Victoria shaft, which extends from the surface above the 1800 level down to the main haulage at the 4100 level, 3.8 miles from the portal. The Victoria workings at present extend from 3100 to 4100 levels and are mainly in the West Victoria or 188 orebody. The Bluff section is serviced from the No. 7 shaft, which extends from the 2200 level to the 4100 level, and is 2.25 miles from the 4100 portal. Production in the Bluff section has come mainly from an orebody above 2700 level and one above 4000 level. The No. 8 section is mined from the No. 8 shaft, 1.8 miles from the 4100 portal, which extends from the 4100 level to the 5700 level. The present No. 8 workings extend from 4400 to 5100 levels, with development going on at 5250, 5400, and 5700 levels. Methods of mining at Britannia include cut and fill, square-set, and long-hole blasting methods.

The following is a summary of development work done in 1965:—

	Ft.
Drifting	5,110
Raising	2,629
Crosscutting	1,297
Diamond drilling	20,331

On the surface a new copper water precipitation plant was installed on the surface at 2200 level. A road was constructed to the Jane basin and Fairview gloryholes to aid in evaluating the remaining mineral reserves in the Bluff and Fairview mines. Some of these reserves may be recovered by leaching in place and possibly by a limited amount of open-pit work.

The concentrator milled 226,005 tons of ore, from which 8,774 tons of copper concentrate and 664 tons of zinc concentrate were produced.

A total crew of 389 men was employed in December, of whom 233 were employed underground.

Copper

Bank of Vancouver (Anaconda American Brass Limited)*

(49° 123° N.E.) Western Exploration Division office, Britannia Beach. Glenn C. Waterman, chief geologist. This property, owned by The Anaconda Company (Canada) Ltd., is in the upper Seymour River area about 22 miles by road from Vancouver. Copper mineralization, mainly chalcopyrite, occurs in a brecciated zone in granitic rocks. In 1965 one hole was diamond drilled 700 feet. A crew of four men was employed on the property for one month under the supervision of W. M. Reed.

Copper-Molybdenum

Bell, London, Roy, Myrtle, Etc. (Anaconda American Brass Limited)*

(49° 122° N.W.) Western Exploration Division office, Britannia Beach. Glenn C. Waterman, chief geologist. This company continued to prospect around the headwaters of Indian River on claims held by The Anaconda Company (Canada) Ltd. and on other groups held by option agreements. The showings include irregular sulphide veins, containing chalcopyrite and pyrite, in tuffaceous rocks. On the Roy No. 1 claim two holes were diamond drilled, totalling 1,034 feet. A crew of four men was employed for 1½ months under the supervision of W. M. Reed.

* By A. R. C. James.

Zel (Bralorne Pioneer Mines Limited)*

(49° 123° N.E.) Company office, 320, 355 Burrard Street, Vancouver 1. J. P. Weeks, chief geologist. This property comprises eight claims, ranging in elevation from 4,100 to 5,500 feet, on Mount Donaldson, east of the head of Salmon Inlet. Early shipments were made from the property prior to 1890.

The showings are reported to consist of quartz veins within a granitic host rock, containing bornite, chalcopyrite, cuprite, and molybdenite mineralization with some values in silver.

Geological mapping was carried out, and 14 trenches totalling 420 feet long were excavated by hand methods. Four men were employed for one month under the supervision of W. Leszczyszyn.

Copper-Zinc-Lead

McVicar (Anaconda American Brass Limited)†

(49° 123° N.E.) Western Exploration Division office, Britannia Beach. The McVicar group consists of 9 Crown-granted mineral claims, 3 Crown-granted fractions, and 32 claims held by record. It is situated on the north slope of Mount Baldwin on the watersheds of Raffuse Creek and its tributary, McVicar Creek. It is 10 miles from Squamish by logging-road and trail up the Mamquam River, and 8 air-miles northeast of Britannia Beach. The logging-road leaves the highway just south of Squamish. Access from the base camp at Britannia Beach is by helicopter.

The original staking was done in 1924 and 1925 as the Goat Creek group, which is briefly described in the 1925 Annual Report. Brief notes are contained in the Annual Reports for 1928, 1929, and 1930; showings are described in detail in the 1937 and 1953 reports.

Early work, including diamond drilling and a Radiore electrical survey, was by Britannia Mining and Smelting Co., Limited, to 1930. In 1946 the property was obtained by Surf Inlet Consolidated Mines Limited, later Western Surf Inlet Mines Limited, which did further drilling, and in 1962 Western Surf Inlet made a horizontal-loop electromagnetic survey. Diamond drilling by these companies amounted to 21,194 feet in 72 holes. In 1964 the ground was optioned by Anaconda American Brass from Western Surf Inlet. The present work has consisted of geochemical and induced polarization surveys across and beyond the old working areas.

Because of adverse weather conditions, the writer was not able to visit the working area. The following notes are from information supplied by W. M. Reed, geologist-in-charge.

The claims are underlain by tuffaceous rocks of andesitic composition cut by felsitic dykes, which in part resemble the Britannia dacite, and by dykes of lamprophyre.

The volcanic rocks are weakly to moderately schistose; locally, within, and adjacent to shear zones, there are well-developed sericitic schists. In general and with local variations the schistosity strikes northwest and dips steeply southwestward.

In the main the beds strike northwestward and dip 55 degrees to 75 degrees southwestward. Folding apparently antedates the schistosity and, generally, bedding and schistosity are parallel.

* By A. R. C. James.
† By N. D. McKechnie.

Mineralization, comprising quartz, pyrite, chalcopyrite, and sparse sphalerite and galena, occurs over an area of about 2,800 by 1,200 feet. Typically it is in shear or fracture zones. In continuity the showings vary from very short mineralized fractures to irregularly mineralized shear zones traceable for several hundred feet. Such shear zones may parallel the schistosity or may cut it at low angles. The better mineralizations appear to be associated with flexures in shear zones which cut the schistosity.

ALTA LAKE

Copper

London (New Jersey Zinc Exploration Company (Canada) Ltd.)* (50° 122° S.W.) Company office, 905, 525 Seymour Street, Vancouver 2. R. C. Macdonald, assistant to the president. The London group comprises Mineral Lease M9, which includes six formerly Crown-granted mineral claims. The company holds a total of 20 claims including Mineral Lease M9. The property is on the southwest side of Fitzsimmons Creek about 5 miles from Alta Lake. A jeep-road connects the property with the Squamish–Pemberton road.

The property was described in some detail in the 1963 Annual Report. Copper mineralization, including chalcopyrite and malachite, occurs near the westerly dipping contact of green schistose tuffs and underlying granodiorite. The present company has been active on the property since 1963. In 1965 six 4½-inch holes totalling ~~348~~ feet were drilled with a rotary drill by Pacific Water Wells Ltd. Half 3,480 a mile of access road was constructed. A crew totalling six men was employed for 4½ months. The work was supervised by M. R. Swanson and J. B. Seaton. (*See* Annual Reports, 1910, pp. 147–149; 1930, p. 312; 1963, p. 94.)

Azure (The Mining Corporation of Canada, Limited)* (50° 122° S.W.) Company office, 44 King Street West, Toronto, Ont.; consulting geologist, J. S. Scott, 402 West Pender Street, Vancouver 1. The property, comprising 98 located claims, covers the valley of Fitzsimmons Creek for a distance of about 4 miles southeasterly from Green Lake. The showings were described in the 1963 Annual Report and consist of disseminated chalcopyrite and pyrite in a schistose host rock.

In 1965 four holes were diamond drilled, totalling 3,600 feet. A crew of 11 men was employed for about four months under the supervision of W. Rainboth.

PEMBERTON

Molybdenum

Sal, R, EE, Etc. (Amax Exploration, Inc.)* (50° 123° N.E.) Company office, 535 Thurlow Street, Vancouver 5. R. A. Barker, manager. The property comprises 179 recorded claims at the headwaters of Salal Creek, a tributary of the Lillooet River, about 40 miles northwest of Pemberton. The property is at an elevation of from 5,000 to 7,500 feet, and servicing and access have been by helicopter.

The showings are reported to consist of molybdenite mineralization with minor amounts of lead, zinc, and copper occurring as disseminations, veins, and stockworks within a quartz monzonite stock intruding the Coast Range complex.

Exploration work was started in 1964 by Norpax Nickel Mines Limited and Purdex Minerals Limited, who hold major interests in the property. In 1965 the property was taken under option by the present company. A geological survey was

*By A. R. C. James.

made of the Salal stock, and six trenches totalling 337 feet were cut on the R and Sal groups of claims. A crew of 13 men was employed for three months under the supervision of D. K. Mustard.

JERVIS INLET

Gold-Silver-Copper-Lead-Zinc

Linda* (50° 124° S.E.) Vanco Explorations Limited, 935, 470 Granville Street, Vancouver 2, optioned 17 mineral claims at the headwaters of Lois Creek approximately 5 miles northwest of Hotham Sound, Jervis Inlet. It was reported that a crew of two men was employed for one month prospecting the claims and surface stripping sulphide lenses in a shear zone in an argillite roof-pendant within Coast granite and diorite. The lenses exhibit minor silicification and have the following minerals present: pyrrhotite, chalcopyrite, galena, sphalerite, silver, and gold.

TEXADA ISLAND

Copper-Molybdenum

Little Billie (Bethex Explorations Ltd.)* (49° 124° N.W.) Company office, 1821, 355 Burrard Street, Vancouver 1. This company optioned the Little Billie property at Vananda from the Ideal Cement Company. Four men were employed for a period of two weeks reopening the 100 (40)-foot adit preparatory to a re-examination of the mine.

Iron-Copper

Texada Mines Ltd.* (49° 124° N.W.) Registered office, 626 West Pender Street, Vancouver 2; mine office, Box 10, Gillies Bay. A. D. Christensen, San Francisco, Calif., president; A. M. Walker, general manager. The mine and plant are at Welcome Bay on the southwest coast of Texada Island, 8 miles by road south of Vananda. The major portion of the ore mined came from underground where long-hole stoping was used to produce 1,148,000 tons, on and above the 2055 or adit level. Open-pit mining in the two Paxton and the Lake pits produced 112,818 tons of ore and 6,587 cubic yards of waste. The combined tonnage of open-pit and underground ore milled was 1,310,064 tons. This produced 595,273 tons of iron concentrate and 9,318 tons of copper concentrate.

Stope preparation was concentrated on the 1855 level, where three new stopes were readied for slusher operation and one new transloader stope was commenced. A model TL-55 Joy transloader was purchased and has been used for development work since June, 1965.

The exploration drive on the 2055 level to the "Lake Extension" orebody was stopped early in the year to permit detail diamond drilling of a new orebody that was intersected by the drive late in 1964. Drilling has now established the presence of a major orebody, the "Le Roi," in excess of 1,000,000 tons. It is located on the favourable limestone-volcanics contact, about 1,000 feet west of the North Paxton open pit and 500 feet northeast of the main Yellow Kid pit, and it extends over a vertical range of more than 400 feet.

Diamond drilling also located a new copper-magnetite orebody to the northeast of the present workings on the 1855 level. This is a flat-lying zone 10 to 20 feet thick with present indications of a tonnage in excess of 500,000 tons.

* By J. E. Merrett.

Development work completed underground comprised 9,535 feet of drifting, 5,637 feet of raising, and 384,023 feet of 2-inch-diameter long-hole drilling. More than half of the drifting completed was for scram development, while the remainder was for haulageways, of which 1,482 feet of 10- by 12-feet drift was driven for transloader haulage.

A total of 31,227 feet of diamond drilling was completed in 186 holes. Two of these holes, totalling 227 feet, were drilled from surface and the remainder were drilled underground.

The crushing-plant circuit was modified by the installation of a screen to remove minus 1-inch material ahead of the secondary crusher. The material removed then passes over a newly installed 36-inch-diameter 36-inch-long Indiana General H.S.D. magnetic separator. To complete the installation, four additional conveyor belts were required.

A washing plant, an extra magnetic pulley, and three new conveyors were added to the waste-disposal system from the dry cobbing magnetic pulleys. This installation removes and recovers fine magnetite adhering to the wet waste rock. The installation has permitted a speeding-up in the milling rate of the ore, particularly of lower-grade material, without an increased loss of magnetite in the coarse waste tailing.

The number of persons employed was 275, of whom 137 were underground.

QUADRA ISLAND

Copper

Copper Road* (50° 125° S.E.) This property comprises 11 recorded mineral claims held by E. G., John, Blanche, and Antoinette Adams, all of Campbell River, and eight recorded mineral claims held by Robert I. Bennett, of Heriot Bay. The Adams' claims are leased to Mr. Bennett. It is on the west side of Quadra Island about 2 miles northeast of Deepwater Bay and is connected by road to the ferry terminus at Quathiaski Cove.

Three men completed 287 feet of crosscutting on the north side of the ore-bearing shear zone. The crosscut intersected the mineralized shear about 150 feet west of the shaft, and 125 feet of drifting was done in an easterly direction along the shear zone. The drift mining produced 553 tons of copper ore, which was trucked to the Deepwater Bay dock and shipped by barge to the concentrator at Britannia Beach. A small assay laboratory building was constructed and a pit was opened to obtain backfill for mining.

VANCOUVER ISLAND

SAYWARD (50° 125° S.W.)

Iron

Iron Mike (Orecan Mines Ltd.)† Company office, 519, 355 Burrard Street, Vancouver 1. A. H. Upton, president; L. J. Manning, manager; H. L. Hill and associates, consulting engineers. The group consists of 48 mineral claims held by record, 13 in the name of Orecan Mines Ltd. and 35 by the Hartt-Caldwell interests. The group is 4 miles southwest of Sayward and 3 miles west of the junction of the White and Salmon Rivers. (*See* Annual Reports, 1960, p. 104; 1961, p. 91; 1962, p. 96; 1963, p. 99; 1964, p. 152.)

* By J. E. Merrett.
† By N. D. McKechnie and J. E. Merrett.

The Iron Mike is a magnetite deposit in basaltic volcanic flows. The principal mineralization found to the present is on the Iron Mike mineral claim and on the Iron Dan mineral claim near its boundary with the Iron Mike. In 1961 this mineralization was diamond drilled in two areas with a gap of some 600 feet between them. In 1963 and 1964, 25 additional holes were drilled, 13 of which were in the gap. This drilling indicated the mineralized zone to be continuous across most of the Iron Mike and into the Iron Dan (Fig. 30), underlying an area roughly 1,000 feet long by 250 feet wide.

The property is underlain by basaltic flows. There is a small exposure of limestone in the footwall of a fault on the truck-road below the starting place of the pit, and about 10 feet of limestone was seen in one drill core on the Iron Mike. There are more numerous and larger exposures of limestone on the Iron Herb mineral claim, some 1,000 to 1,500 feet to the north. Examination of a limited number of thin-sections showed that the basalt varies from a comparatively feldspar-rich type in which the feldspars are in the range An_{50}–An_{55} to a type composed almost wholly of pyroxene. Within and near the magnetite zone, cataclastic textures are prominent, giving a pyroclastic appearance in hand specimen to some of the finer-grained basalt. Only one hole was drilled to an appreciable depth, some 250 feet below the magnetite zone, at which depth the rock showed comparatively little fracturing.

With the exception of a diabase dyke, mineralogically similar to the basalt, no intrusive rocks were recognized.

No continuous flow-contacts and no limestone bedding were observed on surface, and no key beds were distinguished in the drill cores, so no information was obtained on the attitude of the rocks. On the truck-road below the pit a fault is exposed striking north and dipping 25 degrees west; the crushed zone is 6 to 7 feet wide. This fault truncates another striking north 35 degrees west and dipping 70 degrees southwest; the crushed zone is 2 feet wide. A disturbed zone exposed on the truck-road about 1,000 feet north-eastward from the foregoing faults has principal planes striking north 5 degrees west and dipping 75 degrees east, and striking north 25 degrees east and dipping 85 degrees southeastward. The zone is exposed for about 50 feet, but its actual direction is not known. None of these faults have been identified in the magnetite zone.

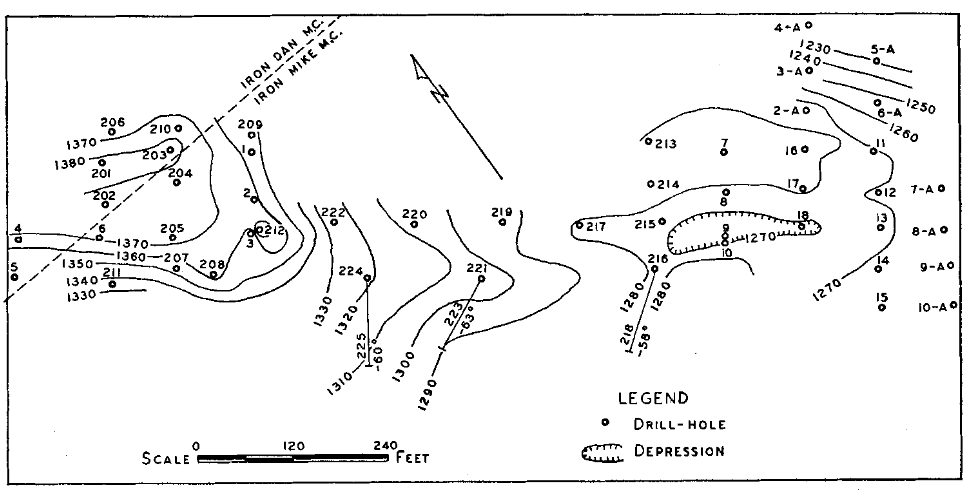


Figure 30. Orecan magnetite zone. Structural contours on hangingwall.

As illustrated by diamond-drill cores, the Iron Mike magnetite zone consists of varying proportions of magnetite in fractured and brecciated basalt. The magnetite occurs as masses yielding core lengths of up to 60 feet, as breccia matrix, and as stringers and threads in the enclosing rocks. A little pyrite and, rarely, chalcopyrite may be present. The magnetite is accompanied by garnet-epidote-actinolite-calcite skarn and by actinolite-amphibolite. The skarn and amphibolite may occur together, and where they do there are definite contacts between them. The amphibolite probably is derived from the pyroxene-rich basalts. Elevation contours drawn on the hangingwall of the zone as indicated by the drill cores (Fig. 30) show the zone to be in the form of a flat, irregular arch plunging southeastward at 5 to 10 degrees. The maximum thickness of the zone appears to be between 50 and 60 feet; the average is of the order of 25 feet. The distribution of magnetite in the drill cores is erratic. Since nothing is known of the structure of the enclosing rocks, the nature of the arch is a matter for conjecture. The zone appears to die out on the two limbs of the arch, and it is limited by diminution of fracturing rather than by structural walls. The fact that the zone includes both skarn and amphibolite suggests that it encompasses several beds of lava. It seems quite possible that the Iron Mike zone is on the crest of a southeastward-plunging anticline. The evidence of fragmental textures and the general lack of shearing within the ore zone suggest that the zone resulted from tensional rather than shearing stresses.

Reconnaissance drilling has been done at three places westward from the Iron Mike mineral claim. On the Lake fractional mineral claim four holes were drilled spanning some 500 feet in a northeast-southwest direction and about 1,000 feet northwest of the Iron Mike zone. Save for a few stringers in skarn near the top of one of the holes, no magnetite was cut. The holes may be west of the northwestward projections of the Iron Mike zone. On the Jim mineral claim some 1,400 feet westward from the southwest corner of the Iron Mike mineral claim, six holes have been drilled in an area of about 100 by 200 feet. Massive magnetite was cut in core lengths of 27 to 63 feet, all near the surface. On the Ken mineral claim, about 1,300 feet south-southeast of the same Iron Mike corner, three holes have been drilled, all of which cut magnetite in core lengths of up to 10 feet. The Jim and Ken areas are about 1,300 feet apart; a line joining them is sub-parallel to the Iron Mike zone.

Crushing and concentrating plants with a daily capacity of 1,000 tons of ore per day, together with ancillary equipment and buildings, were installed by a construction crew of 20 men. A dock with ore-loading facilities for deep-sea vessels was constructed at Menzies Bay, about 30 miles south of the mine.

Mining operations commenced in July, with open-pit bench-mining methods used to remove 75,000 tons of waste and produce 32,000 tons of ore. The concentrator milled 31,000 tons of ore to produce 17,033 tons of iron concentrate with a product size of 100 per cent less than ¼-inch mesh and not more than 33 per cent less than 100 mesh. The concentrate was not shipped. By the end of 1965, 27 men were employed on the property.

Nahwitti Lake (50° 127° N.W.)

Copper-Lead-Zinc

HPH, Norman (Giant Explorations Limited)*

Company office, 1825, 355 Burrard Street, Vancouver 1. This wholly owned subsidiary of Giant Mascot Mines Limited optioned from H. Pugh and M. Hepler 42 mineral claims located about the south and east shores of Nahwitti Lake. Access to the property from Port Hardy is by way of 19 miles

* By J. E. Merrett.

of forest access road. A crew of three men was employed for a three-week period digging and blasting 500 feet of trenches on a sulphide occurrence in a contact metamorphic zone in limestone.

QUATSINO

Copper

Holberg Mines Ltd.* (50° 128° N.E.) Company office, 103, 709 Dunsmuir Street, Vancouver 1. Peter F. Wishart, president. The property, comprising 104 mineral claims, is on the north slope of Mount Hansen and about the head of Holberg Inlet, Quatsino Sound. The camp is about 2½ miles by road from Holberg. A crew of five men constructed three-quarters of a mile of access roads to diamond-drill sites and completed 2,295 feet of diamond drilling in 13 holes.

Yreka (Minoca Mines Ltd.)† (50° 127° S.W.) Company office, 543 Granville Street, Vancouver 2. The company is 51 per cent owned by Mitsubishi Metal Mining Co. Ltd. and 49 per cent by Yreka Mines Ltd., which in turn is controlled by Noranda Mines, Limited. J. R. Billingsley, mine manager. The property consists of 16 Crown-granted mineral claims and 18 claims held by record on Comstock Mountain, 2 miles south of Pender Point on the west shore of Neuroutsos Inlet, the southeast arm of Quatsino Sound. It extends from tidewater to an elevation of about 2,200 feet.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1953, 1955; *Geol. Surv., Canada,* Sum. Rept., 1929, Pt. A, p. 124.]

The geology in the vicinity of the workings is described in the Annual Reports for 1953 and 1955. Since 1955 the sulphide zone has been partially opened and explored on three levels, at elevations of 1,900, 1,750, and 1,600 feet respectively. The writer visited the workings briefly in August, and the following information, in the main, was supplied by the mine geologist, C. R. D. Miller.

The workings are chiefly in coarse agglomerate and tuff, with thin-banded tuffs at the south; the rocks strike north-northwest to northwest. The volcanic rocks are cut by granite porphyry dykes, and these in turn are cut by andesite dykes.

The sulphide mineralization is in skarn, which is developed principally in the agglomerate. Three oreshoots have been recognized within the sulphide zone. They are termed "A," "B," and "C." The "A" body shows on the 1900 and 1750 levels; it is best developed on the 1750 and appears to have a near-vertical plunge. The "B" body is well developed on the 1900 level, but on the 1750 is represented only as a zone of scattered mineral. It has an apparent plunge of about 65 degrees southwest. The "C" orebody consists of two small plums on the 1900 level northeast of the "B" body. It has not been further explored.

Nothing is known of the actual control of the oreshoots. There appears to be one consistent relationship in that the known oreshoots lie in the skarn near rolls in the tuff beds. Where there is not such a roll, there may be mineralization but no ore. The best ore is spatially associated with swarms of porphyry dykes.

It is planned to investigate other showings in the northeast corner of the New Comstock mineral claim and in the Barney and Barney No. 2 areas.

After a period of inactivity since 1956, work commenced at the beach camp in 1964 but was not resumed underground until 1965, when 941 feet of raising and 951 feet of drifting and crosscutting were completed. Two long-hole stopes were prepared on the "A" and "B" orebodies, while the narrower high-grade "C" ore zone was prepared for shrinkage stoping. The ore mined amounted to 13,330 tons.

* By J. E. Merrett.
† By N. D. McKechnie and J. E. Merrett.

The major portion of the work completed was the construction of an aerial tram from the beach camp to just below the 1750 level adit, the building of the mine plant, and the camp. The tramline right-of-way was cleared of trees and three towers were erected—two terminal and one intermediate—on the 4,200-foot slope length. The continuous tram, comprising four 4-man gondolas and twelve 12-cubic-foot-capacity ore buckets, has an average slope of 27 degrees and transports aproximately 25 tons of ore per hour.

The mine plant construction was as follows: A coarse-ore bin of 2,500 tons capacity, a crushing plant, a fine-ore bin of 1,200 tons capacity, a mill of 375 tons per day capacity; a combined power-house, machine-shop, and dry-house building; a concentrate-storage building and a loading-dock.

The power-house installation comprised three 250/300 kw. Waukesha diesel-electric units, each with an output of 514 brake horsepower at 1,200 r.p.m. The units, operating at a temperature of 240 degrees Fahrenheit, are equipped with heat-exchangers, used in the heating of the machine-shop, dry-house, mill, and camp buildings.

In May a fire destroyed the cook-house. This was replaced by one with a seating capacity of 70 men. In addition, three bunk-houses and a staff quarters were built.

Test operations commenced in November, but the mill was not in full operation at the end of December. In this period 9,347 tons of ore was milled to produce 1,618 tons of chalcopyrite concentrate, which was not shipped.

The number of men employed at Minoca Mines Ltd. was 10 underground and 15 on the surface. At the peak of construction a total of 60 men was employed by the various contractors.

Benson River (50° 127° S.E.)

Iron

Empire Development Company Limited*

Company office, 1017, 736 Granville Street, Vancouver 2; mine office, Port McNeill. E. C. Oates, general manager; P. M. Stiles replaced P. W. Billwiller as mine manager. The Empire mine adit is at an elevation of 1,911 feet on Merry Widow Mountain on the west side of the Benson River valley, approximately 2 miles south of Benson Lake. The camp is at an elevation of 800 feet. A 3-mile tote-road connects the adit and camp, and 25 miles of gravel road provides access to the camp from Port McNeill on the east coast of Vancouver Island.

The jig-back aerial-tram installation was completed, and a compressor-house and an additional crusher were installed near the portal.

Underground, 302 feet of drifting and crosscutting and 228 feet of raising were completed in the development of the Merry Widow orebody. Blast-hole drilling was used to mine 41,000 tons of ore, from which 14,655 tons of concentrate was produced and trucked to the Port McNeill loading-dock but was not shipped. Nine exploration diamond-drill holes totalling 2,799 feet were completed underground, while 1,064 feet was drilled in six surface holes.

The average number of men employed was 48, of whom 18 were employed underground.

---

* By J. E. Merrett.

Copper-Iron

Old Sport (Coast Copper Company Limited)*

Company office, Tadanac; mine office, Port McNeill. The Consolidated Mining and Smelting Company of Canada, Limited, is the principal shareholder and manages the operation. H. G. Barker, property superintendent; R. T. Trenaman, mine superintendent; R. L. Merrifield, mill superintendent. This property comprises 48 Crown-granted claims, 5 recorded claims, and 1 mineral lease extending southward from Benson Lake and on the west side of Benson River. It adjoins the north and east boundaries of the Empire property. Access is by way of a 26-mile gravel road from Port McNeill, where an employee residence townsite is located.

A total of 5,166 feet of new drifting and crosscutting and 5,288 feet of drift rehabilitation were done on the south headings of the 5500, 5300, 5100, 4900, and 4700 levels. In this same area 5,808 feet of raising was done and several stopes were brought into production as mining decreased above the 5500 or main adit level. The rehabilitation of No. 2 winze, commenced in 1964, was completed, with 80 feet of it retimbered. The winze was extended 66 feet, and ore and waste pockets were completed below 4700 level. Diamond drilling on the surface and underground amounted to 21,019 feet.

In order to improve the ventilation of the No. 2 winze workings, two 35,000-cubic-feet-per-minute fans operating at a 2.23-inch water gauge were installed in parallel just above 5500 level, south of No. 1 winze. A total of 1,292 feet of raising was done to complete the ventilation circuit.

A crew of 205 men, of whom 132 were employed underground, mined and milled 292,000 tons of ore. Copper and iron concentrates were produced and trucked to the Port McNeill loading terminal for shipment to Japan.

Nimpkish Lake (50° 126° S.W.)

Copper-Iron

Alpha, Gamma (Empire Development Company Limited)*

Company office, 736 Granville Street, Vancouver 2. These three groups, totalling 41 claims, are located at the headwaters of Kinman Creek, which flows into Nimpkish Lake at its southeast shore. These claims cover, in general, the same area as did the former Nimpkish Copper group, on which The Consolidated Mining and Smelting Company of Canada, Limited, did extensive work in 1929 and 1930. In 1965 four men were employed for a period of three months making a detailed geological map of the mineral showings and a dip-needle survey of an area on the Alpha Nos. 1 and 3 claims where three small magnetic anomalies were located.

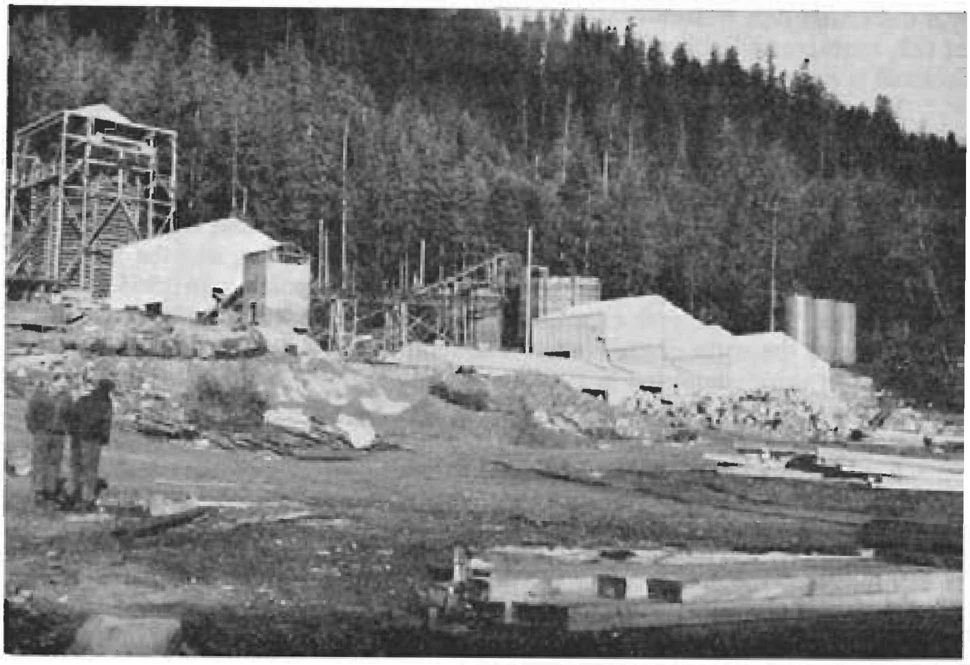
[Reference: Hoadley, J. W., *Geol. Surv. Canada,* Mem. 272.]

Zeballos (50° 126° S.W.)

F.L., Ridge, Cordova (Zeballos Iron Mines Limited)†

Company office, 504, 1112 West Pender Street, Vancouver 1. P. N. Pitcher, president; C. E. Gordon Brown, manager. The property comprises 13 Crown-granted and 15 recorded claims and is 4 miles north of Zeballos. A high-grade magnetite orebody outcrops on the west side of Zeballos River valley at an elevation of approximately 2,600 feet. The out-

* By J. E. Merrett.
† By A. R. C. James.



Minoca Mines Ltd. Yreka mill nearing completion.

Mount Washington Milling Co. Ltd. 1,000-ton capacity mill.

crop of magnetite extends in a north-south direction for 1,500 feet, averaging 70 feet thick, and dips westward at about 40 degrees. The hangingwall is a complex of tuff, intrusive andesite, diorite, and granodiorite locally altered to skarn, and the footwall is composed of grey Quatsino limestone.

The present company commenced work on the property in 1959. Open-pit mining began in 1962, but the property was closed down on February 27, 1963. After a complete reorganization of the company and change of control, the property was reopened on November 1, 1963, and prepared for renewed production as an underground mine. Operations have been continuous since that time. The mine is developed from a main haulage level at 2,280 feet elevation, and the method of mining is long-hole blasting with mucking-machine draw points. In 1965 the three stopes in the "A" zone were mined, and development work was carried out in the " B " zone, to the north of "A" zone. The following is a summary of underground development work completed in 1965:—

	Ft.
Drifting	594
Sub-drifting	2,793
Raising	1,256
Drilling (long-hole)	183,903

The ore is trucked from the mine to the primary crusher at 2,100 feet elevation. It then passes through a secondary crusher and into a 100-ton surge bin. From there it is withdrawn in 9-ton steel skips which descend over a standard-gauge triple-track surface tram to the crude-ore stockpile just above the mill. The tramway is 2,500 feet long and extends from elevation 1,900 feet to the mill horizon of 1,200 feet. At the mill the ore is beneficiated by magnetic separation. It is then trucked to a loading-dock at the head of Zeballos Inlet, where a stacker conveyor delivers the ore to the stockpile, which may contain up to 80,000 tons. An underground conveyor system removes ore from the stockpile and loads directly into the holds of ocean-going freighters at a rate of 900 tons an hour.

In 1965 a number of improvements were made to the mine camp. A compressor-house was erected, a community hall, first-aid, and mine-rescue building was completed for use in July, and at the end of the year arrangements for man-haulage on the surface tram were completed.

A total crew of 106 men was employed, 43 being employed underground. Total production of ore trammed to the mill was 364,115 tons. Total iron concentrates produced in 1965 was 267,823 tons.

Iron

Hiller (Falconbridge Nickel Mines Limited)*

Company office, 504, 1112 West Pender Street, Vancouver 1. The property comprises 42 claims, including the old Churchill property, which is described in Bulletin 27, 1950, pages 131–134. It is situated at the headwaters of Lime Creek and Fault Creek and on the divide between these creeks and Kaouk River. The claims extend from an elevation of 1,000 to 4,366 feet, and are 10 miles by helicopter from Zeballos. The showings are reported to consist of magnetite associated with skarn and a volcanic host rock. In 1944 Privateer Mines Limited did a little work on the Churchill group. In 1951 The Argonaut Mining Co. Ltd. drilled 12 drill-holes totalling 817 feet on the same group. In 1960 Ventures did some work, and the present company commenced exploration in 1964.

In 1965 the company did mapping, both topographical and geological. Magnetometer surveys were carried out over approximately 450 acres. Nineteen AX

* By A. R. C. James.

holes were diamond drilled, totalling 4,352 feet, and 11 EX holes were diamond drilled, totalling 813 feet. A rock cut 8 by 3 by 10 feet was made. Two helicopter landings were constructed and a tent camp established. A crew of eight men was employed under the supervision of R. Saukko and L. Basher for a period of six months. The work was serviced by helicopter from Zeballos.

NIMPKISH RIVER

Copper

Woss (Empire Development Company Limited).*—(50° 126° S.W.) Company office, 736 Granville Street, Vancouver 2. It was reported that a crew of three men was employed for a period of three months making a detailed geological map of a local area 3 miles north of Woss Mountain and 2 miles east of Woss Lake on an occurrence of chalcopyrite as replacement in breccia and in vein deposits within the Karmutsen volcanic rocks.

Copper-Iron

Oktwanch (Empire Development Company Limited)†

(49° 126° N.E.) Company office, 736 Granville Street, Vancouver 2. This group of 18 recorded mineral claims is on the west side of the head of the south fork of Oktwanch River, which flows into Muchalat Lake. It was reported that a crew of four men was employed for three months making a general geological map of the area in the vicinity of occurrences of chalcopyrite and magnetite in skarn zones in a contact metasomatic deposit in sedimentary and volcanic rocks. A limited amount of dip-needle surveying was also done.

CAMPBELL LAKE

Copper-Zinc

Big G (Gunnex Limited)*

(50° 125° S.W.) Company office, 1019, 409 Granville Street, Vancouver 2. Gunnex Limited held by option 10 claims on Greenstone Creek, which empties into Campbell Lake on its west shore. Two men working for a three-month period did geological, geochemical, and geophysical (E.M. and magnetometer) surveys on a localized skarn zone on the Rainbow and Thundercloud mineral claims. Chalcopyrite, pyrrhotite, sphalerite, and magnetite were the ore minerals present in the skarn zone in volcanic and sedimentary host rocks.

Iron-Copper

Iron River (Texada Mines Ltd.)*

(49° 125° N.E.) Registered office, 626 West Pender Street, Vancouver 2; mine office, Box 10, Gillies Bay. This company optioned from Canadian Collieries Resources Limited, Lot 242, 1½ miles east of Middle Quinsam Lake. Access is by 21 miles of road from Campbell River. The mineral occurrence is adjacent to the Iron River, a tributary of Quinsam River, and consists of magnetite and chalcopyrite with garnetite in a contact metamorphic skarn zone. Between 1951 and 1957 The Argonaut Mining Co. Ltd. excavated a small quarry on the deposit and did both aerial and ground magnetometer surveys.

It was reported that in 1965 a crew of nine men, supervised by J. P. Davies, and employed for a period of eight months, did 7,575 feet of EX core diamond-drilling in 20 holes.

* By J. E. Merrett.
† By A. R. C. James.

BUTTLE LAKE (49° 125° N.W.)

Gold-Silver-Copper-Lead-Zinc

Lynx, Price (Western Mines Limited)*

Company office, 802, 850 West Hastings Street, Vancouver 1; mine office, Box 8000, Campbell River. C. M. Campbell, Jr., general manager; J. B. C. Lang, mine manager. Western Mines Limited, together with the wholly owned subsidiaries Myra Falls Mines Ltd. and Price Creek Mines Ltd., now holds a total of 23 Crown-granted mineral claims, 2 mineral leases, and 144 recorded claims, of which 15 are held by option. The area is reached by road from Campbell River to Buttle Lake in central Vancouver Island, and then by boat for 20 miles to the head of the lake. At Myra Creek a 2½-mile road extends westward to the Lynx mine camp. A new road is being constructed on the east shore of Buttle Lake and about 3 miles has been completed to sub-grade at the north end. At the south end, portions of the Myra Creek road were straightened and the road-bed raised in the flood-flats section. In addition, work was started on a 1.5-mile diversion from this road to meet, at Thelwood River, the road being constructed on the east shore of the lake.

At the Lynx mine site a 300-man temporary camp was put into operation to serve both mining and construction personnel. Construction was started on a service building, assay office, and powder magazine, while excavation of the mill-site was started.

Surface stripping was begun in overburden above the ore zone preparatory to open-pit mining, and stripping was done for the new adit on No. 11 level (1075). It is intended to remove all ore above this horizon by open-pit mining.

The nomenclature of the levels was changed so that the former 1225 level is now known as No. 10 level and the number sequence increases as does the depth.

The internal shaft was sunk an additional 936 feet to a bottom elevation of 180 feet. Shaft stations have been cut at all levels from 10 to 16, inclusive, or at respective elevations of 1,225, 1,075, 925, 775, 625, 475, and 330 feet. Development mining was done on all levels below No. 8, and this work included 1,666 feet of raising, 4,361 feet of drifting and crosscutting, and 74,820 feet of diamond drilling. Some experimental stoping was done to determine satisfactory mining methods.

Hydro-electric power development was started at Tennent Lake (elevation 3,400 feet), about 2 miles southwest of the mine camp. A crosscut about 400 feet long was driven to tap the lake 30 feet below water-level. The headworks have been completed and work has begun on the clearing of the penstock right-of-way.

A small exploration diamond-drilling programme was done on the Price claims. Eight holes totalling 4,571 feet were completed. Narrow widths of massive sulphides were intersected, but as the results obtained were not conclusive, further work has been planned.

A total of 134 men was employed, of whom 50 worked underground.

Gold-Silver-Copper-Lead-Zinc

Sevrens, Copper Ridge (Copper Ridge Mines Ltd.)*

Company office, 74 East Pender Street, Vancouver 4. This company owns 27 mineral claims astride Thelwood River and Price Creek at the south end of Buttle Lake. The claims adjoin to the south the Price group of Western Mines Limited. It was reported that a crew of two men employed for a two-

* By J. E. Merrett.

month period completed a total of 300 feet of trenching in six separate trenches on a sulphide mineralized vein in a shear zone in volcanic rocks.

TSOLUM RIVER (49° 125° N.E.)

Copper

Domineer (Mount Washington Milling Co. Ltd.)*

Company office, 202, 569 Howe Street, Vancouver 1; mine office, Box 1809, Courtenay. R. A. Brossard, president; C. W. S. Tremaine, manager. A short history and description of the property was given in the Annual Report for 1964, and the geology has been described in some detail in the Annual Reports for 1959, 1960, and 1963. The mine, which commenced production in September, 1964, is near the summit of Mount Washington at about 4,400 feet elevation, 18 miles from Courtenay by logging-road. The orebody is a flat-lying quartz vein mineralized with chalcopyrite, bornite, and other minerals. The mineralization also extends into adjacent rocks, which consist of Cretaceous sediments and intrusive porphyry and breccia. The average width of the orebody is 10 feet, and it is overlain by waste with an average thickness of 20 feet. So far all mining has been by open-pit methods, using air track drills, ½-cubic-yard shovels, and a D-7 and a D-8 bulldozer. Waste is removed in two 35-ton Euclid trucks, and ore is transported to the mill in twelve 15-ton trucks. In 1965 the mine was operated from May 16th to December 10th; heavy snow conditions on Mount Washington normally curtail operations in the winter and early spring.

The concentrator is situated on the northeasterly slope of Mount Washington, at an elevation of 2,400 feet and 4½ miles by road from the mine. A crushing, grinding, and flotation plant of 750 tons per day capacity operated continuously throughout 1965. Sufficient ore is stockpiled near the mill to enable it to operate during the winter months when the mine is closed.

A total crew of 66 men was employed on the property when the mine was in full operation. This included employees of the mining and hauling contractors. A crew of 30 men was employed in the concentrator.

Production in 1965 was as follows: Total ore mined, 242,125 tons; ore milled, 187,472 tons; ore stockpiled, 54,653 tons; copper concentrate produced, 8,922 tons; 597,651 tons of waste and overburden was removed from the open pit.

TOFINO (49° 125° S.W.)

Copper-Nickel

Meares, Lone Cone, Flon, Etc. (Falconbridge Nickel Mines Limited)*

Company office, 504, 1112 West Pender Street, Vancouver 1. The property comprises 49 mineral claims, ranging in elevation from sea-level to 2,700 feet, on Meares Island between Tofino and Bedwell Sound. It is reported that copper-nickel mineralization associated with pyrrhotite occurs in disseminations and as massive replacement in a host rock of gabbro. Work in 1965 included geological mapping, self-potential and magnetometer surveys, and diamond drilling. Six EX holes totalling 220 feet were diamond drilled. A crew of four men was employed for one month under the supervision of J. J. McDougall. Work was reported to be still in progress at the year-end.

* By A. R. C. James.

Molybdenum-Copper

Sun-West Minerals, Limited* Company office, 501, 1873 Nelson Street, Vancouver 5; field office, Box 111, Tofino. Lorne Hansen, president. The company owns a total of 75 recorded claims at the head of Tofino Inlet, extending from an elevation near sea-level to 850 feet. Access to the property is by boat from Tofino, a distance of 18 miles.

A detailed description of the property was given in the Annual Report for 1963. The mineralization comprises irregular masses and disseminations of molybdenite, chalcopyrite, and magnetite, associated with skarn alteration. The property has been explored intermittently since 1898, and by the present company since 1962.

In 1965 six holes were diamond drilled, totalling 760 feet, and a geophysical survey was carried out. Three men worked for 10 months under the supervision of Lorne Hansen.

KENNEDY LAKE (49° 125° S.E.)

Iron

Brynnor Mines Limited (Kennedy Lake Division)† British Columbia office, 1050 Davie Street, Vancouver 5; mine office, Ucluelet. T. R. Wearing, manager; T. Salmon, pit supervisor; A. M. Cormie, underground superintendent; A. W. Hagerty, mill superintendent. This company is a wholly owned subsidiary of Noranda Mines, Limited. The mine is situated about 2½ miles southeast of Kennedy Lake, near the headwaters of Draw Creek. Access is by Alberni–Tofino road as far as Kennedy Lake and by a logging-road from there to the mine. Ore is trucked from the crushing plant to the mill and loading-dock at Toquart Bay, a distance of 8 miles. Here the magnetite is loaded from a large storage pile into ocean-going ore-carriers for shipment to Japan.

Up to the present time all the ore has been produced by open-pit mining. The open pit is worked by standard benching methods, the benches being approximately 30 feet apart. Down holes are drilled with a 9-inch Bucyrus Erie 40-R and a 6-inch C.I.R. Drillmaster rotary drill and are loaded with AN/FO in conjunction with M2 and M4 aluminum-TNT slurry explosives. Lifter holes are drilled with air tracks and are loaded with conventional explosives. Muck is loaded by two Dominion and one Bucyrus Erie shovels into Dart end-dump trucks and hauled to the crusher or waste dump. By the end of 1965, operations were over 300 feet below the rim of the pit.

Preliminary excavations were begun in August, 1963, for the sinking of a three-compartment shaft to give access to a deeper orebody lying to the southeast of the open-pit orebody. By the end of 1964 the Brynnor No. 1 shaft had been sunk 856 feet and stations were cut on the 400-, 600-, and 750-foot levels. In 1965 a considerable amount of development work was done on the 600- and 750-foot levels. Toward the end of 1965, shaft-sinking was resumed and was still in progress at the year-end when the shaft was 1,062 feet deep. It is intended to sink to 1,250 feet.

A summary of development work done in 1965 is as follows:—

	Ft.
Drifting	3,103
Crosscutting	600
Raising	------
Diamond drilling	7,357

* By A. R. C. James.
† By A. R. C. James and G. E. P. Eastwood.

A mine water sump of 200,000 gallons capacity, together with a pumproom, was constructed on the 750-foot level. Two 1,000-gallons-per-minute-capacity pumps were installed.

The permanent steel headframe at the shaft collar was completed by March, and at the year-end work was in progress on the completion of a well-equipped " dry " and office building near the shaft collar.

The total amount of ore mined was 843,933 tons. This yielded 658,515 tons of concentrate. The number of men employed was 171.

Geology of the Underground Workings

The regional geology is described in the Annual Report for 1962, and the geology of the open pit in the Annual Reports for 1961 and 1963 as well. In 1965 five days were devoted to a study of part of the two levels driven from the shaft.

Briefly, the rocks in and around the open pit include limestone and tuff of the Quatsino Formation and successive intrusions of andesite, older porphyry, batholithic granodiorite and related rocks, and younger porphyry. The Quatsino Formation was folded into a broad anticline, which was then sharply downbuckled. In the open pit all of the rocks are seen to be extensively fractured and faulted. The open-pit magnetite orebody is an irregular body roughly following the tuff-limestone contact down around the downbuckle of the anticline. Adjacent tuff has been extensively altered to skarn.

In the southeast part of the open pit the limestone and tuff are in fault contact with intrusive andesite. The fault strikes a few degrees east of north and dips 70 degrees west. From scattered exposures beyond the pit, and from diamond-drill cores, the andesite body appeared to be relatively extensive. Ore found by drilling east of the fault is some 200 feet deeper than the open-pit orebody, and constitutes in effect a separate orebody. The underground work is designed to prepare this deeper ore for mining.

On the two underground levels, 600 and 750 feet below the shaft collar, the principal rock is fine grained and light green in colour and lacks macroscopic features indicative of its origin. In two places it appears to grade to older porphyry, but two thin sections of the green rock show much closer resemblances to thin sections of andesite and fine-grained diorite. A third thin section is of fine-grained pyroxenite. The light-green rock is extensively replaced by garnet and magnetite near the orebody, and ore, skarn, and green rock are intruded by dykes of younger porphyry. On the lower level the green rock is intruded by granodiorite near the shaft. Possibly the green rock represents bleached andesite of the body indicated by drilling, and to a minor extent bleached older porphyry and diorite. The pyroxenite is thought to be pyroxene skarn, but it is not apparent which rock it replaces.

On the lower level, in the face of a crosscut, a felsite macroscopically resembling the tuff was exposed in the north wall of a composite gouge zone. Since this gouge zone strikes only slightly north of east, it evidently is not the fault in the southeast part of the pit, and this exposure is east of the pit fault. Massive magnetite is exposed south of this gouge zone and in part replaces the felsite in the zone. Under the microscope the felsite consists of a striking graphic intergrowth of quartz and plagioclase feldspar. It is presumably a dyke, and may belong to a group of post-granodiorite felsite dykes that occur in the Draw Creek area.

Magnetite occurs massive, interbanded with skarn, and as lenses, pockets, and disseminations in the skarn. On the upper level the massive magnetite appears to form a band 30 feet wide striking northeast. On the lower level it forms a body that is larger and more irregular, locally replacing tuff. The drilling indicates that this massive magnetite is continuous between levels.

The rocks have been intensively broken by fractures, slips, and gouge zones. Typical shear zones are uncommon. Most of the gouge zones are a few inches thick, but a few are as much as 3 feet thick. Where displacement could be measured, it was less than a foot. The felsite boundary in the crosscut on the lower level is a composite of two overlapping in echelon gouge zones. The more northerly zone passes into a simple fracture in felsite to the east and the southerly zone dies out in massive magnetite to the west. The intervening rock is shattered felsite which to the west is replaced by magnetite.

The over-all control of the magnetite mineralization is not apparent on these levels. In detail, the boundaries of the massive magnetite appear to have been controlled to a considerable extent by slips and gouge zones.

ALBERNI INLET

Copper-Lead-Zinc

Koros (Bralorne Pioneer Mines Limited)*

(48° 124° N.W.) Company office, 320, 355 Burrard Street, Vancouver 1. J. P. Weeks, chief geologist. The property comprises 10 claims, ranging in elevation from sea-level to 500 feet, situated near the mouth of Spencer Creek on the south side and near the south end of Alberni Inlet. The showings are reported to consist of galena, sphalerite, chalcopyrite, and pyrite mineralization within a limestone host rock. Some mapping and a geochemical (total heavy metals) survey were carried out, and five trenches totalling 300 feet were dug. Three men were employed for one month on the property under the supervision of J. P. Weeks.

Copper

Thistle (Vananda Explorations Limited)*

(49° 124° S.W.) Company office, 661 Hornby Street, Vancouver 1. The company holds 11 claims by option agreement, including the Thistle and Sun groups. The property is at an elevation of 2,460 to 2,750 feet near the headwaters of the north fork of Franklin Creek about half a mile south of Father and Son Lake and 8 miles in a straight line east of Alberni Inlet. Access from Port Alberni is by the Bamfield road for about 7 miles and thence by logging-roads for a further 8 miles.

A description of the history and geology of the property is given in the Annual Report for 1944. The last significant work prior to the present exploration was done from 1938 to 1942, when 6,926 tons of ore was mined, containing: Gold, 2,716 ounces; silver, 2,121 ounces; copper, 2,716 pounds. The Thistle showings consist of two chalcopyrite replacement orebodies found along two shear zones in altered limestone about 130 feet apart.

In 1965 the company carried out magnetometer, self-potential, and geochemical surveys. Four holes totalling 1,745 feet were diamond drilled. (*See* Annual Report, 1944, pp. 154–157.)

* By A. R. C. James.

NANAIMO LAKES (49° 124° S.E.)

Copper

Skarn (Gunnex Limited)*

Company office, 1019, 409 Granville Street, Vancouver 2. Kenneth C. Rose, manager. This company carried out regional exploration over an area of approximately 500,000 acres in the E. & N. Land Grant west of Nanaimo Lakes. This work included geological mapping and geophysical and geochemical surveys. More detailed work was done on the Skarn Nos. 1 to 4 claims south of Labour Day Lake. Surface showings of chalcopyrite, pyrite, pyrrhotite, and minor sphalerite mineralization occur on these claims in skarn within a host rock of volcanics and sediments. Work done included diamond drilling six holes totalling 3,562 feet.

A crew of 10 men was employed for 10 months on the regional exploration. On detailed exploration of the Skarn Nos. 1 to 4 claims, a crew of eight men was employed for two months. All work was under the supervision of T. F. Schorn. Exploration on the Skarn Nos. 1 to 4 claims was discontinued.

NITINAT (48° 124° N.W.)

Copper

Mal (Marshall Creek Copper Co. Ltd.)†

Company office, 734 Fort Street, Victoria. James M. McNulty, president. This company has 44 recorded mineral claims on Marchand Creek, which flows westward into Nitinat Lake, 5½ miles from the head of the lake. Access is by logging-roads, either from Port Alberni or from Lake Cowichan, to the head of Nitinat Lake and from there by boat to the property.

In 1965 a detailed geological survey was made over most of the property by Alrae Exploration Ltd.; approximately 1,000 soil samples were taken and tested for copper, and a self-potential geophysical survey was made over portions of the Mal claims Nos. 1, 2, and 4.

JORDAN RIVER (48° 124° S.E.)

Copper

Sunloch and Gabbro (Cowichan Copper Co. Ltd.)†

Company office, 620 Howe Street, Vancouver 1; mine office, River Jordan. O. G. MacDonald, president; J. S. McIntosh, managing director; H. R. Graham, mine manager. This property is on the Jordan River about 1 mile upstream from its mouth and is connected by road to the Victoria highway about one-half mile east of the River Jordan Post Office. Cowichan Copper Co. Ltd., the holder of an operating lease from Sunro Mines Limited (controlled by The Consolidated Mining and Smelting Company of Canada, Limited), has in turn granted a 3½-year management agreement to Aetna Investment Corporation Limited for the capital required to reopen and operate the mine. The operating lease contains 18 contiguous mineral claims, within which are the Cave, Central, and River ore zones.

The reopening of the 5100 level adit, commenced in July, 1964, was completed in August, 1965. In doing this, six separate by-passes, totalling 1,111 feet in length, were required to pass around caved areas. Once reopened, the major task was the cleaning and reconditioning of the crushing, milling, and concentrating

* By A. R. C. James.
† By J. E. Merrett.

areas and equipment. Two 2,500/2,575-kva. General Electric transformers were installed in the mill transformer station, where a fire in July, 1964, destroyed all the electrical equipment.

Underground development mining included an additional 72 feet of drifting and 551 feet of raising, most of the latter being done in the preparation of additional stopes in the " C " ore zone.

A total of 2,773 feet of exploratory diamond drilling was done on the " C " and " D " ore zones.

A concentrate-storage building, 24 by 24 feet, was constructed on the surface.

No stope mining was done, but 2,968 tons of ore was milled to produce 96 tons of copper concentrate, which was not shipped.

At the year-end a crew of 60 men was employed, of whom 45 worked underground.

REPORTS ON GEOLOGICAL, GEOPHYSICAL, AND GEOCHEMICAL WORK

Reports accepted to the end of 1958 for credit on assessment requirements for properties held under the *Mineral Act* and the *Placer-mining Act* since January 17, 1947, and reports on geochemical surveys accepted since April 6, 1951, are listed in the Annual Report for 1958. Starting with 1959, each Annual Report lists the reports accepted during the current calendar year. A copy of each report may be examined in the office of the Mining Recorder for the mining division in which the property is located. A second copy of each report is filed in the office of the Chief of the Mineralogical Branch, Department of Mines and Petroleum Resources, Victoria.

The property name is that which appears to be in most common use. It is not feasible to list all the claim names in each property. The author of each report is given and the principal for whom the report was written.

The co-ordinate given for each report is the southeast corner of the 1-degree quadrilateral within which the property lies.

Reports Credited for Assessment, 1965

Geographic Position		Property Owner or Principal Author of Report Date of Submission of Report	Report No.	Kind of Work		
1° Quadr.	Quarter			Geological	Geophysical	Geochemical
48° 124°	N.E.	Blue Grouse Group Cowichan Copper Co. Ltd. D. C. Malcolm. April 5, 1965.	616	×	—	—
48° 124°	N.E.	MacD. 1–10B, Comego, and New Comego O. G. MacDonald. D. C. Malcolm. June 9, 1965.	641	×	—	—
48° 124°	N.E.	O.G.M. Claims Avallin Mines Ltd. D. C. Malcolm. June 11, 1965.	642	×	—	—
48° 125°	N.E.	PC Nos. 1–15 Peter W. Butler. Kenneth C. Rose. January 26, 1965.	600	×	—	×
49° 115°	N.W.	C, D, and E Royal Canadian Ventures Ltd. Virgil R. Chamberlain. July 13, 1964.	661	×	—	—
49° 118°	N.E.	Franklin Mines Property (1–7 Groups) Franklin Mines Ltd. T. Lisle and R. P. Chilcott. February 11, 1965.	637	×	×	×
49° 118°	S.W.	IT Nos. 1–37 Utah Construction & Mining Co. J. S. Scott. December 21, 1964.	584	×	—	—
49° 119°	S.W.	Buck Nos. 1–3 and Cal Nos. 1–24 K. A. Butler. R. Alan Rudkin. September 23, 1965.	677	×	—	—
49° 119°	N.W.	Deep Creek Group O. V. Burkinshaw and J. B. Newland. M. C. Robinson. September 27, 1965.	672	×	—	—

REPORTS CREDITED FOR ASSESSMENT, 1965—*Continued*

Geographic Position: 1° Quadr.	Geographic Position: Quarter	Property / Owner or Principal / Author of Report / Date of Submission of Report	Report No.	Kind of Work: Geological	Kind of Work: Geophysical	Kind of Work: Geochemical
49° 119°	N.W.	Lakeview-Dividend Property K. A. Butler and D. P. Simpson. D. E. Pegg. June 23,1965.	658	×	×	×
49° 119°	N.W.	Lyla Nos. 1–4 O. V. Burkinshaw and E. H. Ewer. M. C. Robinson. September 27, 1965.	673	×	----	----
49° 119°	S.E.	Mo Group Southwest Potash Corporation. J. M. Patterson and R. A. Barker. August 26, 1965.	654	×	----	×
49° 119°	N.W.	Park (Peach) Group O. V. Burkinshaw. M.C. Robinson. September 27, 1965.	671	×	----	----
49° 120°	N.W.	Dawn and B.R. Claims Lawless Creek Mines Ltd. D. W. Smellie. July 13, 1965.	659	----	×	----
49° 120°	S.E.	Hope-Summit 1–8 Ben Williams. E. B. Nicholls. November 19, 1965.	690	----	×	----
49° 121°	N.E.	Hope Claims and Paul and Karen Fractions Elmer Strom, Anaconda American Brass Limited. Bruce W. Brown and Peter E. Hirst. December 13, 1965.	696	----	----	×
49° 123°	N.E.	McVicar Group Western Surf Inlet Mines Limited. G. C. Waterman. April 12, 1965.	626	----	----	×
49° 123°	N.E.	Rose (Mineral Lease No. 15) The Anaconda Company (Canada) Ltd. R. W. Phendler. January 14, 1965.	601	×	----	----
49° 123°	N.E.	Zel Nos. 1–8 John R. Lakes. W. Leszczyszyn. August 30, 1965.	752	×	----	----
49° 124°	N.W.	December Claims Lafarge Cement of North America Ltd. V. Dolmage. November 23, 1964.	612	×	----	----
49° 125°	N.W.	Buttle Lake Group (Jay Claims) The Buttle Lake Mining Company Limited. L. C. Armstrong. January 22, 1965.	607	----	----	×
50° 117°	N.E.	Winslow Group Trans-Western Oils Limited and W. H. Patterson. James F V. Millar. October 5, 1965.	674	×	----	----
50° 120°	N.E.	B, Fox, Pam, Quamco, Satan, Wade, and X Groups Rolling Hills Copper Mines Limited. C. F. Millar. January 19, 1965.	604, 605	----	×	----
50° 120°	S.W.	Chataway Group Chataway Exploration Co. Ltd. Calbert B. Selmser. January 11,1965.	611	----	×	----
50° 120°	N.W.	Dave and Lodge Claims; B, D, and F Fractions The Consolidated Mining and Smelting Company of Canada, Limited. P. E. Walcott. April 20, 1965.	635	×	----	----

Reports Credited for Assessment, 1965—*Continued*

Geographic Position: 1° Quadr.	Quarter	Property / Owner or Principal / Author of Report / Date of Submission of Report	Report No.	Kind of Work: Geological	Geophysical	Geochemical
50° 120°	S.W.	Ezra Nos. 1–20 Douglas R. Foster, New Indian Mines Ltd., and Vananda Explorations Limited. F. J. Hemsworth. February 10, 1965.	606	—	—	×
50° 120°	N.W.	G.C.M. Groups George J. Saarse. D. L. Hings. February 23, 1965.	596	—	×	—
50° 120°	N.E.	Iron Mask Group Kamloops Copper Consolidated Ltd. E. B. Nicholls. June 4, 1965.	655	—	×	—
50° 120°	S.W.	Job Nos. 1–17 Douglas R. Foster, New Indian Mines Ltd., and Vananda Explorations Limited. F. J. Hemsworth. February 10, 1965.	608	—	—	×
50° 120°	N.W.	Makaoo Group Rolling Hills Copper Mines Limited. E. B. Nicholls. June 8, 1965.	640	—	×	—
50° 120°	S.W.	MLM Claims Mamit Lake Mining Ltd. (G. J. Saarse). D. W. Smellie. January 26, 1965.	594, 595	—	×	—
50° 120°	N.W.	Rainbow, Lee, Lone Tree Grant, LO, RO, Rob, D Fraction, and A Fraction Western Beaver Lodge Mines Ltd. E. B. Nicholls. November 18, 1965.	689	—	×	—
50° 120°	N.W.	Rainbow, Lone Tree Grant, Rob, D Fraction, and A Fraction Western Beaver Lodge Mines Ltd. E. B. Nicholls. April 14, 1965.	634	—	×	—
50° 120°	S.W.	Syl Nos. 1–88 Kamloops Copper Consolidated Ltd. Joseph Sullivan. March 12, 1965.	624	×	×	×
50° 120°	N.W.	TJ Nos. 3–6 E. Koblansk and T. J. Bilinski. B. C. Macdonald. October 14, 1965.	693	—	—	×
50° 120°	N.W.	Valley Copper Group No. 9 Valley Copper Mines Limited. A. R. Dodds and R. K. Watson. May 21, 1965.	631	—	×	—
50° 121°	N.W.	Jay Nos. 1-8 and Weed Nos. 1 and 2 Fractions Kamloops Copper Consolidated Ltd. D. L. Hings. March 12, 1965.	625	—	×	—
50° 121°	S.E.	Valley Copper Groups 3, 4, and 5 Valley Copper Mines Limited. D. W. Heddle. March 19, 1965.	632	—	×	—
50° 122°	N.W.	Aero Nos. 1–6 Western Canada Steel Limited. J. M. Black. July 7, 1965.	649	—	×	—
50° 122°	N.W.	O.C. and K.B. Claims Mining Corporation of Canada (1964) Limited. F. Condon and J. S. Scott. December 9, 1964.	599	×	—	×
50° 124°	S.W.	Red Nos. 1–14 Mastodon-Highland Bell Mines Limited. W. R. Bacon. June 8. 1965.	638	×	×	×

Reports Credited for Assessment, 1965—*Continued*

Geographic Position: 1° Quadr.	Geographic Position: Quarter	Property / Owner or Principal / Author of Report / Date of Submission of Report	Report No.	Kind of Work: Geological	Kind of Work: Geophysical	Kind of Work: Geochemical
50° 125°	S.W.	Thelma Claims Wm. E. Fraser. H. Laanela. December 9, 1965.	699	×	×	×
50° 126°	S.W.	Woss Lake I–VI Hans Knapp (Empire Development Company Limited). John Lamb and John C. Lund. August 24, 1965.	663	×	—	—
50° 127°	N.W.	Beta Claims J. M. Black. J. M. Black. August 25, 1965.	651	—	×	—
50° 127°	N.W.	Wanokana Nos. 1–6 Utah Construction & Mining Co. G. A. Noel. September 13, 1965.	665	×	×	—
50° 128°	N.W.	Hep Nos. 1–8 Utah Construction & Mining Co. G. A. Noel. October 15, 1965.	684	×	×	—
51° 118°	S.E.	Joan, Bea, and Web Groups King Resources Ltd. George A. Wilson. August 30, 1965.	679	×	—	—
51° 118°	S.E.	Ewe Nos. 1–133 and G Nos. 1–16 I. C. Stairs. Joseph Sullivan. February 23, 1965.	614	×	—	—
51° 119°	S.E.	Bet and Saul Claims Edoran Oil Co. H.C.B. Leitch. November 17, 1964.	609	×	×	—
51° 123°	S.E.	M.M. Claims Phelps Dodge Corporation of Canada, Limited. W. Meyer and John DeLeen. February 16, 1965.	610	—	—	×
52° 121°	N.W.	B.J. I–IV Groups Mastodon-Highland Bell Mines Limited. W. R. Bacon. July 23, 1965.	646	×	×	×
52° 121°	N.E.	KE and LO Claims Helicon Explorations Limited. Philip G. Hallof. October 8, 1965.	683	—	×	—
52° 122°	N.E.	B.I. 1–36 Coast Silver Mines Ltd. D. L. Hings. April 13, 1965.	628, 629	—	×	—
52° 122°	N.E.	Gerimi and Sam Groups Mastodon-Highland Bell Mines Limited. W. R. Bacon and D. L. Hings. June 22, 1965.	639	×	×	×
52° 122°	S.E.	GM Nos. 1–108 Peter W. Butler. Kenneth C. Rose. January 27, 1965.	597	×	—	×
52° 122°	N.E.	Jan 5 and 6; Summit 5–8 Coast Silver Mines Ltd. D. L. Hings. March 25, 1965.	618	—	×	—
52° 131°	N.W.	D Nos. 1–20 Orville V. Burkinshaw. George A. Wilson. July 28, 1965.	662	×	—	—

Reports Credited for Assessment, 1965—*Continued*

Geographic Position: 1° Quadr.	Geographic Position: Quarter	Property / Owner or Principal / Author of Report / Date of Submission of Report	Report No.	Kind of Work: Geological	Kind of Work: Geophysical	Kind of Work: Geochemical
52° 131°	S.E.	Jib "B" Claim Group Burnaby Iron Mines Limited. W. R. Bacon. March 3, 1965.	617	—	×	—
52° 131°	N.W.	Marven Nos. 1–10 Placid Oil Company. H. R. Morris. February 19, 1965.	645	—	×	—
52° 131°	N.W.	Pogmohom Nos. 1–7 Placid Oil Company. H. R. Morris. February 8, 1965.	598	—	×	—
52° 131°	N.W.	Raven Nos. 1–6 Placid Oil Company. H. R. Morris. February 21, 1965.	644	—	×	—
53° 122°	S.E.	DD Nos. 1–14 Peso Silver Mines Limited. D. R. Morgan. February 17, 1965.	627	—	×	—
53° 122°	N.E.	Hatu Nos. 1–4 Utah Construction & Mining Co. G. A. Noel. May 4, 1965.	633	×	×	—
53° 122°	N.E.	Stone Claims Asbestos Corporation (Explorations) Ltd. John F. Prochnau and W. G. Stevenson. December 23, 1964.	581	×	×	—
53° 129°	S.W.	Banker Claims Falconbridge Nickel Mines Limited. J. J. McDougall. May 28, 1965.	656, 657	—	×	×
53° 130°	S.E.	Waller Nos. 1–8 Falconbridge Nickel Mines Limited. J. J. McDougall. May 28, 1965.	670	—	×	—
53° 132°	S.E.	B.C. Producers 10–13 and Paymaster 13–18 Placid Oil Company. D. W. Smellie. June 11, 1965.	676	—	×	—
53° 132°	S.E.	Young Group Placid Oil Company. H. R. Morris. May 1, 1965.	667	—	×	—
54° 122°	S.E.	JHG Nos. 1–10 and Samson Nos. 1–22 J. H. Gerlitzki. Arthur O. Hall. February 26, 1965.	636	—	×	×
54° 124°	N.E.	Cin Groups Mastodon-Highland Bell Mines Limited. W. R. Bacon. November 3, 1965.	686	—	—	×
54° 125°	S.E.	Bingo Nos. 1–10, 31–40 Endako Mines Ltd. K. M. Dawson and A. M. Laird. September 3, 1965.	666	×	—	—
54° 125°	S.E.	Bingo and Rac Groups Copper Ridge Mines Ltd. C. B. Selmser. September 28, 1965.	691	—	—	×
54° 126°	N.E.	Penn Claims R. W. Falkins. D. L. Hings. September 8, 1965.	664	—	×	—

Reports Credited for Assessment, 1965—*Continued*

Geographic Position		Property / Owner or Principal / Author of Report / Date of Submission of Report	Report No.	Kind of Work		
1° Quadr.	Quarter			Geological	Geophysical	Geochemical
54° 126°	N.E.	Ketza Group J. H. Montgomery. J. H. Montgomery. August 12, 1965.	678	—	×	×
54° 127°	N.W.	Linda 1–24 and Thelma 1–18 Southwest Potash Corporation. J. N. Schindler and R. A. Barker. October 18, 1965.	698	×	—	×
55° 128°	S.E.	Webb-Woodcock Group (Bow, Moose, Deer Claims) Southwest Potash Corporation. H. G. Sherwood. January 21, 1965.	619	×	—	×
55° 129°	N.E.	Basin and Silver Basin Claims John P. McVittie. Tom Gledhill. August 30, 1965.	680	—	×	—
56° 125°	S.E.	Vega 1–10 Croydon Mines Ltd. E. Bronlund. November 1, 1964.	587	—	—	×
56° 126°	N.E.	Sixty Nos. 5, 7, and 8 J. H. Montgomery. D. R. Cochrane. August 5, 1965.	650	×	×	—
56° 126°	S.E.	Soup Claims William H. White. K. C. McTaggart. August 2, 1965.	675	×	—	—
56° 131°	N.E.	Bron 1–48 The Consolidated Mining and Smelting Company of Canada, Limited. A. B. Mawer and J. Richardson. May 4, 1965.	630	×	—	—
57° 130°	S.W.	Bam Nos. 1–21 Kennco Explorations, (Western) Limited. G. H. Rayner and C. S. Ney. September 28, 1965.	695	×	—	—
57° 130°	S.W.	BIK Nos. 161–196 Silver Standard Mines Limited. Charles A. R. Lammle and Keith Whiting. March 2, 1965.	590	×	—	—
57° 130°	N.E.	GJ Claims Conwest Exploration Company Limited. A. R. Dodds. October 8, 1965.	700	—	×	—
57° 130°	S.W.	Mess Claims Skeena Silver Mines Ltd. Franklin L. C. Price. May 27, 1965.	652	—	×	—
57° 130°	N.E.	QC Claims Conwest Exploration Company Limited. A. R. Dodds. October 18, 1965.	701	—	×	—
57° 130°	S.W.	Sno, Bird, and Bud Groups Silver Standard Mines Limited. H. Naylor and W. St. C. Dunn. January 15, 1965.	588	×	—	—
57° 131°	S.E.	BIK 1–86, 221–226 (Stikine East Group) Silver Standard Mines Limited. R. Falconer. October 28, 1965.	687	—	×	—
57° 131°	S.E.	BIK 1–86, 221–226 (Stikine East Group) Silver Standard Mines Limited. R. E. Gale and Keith Whiting. March 10, 1965.	622	×	—	—

REPORTS CREDITED FOR ASSESSMENT, 1965—*Continued*

Geographic Position: 1° Quadr.	Geographic Position: Quarter	Property / Owner or Principal / Author of Report / Date of Submission of Report	Report No.	Kind of Work: Geological	Kind of Work: Geophysical	Kind of Work: Geochemical
57° 131°	S.E.	BIK 1-86, 221-226 (Stikine East Group) Silver Standard Mines Limited. Ralph D. Falconer and Keith Whiting. March 9, 1965.	593	—	×	—
57° 131°	S.E.	BIK 87-116 Silver Standard Mines Limited. Charles A. R. Lammle and Keith Whiting. March 5, 1965.	623	×	—	—
57° 131°	S.E.	BIK 117-136 Silver Standard Mines Limited. Charles A. R. Lammle and Keith Whiting. March 2, 1965.	589	×	—	—
57° 131°	S.E.	BIK 137-160 Silver Standard Mines Limited. R. E. Gale. March 9, 1965.	592	×	—	—
57° 131°	N.W.	BIK 197-220 Silver Standard Mines Limited. Gavin A. Dirom and Charles A. R. Lammle. March 2, 1965.	591	×	—	—
57° 131°	N.W.	BIK 227-269 and BIK 1-3 Fractions (Stikine North Group) Silver Standard Mines Limited. R. D. Falconer. October 28, 1965.	692	—	×	—
57° 131°	N.W.	BIK 227-269 and BIK 1-3 Fractions (Stikine North Group) Silver Standard Mines Limited. R. E. Gale. October 28, 1965.	694	×	—	—
57° 131°	N.W.	BIK 227-269 and BIK 1-3 Fractions (Stikine North Group) Silver Standard Mines Limited. R. D. Falconer. October 28, 1965.	688	—	×	—
57° 131°	S.W.	CW Group Conwest Exploration Company Limited. G. W. Grant. March 18, 1965.	621	×	—	—
57° 131°	S.E.	Goat and Kim Groups Kennco Explorations, (Western) Limited. Philip G. Hallof. September 13, 1965.	681	—	×	—
57° 131°	S.E.	Horn Claims Silver Standard Mines Limited. N. W. Burmeister. November 8, 1965.	697	×	—	—
57° 131°	S.W.	Joan and MB Groups PCE Explorations Limited. S. Asano. September 27, 1965.	685	×	—	—
57° 131°	S.W.	J.W. Nos. 1-14 Kennco Explorations, (Western) Limited. Philip G. Hallof. August 2, 1965.	669	—	×	—
57° 131°	S.W.	OP Nos. 1-15 PCE Explorations Limited. G. R. Kent. September 27, 1965.	682	×	—	—
57° 131°	S.E.	P Nos. 1-52 and CC Nos. 1-6, 13, and 14 A. C. Racicot. H. Naylor and W. St. C. Dunn. January 28, 1965.	603	×	—	—
57° 131°	S.W.	PH Nos. 1-82 Conwest Exploration Company Limited. G. W. Grant. March 19, 1965.	620	×	—	—

Reports Credited for Assessment, 1965—*Continued*

Geographic Position: 1° Quadr.	Quarter	Property / Owner or Principal / Author of Report / Date of Submission of Report	Report No.	Kind of Work: Geological	Geophysical	Geochemical
57° 131°	S.W.	Sil Claims Bralorne Pioneer Mines Limited. D. H. James. July 6, 1965.	643	×	—	—
57° 132°	S.W.	Lot Nos. 34–75 and Soo 1–31 Copper Soo Mining Company Limited. Henry L. Hill. May 26, 1965.	717	×	—	—
58° 129°	S.W.	June 1–12 and Stikine 1–20 Newconex Canadian Exploration Limited. R. D. Westervelt. May 12, 1965.	660	×	×	—
58° 131°	S.W.	Jan No. 13 Group Newmont Mining Corporation of Canada Limited. G. Gutrath and D. M. Cannon. May 26, 1965.	647	—	×	—
58° 131°	S.W.	Ric and Jay Groups Newmont Mining Corporation of Canada Limited. G. Gutrath and D. M. Cannon. May 26, 1965.	648	—	×	—
58° 132°	S.E.	Bing No. 15 Group Newmont Mining Corporation of Canada Limited. G. Gutrath and D. M. Cannon. May 26, 1965.	653	×	—	—
58° 132°	S.E.	Bing claims Newmont Mining Corporation of Canada Limited. G. Gutrath and D. M. Cannon. May 26, 1965.	668	×	×	×
58° 132°	N.W.	K.S. Nos. 1–26 J. T. Williamson. D. M. Cannon and N. L. Tribe. January 12, 1965.	586	×	×	—
59° 129°	S.W.	Ben, Moon, Lori, Anna, and Jerry Claims Canadian Johns-Manville Company Limited. R. H. Janes. December 8, 1965.	702	×	×	—

Placer

CONTENTS

CASSIAR

McDame Creek (59° 129° S.E.)

Centreville.*—George Zimick built an intake, installed a pipe-line and monitor, and hydraulicked 1,000 cubic yards of gravel. The tailings were cleared with a bulldozer. Work was restricted by a shortage of water.

* By W. G. Clarke.

Jade

DEASE LAKE (59° 130° N.E.)

Greengold Jade Leases*

In the summer of 1963 Ben Seywerd, of Victoria, and his brother went into the Dease Lake country to prospect for jade. First they went part way into Wheaton Creek then began prospecting northward along the east side of Dease Lake. Late in the summer a large jade boulder was found on the roadside where a culvert had been built to carry a small creek beneath the Cassiar–Stewart road. In September, 1963, two placer-mining leases were located on the creek, which flows into the north end of Dease Lake at Sawmill Point. Nephrite boulders were found in considerable quantity along the creek for more than a mile east of the road.

Rocks exposed along the creek are mostly argillites and greywackes, but there are outcrops of serpentinite a short distance south of the creek, and a body of serpentinite is mapped by the Geological Survey about a mile north of the creek.

Numerous jade boulders, some up to 5 tons in weight, have been found along the creek. Quality of the material in most instances is difficult to judge from the exposed surfaces, so as a consequence each boulder is initially sampled by breaking a slab along a saw cut 6 to 10 inches deep made with a portable diamond saw. Although some jade is sheared, and some has inclusions of magnetite or is mottled, some material of very good colour has been found.

During the summer Mr. Seywerd was slabbing pieces about 36 inches long, 8 inches deep, and 3 inches wide from a very large boulder almost a mile upstream. Two tons of jade from the creek were sold in West Germany and about 7,000 pounds in Japan.

Jade is reported to have been found on Thibert and Delure Creeks in 1965.

Gerry Davis flew about 25,000 pounds of jade to Dease Lake from his lease on Wheaton Creek.

WHEATON CREEK (58° 128° S.W.)†

Eric Larsen sold his placer lease on Wheaton Creek to C. O. and D. Davis, of Mount Vernon, Wash., who were reported to have had two men working on the property during the summer.

HYLAND RIVER (59° 128° N.E.)†

Placer leases have been staked on both sides of the bridge at Mile 605½, Alaska Highway. Steve Serli did some testing on his claims below the bridge. F. A. Warbits did a little work on his lease farther downstream.

OMINECA

MCCONNELL CREEK (56° 126° N.E.)†

McConnell Creek (Columbia Placers Limited)

Company office, 161 Rivola Road, Weston, Ont. F. J. Savelli, president; Gene Jack, superintendent. The McConnell Creek property consists of two special leases and five leases owned and optioned. It is reached by a tractor-trail 105 miles long from the end of the truck-road at Uslika Lake or by aircraft to McConnell Lake, which is 7 miles north of the camp. Test work continued on three leases and consisted of digging nine trenches, a total length

* By Stuart S. Holland.
† By W. G. Clarke.

of 500 feet, and 108 test pits, about 9 feet deep, by hand, back-hoe, and bulldozer. A seismic survey was made to determine depth of bedrock on one lease. Forty-two Keystone-drill holes totalling 1,025 feet were put down. An access road was built from the property to McConnell Lake. The property was not visited.

OSILINKA RIVER (56° 124° S.E.)*

Further test drilling was done on the leases at the mouth of Osilinka River held by Western Gold Corporation Ltd., Vancouver. Gene Jack was in charge of work on the property under the supervision of R. E. Legg. The property was not visited.

MANSON CREEK (55° 124° N.W.)†

The Martin Mines Limited

Mrs. W. Tait, president. A drill-road was built up Slate Creek, and a muskeg was drained by a ditch dug by dragline shovel and bulldozer. The company explored the Nation River for platinum 22 miles below the crossing.

John Nielsen did assessment work on his leases on Kildare Gulch and Manson Creek.

SLATE CREEK (55° 124° N.E.)*

Gene Jack did some stripping and test-pitting and built a trail on his Slate Creek leases.

TWENTY MILE CREEK (55° 125° N.E.)*

Sven Kilburg and Dan Nickich staked placer leases on Twenty Mile Creek.

CARIBOO‡

HIXON CREEK (53° 122° S.W.)

Hixon Creek Placers (Chilco Explorations Limited)

Company office, 4136—39th Street Southwest, Seattle, Wash. H. B. Mills, president. This group of 21 placer leases is under lease to Chilco Explorations Limited. In 1965 a crew of 18 men worked from the beginning of May until the end of June. During this time 648 feet of sluice-box was aligned and levelled. The lower end of the pipe-line was relocated, repaired, and caulked. The access road was gravelled and some culverts repaired. A shortage of water stopped hydraulicking after five weeks of operation. Approximately 60,000 cubic yards of gravel was washed in this period.

Little Hixon Creek.—Harold Thorp staked a lease 900 feet above the mouth of the creek. He had a bulldozer clear the stream-bed.

Canyon Creek.—Roy Stanyer is reported to have tried a small suction dredge on his lease at the mouth of Canyon Creek.

AHBAU CREEK (53° 122° S.E.)

Lodi (Lodi Mines Ltd.)

Company office, 1236 West 40th Avenue, Vancouver 13. Evan A. Burnett, senior and junior, owners. This property consists of three special leases covering 3,108 acres. Some trenching was done by bulldozer, two shafts totalling 80 feet

* By H. Bapty.
† By H. Bapty and W. G. Clarke.
‡ By W. G. Clarke, except as noted.

were sunk, and twenty-three 4-inch drill-holes totalling 1,942 feet were put down. Seven men worked on the placer leases for seven months under the direction of the owners. The property was not visited.

Cottonwood River (53° 122° S.E.)

Jeahet Mine.—Mr. and Mrs. Chet Estabrooke did some testing on their leases, which are 1 mile above the old highway crossing on the Cottonwood River.

Swift River (52° 122° N.E.)

Cottonwood Placers (Inland Gold)

Company office, 556 Howe Street, Vancouver 1. G. O. MacLaren, president. Inland Gold had an option on Cottonwood Placers' leases on the Swift River, about 5 miles south of the Wells highway, and accessible by a forest access road. A test-pit of 5,000 cubic yards of gravel was taken out by hydraulic using a No. 4 monitor and water from a 12-inch pump. The washing plant was a 30-inch sluice-box fitted with Hungarian-type riffles. Work was under the supervision of James McKelvie.

Willow River (53° 121° S.W.)

Coulter Creek.—Fleurmont Placers Development Ltd. reported to have had four men and a small bulldozer working on Coulter Creek, where they have a No. 4 monitor.

Antler Creek (53° 121° S.E.)

Grouse Creek Mines Ltd.

Company office, 501, 615 West Pender Street, Vancouver 2. D. L. McRae, president. This property is 5 miles from Barkerville and connected by a gravel road. Seismic surveys and churn drilling were done in 1963 to map the bedrock surface and try to trace the old Heron channel. The past two years have been spent in sinking a shaft and drifting on bedrock. Some 500 feet of drifting was done in 1965, but the workings caved (*see* Dangerous Occurrences) and were abandoned. A new shaft was collared 300 feet from the old. The headframe was finished at the end of the year. There was an average of six men employed in 1965.

Begg's Gulch.—Harry Wade had two men and a bulldozer working on his lease.

Lightning Creek (53° 122° S.E.)

Stanley

Tom Crawford worked his two placer leases, which extend a mile up Lightning Creek from Stanley. He had a bulldozer clear the creek, and he is now cutting a trench toward high ground beyond the old workings.

Quesnel River (52° 121° N.W.)*

McMartin Explorations Ltd.

Company office, 1232 Flury Road, Richmond. N. Pentecost, president. This company holds ground on Little Lake Creek, a tributary of Morehead Creek. During 1965 installation of a hydraulic pipe-line was completed, and in July hydraulicking commenced above the old Morehead pit. An average crew of five men was employed under the direction of Arthur Christmas.

* By W. C. Robinson.

Spanish Placers Ltd.—Registered office, 703, 470 Granville Street, Vancouver 2; mine office, Likely. D. R. Harris, president. In 1965 D. R. Harris and F. P. Clark continued to operate a hydraulic pit on the south bank of the Cariboo River about 1 mile below Spanish Creek. Water for the monitor was supplied from the Cariboo River by a diesel-driven pump having a rated capacity of 7,500 gallons per minute.

Keithley Creek (52° 121° N.E.)*

Ernest Lang worked with two men on his lease 1,700 feet below the confluence of Snowshoe and Keithley Creeks. Underground exploration was continued in 1965, and a further 80 feet of drifting was done from the bottom of the shaft in an attempt to locate the centre of the old channel of Keithley Creek. Other work consisted of drilling five test-holes from underground.

Little Snowshoe Creek.—Tom Kinvig worked on his lease about 1½ miles upstream from the mouth of the creek.

Barr Creek—McMartin Explorations Ltd. made preparations to start a hydraulic operation on Barr Creek. During 1965 work included road construction. A crew of six men was employed under the supervision of R. Grant.

Harvey Creek Mines Ltd.—Company office, 203, 955 West Hastings Street, Vancouver 1. This company holds seven leases on Nigger Creek. During 1965 approximately 40,000 yards of gravel was hydraulicked. Other work included road construction. An average crew of three men was employed under the supervision of Barney Boe between May 26th and July 8th.

Nigger Creek.—John Monet worked on his lease on Nigger Creek.

TULAMEEN

Tulameen River (49° 120° N.W.)†

Olivine Exploration Company Limited—Company office, Tulameen. Fernand Lemieux, president and manager. This company owns eight placer leases on the south side of the Tulameen River. Access is by good road 5 miles west of Tulameen. The scene of activity in 1965 was a glacial outwash deposit, part of a kame terrace high above the river. A keystone-drill hole is reported to have penetrated 150 feet of this material, largely gravel.

A building was erected to house a plant for the announced purpose of recovering fine gold. The plant involved screen sizing and the grinding of certain sizes. Recovery was to be in a jig and on amalgam plates. There was no production. A crew of 22 men was employed.

CRANBROOK‡

Moyie River (49° 115° S.W.)

Monilee—This property is at the lower end of the falls on the Moyie River and has been sub-leased from D. J. Oscarson, of Kimberley, by T. O. Bloomer and P. Kotush. Two small adit

* By W. C. Robinson.
† By M. S. Hedley.
‡ By D. R. Morgan.

tunnels have been driven toward and below an old channel. During 1965 the No. 2 adit was advanced 35 feet. Work was confined to week-ends. There was no activity in the No. 1 adit. No gold was recovered.

FORT STEELE*

Maus Creek (49° 115° N.W.)

Maus Minerals Ltd. Registered office, 209 British Canadian Trust Building, Lethbridge, Alta. G. R. Castles, president. This company, formed in 1964, holds a controlling interest in four placer leases on Maus Creek, 4 miles east of Fort Steele. A crew of three men extended the Strickland shaft 9 feet to bedrock during 1965 and started drifting. The men were employed for a period of two months. There was no gold recovery.

KIMBERLEY*

Lisbon Creek (49° 115° N.W.)

During 1965 R. E. Williams and W. Kludash, of Kimberley, extended a small adit a distance of 15 feet on their placer lease near the confluence of Lisbon and Perry Creeks. The work was confined to week-ends. There was no gold recovery.

CANAL FLATS*

Findlay Creek (50° 115° S.W.)

Hobbs & Hallverson Office address, 1222—18th Street Northwest, Calgary, Alta. These two partners moved equipment onto their four placer leases at the confluence of Deer and Findlay Creeks, 12 miles west of Canal Flats, but did not start operating. The equipment includes one cubic-yard dragline, portable concentrator, 5 by 10 double-deck vibrating screen, one 100-kva. generator, and a D-6 cat.

McKellor P.M.L. 262.—Roy McKellor, of Calgary, Alta., worked alone for a period of three months during the summer of 1965 and hydraulicked and sluiced approximately 200 yards of gravel from his lease on the bank of Findlay Creek, 12 miles west of Canal Flats.

* By D. R. Morgan.

Old steam shovel on Perry Creek. This was a railway shovel, and it was taken in on sections of track under its own power in 1903.

Overshot water-wheel on Perry Creek. This 32-foot wheel was built in 1933 and was moved bodily to Fort Steele in 1965 to form part of a historical exhibit.

Structural Materials and Industrial Minerals

CONTENTS

ASBESTOS

Cassiar Asbestos Corporation Limited*

Mount McDame (59° 129° S.W.). Head office, 1001, 85 Richmond Street West, Toronto, Ont.; mine office, Cassiar. J. D. Christian, president; A. C. Beguin, general superintendent. The property, which consists of 42 Crown-granted and 5 leased claims, is 86 miles by road southwesterly from Mile 648.8 on the Alaska Highway. The open-pit mine is on the top of Mount McDame, between 5,930 and 6,500 feet elevation, while the mill and townsite are in Troutline Creek valley at 3,500 feet elevation.

As a result of continuous operation throughout 1965, 743,765 tons of ore was mined from five benches between 5,930 and 6,050 feet elevation and 4,548,007 tons of waste was mined from 14 benches between 5,930 and 6,500 feet elevation. The rock reject plant at the mine treated 579,604 tons, rejecting 169,134 tons or 29.2 per cent. Approximately 500,000 tons of concentrate and raw ore was delivered from the mine to the mill by tram-line, and the remainder was hauled by truck. The mill produced 85,549 tons of fibre. There were approximately 500 employees.

New plant construction included an ammonium nitrate storage building, a truck-loading bin at the rock reject plant, and an enclosure for No. 26 conveyor

* By W. G. Clarke.

(at the mill waste dump). The streets were paved in the townsite, one frame house was built, and additions were made to the Snack Bar and the Curling Club.

Major pit equipment acquired during 1965 included a Northwest 80-D shovel, a Bucyrus-Erie 40-R rotary drill, and four Kenworth-Dart 40-ton trucks. Additional mill equipment was installed also.

On October 25, 1965, there was a slide of some 7,000,000 tons of material from the 6270 dump at the pit into Troutline Creek valley (*see* " Dangerous Occurrences "). Approximately 5,000,000 tons of waste was put on the 6270 dump between February, 1962, and July, 1963. Both the dump and the hillside were inspected periodically and no abnormal subsidence was observed. In July, 1965, the dump was put into use again and approximately 1,000,000 tons of waste had been added when the slide occurred. Surface material on the hillside was gouged out and added to the mass.

Apparently the slide was caused by three factors:—

(1) The slope of the ground on which the dump was built. The hillside was inclined at 24 degrees at the toe of the dump and steepened to 49 degrees at the top. The angle of repose of this material is 37 degrees.

(2) The flow of ground-water. After the slide it was evident there had been water seepage underneath the dump. Flowing water could have thawed a layer of material between the waste and the hillside, and acted as a lubricant.

(3) The amount of material on the dump. Apparently there is a limit to the amount that may be placed on a dump of this type. In this case there was no evidence of overloading. There appeared to be no abnormal subsidence or bulging of the toe when an examination was made a few hours before the slide. The dump was visibly unstable for only a few seconds; there was very little warning of the impending movement.

An investigation of the stability of other dumps at Cassiar is continuing. (*See* Annual Report, 1960, pp. 127–128.)

ZUS (Canadian Johns-Manville Company Limited)*

(59° 129° S.W.) Company office, Asbestos, P.Q.; field office, 1955 West Fourth Avenue, Vancouver 9. The Zus Mountain chrysotile occurrence, at the headwaters of the Little Blue River, consists of 31 claims held under option. The property is 10 miles by road north and east from Cassiar. A magnetometer survey of the property was made and seven trenches with an aggregate length of 2,250 feet were cut by a bulldozer. Four men were employed for one month under the direction of R. Janes, geologist. The option was terminated. The property was not visited. (*See* Annual Report, 1951, p. 209.)

BARITE

Bear, Moose, Beaver Groups†

(59° 127° N.E.) Magnet Cove Barium Company, of 510 Fifth Street Southwest, Calgary, Alta., holds by record 36 claims on a barite deposit a few miles northeast of mile-post 548 on the Alaska Highway. The first four claims were located on the discovery in October, 1963, by Gordon B. Smith, of Edmonton. These were taken over by the company in 1964. Since then the company has recorded the other claims at intervals. During a brief examination made at the end

* By W. G. Clarke.
† By J. W. McCammon.

of June, 1965, two showings of barite were seen. These are 4½ miles northeast of mile-post 548. They can be reached by a road, suitable for four-wheel-drive vehicles in dry weather, that branches north off the Alaska Highway one-quarter mile west of mile-post 547, with an auxiliary entry at mile-post 548.

The claims are in an area of gently rolling jack pine country that contains numerous small lakes and swamps. Bedrock outcrops are few, small, and isolated. The only rock seen was at the barite showings.

One showing is on the west side of a low knoll at the end of the main road. An area roughly 400 feet long and 150 feet wide has been stripped of overburden. The exposed bedrock consists of thinly laminated brown to grey argillite. Much of the rock is brecciated into sharp angled fragments 1 inch or less in diameter, some closely packed and some relatively widely spaced in a sometimes vuggy siliceous matrix. Barite is present as vein segments, pods, and narrow stringers. The largest mass of barite seen is at the southwest end of the stripped area. Here a vein 20 feet wide is exposed from an 8-foot-high bluff for 60 feet in an easterly direction. On the south side the vein is covered; on the north it is in contact with brecciated argillite along a vertical wall that strikes north 77 degrees east. The vein is streaked grey and white and is ribboned by fractures parallel to its north wall. Galena and minor sphalerite are present in irregular patches along some fractures; other fractures are open and contain a honeycombed arrangement of barite crystals. The east end of the vein is covered. About 360 feet northeast of this main vein another vein 3 to 5 feet wide is exposed for 15 feet on a strike of north 5 degrees west across a roadway. The bedrock around it is sheared and brecciated. The only other barite recognized was in pods less than 3 feet in maximum dimension and in randomly oriented thin veinlets with quartz scattered throughout the exposure. Small piles of rock chips were examined at numerous drill-hole sites on rough roadways in the surrounding area, but no barite was recognized in any of them.

About 1,000 feet in a direction south 50 degrees west from the above showing another stripped area 300 feet long in a north 60 degrees east direction and 100 feet wide was examined. In this showing, yellow to whitish barite is exposed in scattered isolated patches up to 3 feet in diameter and in an irregular vein-like mass that extends the length of the clearing. The maximum continuous width of the main mass is 10 feet. Surrounding rock is brecciated and closely fractured argillite with numerous small barite and quartz veinlets similar to that at the first showing.

In one exposure on the road midway between the barite showings the rocks strike north 30 degrees west and dip 65 degrees east. Elsewhere the beds are flat or strike northerly with low dips to the east.

Two samples were collected: No. 1 consisted of chips taken from across the 20-foot width of the vein exposed in the bluff at the southwest end of the first showing, and No. 2 consisted of chips collected at random from the surface of the barite exposed in the second exposure. The percentage compositions of the samples were as follows:—

No. 1: $BaO=52.80$; $SO_3=27.72$; $CaO=0.11$; $SiO_2=16.26$.
No. 2: $BaO=64.52$; $SO_3=33.94$; $CaO=0.00$; $SiO_2=1.35$.

Mountain Minerals Limited* Company office, P.O. Box 700, 529 Sixth Street South, Lethbridge, Alta.; quarry office, Brisco. R. A. Thrall, managing director; William McPherson, superintendent. This company owns and operates barite properties at Brisco

* By D. R. Morgan.

(50° 116° N.E.) and Parson (51° 116° S.W.) in the Columbia valley, south of Golden. A detailed description of the properties is included in the 1958 Annual Report.

The main activity in 1965 was at the Brisco property, where a crew of three men mined, crushed, and shipped 5,516 tons of barite to the company's processing plant at Lethbridge. The whole production came from the underground drift below No. 1 quarry. No barite was mined at the Parson property, but the same crew of three men loaded and shipped 1,088 tons of chemical-grade barite to Montreal from the barite that was mined and stockpiled on the property in 1964. The men were employed for a period of about nine months.

Baroid of Canada, Ltd.*

Spillimacheen (50° 116° N.E.). Company office, 44 King Street West, Toronto, Ont. J. A. Martino, president; H. K. Beggs, plant superintendent. This company, a subsidiary of National Lead Company, Ltd., of Houston, Texas, owns and operates the old Giant Mascot lead and zinc property at Spillimacheen, south of Golden, for the purpose of producing barite. The property was purchased in 1960, and since that time most of the activities have been directed to the recovery of barite from a large tailings dump that was left by the former operators. The tailings are loaded by a front-end loader, trucked to the mill, and crushed to a slurry by a new unit that was installed in 1960. A barite concentrate is then recovered by a new set of separation tables and dewatered by a Dorrco filter.

During 1965 a crew of eight men treated and recovered 8,093 tons of barite. The barite was trucked to a siding on the Kootenay Central Railway at Spillimacheen, and shipped by rail to the company's processing plant at Onaway, Alta. The men were employed for four months, and work was suspended for the winter in October. There were no major changes during 1965. One mechanic remained on the property during the winter months.

BERYL

Lynda and MM1 (Richfield Oil Corporation)*

(49° 116° N.E.) Field office, 320 Seventh Avenue Southwest, Calgary, Alta. This property is on the west fork of Hellroaring Creek, 10 miles southwest of Kimberley, and is reached by road from Marysville. The property comprises 56 mineral claims, part of which are optioned by the company and others held by record. The claims are located at elevations ranging from 4,000 to 7,000 feet. A crew of four men trenched some 5,000 feet with a D-8 "Cat" during a period of six weeks in the summer of 1965. A portable drill was used for drilling and blasting samples from some 1,200 feet of pegmatite showing exposed by the trenching. The work was under the direction of A. J. Drysdale, geologist.

BUILDING-STONE

Peter Kiewit Sons Company of Canada Limited†

Kitsumkalum River (54° 128° N.W.). Head office, 2412 Columbia Street, Vancouver 10. J. Murray, job superintendent. A portable crushing plant was set up alongside the Canadian National Railway on a spur about a mile north of Highway 16, 3½ miles west of Terrace. Rock

* By D. R. Morgan.
† By H. Bapty.

was quarried nearby and trucked to the crushing plant, where it was crushed, sized, and cleaned for railroad ballast. Several large stockpiles were stored for future use. The plant ceased operation in September. It was not visited.

International Marble & Stone Company Limited* Sirdar (49° 116° S.W.). Company office, 4030 Seventh Street Southeast, Calgary, Alta.; plant office, Sirdar. H. Rennich, manager; A. Rennich, pit superintendent; W. Cyzborr, plant superintendent. The company operates a crushing and bagging plant near Sirdar and several pits near Crawford Bay. Products include dolomite chips, limestone grit, quartzite chips, and granite grit. Production was increased during 1965.

Sheep Creek* (49° 117° S.E.) More than 100 tons of facing-stone was produced from quartzite beds exposed in the vicinity of Sheep Creek. Most of this material was sold locally.

Porcupine Creek* (49° 117° S.E.) Jim Bakken and partners, of Salmo, produced several tons of quartzite facing-stone from their quarry on Porcupine Creek. This stone was crated near the mouth of Porcupine Creek and then sold through International Marble & Stone Company Limited.

Continental Marble and Granite Ltd.† (49° 119° S.E.) Company office, 880 Beach Avenue, Vancouver 1. This company operated a quarry located adjacent to the highway in a large granite deposit 9 miles south of Beaverdell. The product is trucked to Beaverdell and then shipped by Canadian Pacific Railway to Vancouver. The stone is crushed and sized for use as facing material in building blocks. A crew of three men was employed under the direction of Harold Thomas.

Valley Granite Products Limited‡ Cheam View (49° 121° S.W.). Company office, 410 Mayfair Avenue, Chilliwack; plant, Cheam View. K. Jessiman, general manager. The quarry and plant are on the west side of the Trans-Canada Highway about 10 miles west of Hope. The plant consists of a jaw and cone crusher, drier, screens, and bagging machinery. A crew of six men produced 6,287 tons of granite products in 1965. This is reported to be slightly less than the 1964 production. The principal market is for sand blasting, filler, concrete mix, chicken grit, roofing rock, and stucco dash.

Inland Quarries Ltd.‡—This company did not operate a quarry during 1965.

Ocean Cement Limited (Gilley Quarry)§ Pitt River (49° 122° S.W.). Company office, 1295 West 77th Avenue, Vancouver 14. N. D. MacRitchie, manager, Evco Aggregates Division; Francis J. MacDonald, quarry superintendent. The quarry is on the west bank of Pitt River immediately south of its confluence with Munro Creek. During a nine-month operating period, a crew of 11 men produced 109,547 tons of quartz diorite.

* By P. E. Olson.
† By D. Smith.
‡ By A. R. C. James.
§ By J. E. Merrett.

Parsons Tractor Service Ltd.*—(50° 124° N.W.) Company office, Box 130, Powell River. Six men were employed to produce 8,000 cubic yards of rock from a quarry immediately east of Cranberry Lake. The material was used for foundation rock fill for the expansion of the MacMillan, Bloedel and Powell River (B.C.) Limited pulp and paper plant at Powell River.

Northern Construction Company & J. W. Stewart Limited.*—Haddington Island (50° 127° N.E.). Company office, 1304 Hornby Street, Vancouver 1. A crew of eight men was employed for three months quarrying and shipping 1,500 tons of andesite to be used for facing the new Provincial museum that is being constructed in Victoria, adjacent to the Parliament Buildings.

CEMENT

Ocean Cement Limited (B.C. Cement Division).†—Bamberton (48° 123° N.W.). Head office, north foot of Columbia Street, Vancouver 4. W. F. Foster, president; B. M. Brabant, executive vice-president; R. E. Haskins, vice-president in charge of production. During 1965 this company operated its cement plant at approximately two-thirds rated capacity.

Lafarge Cement of North America Ltd.†—Lulu Island (49° 123° S.E.). This company operated its cement plant above rated capacity during 1965.

CLAY AND SHALE

Mountain Minerals Limited‡—Canal Flats (50° 115° S.W.). Company office, P.O. Box 700, 529 Sixth Street South, Lethbridge, Alta. R. A. Thrall, managing director; William McPherson, superintendent. This property is at the bottom of Thunder Hill, 2 miles west of Canal Flats. A crew of three men quarried and loaded 903 tons of shale during a period of three weeks in the summer of 1965 for shipment to the company's processing plant at Lethbridge.

Clayburn-Harbison Ltd.*—(49° 122° S.E.) Head office, 1690 West Broadway, Vancouver 9; plants, Kilgard and Abbotsford. R. M. Hungerford, president; G. H. Peterson, general manager; Brian Stephens, mine superintendent. Two plants are operated by this company—one at Kilgard, where sewer pipe and flue linings are manufactured, and the other at Abbotsford, where face and refractory bricks are made. Clay was produced from two underground and two open-pit operations. Eight men employed underground in the Fireclay and New Fireclay adits at Kilgard produced 28,032 tons of clay. Two men employed at the Kilgard No. 9 pit, on the mountain above the Fireclay portal and at the Selby pit, 2½ miles east of Abbotsford, produced 60,305 tons of clay. The combined production of the two plants was 77,670 tons of clay products.

A new pit has been opened immediately west of Straiton road, 1½ miles north of Kilgard.

* By J. E. Merrett.
† By J. W. McCammon.
‡ By D. R. Morgan.

Richmix Clay Products Ltd.*—Kilgard (49° 122° S.E.). Office and plant, 2890 Kent Avenue East, Vancouver 16; quarry, Kilgard. G. W. Richmond, manager. The quarry is immediately south of the New Fireclay portal of Clayburn-Harbison Ltd. One man quarried and trucked to Vancouver 7,907 tons of fireclay.

Haney Brick and Tile Limited*—Haney (49° 122° S.W.). Company office and plant, Haney. E. G. Baynes, president; J. Hadgkiss, managing director. Two men were employed removing clay from a pit with the aid of a power-shovel, and surface scraping clay from an area adjacent to the plant, which is on the north bank of the Fraser River at Haney. Twenty-seven men were employed in the plant, which produced 10,152 tons of clay products consisting of face brick, common brick, drain and structural tile, flue lining, and flower-pots.

Mainland Clay Products Limited*—Barnet (49° 122° S.W.). Head office, 8699 Angus Drive, Vancouver 14; plant, Barnet. This company, a subsidiary of Pitkethly Brothers Limited, employing a crew of two men, used 735 tons of clay and associated materials to produce red clay building-bricks and firebricks at the plant adjacent to the highway on the north slope of Burnaby Mountain. Clay for the building-bricks was obtained from an adjacent pit, and fireclay was obtained from Kilgard.

Fairey & Company Limited.†—Vancouver (49° 123° S.E.). L. T. Fairey, manager. This company produced a variety of fireclay bricks, shapes, and cements from local and imported raw materials.

British Columbia Lightweight Aggregate Ltd.†—Saturna Island (48° 123° N.E.). This company shipped 85,906 cubic yards of expanded shale aggregate in 1965.

DIATOMITE

Fairey & Company Limited.†—Quesnel (53° 122° S.W.). Company office and plant, 661 Taylor Street, Vancouver 3. L. T. Fairey, president. Diatomite was quarried from Lot 6182 at Moose Heights and shipped to the Vancouver plant.

Crownite Diatoms Ltd.†—Quesnel (52° 122° N.W.). Head office, 507, 1640—16th Avenue Northwest, Calgary, Alta.; mine and mill, Quesnel. H. A. Carswell, president. This company owns a diatomite deposit on Lot 906 in West Quesnel and leases a shale deposit just south of Quesnel. It also operates a milling plant located on Lot 906 in which diatomite and shale pozzolan are processed and packaged. Several hundred tons of the pozzolan was shipped to the Peace River area for use in the construction of the Portage Mountain dam in 1965.

DOLOMITE

International Marble & Stone Company Limited.†—Crawford Creek (49° 116° N.W.). *See* report under Building-stone.

* By J. E. Merrett.
† By J. W. McCammon.

FLUORITE

Eaglet Group* Quesnel Lake (52° 120° N.W.). The Eaglet Group consists of 10 claims located on a fluorite showing on the east side of Quesnel Lake 2 miles northeast of the point at the junction of the North Arm and the main lake. The fluorite was discovered in 1946 by H. H. Forster. Six of the claims are at present registered in his name, and the others are registered in the name of C. D. P. Johnson. Both men live in Kamloops.

The claims are between 100 and 800 feet above the lake along the hillside half a mile north of the mouth of Wasko Creek. This creek flows westward into a small bay on the North Arm. The best exposure of fluorite mineralization is in the lower part of the canyon of the most westerly tributary that flows southward into Wasko Creek.

Access to the property is by road for 70 miles from 150 Mile House, on the Cariboo Highway, via Horsefly to the south shore of Quesnel Lake and thence by boat for about 5 miles across the lake to a cabin camp-site on the shore half a mile west of the mouth of Wasko Creek. A rough logging-road extends for 4,000 feet northeastward from the camp-site to the lower end of the canyon.

The fluorite mineralization is in quartz-feldspar-mica gneiss injected with masses of pegmatite, aplite, and granitic rock of normal texture. Foliation in the gneiss strikes east to northeastward and dips 35 to 45 degrees to the north. Just below the third falls in the tributary creek, about 2,000 feet up from the mouth of the canyon, the gneiss encloses a narrow band of limestone, and within a short distance farther upstream it is in contact with mica schist of apparent conformable attitude. The rocks are highly fractured by numerous joints and faults that fit roughly into two sets—one that strikes north to slightly west of north and is generally nearly vertical, and a second that strikes northeastward and is vertical or dips steeply to the southeast.

The fluorite occurs as grains disseminated in the country rock, as thin films on fractures, as veinlets and scattered veins as much as 6 inches thick, and as pods and irregular masses 6 to 8 inches wide. The colour ranges from pale greenish white through blues to blackish purple, most commonly being blue. The dark shades rapidly lose colour when exposed to the weather. Quartz is the most abundant associated mineral. Minor amounts of calcite, some of which fluoresces bright reddish orange, dickite, celestite, pyrite, galena, sphalerite, molybdenite, and allanite also are found with the fluorite. In certain zones, microcline and albite with sericite are strongly developed.

Mineralization is well exposed through the canyon of the tributary creek, wherein it extends from the canyon mouth at 2,530 feet elevation for 2,000 feet upstream to the third falls at 2,990 feet elevation. Little fluorite has been found above the falls. The walls of the canyon are nearly vertical and range from 50 to 100 or more feet high. Where access could be gained, typical mineralization was found up the walls. Eastward from the top of the canyon wall there are few bedrock exposures, so the extent of mineralization in that direction is unknown. To the west, discontinuous but relatively closely spaced outcrops show fluorite mineralization in the gneiss for 1,200 feet. Exposures are scarce beyond this, and fluorite is not common. At a point on the lake-shore 1 mile farther west, the gneiss outcrops again and it contains some fluorite.

A few scattered shallow trenches have been dug on the property, and access trails have been built to various parts of the canyon.

* By J. W. McCammon.

Because of the disseminated and irregular nature of the mineralization, this is a difficult property to sample, and a reasonable assessment could only be obtained by using some method of bulk sampling. No concentrations of fluorite sufficient for mining to produce shipping ore were seen. The value of the property lies in the possibility that development might prove it to be a large low-grade deposit containing material capable of being economically concentrated to a marketable product.

Rock Candy (The Consolidated Mining and Smelting Company of Canada, Limited)*

(49° 118° S.E.) Exploration office, 1150 Bay Avenue, Trail. The Rock Candy property of 23 Crown-granted and recorded mineral claims owned by the company is on Kennedy Creek, which flows into the North Fork of the Kettle River from the west, about 15 miles from Grand Forks. The mine has been operated in the past by the company as a source of fluorite. Mineralization occurs along a contact between syenite and volcanics. Diamond drilling amounting to 508 feet was done with a view to finding further indication of fluorite along the contact. The work was supervised by G. J. Ryznar.

GYPSUM

O'Conner (Falconbridge Nickel Mines Limited)†

(59° 136° N.W.) Company office, 7 King Street East, Toronto 1, Ont. H. J. Fraser, president; A. Smith, manager; J. J. McDougall, engineer in charge on the property. The property consists of 20 recorded claims on a gypsum deposit 53 miles west-northwest of Skagway. Five men worked for one month diamond drilling 1,000 feet and blasting two rock cuts 3 to 6 feet deep and 45 feet long. Transportation to the property was by helicopter. The property was not visited. (*See* Annual Report, 1960, p. 139.)

Western Gypsum Products Limited‡

Windermere (50° 115° S.W.). Company office, 2650 Lakeshore Highway, Clarkson, Ont.; quarry office, Athalmer. Nigel W. Puttock, president; A. E. Portman, superintendent. This company owns and operates a large gypsum property on the north side of Windermere Creek 8 miles east of Windermere. It comprises 84 claims, and is served by a private mining-road from the mill at Wilmer that crosses No. 95 highway north of Invermere Junction. The property has been in operation many years, and a detailed description has been given in past Annual Reports.

All of the 1965 production came from the No. 3 quarry, opened in 1964. The gypsum is over 100 feet thick. It is mined in 15-foot lifts, loaded by power-shovel, and transported in 50-ton tandem trucks to the crushing plant adjacent to the Kootenay Central Railway, near Wilmer. Total production in 1965 was 258,420 tons, of which 207,858 tons was crushed and shipped by rail and the remainder placed on stockpile. The operation was active the year round. The average number of men employed was 20.

LIMESTONE

Terrace Calcium Co.§

Terrace (54° 128° N.W.). This company, organized by Art Curfman, of P.O. Box 207, Terrace, has a 150-acre lease on a deposit of Permian limestone on Copper Mountain, 4½ miles due east of Terrace. The limestone is on the south-

* By P. E. Olson.
† By H. Bapty.
‡ By D. R. Morgan.
§ By J. W. McCammon.

western part of the flattish top of the mountain about 3,000 feet above sea-level. A road being built to a microwave relay station site on Mount Thornhill passes through the southeast corner of the lease. It is 4.3 miles from the deposit down this road to its junction with the Kitimat Highway 4½ miles south of the Skeena River bridge. Except for the southwest corner, where the ground drops off sharply into a small basin, the area covered by the lease consists of gently rolling park-like country.

On Geological Survey of Canada Map 1136A, Terrace, the limestone is shown as a crescent-shaped mass about 2½ miles long and up to three-quarters of a mile wide. This mass is a detached part of a limestone band that extends for 8 miles to the east. When examined in mid-June, 1965, most of the ground was covered with snow and the boundaries of the limestone on the lease could not be determined. The exposures that could be seen suggest that the limestone forms a rather flat-lying body above siliceous and slaty argillites. Near the southeast corner of the lease, just below a sharp bend in the road, the limestone forms a 15-foot-high bluff about 60 feet long in a northerly direction. At the south end of the bluff the limestone has been intruded by an irregular body of white quartz, and a mixed mass of quartz, calcite, and various calcium silicates has been formed. Intermittent outcrops of limestone were seen in cuts along the road for 1,500 feet northeasterly from the bend above the bluff. Good exposures were also seen for 250 feet along the bed of a small creek that flows southwest parallel to the road and about 300 feet northwest of it. To the east of the road and not in contact with the limestone, some beds of cherty and slaty argillites were noted. These beds strike north 30 degrees east and dip 45 degrees northwest under the limestone. Fine-grained massive sericitic quartzite is exposed in the creek bed below a small falls at the southwest limit of the limestone in the creek some 200 feet northwest of the limestone bluff previously mentioned. No other rock outcrops were exposed in the immediate vicinity. Except for the siliceous material at the bluff, most of the limestone seen consisted of medium- to coarse-grained crystalline rock, generally very white but with occasional grey streaks. One lens of granular magnetite about 8 feet wide was noticed in an outcrop in the creek bed. Along the bluff a strong set of joints has developed. The joints are spaced at 2-inch to 1-foot intervals, strike southeasterly, and dip steeply westward. Three samples of limestone were collected for analyses. Sample No. 1 consisted of chips gathered on a line for 60 feet along the base of the bluff previously mentioned, No. 2 consisted of chips gathered at 10-foot intervals for 200 feet along the creek bed from the top of the falls northeastward, and No. 3 consisted of random chips collected from road cuts for 1,500 feet along the road across the southeast side of the lease. The analyses of the samples were as shown in the table below:—

Sample	Insol.	R_2O_3	Fe_2O_3	MnO	MgO	CaO	P_2O_5	S	Ig. Loss	H_2O (105° C.)
No. 1	0.51	0.11	0.07	———	0.30	55.28	0.03	0.004	43.61	0.04
No. 2	0.36	0.12	0.04	———	0.29	55.36	0.03	0.002	43.52	0.03
No. 3	0.34	0.10	0.06	0.01	0.29	55.34	0.03	0.003	43.49	0.04

McLeod Lake*

(54° 122° N.W.) Two samples of limestone were collected from outcrops on logging-roads east of the Hart Highway near McLeod Lake. Sample No. 1 consisted of chips collected at random across a 50-foot thickness of beds of limestone in a small road-material quarry six-tenths of a mile east of the highway on the Hodgkin, King, and

* By J. W. McCammon.

Marble Company logging-road that leaves the highway at Mile 72 north of Prince George. The limestone is black fetid siliceous rock containing lenses and seams of dark chert. In places the fracture surfaces are covered with a bright blue bloom. The rocks strike north 10 degrees west and dip 58 degrees west. Glacial overburden is from a foot to several feet thick. On Geological Survey of Canada Map 2-1962, McLeod Lake, the rock is indicated as being of Upper Ordovician or Mid Silurian age. The sample had the following chemical composition: Insol.=12.34; R_2O_3 =2.04; Fe_2O_3=0.29; MnO=0.02; MgO=13.59; CaO=31.88; P_2O_5=0.03; S=0.048; Ig. Loss=40.89; H_2O=0.01 (105 degrees centigrade).

Sample No. 2 was collected across 150 feet of bedded limestone in a road cut on the south branch 1,000 feet south of the forks in the Anzac station road 3½ miles east of the Hart Highway. This road leaves the highway one-quarter mile south of Redrocky Creek about 57 miles north of Prince George. The limestone is thin bedded, black, fetid, and highly fossiliferous. It strikes north and is nearly vertical. Map 2-1962 shows it as being of Cambrian age. The sample had the following chemical composition: Insol.=2.53; R_2O_3=0.76; Fe_2O_3=0.14; MnO=*nil*; MgO=3.05; CaO=50.52; P_2O_5=0.01; S=0.005; Ig. Loss=43.04; H_2O= 0.02 (105 degrees centigrade).

Hansard*

(54° 121° S.W.) Two samples of limestone were collected for analyses from road cuts on the road from Hansard to Prince George. The first outcrop is on the south side of the road 2.7 miles west of the railroad crossing at Hansard. Limestone is exposed in a road-material quarry 200 feet long, 50 feet wide, and 20 feet high. The rock is very black, badly sheared and fractured, and is cut by numerous narrow white calcite stringers. Near the west end of the quarry a vertical 30-inch-wide volcanic dyke strikes northward through the limestone. A sample consisting of chips collected from across the 50-foot width of the quarry floor had the following percentage analysis: Insol.=6.35; R_2O_3=1.92; Fe_2O_3=1.06; MnO=0.07; MgO=2.21; CaO =48.58; P_2O_5=0.05; S=0.152; Ig. Loss=40.59; H_2O=0.02 (105 degrees centigrade).

The second sample was taken from a small quarry on the south side of the road 0.2 mile west of the first quarry. A face 100 feet long and 30 feet high has been opened up across the end of a steep nose. The exposed rock is mostly light-grey medium- to fine-grained limestone cut by numerous white calcite stringers. An analysis of a sample of chips collected across the face had the following percentage analysis: Insol.=3.14; R_2O_3=0.72; Fe_2O_3=0.39; MnO=0.03; MgO=0.93; CaO=52.72; P_2O_5=0.02; S=0.005; Ig. Loss=42.56; H_2O=0.02 (105 degrees centigrade).

Fraser Valley Lime Supplies†

Popkum (49° 121° S.W.). Head office, 7583 Edmonds Street, Burnaby 3. W. T. Mairs, manager. The quarry and crushing plant are on the east side of the Trans-Canada Highway, adjoining the southernmost tip of Indian Reserve No. 1, three-quarters of a mile east of Popkum station on the Canadian National Railway. The crushing and screening plant was operated partly with stone from the quarry and partly with stone trucked in from other sources. Production from the quarry in 1965 was 5,684 tons, a considerable increase on the previous year's production. A total of 876 tons of stone was trucked in from other sources, making a total of

* By J. W. McCammon.
† By A. R. C. James.

6,560 tons put through the plant. The products are sold for agricultural use and as an industrial filler. An average crew of eight men was employed.

Beale Quarries Division (Lafarge Cement of North America Ltd.).*—Vananda (49° 124° N.W.). Head office, 1051 Main Street, Vancouver 4; quarry office, Vananda. W. D. Webster, quarry superintendent. Open-pit bench-mining methods were used to produce 662,804 tons of limerock, of which 468,642 tons was crushed and 494,016 tons shipped. A crew of 20 men was employed.

Ideal Cement Company Limited*

Vananda (49° 124° N.W.). British Columbia office, 210, 1033 Davie Street, Vancouver 5; quarry office, Vananda. W. S. Beale, general manager, Rock Products Division; J. K. Johnson, superintendent. Limerock, quarried by open-pit benching on Lot 25, 2 miles south of Vananda, was trucked to the processing plant at Marble Bay quarry for crushing, washing, and screening as necessary. A crew of 23 men quarried 514,000 tons of limerock, of which 498,013 tons was shipped.

Imperial Limestone Company Limited*

Vananda (49° 124° N.W.). Office, 7309½ East Marginal Way South, Seattle, Wash. 98108; quarry office, Vananda. James H. Jack, general manager; A. Diewert, quarry superintendent. This company operated a limestone quarry at the summit of a small hill 1 mile west of Spratt Bay on the northeast coast of Texada Island. Two crushing plants were operated, one at Vananda dock where stucco dash and whiting were produced and the other, a larger one, at Spratt Bay where whiting and coarse limestone were produced. An electric-power transmission-line was erected from the Spratt Bay plant to Vananda by way of the quarry and public road.

Open-pit bench mining was used to produce 91,448 tons of limerock, while 96,756 tons was crushed and shipped to the Seattle plant. A crew of 16 men was employed.

Domtar Chemicals Limited (Lime Division)*

Blubber Bay (49° 124° N.W.). British Columbia office, 1105 West Pender Street, Vancouver 1; quarry office, Blubber Bay. J. M. Greenaway, Blubber Bay plant manager. The quarry is approximately 2 miles south of Blubber Bay at the north end of Texada Island. Open-pit bench mining was used to produce 850,000 tons of limerock, of which 800,000 tons was crushed and shipped. A crew of 44 men was employed.

Koeye River (Koeye Limestone Company Limited)*

Koeye River (51° 127° N.W.). Company office, Bella Bella; quarry office, Namu. A. O. Widsten, manager. White limestone is quarried by benching methods from the west of two adjacent quarries on the north side of the mouth of Koeye River on Fitz Hugh Sound, 6 miles south of Namu. A crew of four men produced 11,875 tons of limerock, which was shipped to the Crown Zellerbach Canada Limited paper-mill at Ocean Falls. In addition, 1,200 tons of waste rock was produced and shipped.

* By J. E. Merrett.

Ocean Cement Limited (B.C. Cement Division).*—Cobble Hill (48° 123° N.W.). This company quarried the limestone required for its Bamberton cement plant from a quarry at Cobble Hill.

MARL

Cheam Marl Products†

Popkum (49° 121° S.W.). Head office, 13 Fletcher Street South, Chilliwack. P. C. Woodward, general manager. This property consists of a lake deposit of marl ranging up to 10 feet thick. The deposit is post-glacial and accumulated on the bed of Cheam Lake, which was drained some years ago. The marl and topsoil are excavated by two small draglines and sold for agricultural purposes. The material is either trucked wet to the consumer or stockpiled on a drainage pad.

Production in 1965 was 33,207 tons of marl and 7,047 cubic yards of topsoil. A crew of three men was employed at the property.

MICA

Rose and Rose II*

Chemainus (48° 123° N.W.). In May and June, 1963, R. Armstrong and J. Massy, of North Surrey, located two claims on mica schist showings 5 miles southwest of Chemainus. The showings are at 1,400 feet elevation about 1,000 feet northeast of Holyoak Creek. They are in cuts 1½ miles up an abandoned logging-road that branches north off the main MacMillan, Bloedel and Powell River Company Chemainus River logging-road at a curve 4½ miles west of Highway No. 1. The road distance from the claims to deep-water docks at Chemainus is between 8 and 9 miles.

The schist has been uncovered intermittently for 250 feet along the north side of the road. A few scattered outcrops occur for 100 to 200 feet up the slope above the road. From the southwest limit of the exposures along the road in a northeasterly direction the sequence of rocks visible in the cuts is as follows: 10 feet of mixed light-green sericite schist and quartz-graphite schist, 30 feet covered, 10 feet of dark slightly graphitic schist, 30 feet of sericite schist, 30 feet covered, 60 feet of mixed bands of sericite schist and unschisted siliceous argillite, 80 feet of light-grey partly brown-stained sericite schist with narrow unschisted zones. In the rocks a strongly developed schistosity strikes north 65 degrees west and dips 79 degrees north about parallel to a second foliation that probably represents original bedding. A thin-section of the sericite schist consisted of sericite with abundant quartz and minor chlorite. The quartz is present as fine grains and as scattered porphyroclasts as much as 5 millimetres in diameter.

When the property was examined in mid-September, 1965, no one was there. Apart from a small amount of digging at some of the road cuts, no other evidence of work done on the deposit was found.

PHOSPHATE

Western Co-operative Fertilizers Ltd.‡

Flathead (49° 115° S.W.). Company office, P.O. Box 2500, Calgary, Alta. This company recorded 600 claims in the Lodgepole and Cabin Creek areas of the Flathead River, 15 miles southeast of Fernie, during the past two years while searching for phosphate for its fertilizer plant at Cal-

* By J. W. McCammon.
† By A. R. C. James.
‡ By D. R. Morgan.

gary. The property covers a showing of marine sedimentary rocks containing fluoapatite. It is located at elevations ranging from 3,500 to 7,500 feet, and can be reached by road from Morrissey, south of Fernie. Some trenching was done in 1965, and a crew of 22 men drilled 22 holes, totalling 8,400 feet. Approximately 7 miles of access roads were built to the drill-sites. The work was under the direction of C. Warren Hunt, geologist.

POZZOLAN

Holdfast Pozzolan Limited* Ganges (49° 123° N.E.). Company office, 813, 475 Howe Street, Vancouver 1; plant office, Box 13, Ganges. This wholly owned subsidiary of Holdfast Natural Resources Ltd. operated a shale pit and roasting plant at Long Harbour on the northeast coast of Saltspring Island. In 1965, 11,000 tons of shale was quarried, of which 9,000 tons was processed to produce 7,500 tons of pozzolan. The number of men employed was 23, but the size of the crew varied according to the work being done.

Crownite Diatoms Ltd.—Quesnel (52° 122° N.W.). *See* report under this name in Diatomite section.

SAND AND GRAVEL

Data on sand and gravel production are presented on the following pages. The abbreviations used in the table for the types of sand and gravel produced are as follows: AA=asphalt aggregate; SA=sized aggregate; WS=washed and sized aggregate; RP=run-of-pit material; AP=asphalt paving mix; RM=ready-mix concrete.

* By J. E. Merrett.

Sand and Gravel Pits

Location	Operator	Equipment and Plant	Men	Production
Kitimat	Kitimat Concrete Products (1961) Ltd.	Sauerman dragline, crusher, screening, washing, ready-mix concrete, and concrete bricks	15	RP, WS, RM, and brick.
Terrace	Skoglund Construction Company Limited	Front-end loader	2	RP.
Kamloops—				
(1) North Thompson Highway	Western Sand & Gravel Ltd.	Loading, crushing, screening, washing, and ready-mix plant	18	RP, WS, and RM.
(2) North Thompson Highway	Yellowhead Sand & Gravel	Tractor, front-end loader, crushing, screening, and washing	6	RP and WS.
Creston—Goat River	Louis Salvador & Sons	Front-end loader, crusher, screens	3	WS and RM.
Wynndel—Duck Creek	Louis Salvador & Sons	Front-end loader, crusher, screens	2	RP and RM.
Wynndel—Duck Lake	Frank Merriam & Sons	Front-end loader, screens	3	RP and AP.
Nelson—Anderson Creek	Premier Sand and Gravel Company Limited	Scraper, crusher, screens	5	RP, WS, and RM.
Trail—Casino Road	McGauley Ready-Mix Concrete Company	Scraper, washing plant, screens	5	RP, WS, and RM.
Castlegar—Columbia River	McGauley Ready-Mix Concrete Company	Front-end loader, screening plant	4	RP, WS, and RM.
Salmo—Erie Creek	Valley Concrete Products Ltd.	Front-end loader, screening	2	Concrete pipe.
North Vancouver—				
(1) West end of East Keith Road, east of Seymour Creek	E. R. Taylor Construction Co. Ltd., 2645 Dollarton Highway	Gas shovel, paving plant	1[1]	Sand=78,735 yd.
(2) Dollarton Highway, ½ mile east of Seymour Creek	Morris Bros. Trucking Ltd., 829 East Seventh Street	Front-end loader	1	RP=18,000 yd.
Coquitlam Municipality—				
(1) West end of Westwood Road	Corporation of the District of Coquitlam	Front-end loader, portable crushing, and screening	—	RP and SA.
(2) Pipeline Road, 3½ miles north of Lougheed Highway	Jack Cewe Ltd., 309 Cedar St., New Westminster	Shovel, screening, crushing, paving plant	20	RP and SA=150,000 yd.
(3) Pipeline Road, 3 miles north of Lougheed Highway	S & S Sand and Gravel Limited, 1101 Eighth Ave., New Westminster	Front-end loader, crushing, screening, and washing	8	WS and RP=191,561 yd.
(4) Pipeline Road, 2½ miles north of Lougheed Highway	Pine Pass Construction Co. Ltd., Box 10, Yarrow	Front-end loader, crushing and screening	8[1]	SA=50,084 yd.
(5) Pipeline Road, 1½ miles north of Lougheed Highway	Allard Concrete Construction Co., 1930 Pitt River Road, New Westminster	Front-end loader	1	RP=18,000 cu. yd.
(6) Pipeline Road, 1 mile north of Lougheed Highway	Deeks-McBride Ltd., 1051 Main St., Vancouver	Shovel, 600 tons per day, washing and screening, ready-mix	8	SA, WS, and RM= 479,058 yd.
(7) Coquitlam River, east bank, 2 miles north of Lougheed Highway	Knight Gravel Ltd.	Front-end loaders	12	RP=228,000 yd.
(8) Fraser River at Mary Hill, 2 miles south of Port Coquitlam	Ocean Cement Limited, north foot of Columbia St., Vancouver 4	Shovels, etc., 500 tons-per-hour processing plant, barge-loading facilities	56	WS=1,184,631 yd.
Pitt Meadows District Municipality—				
(1) 1 mile northwest of Port Hammond	Haney Brick & Tile Ltd.	Front-end loader	1[1]	Sand=1,505 yd.
(2) Bonson Road (196th St.), 1 mile north of Fraser River	Lasser Trucking Co., Box 38, Pitt Meadows	Front-end loader	1[1]	RP=3,500 yd.

Maple Ridge Municipality—				
(1) Grant Hill, 1 mile east of Albion and also adjoining Kirkpatrick pit	Corporation of the District of Maple Ridge		—	Fill.
(2) Grant Hill, ½ mile north of municipal pit	McIntosh Sand and Gravel, 10412 Industrial Ave., Whonock	Shovel, crushing, and screening	3[1]	RP and SA=25,000 yd.
(3) Grant Hill, north of McIntosh pit	Henry Van Boeyen, Albion	Shovel	1[1]	RP=1,518 yd.
(4) Lougheed Highway south of Grant Hill	Valley Ready Mix Co. Ltd., Haney	Shovel, front-end loader, crushing, washing and screening, ready-mix	2	WS and RM=35,000 yd.
(5) East end of No. 27 Road, Alouette River	Kirkpatrick Sand and Gravel Ltd., 22357 McIntosh St., Haney	Shovel, crushing, screening, washing	2	WS and RP=10,962 yd.
(6) Lougheed Highway, 1 mile east of Whonock	Ralph E. George	Front-end loader	1[1]	RP=1,483 yd.
Mission Municipality—				
(1) 1 mile and 3 miles east of Stave Falls power-house, 2 miles east of Ruskin power-house	Corporation of the District of Mission	Screening plants	—	RP and fill.
(2) 1.8 miles south of Steelhead, Dewdney Trunk Road	Department of Highways		—	
(3) 2.3 miles south of Steelhead, Dewdney Trunk Road	Cannon Contracting Ltd., 33323 Broadway, Mission	Front-end loader	—	RP.
(4) Dewdney - Lougheed Highway, 2 miles west of Squakum	Department of Highways	Front-end loader	—	RP.
Kent Municipality—				
(1) West end of Cemetery Road, south of Mount Agassiz	Corporation of the District of Kent	Shovel and front-end loader	—	RP.
(2) McCallum Road, 1 mile west of Harrison Hot Springs road	Department of Highways	Front-end loader	—	RP.
(3) McCallum Road, 1½ miles west of Harrison Hot Springs road	Danielson Contractors Ltd., McCallum Road, Agassiz	Front-end loader	1[1]	RP=6,583 yd.
Chilliwack Municipality—				
(1) Arnold Road—from Fraser River bar	P. Heppner & Son, 7113 Sumas Prairie Road	Front-end loader	1[1]	RP.
(2) Fraser River bars, etc.	Chilliwack Municipality	Front-end loaders	—	RP=49,342 yd.
Sumas Municipality—				
(1) At foot and east of Taggart Peak	Various operators but owned by H. Quadling, Yarrow	Front-end loader	—	Angular fragmental fill = 4,000 yd.
(2) Vye Road, 3 miles south of Abbotsford	Corporation of the District of Matsqui	Shovel	—	RP.
Matsqui Municipality—				
(1) 1 mile east of Abbotsford	Blackham's Construction Ltd., Abbotsford	Screening and Crushing	6	RP and SA=88,658 yd.
(2) Tretheway Road, ¾ mile north of Clearbrook	Department of Highways	Front-end loader	—	
(3) Tretheway Road, ½ mile north of Clearbrook	M.S.A. Paving Co. Ltd., Box 101, Clearbrook	Front-end loader, screening	1	RP and SA=10,060 yd.
(4) Clearbrook Road, ½ mile north of border	Abbotsford Gravel Sales Ltd., Abbotsford	Scraper, front-end loader, screening, washing, and ready-mix plant of Totem Trucking Limited	3	WS, RP, and RM=32,805 yd.

[1] Part time.

Sand and Gravel Pits—Continued

Location	Operator	Equipment and Plant	Men	Production
Matsqui Municipality—*Continued*				
(5) 12th Ave., ¼ mile west of Clearbrook Road	Valley Rite-Mix Ltd., Box 430, Clearbrook	Front-end loader, screening, washing, and crushing, ready-mix plant	12	RP, SA, WS, and RM = 47,026 yd.
(6) Corner of King (16th Ave.) and Foy Roads (316th St.)	Lepp Trucking, Abbotsford	Front-end loader	1[1]	RP=9,000 yd.
(7) Lefevre Road, ¼ mile north of Eighth Ave.	Corporation of the District of Matsqui	Shovel	—	RP.
(8) Corner of Lefevre Road and Eighth Ave., Caplette pit	E. Bird, Aldergrove	Front-end loader	2[1]	RP=3,383 yd.
Langley Municipality—				
(1) Northwest corner of Jackman Road and Eighth Ave.	Corporation of the Township of Langley	Shovel	—	RP.
(2) ½ mile west of Carvolth Road, north of 24th Ave.	Corporation of the Township of Langley	Shovel	—	RP.
(3) Kinch Road at 36th Ave.	Corporation of the Township of Langley	Shovel	—	RP.
(4) North of the northeast corner of Jackman Road and Eighth Ave.	Aldergrove Cement Tile Product, S. Omelaniec, manager	Front-end loader	1[1]	RP=1,280 yd.
(5) ¼ mile north of corner of Jackman Road and Eighth Ave.	J. Craig, Trans-Canada Highway, Langley	Front-end loader	1[1]	RP=2,085 yd.
(6) Dogwood Ave., off Brown Road	Kitsul Bros. Gravel Sales Ltd., 23862 Old Yale Road, R.R. 3, Langley	Front-end loader	1[1]	RP=17,500 yd.
(7) Glen Valley Road at 252nd St.	Fort Langley Aggregates, J. K. McArthur, 11364—95th Ave., North Surrey	Front-end loader, crushing, screening	3[1]	RP and SA=35,000 yd.
(8) 8802 Hudson Bay Road, Fort Langley	H. G. Clark, Box 145, Fort Langley	Front-end loader, screening, washing, and ready-mix	1[1]	WS and RM=5,615 yd.
(9) Bradshaw and Berry Roads (Gun Club pit)	B & B Trucking, Cloverdale	Shovel, crushing, screening, asphalt	2	SA and RP=12,768 yd.
(10) 2962 Lambert Road (Highland pit)	Ocean Cement Limited, north foot of Columbia St., Vancouver	Shovel, crushing, screening, and washing	5	RP and WS=70,280 yd.
(11) 32nd Ave. at Kinch Road	Oscar W. Rees, 3003—208th St., R.R. 2, Langley	Shovel	2[1]	RP=10,598 yd.
(12) 16th Ave. at Surrey boundary	Department of Highways	Shovel	—	Fill.
(13) Boundary Road at Surrey boundary	Border Sand & Gravel Ltd., Boundary Ave., R.R. 2, White Rock	Front-end loader, crushing, screening, and washing	3	RP and WS=17,097 yd.
Surrey Municipality—				
(1) Campbell River Road at Langley boundary	White Rock Sand and Gravel, C. E. Schuler, 2546—176th St., R.R. 2, Cloverdale	Shovel, screening	1[1]	RP and SA=12,476 yd.
(2) Northwest corner of 32nd Ave. and 206th St., Langley	Deeks-McBride Ltd., 1051 Main St., Vancouver	Scraper, front-end loader, crushing, washing, screening, and ready-mix	3	WS, RP, and RM=55,050 yd.
(3) East end of Stokes Road (20th Ave.)	Corporation of the District of Surrey	Shovel	—	Fill.
(4) 53rd Ave. at Delta boundary	Corporation of the District of Surrey	Shovel, paving plant	—	Fill and AP.
(5) 112th Ave. east of Pike (160th) St.	United Sand & Gravel Ltd., c/o Steeves and Mann Equipment Ltd.	Shovel, crushing, screening	2	RP and SA=55,498 yd.

12

Delta Municipality—				
(1) ¼ mile south of west end of 72nd St.	Western Peat Moss Ltd.		1[1]	RP=680 yd.
(2) ½ mile west of Scott Road at 68th St.	Western Paving Ltd., 6631—120th St., North Surrey (Lintons Construction Co. Ltd.)	Shovels, crushing, screening, and washing	3	RP and SA=84,356 yd.
(3) Corner of First Ave. and 56th St.	Century Manufacturing Co. Ltd.	Shovel	3[1]	RP=8,000 yd.
Howe Sound—				
(1) Britannia Beach and Furry Creek	Construction Aggregates Ltd.	Front-end loader, scraper, crushing, screening, and washing	33	WS, RP, and SA=945,051 yd.
(2) Mamquam River	PaCo Cement Products Ltd.	Front-end loader	....	RP=11,230 yd.
(3) Gower Point, Sechelt Highway	Ed Fiedler, Gibsons	Front-end loader	1	RP=9,000 yd.
(4) Veterans Road, Gibsons (Pacific pit)	Gibsons Building Supply, Gibsons	Front-end loader	1½	RP=3,000 yd.
(5) Cemetery Road, Gibsons	P & W Development Co. Ltd., Gibsons	Front-end loader, crushing, screening, ready-mix	1	SA and RM=5,000 yd.
(6) Porpoise Bay Road, Sechelt	L & H Swanson Ltd.	Front-end loader, shovel, screening	2[1]	SA and RP=2,196 yd.
Powell River—Off Allen Road, 3 miles north-east of Westview	P. Nassichuk	Screening	1	Sand=8,590 yd.
Vancouver Island—				
(1) Campbell River — south of Buttle Lake Road at Elk Falls Road	G & A Trucking Ltd.	Front-end loader	....	RP=21,130 yd.
(2) Painter's Spit, Campbell River	Central Gravel Supplies Mission Limited	High-line scraper, front-end loader, crushing, washing, and screening	3	WS, SA, and RM=47,332 yd.
(3) 2½ miles from Courtenay	Island Ready-Mix Ltd.	Mobile loader, rotary screening	3	SA and RM=28,080 yd.
(4) Anderton Road	S. H. Marriott Sand & Gravel	Front-end loader	....	RP=69,260 yd.
(5) Point Holmes	S. H. Marriott Sand & Gravel		....	Sand=5,845 yd.
(6) Cassidy No. 4 pit — Island Highway at Cassidy	Ocean Cement Limited	Front-end loader, washing, crushing, and screening	4	WS, RP, and SA=36,500 yd.
(7) Duncan-Cowichan Lake Road	Butler Bros. (Duncan) Ltd.	Front-end loader, washing, crushing, screening, ready-mix	16	WS, RP, and RM=63,270 yd.
(8) Duncan-Koksilah	Armour & Saunders Ltd., Duncan	Front-end loader, crushing, washing, screening, asphalt paving, ready-mix	8	WS, SA, AP, and RM=110,000 yd.
(9) Sooke—Sooke Road east of Milnes Landing	Wickheim Sand and Gravel	Front-end loader	3	RP=12,000 yd.

[1] Part time.

SILICA

Longworth* (53° 121° N.E.). Western Silica Products Ltd., 1300 Southwest Marine Drive, Vancouver 14, controls 12 claims on a silica deposit 2 miles north of Longworth, a station on the Canadian National Railway northern line about 60 miles east of Prince George. The claims were located in March, 1959, by W. and F. Blackman and sold to the company.

The silica consists of a thick band of white quartzite that extends from a forestry fire tower at 5,835 feet elevation on the mountain-top northwestward down across the face of the mountain to about 3,700 feet elevation. The railway siding at Longworth is at 2,200 feet elevation. A rough road has been built from the siding for 2 miles up the hillside to 3,200 feet elevation toward the lowest outcrop of the band, which forms a bluff in a small creek canyon. The road ends half a mile from this bluff. A trail extends from the end of the road up the mountain to the fire tower. The quartzite band forms a prominent line of bare bluffs across the mountainside. Elsewhere timber is thick and outcrops are scarce.

The quartzite band ranges from 300 to 800 feet thick and can be traced across the mountainside for more than 2 miles. No bedding was seen in it, but sandy and dolomitic limestone just to the north strikes north 60 to 70 degrees west and stands almost vertical. A few small isolated outcrops of argillite, quartzite, fossiliferous dolomite, and amygdaloidal lava are exposed in low cuts in the road a mile or so south of the main quartzite band. The quartzite is of very uniform appearance, although the colour ranges from bluish through light grey to white. It is highly fractured with joints that are multi-directional at random spacings. Here and there iron staining is present on fracture surfaces. Veinlets of white quartz are present in variable abundance. In two thin-sections examined under the microscope the rock was found to be composed of well-rounded quartz grains firmly cemented by quartz with a few scattered shreds of sericite. The grain diameters averaged 0.15 to 0.3 millimetre with stray ones up to 0.6 millimetre.

Three samples of the quartzite were collected for analysis. Nos. 1 and 2 were from the bluff in the creek toward which the road was being built and No. 3 was from the top of the mountain. Sample 1 consisted of chips gathered across 100 feet, starting at the south side of the bluff and going along a bearing of north 70 degrees east approximately perpendicular to the assumed strike of the band. This rock had a bluish tinge. Sample 2 consisted of very white rock collected across 100 feet on the same bearing about 400 feet farther to the northeast. Sample 3 was collected across 250 feet perpendicular to the strike of the band about 200 feet east of the fire tower. The analyses are shown below:—

	SiO_2	Al_2O_3	Fe (Total)	CaO
No. 1	99.02	0.28	0.13	0.53
No. 2	99.60	0.17	0.15	0.07
No. 3	99.68	0.13	0.13	0.04

Quartzite Point* Shuswap Lake (50° 119° N.E.). A band of quartzite is exposed on the east shore of Shuswap Lake at Quartzite Point, 6 miles northwest of Sicamous. Quartz was shipped from the deposit in 1923 and within the last two or three years. There was no activity at the property in 1965.

* By J. W. McCammon.

The quartzite forms a 25- to 30-foot-thick band between layers of gneiss. The rocks are part of the Monashee Group of the Shuswap Terrane. They strike northeastward and dip flatly to the southeast. Quartzite exposures begin about 250 feet south of the navigation light on the point and extend more or less continuously southward along the beach for 900 feet. At the north end the quartzite terminates at a northwest-trending fault, and at the south end it plunges under the water. It is exposed for 80 to 110 feet across the strike. The rock is medium grained and white to glassy with patches of brown stain on fracture surfaces. It weathers milky white.

The deposit has been worked by means of a quarry which is 15 feet wide and 40 feet long parallel to the beach and 15 to 20 feet from the water. It is reported that in 1923 a shipment of 100 tons of quartzite went from the property to the Trail smelter to be used in the manufacture of hydrofluosilicic acid. The remains of a crushing plant indicate that the recent production was of sized chips or granules.

A chip sample across the band for 80 feet at the quarry contained the following percentages: SiO_2=97.84; Al_2O_3=0.59; Fe (total)=0.02. A sample of chips resulting from recent blasting and from material at the crusher-site contained: SiO_2=98.90; Al_2O_3=0.13; CaO=0.46; Fe (total)=0.23.

[References: *Minister of Mines, B.C.,* Ann. Rept., 1923, p. 172; *Canada, Dept. Mines,* Mines Branch Pub. No. 686, 1928, p. 38.]

Shuswap Lake* (50° 119° N.E.) G. Gavel and W. Campbell, of Sicamous, have a silica showing on the hillside 1 mile due east of Quartzite Point on Shuswap Lake, 6 miles northwest of Sicamous. The deposit is 800 feet above the lake, about 6,000 feet up an old logging-road that starts on the lake-shore half a mile northeast of the point.

The deposit consists of a band of medium-grained white quartzite that is interbedded with biotite-hornblende gneiss. Map 1059A of the Geological Survey of Canada shows the rocks as part of the Monashee Group of the Shuswap Terrane. The quartzite band is well exposed for 1,000 feet along a north 35 degrees east strike on the surface of a small flat bench and in bluffs along its edge. It dips at about 10 degrees to the southeast. The thickness is 30 to 40 feet, but because of the topography the exposed width is as much as 180 feet. Steep west-dipping joints that strike north 60 to 65 degrees east are abundant at ½- to 6-inch spacings. Bedding is not well displayed, but some parallel coloured lines and ⅛-inch-thick sandy zones, apparently bedding features, indicate the attitude of the quartzite. Much of the rock is glassy to milky white, but some is stained yellow to brownish. It all weathers very white. Scattered small patches of pyrite appear to be the source of the staining.

Workings seen on the deposit consist of one pit 6 feet in diameter by 3 feet deep, a cut on the edge of a bluff that is 15 feet long by 10 feet wide and 8 feet deep, and three small blast-holes. A mixed grab sample consisting of chips gathered from all of the workings had the following percentage analysis: SiO_2=97.28; Al_2O_3=0.29; CaO=2.09; Fe (total)=0.25.

Mountain Minerals Limited† Golden (51° 116° S.W.). Company office, P.O. Box 700, 529 Sixth Street South, Lethbridge, Alta. R. A. Thrall, managing director; William McPherson, superintendent. This company owns a large silica property on Moberly Moun-

* By J. W. McCammon.
† By D. R. Morgan.

tain, 5 miles northeast of Golden. In May, 1965, a crew of six men quarried and loaded 3,255 tons of silica. It was trucked to a crusher at Brisco and shipped to Wenatchee and Vancouver, Wash., for testing.

Oliver Silica Quarry*

(49° 119° S.W.) Pacific Silica Limited. Registered office, 717 West Pender Street, Vancouver 1; quarry office, Box 39, Oliver. I. A. Hunter, manager. The Oliver silica quarry is on the Gypo mineral claim, Lot 30985, owned by The Consolidated Mining and Smelting Company of Canada, Limited, and operated under lease by Pacific Silica Limited. The claim is less than one-quarter of a mile west of Highway No. 97, 1 mile north of Oliver. Production for 1965 was 50,272 tons, and shipments made were 9,272 tons sacked and 41,000 tons in bulk. Additions to plant and equipment in 1965 consisted of modifications to the dust-cleaning equipment. Twenty-three persons were employed.

Lafarge Cement of North America Ltd.†

Holberg Inlet (50° 127° N.W.). Head office, 1051 Main Street, Vancouver 4; quarry, Apple Bay, 6½ miles west of Coal Harbour. A crew of three men was employed to quarry and ship 5,000 tons of rhyolite to the Vancouver plant. Seven 100-foot diamond-drill holes were drilled in order to determine reserves.

SILICA-TALC

Gisby Group‡

North Bend (49° 121° N.E.). This group consists of five claims and three fractions, all Crown-granted, located in line along the west bank of the Fraser River directly south of the mouth of the Nahatlatch River. The Canadian Pacific Railway tracks pass along the east side and a logging-road passes through the centre of the claims. It is 8 miles north by road from the aerial-tram landing at North Bend to the south limit of the property.

The claims were orginally located before 1900 by Gisby and Allen as a gold prospect. The first attempt to produce silica and talc, made by the British Columbia Talc and Silica Company in 1920, was unsuccessful. Two years later Pacific Talc and Silica Company took over the property and produced a small amount of both products for a year or two. Since that time there does not appear to have been any attempt to produce these materials.

On the claims talc and quartz occur in a mixed group of metamorphosed sedimentary rocks intruded by small bodies of fine-grained diorite. The dominant rock type is slaty argillite, usually very thin bedded and frequently interlayed with ½-inch-thick quartzite beds. Greywacke, calcareous bands, and chlorite-carbonate schist accompany the argillite. Two small masses of diorite are exposed near the southern part of the property. Except for the diorite, the rocks are highly sheared and contorted. They strike northwestward and dip steeply to the west and east. Small dragfolds suggest some of the westerly dips may be on overturned surfaces. Therefore, the structure may consist of nearly isoclinal folds slightly overturned to the northeast.

The quartz occurs as small veinlets, large discontinuous veins, and lensy pods in the slaty argillites. In the old quarry at the south boundary of the Mary Ann claim a vein of quartz is exposed for 100 feet parallel to the bedding of the country

* By David Smith.
† By J. E. Merrett.
‡ By J. W. McCammon.

rock and for 25 feet perpendicular to it. The edges of the quartz are obscured by drift and the refuse of an abandoned sawmill-site, except for a short contact with slaty argillite at the southeast corner, so it is not known what the actual dimensions of the body are. Cairnes described it as 50 feet wide without the limits having been reached. A sample of chips from across 25 feet perpendicular to the beds had the following percentage composition: SiO_2=95.52; Al_2O_3=0.41; Fe (total)=1.88; CaO=*nil*. Around and uphill from the portal of the caved adit near the centre of

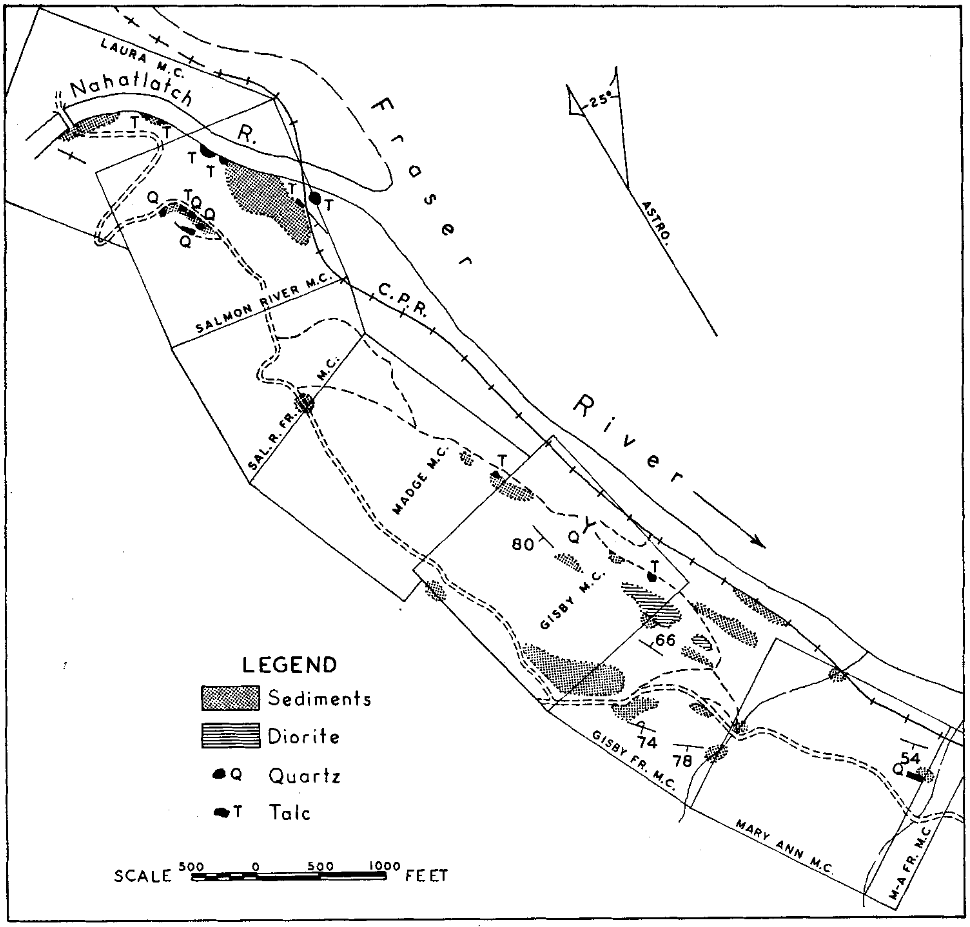


Figure 31. Geology of Gisby property.

the Gisby claim are several large lumps of quartz, but none seem to be in place. The first 50 feet of the adit is caved, and entry to the remainder is impossible. Rock exposed above the caved area is badly sheared argillite mixed with talcy serpentine. A 10-ton pile of broken quartz is stacked beside the portal, and a similar pile lies 200 feet to the east at the site of the old grinding-mill. At the centre of the Salmon River claim on a knoll at the bend in the road, four masses of quartz are exposed. The most southwesterly is 8 feet wide and 40 feet long and covered by drift at all edges. About 250 feet to the northwest is a 6-foot-wide vein exposed for 33 feet by an old trench. No walls are uncovered and the ends plunge beneath drift. Along the roadside two or three other pods of quartz 3 to 5 feet thick occur in highly sheared talcose schist and slaty argillite. The adit with a 35-foot-wide quartz vein described by Cairnes was apparently in this area, but road construction and slides on the slope must have obliterated it. On the whole, although not well exposed, the quartz bodies give the impression that they are probably lens-like pods more or less parallel to the strata and not lengthy veins.

Talc is visible on the Gisby, Madge, Salmon River, and Laura claims. A mound of talc-carbonate rock, 4 feet wide by 12 feet long, lies beside the old road 700 feet south of the caved adit on the Gisby claim. A shallow trench dug around the mound does not expose any other rock. The percentage of carbonate present in this exposure is large. Some talc is contained in a sheared mixture of serpentine and sedimentary rocks at the portal of the caved adit on the Gisby claim. No other talc is exposed nearby. Cairnes described a 150-foot-wide zone of talcose schist containing a 5-foot-thick central band of nearly pure talc. This was in the adit between 150 and 300 feet from the portal. The talcose rock had slates on either side. About 700 feet northwest of the adit and 100 feet or so west of the old road is a large knoll of altered schistose rock now composed largely of chlorite, carbonate, quartz, and zoisite. In some places this rock is partly altered to impure talc. The most numerous talc outcrops are on the Salmon River claim. Sheared talc-carbonate rock mixed with pods of quartz and argillaceous material outcrop at 2 or 3 places around the bend in the logging-road near the centre of the claim. Exposures are too small to delimit the talcy zones. On the south side of the Nahatlatch River, 600 feet upstream from the railway bridge, talc forms a 15-foot-high bank for 20 to 30 feet along the stream. The talc is intermixed with considerable carbonate and is highly sheared. About 150 feet farther upstream a second zone of highly sheared talc-carbonate schist forms a steep, bare, 20-foot-high bank for 100 feet along the edge of the water. Talc also occurs in impure schist on both sides of the railway tracks at the south abutment of the bridge. Two small showings of talc are exposed on the Laura claim on the south bank of the Nahatlatch River about 600 feet downstream from the road bridge. In each the amount of talc is small and is associated with serpentine, from which it has formed. The serpentine is interbedded with schistose sedimentary rocks.

This deposit could probably be developed as a source of low-grade talc for grinding should the economics warrant, but it is unlikely that high-grade material could be produced without extensive separation treatment.

[References: Cairnes, C. E., *Geol. Surv., Canada,* Ec. Geol. Series No. 2, Talc Deposits of Canada, 1926, pp. 41–49; *Canada, Dept. of Mines and Resources,* Mines Br. Publ. No. 803, Talc, Steatite, and Soapstone, 1940, p. 56; *Canada, Dept. of Mines,* Mines Br. Publ. No. 583, Talc and Soapstone in Canada, 1922, pp. 19–20; *Canada, Dept. of Mines,* Mines Br. Pbl. No. 686, Silica in Canada, Pt. II, 1928, pp. 38–41.]

TALC

View 1, 2, 3*

Placer Creek (49° 116° S.W.). The View recorded mineral claims are on Placer Creek, which is a tributary of Summit Creek, on the Salmo–Creston highway. These claims were staked by R. Emel and R. Maddess, of Creston, who sold the property in 1965 to Cypress Mines Corporation, 523 West Sixth Street, Los Angeles, Calif.

The mining company contracted R. Golac, of Nelson, to sink a shaft and put in crosscuts on a talc zone to determine purity and extent of the deposit. By the end of 1965 the shaft was down 35 feet and was in talc. The talc appears to have developed along a shear zone which embraces a bed of dolomite. Stripping has exposed the talc zone for several hundreds of feet, but nowhere has pure talc been noted. (*See* Annual Report, 1964, pp. 207–208.)

* By P. E. Olson.

Petroleum and Natural Gas

CONTENTS

TABLES—*Continued* PAGE

GENERAL ADMINISTRATION

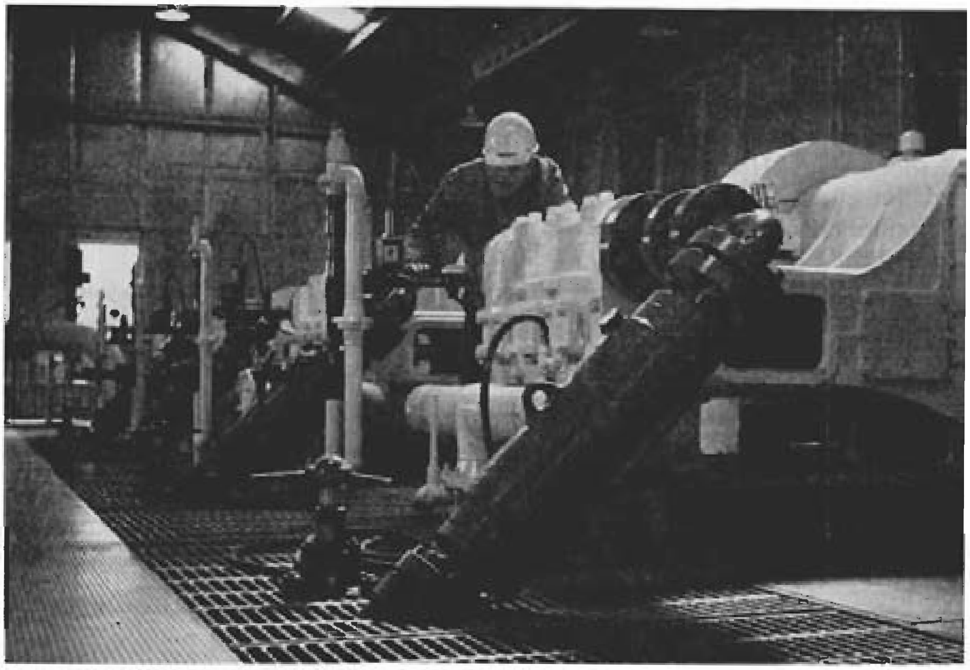
Administration of the *Petroleum and Natural Gas Act* in the Department is divided between a General Administrative Section and a Petroleum and Natural Gas Branch. The former, under the direction of the Chief Commissioner, is responsible for the administration of the *Petroleum and Natural Gas Act,* which includes all matters related to and affecting title to Crown petroleum and natural-gas rights. The regulations governing geophysical operations are also administered by the Chief Commissioner.

The Petroleum and Natural Gas Branch, under the direction of the Chief of the Branch, is responsible for administration of the " Regulations Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas," pursuant to the *Petroleum and Natural Gas Act.* The regulations specify the conditions which must be employed for efficiency and safe practice in the drilling, completion, and abandonment of wells; for well spacing; prevention of waste; conservation; and all related matters.

As at December 31, 1965, 35,237,492 acres, or approximately 55,059 square miles, of Crown petroleum and natural-gas rights, issued under the *Petroleum and Natural Gas Act,* were held in good standing by operators ranging in stature from small independent companies to major international ones. The form of title held, total number issued, and acreage in each case were as follows:—

Form of Title	Number	Acreage
Permits	319	23,517,709
Natural-gas licences	*Nil*	*Nil*
Drilling reservations	34	534,868
Leases (all types)	3,779	11,184,915
Total		35,237,492

Details of land disposition for the years 1947 to 1960, inclusive, may be found on page A 61 of the 1960 Annual Report. Figures for 1961 to 1964 will be found in the respective Annual Reports for those years.



Water-flood injection station at Boundary Lake. (Imperial Oil photo.)

Loading trainload of sulphur aboard ship at Vancouver. (B.A. Oil photo.)

The northeastern corner of the Province continued to be the area of major interest in the acquisition of title to petroleum and natural gas as well as the development and production of those substances.

Early in the year Shell Oil Company, which has been carrying out offshore exploratory work along the west coast of Vancouver Island and in the Queen Charlotte Sound-Hecate Strait area, contracted with Victoria Machinery Depot Co. Ltd. for construction of a $9,000,000 Sedco-type drilling-platform, from which exploratory drilling will be done. It is understood that completion of the platform is scheduled for late 1966.

During 1965, land disposition was changed by the following transactions:—

Form of Title	Issued	Terminated	Decrease (—) or Increase (+)
	No.	No.	No.
Permits	52	35	+17
Natural-gas licences	...	1	—1
Drilling reservations	27	12	+15
Leases—			
Petroleum and natural gas	389	315	+74
Natural gas	2	13	—11
Petroleum	....	....	—

Petroleum and natural-gas revenue for the year 1965 was as follows:—

Rentals and fees—		
Permits	$1,176,501	
Drilling reservations	114,483	
Natural-gas licences	....	
Petroleum, natural-gas, and petroleum and natural-gas leases	7,013,187	
Total rentals and fees		$8,304,171
Sale of Crown reserves—		
Permits	$1,825,322	
Drilling reservations	3,278,641	
Leases	13,057,470	
Total Crown reserve sales		18,161,433
Royalties—		
Gas	$1,682,444	
Oil	3,697,668	
Processed products	93,226	
Total royalties		5,473,338
Miscellaneous fees		17,790
Total petroleum and natural-gas revenues		$31,956,732

Details of yearly revenue, 1947 to 1962, inclusive, are tabled on page 168 of the Annual Report for 1962. For 1963 and 1964 figures *see* the Annual Reports for those years.

Cumulative totals, April 1, 1947, to December 31, 1965, are as follows:—

Rentals and fees—		
Permits	$38,362,577	
Drilling reservations	705,260	
Natural-gas licences	63,788	
Petroleum, natural-gas, and petroleum and natural-gas leases	35,238,397	
Total rentals and fees		$74,370,022
Sales of Crown reserves—		
Permits	$18,172,066	
Drilling reservations	15,769,943	
Leases	48,662,727	
Total Crown reserve sales		82,604,736
Royalties—		
Gas	$9,061,692	
Oil	14,263,933	
Processed products	749,562	
Total royalties		24,075,187
Miscellaneous fees		209,047
Total petroleum and natural-gas revenues		$181,258,992

GENERAL REVIEW

Significant increases were made during 1965 in almost every phase of the petroleum and natural-gas industry of British Columbia compared with 1964.

The footage drilled was 64 per cent greater, while the production of oil and natural gas each increased 17 per cent.

Of the 1,103,151 feet drilled in 1965, development wells accounted for 658,379 feet, exploratory outpost for 305,857 feet, and exploratory wildcat for 138,915 feet. These totals represent gains of 71 and 122 per cent respectively for development and exploratory outpost footages and a decrease of 9 per cent for exploratory wildcat footage compared with the footages drilled in 1964. The comparative footages are indicative of the concentration of drilling along the Halfway oil trend in the general Peejay area. The number of completions indicate this also, as an increase of 158 per cent in the number of oil completions was made compared with 1964, while only an 8-per-cent increase was made in the number of gas completions. At the close of 1965, 497 oil wells and 530 gas wells were producible, with 412 oil and 248 gas wells actually on production.

Exploration activity continued to decrease in 1965. The seismic work done off the west coast of Vancouver Island continued in 1965, with follow-up drilling operations expected to commence in early 1967. An offshore drilling rig is presently under construction to probe the offshore sedimentary basin.

Production increases resulted from the drilling operations and from the completion of the natural-gas transmission-line and gas plant serving the Fort Nelson area. Further expansion of the pressure-maintenance schemes in the oil reservoirs contributed to the increase in oil production. During 1965 there were 13,502,539 barrels of oil and field condensate and 171,514,420 M s.c.f. of natural gas produced.

Slight additions were made in the Provincial reserves of petroleum products.

FIELD OFFICE

Field Work

The field office of the Petroleum and Natural Gas Branch of the Department of Mines and Petroleum Resources is located at mile 52 on the Alaska Highway. A trailer office is used for extended work in isolated areas of the Province.

The main responsibility of the field office is the field administration of the "Regulations Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas." In addition to the enforcement of the regulations, the field office is responsible for the collection and calculation of technical information and data gathered from drilling and producing wells.

The increase in oil and gas production during 1965 resulted in an increase in the number of inspections made on producing wells. Complete inspections were given to a total of 313 gas meters. In addition to the "complete checks," 536 gas meters were given "fast checks." Fifty-eight oil batteries were inspected in conjunction with the oil wells that produce into the batteries. Production tests to determine the well's potential were conducted on 25 oil wells. Ninety-one absolute open-flow tests were witnessed on gas wells. Segregation tests were run on six wells to assure that production from different formations of the same well do not commingle.

The Department of Mines and Petroleum Resources bottom-hole truck and pressure bombs were used to conduct 31 pressure and temperature surveys on producing wells. Results of these surveys are used by Departmental personnel in engineering studies and to check data submitted to the Department by operating companies. Bottom-hole pressure and temperature data obtained from operating or service company equipment is accepted by the Department, provided that the equipment is calibrated to the Government standard located at the field office. A total of 106 calibrations was made on bottom-hole pressure bombs during 1965. No charge is made for calibration of the pressure or temperature bombs.

Inspections were made at 218 drilling locations and 1,145 producing or abandoned leases.

Seven vehicles were driven 105,010 miles to complete the inspections and surveys done during 1965.

GEOLOGICAL SECTION

Staff geologists were engaged primarily in subsurface geological studies in 1965, with the greatest emphasis on Mesozoic and Devonian strata capable of producing oil and gas in northeastern British Columbia. Considerable attention was given to oil and gas reserve estimations, Crown sale evaluations, and various studies of a semi-regional nature.

Most of these studies were completed in Victoria. However, Branch geologists examined core and samples at the Charlie Lake core and sample library to augment the staff's mapping projects. Numerous problems, arising from current exploration and production operations, required special examinations of core and bit-cutting samples as well as electrical log interpretations. A preliminary surface study was made of Dunvegan Formation exposures in the area of the Laprise and Jedney fields of northeastern British Columbia.

Geological Laboratories

Core and Well Samples

All cores from British Columbia wells must be preserved in labelled boxes having an inside length not greater than 30 inches and must be delivered to the geological laboratory for permanent storage. During 1965, 1,777 boxes of core from 179 wells were received at the laboratory. At the end of 1965, 22,536 boxes from 1,227 wells were stored.

Unless otherwise directed, any operator who drills a well for petroleum or natural gas is required to take a sample of drilled rock (bit cuttings) at least every 10 feet of depth. Each sample, consisting of several ounces of rock fragments, is placed in a small bag at the well, labelled, and submitted to the geological laboratory, where it is washed and bottled.

Each 10-foot sample is divided, resulting in three complete sets of samples for each well. One set is retained at the Charlie Lake sample library, one is sent to headquarters at Victoria, and the other to the Geological Survey of Canada in Calgary. The remainder of the 10-foot sample from the original sample-bag is retained at the laboratory for a period not exceeding one year should further samples be required. The main sample-examination facilities are at Charlie Lake, with limited facilities available at Victoria.

The Charlie Lake sample library and the Geological Survey of Canada sample library in Calgary each has a set of samples from wells drilled in British Columbia since 1948; the Victoria sample library has samples from wells drilled since September, 1957. At the end of 1965 the Charlie Lake sample library contained 462,836 samples and the Victoria library contained 461,197 samples.

During 1965, samples were received at the laboratory from 242 wells. This represented over 490,000 feet of drilling in northeastern British Columbia. A total of 54,561 10-foot samples was washed and bottled in 1965.

Core and Sample Examination

A nominal fee is charged for the use of the core- and sample-examination facilities provided by the Department.

In 1965, 10,185 boxes of core from 675 wells were studied by oil company personnel and other interested individuals. Cores from 88 wells were temporarily removed from the laboratory by the operators for further studies. Samples from 36 wells were studied, using the laboratory facilities at Charlie Lake.

Since the core- and sample-examination laboratory at Charlie Lake was made available to the public in February, 1961, 41,927 boxes of core have been removed from the racks for examination.

Exploration

In 1965, 20 oil and gas companies did seismic work in northeastern British Columbia, and one other company conducted a limited gravity meter survey in the area. In the Fernie area, seismic work was done by two companies, and two companies operated marine seismic parties off the west coast. In northeastern British Columbia, 172 seismic crew-weeks were completed (Table 1). One company studied the surface geology on Vancouver Island and the Gulf Islands (Table 2). No exploratory test-holes were drilled in the Province in 1965.

In 1965 all the drilling for oil and gas was in northeastern British Columbia, and a total of 74 exploratory wells was completed. Of these, 31 were discovery wells, compared with 11 in 1964. One discovery well was drilled in the foothills south of the Peace River, Triad BP Sukunka a-43-B, a gas discovery in the Triassic

Schooler Creek Group. The remaining 30 discoveries were in the plains area of northeastern British Columbia north of the Peace River; seven of these were Middle Devonian gas wells in the Fort Nelson area and the others were Triassic and Cretaceous discoveries in the Fort St. John area (*see* Fig. 33).

In the Fort St. John area, Mesozoic horizons were the main objectives, and exploratory drilling was again focused on the developing trend of oil pools trapped along the depositional edge of the Triassic Halfway Formation.

The most significant oil discoveries in this area during 1965 were made by the well Tenn Ashland Weasel d-35-B, which established the Weasel oilfield 5 miles west of the Wildmint field, and the well Union HB Sinc Pac Crush b-9-F, which extended the Peejay oilfield to the southeast. A new oil pool, the extent of which is not yet known, was discovered by the well Pacific SR CanDel Osprey d-4-J. Oil was also discovered adjacent to the Rigel gasfield in the well Monsanto Rigel 6-13-87-17.

A significant gas discovery was made approximately 8 miles east of the Blueberry field by Tenn Cdn-Sup et al Inga 13-7-88-23, which found gas in the Triassic Charlie Lake Formation. The Nig Creek gasfield was extended to the east by the Triassic Baldonnel gas discovery in Texaco NFA Nig c-6-H. A new gas pool was discovered in the same formation 8 miles southeast of the Nig Creek field in the well Union Birch d-99-E. New gas discoveries were made in the Lower Cretaceous Bullhead Group of Pacific West Prod N Buick c-22-F and Richfield N Rigel a-27-I.

In the Fort Nelson area most of the discoveries were made along the well-established producing trend of the Slave Point Formation. Two of the northern wells, however, opened up a new reservoir in the Pine Point Formation in the Sierra area. A well previously abandoned, Altair et al Tenaka d-82-L, was completed as a gas well in the Slave Point-Sulphur Point Formations.

RESERVOIR SECTION

Maximum Permissible Rates

In 1965 the Reservoir Section established 100 maximum permissible rates for oil wells, of which 13 were initial rates and 87 were interim approvals granted pending further evaluation of reservoir data. Eight of the interim approvals were revisions of existing rates. One interim approval was cancelled due to reclassification. The maximum permissible rates at December 31, 1965, are shown in Table 6.

Eight applications for revision of existing pool M.P.R.'s were received. All were approved as submitted.

Dome Petroleum Limited applied to have the Project No. 1 M.P.R. increased from 2,343 to 2,429 barrels per day. The application was approved on October 1st.

Imperial Oil Limited applied for three separate increases to Boundary Lake Unit No. 1 M.P.R., all resulting from extensions of the unit boundary to include newly completed oil wells. The increases were approved as follows: 18,818 barrels per day effective February 1, 18,887 per day effective April 1, and 19,090 barrels per day effective September 1, 1965.

Texaco Exploration Company applied to have the M.P.R. of Boundary Lake Unit No. 2, which became effective on May 1st, increased from 9,754 to 9,892 barrels per day. The application was approved to take effect on October 1st.

Triad Oil Company applied to have the Beatton River pool M.P.R. increased from 1,960 to 2,054 barrels per day. Approval was granted on July 1st.

Union Oil Company of Canada Limited applied for two revisions to existing pool M.P.R.'s. The first, which was approved on May 1st, increased the Aitken Creek unit M.P.R. from 582 to 874 barrels per day, and the second approval, granted on December 16th, increased the Wildmint Upper Halfway pool M.P.R. from 1,191 to 1,566 barrels per day.

The pool, project, and unit M.P.R.'s at December 31, 1965, are listed in Table 7.

Absolute Open-flow Tests and Production Rate Limits

The results of 248 absolute open-flow potential tests of gas wells were processed and production rate limits were established in 1965. Six of the test results received were retests made in the same year.

The absolute open-flow potentials and production rate limits for all gas wells at December 31, 1965, except those still held confidential, are shown in Table 8.

Dome Petroleum Limited was granted approval on December 14th for a Laprise Creek Baldonnel Gas Unit. Application was then made for a production rate limit for the gas wells in the Laprise Creek Baldonnel Gas Unit No. 1 equal to the sum of all the individual well production rate limits. Approval had not been granted at the end of December.

Pacific Petroleums Limited applied for exemption from normal gas-well production rate limits for wells producing from the Wabamun zone of the Parkland field, and sought permission to produce gas from the field in accordance with good engineering practice. Approval was granted on December 15th subject to periodic review and amendment as deemed necessary.

Pressure Maintenance

Pressure maintenance by gas injection and water injection to supplement the natural driving energy of oil pools continued and was extended during 1965. Three applications were received, two were given final approval, and one was granted approval in principle.

Dome Petroleum Limited commenced water injection in Boundary Lake Project No. 2 in March, obtaining water from the Moose Creek Reservoir. Texaco Exploration Company commenced pressure maintenance by water injection in Boundary Lake Unit No. 2 on May 11th, obtaining water from the Peace River via the Imperial Oil Limited supply system.

Western Natural Gas Co. Inc. applied for a pilot water-injection scheme in the Blueberry Mississippian pool. It was proposed to inject water into West Nat et al Blueberry d-9-K to obtain reservoir data for future full-scale pressure maintenance of the pool. Approval of the scheme was granted on March 4th.

Union Oil Company of Canada Limited applied on behalf of itself and Hudson's Bay Oil and Gas Company Limited for approval of a pressure-maintenance scheme by water injection in the Wildmint Upper Halfway pool. The application was approved in principle on November 8th. Also applied for was enlargement of gas-injection facilities in the same Upper Halfway pool. Approval was granted on December 16th.

Gas-Oil Ratio Adjustment Factors

The application of gas-oil ratio adjustment factors to all oil wells producing either singly or in a group was continued during 1965.

Reserves

As a result of additional pools discovered, and extensions to the existing fields, the proved recoverable reserves of oil and established reserves of gas increased slightly during 1965 compared with 1964.

A summary of the reserves of oil, gas, natural-gas liquids, and sulphur at the end of 1965, with explanatory notes, is given in Table 5.

Oil and gas reservoir data as compiled at the end of 1965 is given in Tables 3 and 4.

DEVELOPMENT SECTION

Drilling

During 1965 a significant increase was made in the footage drilled in British Columbia, compared with 1964. All the drilling activity took place in the northeastern corner of the Province, although one well, located near Chilliwack, remained suspended pending further drilling.

The annual footage drilled increased 64 per cent over the 1964 footage and totalled 1,103,151 feet. This is the third time in the history of the industry in British Columbia that the annual footage exceeded 1,000,000 feet. In the other two years, 1961 and 1962, that footage was accomplished during the development of the Boundary Lake field. Although the exploratory wildcat footage decreased 9 per cent, that of the other two well classifications, development and exploratory outpost, recorded increases of 71 and 122 per cent respectively. These latter figures reflect the concentration of activity along the Halfway oil trend between the Beatton River and Currant fields, where many outpost or stepout locations were drilled, followed by the development of newly discovered pools. Exploratory wildcat drilling totalled 138,915 feet, while exploratory outpost and development footages were 305,857 and 658,379 feet respectively.

The number of operators, drilling contractors, and drilling rigs active in the Province during 1965 did not change significantly relative to 1964. In 1965, 45 operating companies engaged 15 different drilling contractors that employed 47 individual rigs to complete the drilling.

Well completions increased 71 per cent, there being 250 wells in 1965 and 146 in 1964. As in previous years, each zone of a multiple completion was considered as one completed well. Only one multiple completion was made in 1965, which means that 249 separate wells were actually completed. The increase in the total number of completions was due to the large gain in the number of oil-well

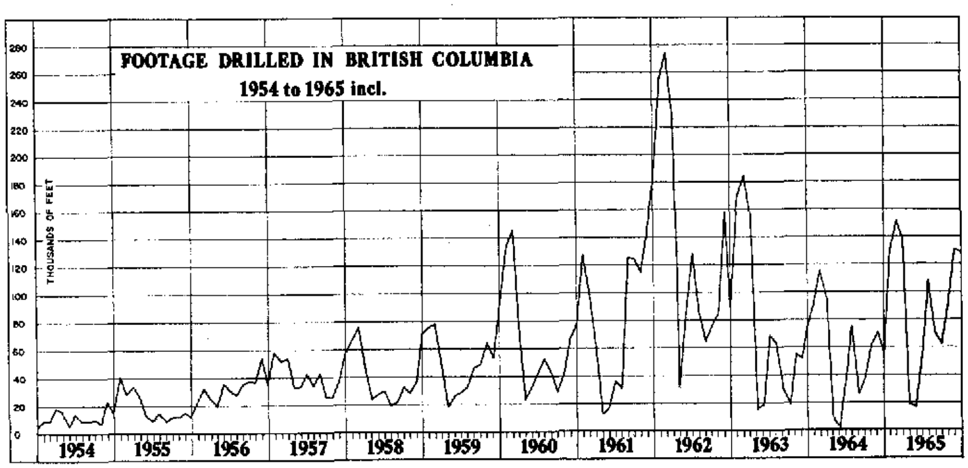


Figure 32. Footage drilled in British Columbia, 1954–65.

completions. During 1965, 116 wells were completed as producible oil wells, an increase of 158 per cent over the 45 oil-well completions of 1964. While the activity of oil-well completions was mainly in one specific area, the gas-well completions were widely scattered, although they generally were near known gas pools. The number of gas completions in 1965 was up 8 per cent, while abandonments increased 48 per cent. British Columbia's high success ratio was maintained as 156 of the 244 locations drilled for production of oil or gas in 1965 resulted in successful wells.

At the end of 1965, 23 locations were being actively drilled, one was suspended, and two were considered as finished drilling with their final status not determined.

Wells drilled and drilling in 1965 are listed in Table 9, and monthly footages from 1954 to 1965 are shown graphically in Figure 32.

Work-over operations at completed wells during 1965 increased 16 per cent compared with 1964, as 75 wells were re-entered to change the producing interval or producing characteristics of the wells. Such operations as perforating, acidizing, fracturing, installing pumping equipment, changing chokes, or cementing are considered as work-overs.

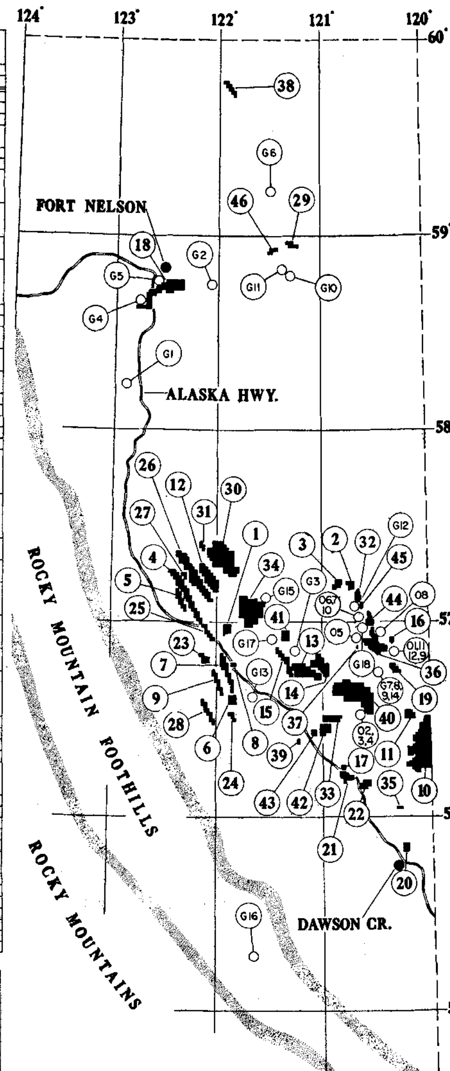
Quarterly studies of the Branch-designated fields were continued during 1965. New fields were established in three areas—Boundary Lake North, Currant, and Yoyo—while 15 amendments were made to existing fields. At the end of 1965 there were 46 fields, which are listed in Table 10 with their locations shown on Figure 33. The field boundaries, previously determined by an arbitrary method only, were based more upon geological interpretations during 1965. The rules of designating a field were continued—namely, when one well is on continuous production or when three or more wells in contiguous spacing areas are producible. Study of the geology of the immediate areas was employed to help determine the extent of initial fields or extensions to established fields. Release of well information depends upon the well's position relative to the designated fields. For wells located within a field boundary the data are held confidential for 30 days, and for wells located outside a field the data are held confidential for one year.

All submissions made to the Branch pertaining to drilling operations, except abandonments which are dealt with by the field engineer, are referred to the Development Section. Approvals must be obtained by operators for commencement of drilling, relocation or abandonment of wells, or for any alteration to a well's physical characteristics. Well names or any changes of well names must also be approved by the Development Section.

During 1965 the Section approved 276 well authorizations, compared with 146 in 1964. Issuance of well authorizations represents a significant part of the work of the Development Section. The title and submitted survey for each application must be examined and all aspects of the proposed drilling programme studied to assure conformation with the regulation. A classification is assigned to each well location that is used as the basis for survey and reporting requirements. The Branch classifies well locations as development, exploratory outpost, or exploratory wildcat, according to their distance from oil or gas wells capable of production. Further classifications of deep-pool or shallow-pool tests are employed in special instances where exploration is planned below or above the known pools of an area. During 1965 a Lahee well classification was also assigned. This system is used by the geological profession in an attempt to standardize well classifications in North America.

FIELDS & POOLS - DEC. 31, 1965

NO	FIELD	PRODUCING HORIZON OIL	PRODUCING HORIZON GAS
1	AITKEN CR.	Gething	
2	BEATTON R.	Halfway	
3	BEATTON R. WEST	Bluesky-Gething	
4	BEG		Baldonnel Halfway
5	BEG WEST		Baldonnel
6	BERNADET		Bluesky-Gething
7	BLUEBERRY	Mississippian	Dunlevy Baldonnel Charlie Lake
8	BLUEBERRY EAST		Baldonnel Halfway Mississippian
9	BLUEBERRY WEST		Dunlevy Baldonnel
10	BOUNDARY LAKE	Boundary Lake Halfway	Bluesky-Gething Gething Dunlevy Baldonnel
11	BOUNDARY L. N.		Halfway
12	BUBBLES		Baldonnel
13	BUICK CREEK		Dunlevy Charlie Lake
14	BUICK CR. EAST		Bluesky-Gething Dunlevy
15	BUICK CR. WEST	Dunlevy	Baldonnel Halfway
16	BULRUSH	Halfway	
17	CHARLIE LAKE	Gething	
18	CLARKE LAKE		Slave Point
19	CURRANT	Halfway	Halfway
20	DAWSON CREEK		Cadotte
21	FORT ST JOHN	Charlie Lake	Cadomin Baldonnel Halfway Belloy
22	FORT ST. JOHN S.E.		Cadomin Baldonnel Halfway Belloy
23	GUNDY CREEK		Baldonnel Charlie Lake
24	HALFWAY		Baldonnel Halfway
25	HIGHWAY		Dunlevy Baldonnel Mississippian
26	JEDNEY		Gething Baldonnel Halfway
27	JEDNEY WEST		Baldonnel Halfway
28	KOBES-TOWNSEND		Dunlevy Charlie Lake Halfway Mississippian
29	KOTCHO LAKE		Slave Point
30	LAPRISE CREEK		Baldonnel
31	LAPRISE CR. WEST		Baldonnel
32	MILLIGAN	Halfway	
33	MONTNEY		Bluesky-Gething Charlie Lake Halfway
34	NIG CREEK		Baldonnel
35	PARKLAND		Wabamun
36	PEEJAY	Halfway	
37	PEEJAY WEST	Halfway	
38	PETITOT RIVER		Slave Point
39	RED CREEK		Charlie Lake Halfway
40	RIGEL		Dunlevy
41	SNYDER CREEK		Dunlevy
42	STODDART		Belloy
43	STODDART WEST		Belloy
44	WILDMINT	Halfway	
45	WILLOW	Bluesky-Gething	Halfway
46	YOYO		Slave Pt.-Pine Pt.



DISCOVERY WELLS — 1965

-GAS-

G1 ALTAIR ET AL TENAKA d-82-L/94-J-2
G2 IOE E CLARKE b-6-A/94-J-16
G3 PACIFIC WEST PROD N BUICK c-22-F/94-A-14
G4 PACIFIC APACHE CLARKE a-61-F/94-J-10
G5 PACIFIC IMPERIAL CLARKE c-92-I/94-J-10
G6 PLACID LOUISE c-80-L/94-P-3
G7 RICHFIELD N RIGEL a-27-I/94-A-10
G8 RICHFIELD N RIGEL d-33-I/94-A-10
G9 SINCLAIR PACIFIC MINK d-88-A/94-A-15
G10 SOCONY MOBIL SIERRA c-78-C/94-I-14
G11 SOCONY MOBIL SIERRA c-91-D/94-I-14
G12 SUN TEXACO W WILLOW d-95-B/94-H-2
G13 TENN CDN-SUP ET AL INGA 13-7-88-23
G14 TEXACO NFA CURRANT a-3-C/94-A-16
G15 TEXACO NFA NIG c-6-H/94-H-4
G16 TRIAD BP SUKUNKA a-43-B/93-P-5
G17 UNION BIRCH d-99-E/94-A-14
G18 SINCLAIR PACIFIC WEASEL d-93-J/94-A-15

-OIL-

O1 CIGOL PEEJAY d-43-E/94-A-16
O2 MONSANTO IOE FINA RIGEL 8-18-87-16
O3 MONSANTO RIGEL 6-13-87-17
O4 MONSANTO RIGEL 6-31-87-17
O5 PACIFIC SR CANDEL OSPREY d-4-J/94-A-15
O6 SINCLAIR PACIFIC WEASEL d-30-A/94-H-2
O7 SINCLAIR PACIFIC WEASEL d-13-B/94-H-2
O8 TENN BEAVERDAM d-38-L/94-A-16
O9 UNION HB PEEJAY d-25-E/94-A-16
O10 TENN ASHLAND WEASEL d-35-B/94-H-2
O11 TEXCAN BUCKTHORN d-90-C/94-A-16
O12 UNION HB SINC PAC CRUSH b-9-F/94-A-16

OIL & GAS FIELDS
OF NORTHEASTERN BRITISH COLUMBIA

PETROLEUM & NATURAL GAS BRANCH
BRITISH COLUMBIA DEPARTMENT OF MINES & PETROLEUM RESOURCES
VICTORIA, B.C., DECEMBER 31, 1965

Figure 33. Petroleum and natural-gas fields, 1965.

In 1965 the Development Section issued six new rig licences and renewed 52 that had been issued in previous years. These licences are required by regulation and are issued to each individual drilling rig operating in the Province.

The preparation of several maps was continued during 1965. The location of the Branch-designated fields, the well locations and their status, plus many of the production facilities are shown on the distributed maps. Regular subscribers and other persons interested in the petroleum industry obtain the maps from the Victoria office.

One serious accident, in which one man was killed during the testing of a gas well, and two minor fires occurred in 1965. The fires involved the Aitken Creek Gas Cycling Plant and a dehydrator at one of the Jedney gas wells.

Two salt-water disposal wells were in operation in 1965 and received 275,841 barrels to be disposed of in underground formations. This volume is nearly five times the 46,337 barrels disposed of during 1964. Other volumes of salt water obtained from the producing wells, which amounted to 310,256 barrels, was placed in surface pits for disposition by evaporation.

Drilling and other activities related to the petroleum industry do much to open new lands for settlers. Many areas that previously were isolated are now provided with year-round access to the populated centres.

Production

Petroleum and natural-gas production each increased by 17 per cent compared with the 1964 production.

Crude-oil and field condensate produced during 1965 was 13,502,539 barrels. Seventy-five per cent of this total was obtained from the Boundary Lake, Peejay, and Milligan fields, with the Boundary Lake field accounting for 39 per cent of the Provincial total.

Natural-gas production, which includes wet and dry well-head gas plus the associated gas produced from oil wells, was 171,514,420 M s.c.f. in 1965. The Jedney field was the largest producer with 20,734,378 M s.c.f. The Clarke Lake and Laprise Creek fields each produced more than 17 billion cubic feet, while the Beg, Buick Creek, Nig Creek, and Rigel fields each produced more than 10 billion cubic feet.

Monthly crude-oil and natural-gas production by fields and pools for 1965 are given in Tables 12 and 13.

Graphs of the monthly production from 1954 to 1965 are shown in Figures 34 and 35.

There was little change in the 1965 production of condensate/pentanes plus compared with 1964. A total of 979,211 barrels was produced in 1965 and, of the 925,308 barrels sold, over 50 per cent was exported.

Butane production for 1965 decreased 8 per cent compared with 1964, as a result of the reduced production at the oil refineries and the 40-per-cent decrease in export volume.

Propane production for 1965 increased 17 per cent to 635,313 barrels. Most of the sales, 84 per cent, were made in British Columbia with minor amounts to neighbouring Provinces and for export.

Sulphur production for 1965 decreased 13 per cent while sales increased 28 per cent compared with 1964. Of 88,785 short tons sold in 1965, 83 per cent was exported.

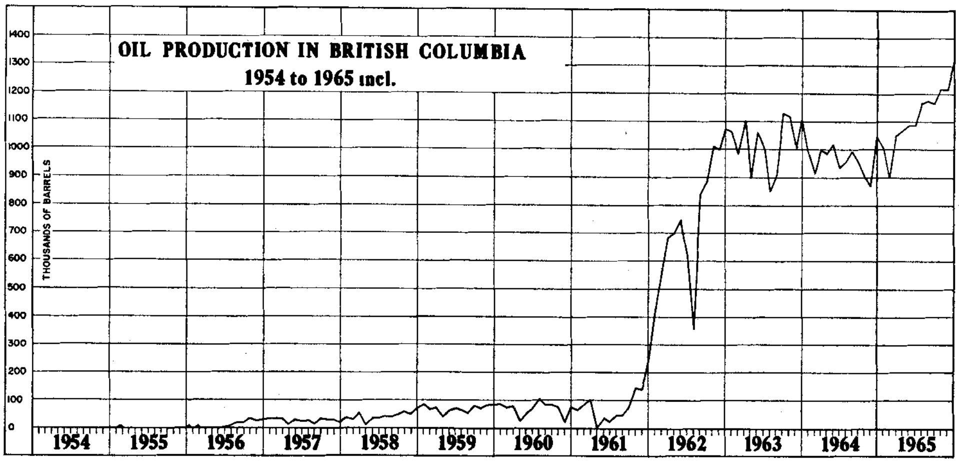


Figure 34. Oil production in British Columbia, 1954–65.

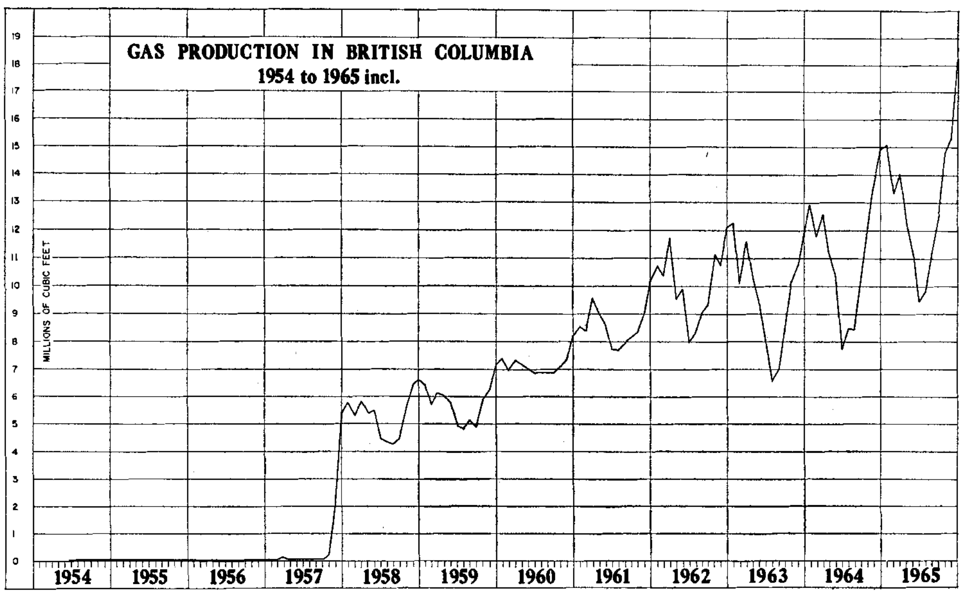


Figure 35. Gas production in British Columbia, 1954–65.

General statistics showing well operation and production data are given in Table 14. The monthly dispositions of the various petroleum products are shown in Tables 15, 16, and 17. Monthly values to the producers are given in Table 18.

PIPE-LINES

Gas-gathering System

No changes were reported in the gas-gathering system of British Columbia during 1965.

Gas-transmission System

The major pipe-line construction project completed in 1965 was the Westcoast Transmission 30-inch line from Fort Nelson to Chetwynd, a distance of 220 miles.

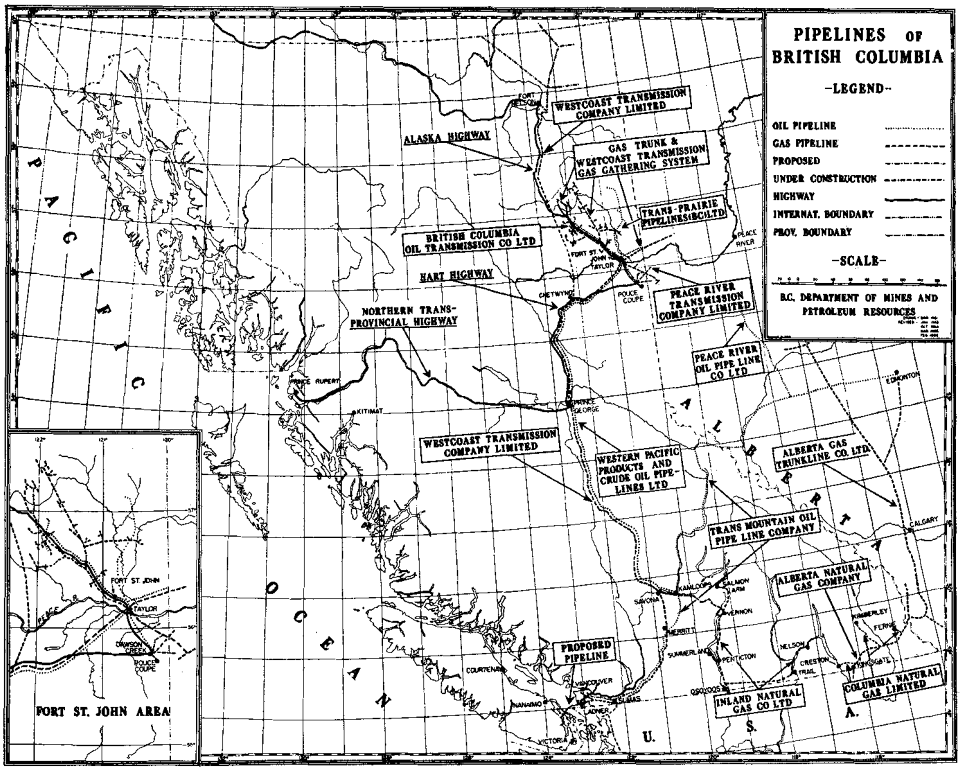


Figure 36. Petroleum and natural-gas pipe-lines.

The line has a capacity of 325 million cubic feet per day. Natural gas commenced flowing through it early in 1965. To handle the additional volumes through its main line to the Lower Mainland, Westcoast Transmission Co. Ltd. doubled the number of compressor stations and raised the capacity to 665 million cubic feet per day.

Inland Natural Gas Co. Ltd. added 8 miles to its gas-transmission pipe-lines.

Gas-distribution System

Three expansions to gas-distribution systems were reported for 1965. British Columbia Hydro and Power Authority increased the Lower Mainland network by 257 miles, Inland Natural Gas Co. Ltd. expanded by 39.5 miles to serve Hudson Hope and the Cariboo, and Columbia Natural Gas Limited increased the Kootenay system by 0.8 mile.

Oil-gathering System

Trans-Prairie Pipelines (B.C.) Ltd. increased its main pipe-line by 30 miles and its gathering pipe-lines by 20 miles to reach the newly discovered oil pools between the Beatton River and Currant fields. The throughput of this system was raised to 33,629 barrels per day, while storage capacity at the end of 1965 was 160,000 barrels.

Oil-transmission System

During 1965 Western Pacific Products and Crude Oil Pipelines Ltd. increased the throughput of the pipe-line from Taylor to Kamloops to 32,680 barrels per day.

Gas-processing Plants

In conjunction with the production and delivery of natural gas in the Fort Nelson area, Westcoast Transmission Co. Ltd. completed and put into operation a gas-processing plant in the Clarke Lake field. The output capacity of the plant was 170,000 cubic feet per day.

Oil Refineries

No changes were made in the six British Columbia refineries, but the operation of the refinery located at Kamloops was assumed by British American Oil Company in 1965.

Sulphur Plant

No change was made to the sulphur plant located adjacent to the gas-processing plant at Taylor.

Tables 19, 20, 21, 22, and 23 provide data on the pipe-lines, gas-processing plants, oil refineries, and sulphur plant at the end of 1965.

Well Records

Information concerning the petroleum and natural-gas industry in British Columbia is collected and compiled by the Petroleum and Natural Gas Branch.

The data are made available to interested persons, in strict accordance with section 51 of the regulations. Location, elevation, current depth, casing, status, and monthly production of individual wells are released upon request. Other information is held confidential, depending upon the relationship of the well location to the designated fields.

Data obtained from wells located within a field are available 30 days after the release of the drilling rig, provided that one year has expired since the rig release date of the discovery well for the field. When a well location is not within a designated field, all data are confidential for one year after the release of the drilling rig. In the case of deep-pool and shallow-pool tests, the data from the exploratory portions of the wells are held confidential for the one-year period. Confidential well information may be released to an interested person, if a letter is received by the Branch from the operator of the well authorizing its release.

Information is released by publication, examination of Branch records, or reproduction of data. Cost-defraying charges are made by the Branch for these services.

The records maintained by the Branch are in constant use by the Reservoir, Development, and Geological Sections. Therefore, they must be kept up to date and in a manner suitable for many purposes. As the published reports are expanded to meet the requirements of the industry and of other government bodies, the systems of keeping records must be altered.

The Branch has representation on the Statistical Sub-committee which was established at the request of the Mines Ministers' Conference in 1955. This committee is composed of representatives from each Province actively engaged in the petroleum industry and personnel employed by oil companies. The objectives of the group are as follows:—

(1) Standardization of forms designed for the same purpose but which are required individually by both the Provincial and Federal Governments under different formats.

(2) Standardization of forms to accommodate machine accounting procedures for reporting production statistics to the Provincial Governments.

(3) Amendment of existing model report forms to conform with present requirements.

(4) Investigation of ways and means to obtain the co-operation of both Provincial and Federal Government agencies and provide earlier availability of information on all phases of the oil and gas industry.

One meeting of the Statistical Sub-committee was held in 1964, when revisions in the model forms were approved and discussions were held concerning the procedures and reports employed by the Provincial authorities. The Petroleum and Natural Gas Branch has adopted many features of these model forms and uses the following applications and reports:—

Form No.	Form Name
1.	Well Register.
2.	Application for a Well Authorization.
3.	Application to Amend a Well Authorization.
4.	Application to Change a Well Name.
5.	Application to Abandon a Well.
6.	Application to Alter a Well.
7.	New Oil Well Report.
8.	New Gas Well Report.
9.	Application for M.P.R.
10.	Report of Wells Connected to a Battery.
BC S1.	Monthly Production Report.
BC S2.	Monthly Disposition and Crown Royalty Statement.
15.	Monthly Gas-gathering Operations Report.
16.	Monthly Natural Gas Plant Statement.
17.	Monthly Natural Gas Processing Statement.
18.	Monthly Sulphur Plant Operations Report.
19.	Monthly Refinery Operations Report.
20.	Monthly Crude Oil and Condensate/Pentanes Plus Purchaser's Statement.
21.	Monthly Liquefied Petroleum Gas Purchaser's Statement.
22.	Well Completion Report.
23.	Supplement to Well Completion Report.
24.	Work-over Report No. .
*25.	Work-over Card.
*26.	Monthly Operations Report.
27.	Application for a Rig Licence.
28.	Monthly Water Flood Operations Report.
29.	Monthly Water Receipts and Disposal Report.
30.	Statement of Nomination and Estimated Requirements for British Columbia Crude Oil, Condensate/Pentanes Plus.
31.	New Service Well Report.
32.	Well Allowable Report.
*33.	Drilling Report.
*7C.	Meter Inspection Report.
*7D.	Battery Inspection Report.
	†Monthly Natural Gas Distributor's Statement.
	†Monthly Report on Oil Pipeline Gathering Operations.

* For Department use only.
† Used in conjuction with the Dominion Bureau of Statistics.

The Branch has representation on the Provincial-Federal Committee on Oil and Gas Statistics, which held one meeting during 1965. The purpose of this committee is to establish and revise, as required, statistical forms on the production, transportation, and distribution of oil and gas and to foster the joint collection of these statistics, eliminating as much duplication by the Provincial and Federal agencies as possible.

Reports

Schedule of Wells

An annual volume is compiled and published giving all well information released during the year. It covers the period from 8 a.m. January 1st to 8 a.m. January 1st of the succeeding year.

The data are arranged by geographical areas and provide the following information when applicable: Well name, classification, well authorization number, operator, title and title number, location, co-ordinates, spud date, rig release date, ground elevation, Kelly bushing elevation, total depth, status, interval open to production, casing details, logs, core intervals, sample intervals, drill-stem tests, wireline tests, and geological markers as determined by the operator and the Branch.

This information is condensed from reports submitted to the Branch by the various operators.

Weekly Report

A weekly report is published for Departmental use from data collected by the field office staff at Charlie Lake. The week reported is from 8 a.m. Friday to 8 a.m. of the succeeding Friday. The following information is included:—

(1) Well locations approved.
(2) Well locations pending approval.
(3) Well locations cancelled.
(4) Changes of well names.
(5) Changes of well classification.
(6) Changes of well status.
(7) Wells spudded.
(8) Rigs operating.
(9) Wells approved but not spudded.
(10) Suspended wells.
(11) Finished drilling wells.
(12) Abandoned wells.
(13) Completed wells.
  (*a*) Oil wells.
  (*b*) Gas wells.
  (*c*) Water-injection wells.
  (*d*) Gas-injection wells.
  (*e*) Water-source wells.
  (*f*) Observation wells.
(14) Work-overs.
(15) Summary of well count giving the following totals:—
  (*a*) Finished drilling wells.
  (*b*) Abandoned wells.
  (*c*) Oil wells.
  (*d*) Gas wells.
  (*e*) Injection wells.
  (*f*) Disposal wells.
  (*g*) Completed wells.
  (*h*) Locations drilled.

(*i*) Multiple wells.
(*j*) Drilling wells.
(*k*) Suspended wells.
(*l*) Approved but not spudded wells.
(*m*) Locations in good standing.
(*n*) Locations approved.
(*o*) Locations cancelled.

The number of completed wells is calculated by two methods to provide verification. The number of wells of different status, counting each zone of a multiple completion as a well, is compared to the number of locations drilled less the multiple completions.

The number of locations in good standing is calculated also by two methods. The total number of locations drilled, drilling, suspended, and approved but not spudded is compared to the total number of locations approved less the number of locations cancelled.

Oil and Gas Production Report

The Oil and Gas Production Report is prepared monthly from returns made by the operators of the producing wells, pipe-lines, gas plants, refineries, and distribution facilities. The contents of the report are as follows:—

(1) Graphical presentations of the daily average oil production, the daily average residual and dry gas production, and the monthly footage drilled with comparative graphs of the totals for the preceding year.
(2) Monthly summary of the drilling and completion activity with cumulatives for the year and comparative figures for the same month of the preceding year.
(3) New oil- and gas-well reports received.
(4) The number of producing and producible oil and gas wells by field and pool and comparative figures for the same month of the preceding year.
(5) Production of crude oil, natural gas, condensate, and water by field and pool with comparative volumes produced in the same month of the preceding year. These quantities are given for the current month, the current year, and the all-time cumulative.
(6) Estimated oil production for the succeeding month.
(7) Crude oil and equivalent disposition.
(8) Value of crude-oil sales to British Columbia producers.
(9) Disposition of produced water.
(10) Tabulation of nominations and estimated requirements for British Columbia crude oil and condensate/pentanes plus.
(11) Approved maximum permissible rates.
(12) Withdrawn maximum permissible rates.
(13) Approved absolute open-flow potential tests.
(14) Natural-gas disposition.
(15) Value of natural gas to British Columbia producers and distributors.
(16) Production and disposition of condensate/pentanes plus, butane, propane, and sulphur.
(17) Value of sales of natural-gas liquids and sulphur to British Columbia producers.
(18) Water-flood operations showing the number of injection wells and the current monthly, current yearly, and all-time cumulative figures for each formation in each pool and field.

This report is compiled and mailed to subscribers approximately two weeks after receipt of the returns from the operators.

Drilling and Land Report

The Drilling and Land Report is published and distributed monthly concurrently with the Oil and Gas Production Report.

The Drilling Section is compiled from information forwarded by the Branch field office and contains the following:—

(1) Monthly summary of drilling and completion activity with cumulatives for the year, and comparative figures for the same month of the preceding year.

(2) Summary of the well count giving the following totals:—
 (*a*) Locations drilled.
 (*b*) Finished drilling wells.
 (*c*) Abandoned wells.
 (*d*) Oil wells.
 (*e*) Gas wells.
 (*f*) Water-injection wells.
 (*g*) Gas-injection wells.
 (*h*) Water-source wells.
 (*i*) Observation wells.
 (*j*) Disposal wells.

(3) Well authorizations approved.
(4) Locations cancelled.
(5) Locations outstanding.
(6) Changes of well status.
(7) Changes of well classification.
(8) Changes of well names.
(9) Suspended wells.
(10) Drilling and completed wells.
(11) Rig licences issued.
(12) Rig licences renewed.
(13) Rig licences cancelled.
(14) Well data released from confidential status.
(15) Descriptions of designated fields.

The Land Section is prepared by the Petroleum and Natural Gas Titles Section and contains the following:—

(1) Acreage synopses.
(2) Summary of changes in acreage held under the following titles:—
 (*a*) Permits.
 (*b*) Leases.
 (*c*) Natural-gas licences.
 (*d*) Drilling reservations.
(3) Geophysical licences issued and renewed.
(4) Notices regarding sales of Crown petroleum and natural-gas rights.
(5) Summary of disposition of permits, leases, natural-gas licences, and drilling reservations.

PUBLICATIONS

Various publications, maps, and services concerning petroleum and natural-gas operations in British Columbia are available. A catalogue containing descriptions and prices is available from the Chief Petroleum and Natural Gas Commissioner, Administration Branch, or the Chief, Petroleum and Natural Gas Branch, Department of Mines and Petroleum Resources, Parliament Buildings, Victoria, B.C.

TABLES

TABLE 1.—GEOPHYSICAL EXPLORATION, 1965

Seismic Surveys

NOTE.—Unless otherwise shown, the exploration method used is land reflection seismic survey. For indicating location, the National Topographic map numbering system is used, except in the Peace River Block, where the township system is used.

Company	Location of Exploration	Number of Seismic Crews	Number of Crew-weeks
January			
Amerada Petroleum	94-J-7	1	2.5
Atlantic Refining	94-I-11, -14	1	3
	94-I-7, -10	1	1.5
	94-P-4	1	3
British American	94-J-9; 94-I-12	1	4
California Standard	94-J-2, -3, -5, -6, -11	1	3.5
Calgary & Edmonton	94-J-9	1	4
Imperial Oil Enterprises	94-I-7	1	2
	94-I-8	1	2
	94-I-1	1	1
Marathon Oil	94-I-11, -12	1	3
	94-P-7, -8	1	1
Monsanto Oils	94-G-7, -8	1	4
	94-G-1; 94-H-4	1	1.5
Pacific Petroleums	Tp. 88, R. 24, 25, W. of 6th M.; 94-A-12	1	1
	94-J-10; 94-J-15	1	1
	94-I-13; 94-J-16	1	1
	94-J-10	1	2
Placid Oil	94-I-12, -13	1	6
Richfield Oil	94-I-11, -14	1	1
	94-P-7, -8	1	3
	94-B-9	1	0.5
	94-A-10, -11	1	1
Triad Oil	94-H-4, -5	1	3.4
February			
Amerada Petroleum	94-J-7	1	3
	94-J-2	1	1
Atlantic Refining	94-I-7, -8, -10, -15	1	3
British American	94-J-9; 94-I-12	1	4
California Standard	94-J-2, -3, -5, -6, -11	1	1
Calgary & Edmonton	94-J-9; 94-P-5	1	4
Imperial Oil Enterprises	94-I-1	1	2
	93-P-8	1	1
	93-P-7	1	2
	93-P-10	1	0.5
Marathon Oil	94-P-7, -8	1	4
Monsanto Oils	94-J-10, -15	1	3
	94-G-7, -8	1	1
Pacific Petroleums	94-J-8	1	1
	94-P-3, -4, -5	1	2
	94-J-10, -11, -14	1	1
Placid Oil	94-J-9	1	1
Pure Oil	94-J-1; 94-I-4	1	3
Richfield Oil	94-P-7, -8	1	4
	94-A-10, -11	1	2
Shell Oil	103-F, -G	1[1]	2
Triad Oil	94-J-8, -9	1	0.6
Union Oil	94-J-10	1	1
March			
Altair Oil & Gas	94-I-11	1	1
Amerada Petroleum	94-J-2	1	1
	94-J-7	2	2
	94-I-3	1	1
	94-I-14	1	0.5

[1] Marine seismic.

TABLE 1.—GEOPHYSICAL EXPLORATION, 1965—*Continued*

Seismic Surveys—Continued

Company	Location of Exploration	Number of Seismic Crews	Number of Crew-weeks
March—Continued			
Atlantic Refining	94-I-14	1	0.4
British American	94-J-8, -9; 94-I-5, -12	1	2
Calgary & Edmonton	94-J-9; 94-A-13	1	4
Imperial Oil Enterprises	93-P-8	1	0.5
	93-P-7	1	2
	93-P-2	1	1
	93-P-1	1	0.5
Monsanto Oils	Tp. 87, R. 17, W. of 6th M.	1	1
Pacific Petroleums	94-J-11, -14	1	1.5
	94-J-14, -15	1	2.5
Pan American	94-G-9, -10	1	4
Pure Oil	94-J-2, -7	1	2
Richfield Oil and Marathon Oil	94-P-7, -8	1	4.5
Triad Oil	94-A-13; 94-B-16; 94-G-1; 94-H-4	1	1
	94-I-12; 94-J-9	1	1
Union Oil	94-J-10	1	1
April			
British American	94-A-3	1	2
Shell Oil	92-C, -D, -E	2[1]	8
May			
British American	94-A-3, -4	1	4
Shell Oil	92-C, -E	2[1]	8
June			
British American	92-F, -G	1[1]	4
Shell Oil	92-E; 103-A	2[1]	8
July			
British American	82-G-7	1	1
Shell Oil	103-B, -G	2[1]	8
Triad Oil	93-P-5, -6	1[2]	1
August			
British American	82-G-7, -10, -5	1	4
Imperial Oil Limited	82-G-1, -2	1	2
Shell Oil	92-C, -D, -E	2[1]	8
Triad Oil	93-P-5, -6	1[2]	1
Winter Oil	94-K-16; 94-J-13	1	4.4
September			
British American	82-G-7, -10	1	4
Imperial Oil Limited	82-G-1, -2	1	2
Pacific Petroleums	94-J-10	1	2
Shell Oil	92-C, -E	1[1]	2
Winter Oil	94-K-16; 94-J-4, -13	1	3.9
October			
British American	82-G-7, -10	1	2.5
Pacific Petroleums	94-J-10	2	4
	94-I-1, -8	2	2
Sinclair Canada	94-I-1, -8	1	0.5
Winter Oil	94-K-16; 94-J-4, -13	1	3.5
November			
Pacific Petroleums	94-I-1, -8	2	2
Sinclair Canada	94-I-1	1	0.2
December			
Dome Petroleums	94-H-4	1	2
	94-A-14	1	1
Pacific Petroleums	94-J-10; 94-H-2; 94-A-13	1	3

[1] Marine seismic.
[2] Seismic refraction.

TABLE 1.—GEOPHYSICAL EXPLORATION, 1965—*Continued*

Gravity Surveys

Company	Location of Survey	Number of Crews	Number of Crew-weeks
June			
Socony Mobil	94-I-14	1	2

TABLE 2.—SURFACE GEOLOGICAL EXPLORATION, 1965

Company	Location	Number of Geologists	Two-man Party-weeks
June			
British American	92-G	2	1
July			
British American	92-B-14; 92-G-4	2	4
August			
British American	92-F-8, -10	2	4

TABLE 3.—OILFIELD RESERVOIR DATA AT DECEMBER 31, 1965

Field	Pool	Rock Type	Age	Trap	Drive Mechanism	Average Porosity (per Cent)	Average Reservoir Thickness (Net Ft.)	Average Permeability (Md.)	Average Water Saturation (per Cent)	Shrinkage Factor (Stock Tank Barrel per Reservoir Barrel)	Gravity Degrees (A.P.I.)	Original Pressure (Psig.)	Average M.P.R. (Bbl./Day)
Aitken Creek	Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	Depletion and gas cap	12.0	17.0	1,993	18.0	0.77	39.2	1,534	175[1]
Beatton River	Halfway	Sandstone	Triassic	Structural-stratigraphic	Depletion	20.0	9.6	288	24.0	0.86	40.4	1,158	205[1] 49[2]
Beatton River West	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	Depletion and gas cap	14.0	8.0	65	31.0	0.80	42.1	1,017	78
Blueberry	Mississippian	Carbonate	Mississippian	Structural-stratigraphic	Gas cap and partial water	10.5	27.9	31[3]	16.6	0.75	42.4	2,701	256[1]
Boundary Lake	Boundary Lake	Carbonate	Triassic	Structural-stratigraphic	Depletion	18.3	11.9	45	10.9	0.80	33.7	1,800	141[1] 110[2]
Boundary Lake	Halfway	Sandstone	Triassic	Structural	Water and partial gas cap	13.2	10.7	14	26.0	0.82	42.6	1,685	74
Bulrush	Halway	Sandstone	Triassic	Stratigraphic	Depletion and gas cap	14.2	6.0	212	19.0	0.83	41.1	1,336	62
Charlie Lake	Gething	Sandstone	Lower Cretaceous	Stratigraphic	Depletion	19.0	13.0	([4])	25.0	0.83	34.4	1,097	36
Currant	Halfway	Sandstone	Triassic	Stratigraphic	Depletion and gas cap	16.2	6.6	81	15.0	0.83	38.8	1,398	83
Fort St. John	Charlie Lake	Sandstone	Triassic	Stratigraphic	Gas cap	13.8	3.3	570	25.0	0.77	39.6	1,939	37
Fort St. John	Belloy	Carbonate	Permian	Structural-stratigraphic	Depletion	10.0	21.0	23	25.0	0.75	43.0	2,770	85
Milligan Creek	Halfway	Sandstone	Triassic	Structural-stratigraphic	Depletion	24.7	16.5	23	13.9	0.88	40.4	1,170	476[1] 157[2]
Peejay	Halfway	Sandstone	Triassic	Stratigraphic	Depletion	15.9	9.9	81	21.0	0.83	39.0	1,368	201[1] 124[2]
Peejay West	Halfway	Sandstone	Triassic	Stratigraphic	Depletion	22.0	20.0	82	31.0	0.83	39.0	1,426	170
Rigel	Dunlevy	Sandstone	Lower Cretaceous	Stratigraphic	Depletion	13.1	5.0	297	42.0	0.87	38.6	1,274	145
Wildmint	Halfway	Sandstone	Triassic	Structural-stratigraphic	Depletion	17.3	13.0	380	21.0	0.87	40.0	1,212	112[1] 122[2]
Willow	Bluesky-Gething	Sandstone	Lower Cretaceous	Stratigraphic	Depletion	29.0	9.0	150	13.0	0.89	44.2	973	122

[1] Daily average M.P.R. obtained by dividing unit M.P.R. by the number of producible wells in the unit.
[2] Daily average M.P.R. of wells not included in a unit or pool M.P.R.
[3] Plus fractures.
[4] Not available.

TABLE 4.—GASFIELD RESERVOIR DATA AT DECEMBER 31, 1965

Field	Pool	Rock Type	Age	Trap	Av. Porosity (per Cent)	Av. Reservoir Thickness (Net Ft.)	Av. Permeability (Md.)	Av. Water Saturation (per Cent)	Compressibility Factor	Specific Gravity (Air=1.0)	Original Pressure (Psig.)	Av. A.O.F.P. (M S.C.F./Day)
Beg	Baldonnel	Carbonate	Triassic	Structural	8.0	32.0	64.7[1]	21.0	0.840	0.652	1,630	4,660
Beg	Halfway	Sandstone	Triassic	Structural	10.0	36.0	10.0	35.0	0.839	0.673	1,820	7,430
Beg West	Baldonnel	Carbonate	Triassic	Structural	8.0	86.0	22.9	23.0	0.848	0.653	1,674	1,430
Bernadet	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	8.0	13.0	(2)	15.0	0.838	0.644	1,193	3,840
Blueberry	Dunlevy	Sandstone	Lower Cretaceous	Structural	11.0	32.7	10.3	33.0	0.840	0.659	1,363	3,050
Blueberry	Baldonnel	Carbonate	Triassic	Structural	10.0	17.0	38.3	37.0	0.837	0.673	1,611	1,380
Blueberry	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	9.3	26.0	(2)	27.5	0.706	0.939	2,073	......
Blueberry East	Baldonnel	Carbonate	Triassic	Structural	10.0	30.0	47.7	25.0	0.832	0.675	1,715	2,500
Blueberry East	Mississippian	Carbonate	Mississippian	Structural	12.3	17.0	32.5	30.5	0.871	0.615	2,680	3,260
Blueberry West	Dunlevy	Sandstone	Lower Cretaceous	Structural	10.0	9.0	61.8	25.0	0.850	0.658	1,410	1,930
Blueberry West	Baldonnel	Carbonate	Triassic	Structural	9.3	16.0	83.7	22.8	0.824	0.648	1,715	1,450
Boundary Lake	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.7	9.0	(2)	28.0	0.858	0.634	1,276	830
Boundary Lake	Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.0	57.0	(2)	16.0	0.843	0.648	1,371	13,000
Boundary Lake	Dunlevy	Sandstone	Lower Cretaceous	Structural	24.1	46.0	(2)	38.0	0.845	0.629	1,453	......
Boundary Lake	Baldonnel	Carbonate	Triassic	Structural	14.0	19.6	(2)	34.0	0.799	0.677	1,447	4,610
Boundary Lake	Halfway	Sandstone	Triassic	Structural	10.0	25.0	(2)	11.0	0.841	0.632	1,556	360
Boundary Lake North	Halfway	Sandstone	Triassic	Stratigraphic	14.5	28.0	57.4	25.0	0.845	0.657	1,566	......
Bubbles	Baldonnel	Carbonate	Triassic	Structural	10.0	52.0	33.3	17.0	0.843	0.663	1,596	10,800
Buick Creek	Dunlevy	Sandstone	Lower Cretaceous	Structural-stratigraphic	13.3	25.0	139.8	28.0	0.836	0.659	1,293	8,720
Buick Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	13.0	6.0	(2)	33.0	0.859	0.613	1,554	2,300
Buick Creek East	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	10.0	10.0	(2)	47.0	0.865	0.639	1,096	1,000
Buick Creek East	Dunlevy	Sandstone	Lower Cretaceous	Structural-stratigraphic	11.0	20.3	125.0	29.0	0.853	0.648	1,289	6,250
Buick Creek West	Dunlevy	Sandstone	Lower Cretaceous	Structural-stratigraphic	11.0	28.0	165.0	32.0	0.850	0.657	1,305	7,380
Buick Creek West	Baldonnel	Carbonate	Triassic	Structural-stratigraphic	11.4	18.0	44.9	27.0	0.817	0.698	1,467	2,160
Buick Creek West	Halfway	Sandstone	Triassic	Structural	11.0	39.0	20.8	31.0	0.782	0.748	1,721	......
Clarke Lake	Slave Point	Carbonate	Devonian	Stratigraphic	9.0	157.0	247.8	14.0	0.935	0.670	2,896	56,260
Dawson Creek	Cadotte	Sandstone	Lower Cretaceous	Structural-stratigraphic	16.5	48.6	33.2	25.0	0.921	0.580	686	1,440
Fort St. John	Cadomin	Sandstone	Lower Cretaceous	Structural	12.4	8.0	421.0	40.0	0.869	0.581	1,324	......
Fort St. John	Baldonnel A	Carbonate	Triassic	Structural	15.9	18.9	120.4	25.0	0.822	0.661	1,604	4,260
Fort St. John	Baldonnel A/B	Carbonate	Triassic	Structural	12.0	44.1	101.6	25.0	0.822	0.661	1,604	4,950
Fort St. John	Charlie Lake	Sandstone	Triassic	Stratigraphic	15.0	6.0	(2)	10.0	0.825	0.648	1,906	......
Fort St. John	Halfway	Sandstone	Triassic	Structural	11.1	28.2	22.6	25.0	0.799	0.679	2,006	4,430
Fort St. John	Belloy	Carbonate	Permian	Structural-stratigraphic	12.0	11.0	59.3	25.0	0.828	0.655	2,756	780
Fort St. John Southeast	Cadomin	Sandstone	Lower Cretaceous	Structural	15.8	32.0	64.2	40.0	0.876	0.581	1,389	2,950
Fort St. John Southeast	Baldonnel A	Carbonate	Triassic	Structural	18.0	12.0	30.0	28.0	0.778	0.702	1,634	4,110
Fort St. John Southeast	Halfway	Sandstone	Triassic	Structural	9.8	16.0	14.5	25.0	0.821	0.693	2,072	4,550
Fort St. John Southeast	Belloy	Carbonate	Permian	Structural-stratigraphic	9.2	16.0	62.2	25.0	0.842	0.640	2,814	10,400
Gundy Creek	Baldonnel	Carbonate	Triassic	Structural	8.9	9.0	69.3	20.0	0.850	0.636	1,731	3,630

TABLE 4.—GASFIELD RESERVOIR DATA AT DECEMBER 31, 1965—*Continued*

Field	Pool	Rock Type	Age	Trap	Av. Porosity (per Cent)	Av. Reservoir Thickness (Net Ft.)	Av. Permeability (Md.)	Av. Water Saturation (per Cent)	Compressibility Factor	Specific Gravity (Air=1.0)	Original Pressure (Psig.)	Av. A.O.F.P. (M S.C.F./Day)
Gundy Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	7.0	10.0	(2)	25.0	0.810	0.653	2,339	......
Halfway	Baldonnel	Carbonate	Triassic	Structural	7.9	31.0	5.9[1]	35.0	0.818	0.639	1,642	2,720
Halfway	Halfway	Sandstone	Triassic	Structural	16.0	7.0	49.1	25.0	0.800	0.650	2,212	720
Highway	Dunlevy	Sandstone	Lower Cretaceous	Structural	8.7	14.0	84.9	25.0	0.857	0.669	1,346	920
Highway	Baldonnel	Carbonate	Triassic	Structural	10.0	5.0	124.0	25.0	0.805	0.675	1,666	920
Highway	Mississippian	Carbonate	Mississippian	Structural	10.0	13.0	104.7	25.0	0.903	0.609	3,122	2,820
Jedney	Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	10.6	10.0	(2)	24.0	0.870	0.663	1,126	13,600
Jedney	Baldonnel	Carbonate	Triassic	Structural	10.4	57.0	33.7	13.0	0.852	0.693	1,602	7,300
Jedney	Halfway	Sandstone	Triassic	Structural	9.8	51.0	16.4	22.0	0.842	0.673	1,688	7,550
Jedney West	Baldonnel	Carbonate	Triassic	Structural	9.0	11.0	(2)	64.0	0.850	0.693	1,622	750
Jedney West	Halfway	Sandstone	Triassic	Structural	8.0	32.0	(2)	45.0	0.839	0.673	1,768	1,900
Kobes-Townsend	Dunlevy	Sandstone	Lower Cretaceous	Structural	12.5	26.0	17.9	19.8	0.782	0.651	1,486	1,790
Kobes-Townsend	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	11.0	12.0	(2)	29.0	0.820	0.629	2,470	1,810
Kobes-Townsend	Halfway	Sandstone	Triassic	Structural-stratigraphic	7.6	24.0	5.1	28.0	0.823	0.638	2,636	14,500
Kobes-Townsend	Mississippian	Carbonate	Mississippian	Structural-stratigraphic	4.9	21.0	10.4	16.2	0.841	0.647	3,025	6,210
Kotcho Lake	Slave Point	Carbonate	Devonian	Stratigraphic	10.0	19.0	45.7	8.0	0.920	0.670	2,550	......
Laprise Creek	Baldonnel	Carbonate	Triassic	Structural-stratigraphic	10.0	60.5	130.0	19.0	0.843	0.679	1,528	8,750
Laprise Creek West	Baldonnel	Carbonate	Triassic	Structural-stratigraphic	10.3	43.8	47.7	23.0	0.845	0.694	1,326	2,300
Montney	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.0	6.0	(2)	45.0	0.843	0.670	1,250	810
Montney	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	20.0	5.0	(2)	30.0	0.830	0.664	1,746	2,200
Montney	Halfway	Sandstone	Triassic	Structural	14.6	15.0	67.1	33.0	0.805	0.702	1,846	3,550
Nig Creek	Baldonnel	Carbonate	Triassic	Structural-stratigraphic	10.0	51.0	61.3	21.0	0.849	0.678	1,642	12,520
Parkland	Wabamun	Carbonate	Devonian	Structural-stratigraphic	13.0	53.0	......	16.0	1.022	0.623	4,900	21,000
Petitot River	Slave Point	Carbonate	Devonian	Structural-stratigraphic	7.2	79.9	(2)	18.0	0.936	0.674	2,775	185,000
Red Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	18.0	6.0	(2)	32.0	0.838	0.614	1,866	2,200
Red Creek	Halfway	Sandstone	Triassic	Structural	11.0	19.0	18.1	20.0	0.719	0.779	2,021	1,770
Rigel	Dunlevy	Sandstone	Lower Cretaceous	Structural-stratigraphic	14.0	18.7	25.1[1]	25.0	0.848	0.654	1,274	14,270
Snyder Creek	Dunlevy	Sandstone	Lower Cretaceous	Structural-stratigraphic	12.0	10.5	(2)	30.0	0.858	0.664	1,275	2,300
Stoddart	Belloy	Carbonate	Permian	Stratigraphic	15.0	17.0	105.9[1]	10.0	0.805	0.695	2,411	17,500
Stoddart West	Belloy	Carbonate	Permian	Stratigraphic	14.0	15.0	23.8	14.0	0.805	0.695	2,411	9,300
Willow	Halfway	Sandstone	Triassic	Stratigraphic	23.0	11.0	169.0	18.0	0.854	0.635	1,227	......
Yoyo	Pine Point	Carbonate	Devonian	Stratigraphic-structural	7.5	90.0	......	15.0	0.927	0.704	2,900	......

1 Plus fractures.
2 Not available.

TABLE 5.—PROVED RESERVES OF CRUDE OIL AND ESTABLISHED RESERVES OF NATURAL GAS AND NATURAL-GAS PRODUCTS, DECEMBER 31, 1965

	Crude Oil[1] (Thousands of Barrels of 34.97 Imperial Gallons at 60° F.)	Disposable Gas[2] (Billion S.C.F. at 14.65 Psia. and 60° F.)	Gas Liquids (Thousands of Barrels of 34.97 Imperial Gallons at 60° F.)	Sulphur (Thousands of Short Tons)
Reserves remaining at December 31, 1964	254,017	6,598.1	152,328	3,418
Revisions and extensions[3]	+26,066	+329.0	−31,447	−262
Production, 1965	13,470	156.4	4,995	79
Reserves remaining at December 31, 1965	266,613	6,770.7	115,886	3,077

[1] Includes only proved drilled reserves. There are an additional 15,416,000 barrels of probable reserves which are in effect proved and undrilled reserves.

[2] Associated gas is included only for pools in which gas-conservation schemes are in operation.

[3] Includes discovery from new drilling and revisions arising from new information.

The production of residual gas, gas liquids, and sulphur are the quantities calculated from gas analyses to have been produced with the raw gas and are not the quantities actually extracted. The quantity of gas delivered to the transmission-line and distributed in 1965 was 138,814,144 M s.c.f., and the amounts of natural-gas liquids and sulphur extracted were 1,815,977 barrels and 57,297 short tons respectively.

TABLE 6.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1965

Field	Well Authorization No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Aitken Creek	1160	Union Aitken d-33-L	d-33-L/94-A-13	Gething	
	1205	Union Aitken d-34-L	d-34-L/94-A-13	Gething	
	485	Union Aitken Creek b-42-L	b-42-L/94-A-13	Gething	874[1]
	1173	Union Aitken d-43-L	d-43-L/94-A-13	Gething	
	1186	Union Aitken d-44-L	d-44-L/94-A-13	Gething	
Beatton River	1224	Triad Beatton b-28-J	b-28-J/94-H-2	Halfway	
	396	Triad Beatton River d-28-J	d-28-J/94-H-2	Halfway	
	395	Triad Beatton River d-29-J	d-29-J/94-H-2	Halfway	
	309	Triad Beatton River b-38-J	b-38-J/94-H-2	Halfway	
	393	Triad Beatton River d-39-J	d-39-J/94-H-2	Halfway	2,054[1]
	1419	Triad Beatton b-49-J	b-49-J/94-H-2	Halfway	
	896	Triad Beatton d-49-J	d-49-J/94-H-2	Halfway	
	816	Triad Beatton d-50-J	d-50-J/94-H-2	Halfway	
	1552	Triad Beatton b-58-J	b-58-J/94-H-2	Halfway	
	1038	Triad Beatton b-59-J	b-59-J/94-H-2	Halfway	
	869	Triad et al Beatton d-41-K	d-41-K/94-H-2	Halfway	49
Beatton River West	408	Triad West Beatton River d-39-K	d-39-K/94-H-2	Bluesky-Gething	47
	1604	Triad W Beatton a-40-K	a-40-K/94-H-2	Bluesky-Gething	115
	441	Triad West Beatton River d-48-K	d-48-K/94-H-2	Bluesky-Gething	94
	515	Triad West Beatton River d-57-K	d-57-K/94-H-2	Bluesky-Gething	78
	1398	Triad W Beatton d-58-K	d-58-K/94-H-2	Bluesky-Gething	30
	512	Triad West Beatton River d-59-K	d-59-K/94-H-2	Bluesky-Gething	78
	1408	Whitehall et al W Beatton d-21-L	d-21-L/94-H-2	Bluesky-Gething	105
Blueberry	1333	Decalta Blueberry d-57-D	d-57-D/94-A-13	Mississippian	97
	785	West Nat et al Blueberry d-19-K	d-19-K/94-A-12	Mississippian	
	549	West Nat et al Blueberry c-A29-K	c-29-K/94-A-12	Mississippian	
	746	West Nat et al Blueberry d-30-K	d-30-K/94-A-12	Mississippian	
	783	West Nat et al Blueberry d-40-K	d-40-K/94-A-12	Mississippian	
	242	West Nat et al Blueberry d-50-K (13)	d-50-K/94-A-12	Mississippian	
	851	West Nat et al Blueberry b-60-K	b-60-K/94-A-12	Mississippian	
	1317	West Nat et al Blueberry d-41-L	d-41-L/94-A-12	Mississippian	
	948	West Nat et al Blueberry c-71-L	c-71-L/94-A-12	Mississippian	
	205	West Nat et al Blueberry d-82-L (11)	d-82-L/94-A-12	Mississippian	4,600[1]
	1072	West Nat et al Blueberry b-92-L	b-92-L/94-A-12	Mississippian	
	1242	West Nat et al Blueberry d-93-L	d-93-L/94-A-12	Mississippian	
	1258	West Nat et al Blueberry b-24-D	b-24-D/94-A-13	Mississippian	
	1169	West Nat et al Blueberry d-25-D	d-25-D/94-A-13	Mississippian	
	1146	West Nat et al Blueberry b-35-D	b-35-D/94-A-13	Mississippian	
	960	West Nat et al Blueberry d-36-D	d-36-D/94-A-13	Mississippian	
	745	West Nat et al Blueberry 6-25-88-25	6-25-88-25 W6M	Mississippian	
	850	West Nat et al Blueberry 14-25-88-25	14-25-88-25 W6M	Mississippian	
	272	West Nat et al Blueberry d-46-D (16)	d-46-D/94-A-13	Mississippian	78[2]

Boundary Lake	1033	Dome Boundary 6-22-85-14	6-22-85-14 W6M	Boundary Lake	
	768	Dome Boundary 8-22-85-14	8-22-85-14 W6M	Boundary Lake	
	1669	Dome Boundary 2-26-85-14	2-26-85-14 W6M	Boundary Lake	
	1672	Dome Boundary 4-26-85-14	4-26-85-14 W6M	Boundary Lake	
	550	Dome Boundary Lake 8-26-85-14	8-26-85-14 W6M	Boundary Lake	
	1673	Dome Boundary 10-26-85-14	10-26-85-14 W6M	Boundary Lake	
	1674	Dome Boundary 12-26-85-14	12-26-85-14 W6M	Boundary Lake	
	573	Dome Boundary Lake 14-26-85-14	14-26-85-14 W6M	Boundary Lake	
	1668	Dome Boundary 10-34-85-14	10-34-85-14 W6M	Boundary Lake	
	1470	Dome Boundary 14-34-85-14	14-34-85-14 W6M	Boundary Lake	
	1676	Dome Boundary 2-35-85-14	2-35-85-14 W6M	Boundary Lake	
	1471	Dome Boundary 4-35-85-14	4-35-85-14 W6M	Boundary Lake	
	488	Dome Boundary Lake 8-35-85-14	8-35-85-14 W6M	Boundary Lake	2,429[1]
	1667	Dome Boundary 10-35-85-14	10-35-85-14 W6M	Boundary Lake	
	1665	Dome Boundary 12-35-85-14	12-35-85-14 W6M	Boundary Lake	
	528	Dome Boundary Lake 14-35-85-14	14-35-85-14 W6M	Boundary Lake	
	1440	Dome Boundary 6-2-86-14	6-2-86-14 W6M	Boundary Lake	
	642	Dome Boundary Lake 8-2-86-14	8-2-86-14 W6M	Boundary Lake	
	1064	Dome Boundary 14-2-86-14	14-2-86-14 W6M	Boundary Lake	
	1666	Dome Boundary 2-3-86-14	2-3-86-14 W6M	Boundary Lake	
	1702	Dome Boundary 6-3-86-14	6-3-86-14 W6M	Boundary Lake	
	1156	Dome Boundary 8-3-86-14	8-3-86-14 W6M	Boundary Lake	
	764	Dome Boundary 8-11-86-14	8-11-86 14 W6M	Boundary Lake	
	765	Dome Boundary 16-11-86-14	16-11-86-14 W6M	Boundary Lake	
	808	Dome Boundary 8-14-86-14	8-14-86-14 W6M	Boundary Lake	
	1070	Dome Boundary 16-14-86-14	16-14-86-14 W6M	Boundary Lake	
	1670	Dome Boundary 2-12-85-14	2-12-85-14 W6M	Boundary Lake	
	1671	Dome Boundary 4-12-85-14	4-12-85-14 W6M	Boundary Lake	
	625	Dome Boundary Lake 8-12-85-14	8-12-85-14 W6M	Boundary Lake	733[1]
	1675	Dome Boundary 10-12-85-14	10-12-85-14 W6M	Boundary Lake	
	1677	Dome Boundary 2-13-85-14	2-13-85-14 W6M	Boundary Lake	
	603	Dome Boundary Lake 8-13-85-14	8-13-85-14 W6M	Boundary Lake	
	1041	Homestead et al Boundary 6-18-84-13	6-18-84-13 W6M	Boundary Lake	
	1108	Homestead et al Boundary 8-18-84-13	8-18-84-13 W6M	Boundary Lake	
	1104	Imp Pac Boundary 14-18-84-13	14-18-84-13 W6M	Boundary Lake	
	1098	Imp Pac Boundary 6-19-84-13	6-19-84-13 W6M	Boundary Lake	
	1078	Imp Pac Boundary 8-19-84-13	8-19-84-13 W6M	Boundary Lake	
	998	Imp Pac Boundary 14-19-84-13	14-19-84-13 W6M	Boundary Lake	
	1117	Imp Pac Boundary 6-20-84-13	6-20-84-13 W6M	Boundary Lake	
	296	Imp Pac Boundary 14-20-84-13	14-20-84-13 W6M	Boundary Lake	
	1091	Imp Pac Boundary 6-29-84-13	6-29-84-13 W6M	Boundary Lake	
	1400	Imp Pac Boundary 8-29-84-13	8-29-84-13 W6M	Boundary Lake	
	1060	Imp Pac Boundary 14-29-84-13	14-29-84-13 W6M	Boundary Lake	
	1019	Imp Pac Boundary 6-30-84-13	6-30-84-13 W6M	Boundary Lake	
	1425	Imp Pac Boundary 16-29-84-13	16-29-84-13 W6M	Boundary Lake	
	1061	Imp Pac Boundary 8-30-84-13	8-30-84-13 W6M	Boundary Lake	
	975	Imp et al Boundary 14-30-84-13	14-30-84-13 W6M	Boundary Lake	

[1] Pool.

[2] Included in pool M.P.R. but not to exceed individual M.P.R.

TABLE 6.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1965—*Continued*

Field	Well Authorization No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Boundary Lake	931	Imp et al Boundary 6-31-84-13	6-31-84-13 W6M	Boundary Lake	
	930	Imp et al Boundary 8-31-84-13	8-31-84-13 W6M	Boundary Lake	
	888	Imp Pac Boundary 14-31-84-13	14-31-84-13 W6M	Boundary Lake	
	965	Imp Pac Boundary 6-32-84-13	6-32-84-13 W6M	Boundary Lake	
	935	Imp Pac Boundary 14-32-84-13	14-32-84-13 W6M	Boundary Lake	
	813	Imp Pac Boundary 6-5-85-13	6-5-85-13 W6M	Boundary Lake	
	878	Imp Pac Boundary 8-5-85-13	8-5-85-13 W6M	Boundary Lake	
	832	Imp Pac Boundary 14-5-85-13	14-5-85-13 W6M	Boundary Lake	
	789	Imp Pac Boundary 6-6-85-13	6-6-85-13 W6M	Boundary Lake	
	795	Imp Pac Boundary 8-6-85-13	8-6-85-13 W6M	Boundary Lake	
	792	Imp Pac Boundary 14-6-85-13	14-6-85-13 W6M	Boundary Lake	
	796	Imp Pac Boundary 16-6-85-13	16-6-85-13 W6M	Boundary Lake	
	763	Imp Pac Boundary 6-7-85-13	6-7-85-13 W6M	Boundary Lake	
	807	Imp Pac Boundary 8-7-85-13	8-7-85-13 W6M	Boundary Lake	
	368	Imp Pac Boundary 14-7-85-13	14-7-85-13 W6M	Boundary Lake	
	847	Imp Pac Boundary 6-8-85-13	6-8-85-13 W6M	Boundary Lake	
	906	Imp Pac Boundary 8-8-85-13	8-8-85-13 W6M	Boundary Lake	
	767	Imp Pac Boundary 14-8-85-13	14-8-85-13 W6M	Boundary Lake	
	889	Imp Pac Boundary 16-8-85-13	16-8-85-13 W6M	Boundary Lake	
	760	Imp Pac Boundary 6-17-85-13	6-17-85-13 W6M	Boundary Lake	
	738	Imp Pac Boundary 14-17-85-13	14-17-85-13 W6M	Boundary Lake	
	734	Imp Pac Boundary 6-18-85-13	6-18-85-13 W6M	Boundary Lake	
	523	Imp Pac Boundary 8-18-85-13	8-18-85-13 W6M	Boundary Lake	
	524	Imp Pac Boundary 6-20-85-13	6-20-85-13 W6M	Boundary Lake	
	774	Imp Pac Boundary 8-20-85-13	8-20-85-13 W6M	Boundary Lake	
	1386	Imp Pac Boundary 16-20-84-13	16-20-84-13 W6M	Boundary Lake	
	1166	Imp Pac Boundary 14-2-84-14	14-2-84-14 W6M	Boundary Lake	
	1369	Imp Pac Boundary 14-4-84-14	14-4-84-14 W6M	Boundary Lake	
	1358	Imp Pac Boundary 16-4-84-14	16-4-84-14 W6M	Boundary Lake	
	1450	Imp Pac Boundary 14-7-84-14	14-7-84-14 W6M	Boundary Lake	
	1357	Imp Pac Boundary 16-7-84-14	16-7-84-14 W6M	Boundary Lake	
	1164	Imp Pac Boundary 14-8-84-14	14-8-84-14 W6M	Boundary Lake	
	1367	Imp Pac Boundary 8-9-84-14	8-9-84-14 W6M	Boundary Lake	
	1133	Imp et al Boundary 16-9-84-14	16-9-84-14 W6M	Boundary Lake	
	843	Imp Pac Boundary 14-10-84-14	14-10-84-14 W6M	Boundary Lake	
	1079	Imp Pac Boundary 16-10-84-14	16-10-84-14 W6M	Boundary Lake	
	1127	Imp Pac Boundary 6-11-84-14	6-11-84-14 W6M	Boundary Lake	
	1136	Imp Pac Boundary 8-11-84-14	8-11-84-14 W6M	Boundary Lake	
	1080	Imp Pac Boundary 14-13-84-14	14-13-84-14 W6M	Boundary Lake	
	1085	Imp Pac Boundary 16-13-84-14	16-13-84-14 W6M	Boundary Lake	

	1059	Imp Pac Boundary 14-14-84-14	14-14-84-14 W6M	Boundary Lake	
	1175	Imp Pac Boundary 16-14-84-14	16-14-84-14 W6M	Boundary Lake	
	1084	Imp Pac Boundary 6-15-84-14	6-15-84-14 W6M	Boundary Lake	
	1076	Imp Pac Boundary 8-15-84-14	8-15-84-14 W6M	Boundary Lake	
	1035	Imp et al Boundary 6-16-84-14	6-16-84-14 W6M	Boundary Lake	
	1128	Imp et al Boundary 8-16-84-14	8-16-84-14 W6M	Boundary Lake	
	1143	Imp Pac Boundary 14-16-84-14	14-16-84-14 W6M	Boundary Lake	
	1102	Imp Pac Boundary 6-17-84-14	6-17-84-14 W6M	Boundary Lake	
	1151	Imp Pac Boundary 8-17-84-14	8-17-84-14 W6M	Boundary Lake	
	1220	Imp Pac Boundary 14-17-84-14	14-17-84-14 W6M	Boundary Lake	
	1158	Imp Pac Boundary 16-17-84-14	16-17-84-14 W6M	Boundary Lake	
	1273	Imp Pac Boundary 8-18-84-14	8-18-84-14 W6M	Boundary Lake	
	1343	Imp Pac Boundary 16-18-84-14	16-18-84-14 W6M	Boundary Lake	
	1189	Imp Pac Boundary 8-20-84-14	8-20-84-14 W6M	Boundary Lake	
	1228	Imp Pac Boundary 16-20-84-14	16-20-84-14 W6M	Boundary Lake	19,090[1]
	1157	Imp Pac Boundary 6-21-84-14	6-21-84-14 W6M	Boundary Lake	
	1120	Imp Pac Boundary 8-21-84-14	8-21-84-14 W6M	Boundary Lake	
	1172	Imp Pac Boundary 14-21-84-14	14-21-84-14 W6M	Boundary Lake	
	1122	Imp Pac Boundary 16-21-84-14	16-21-84-14 W6M	Boundary Lake	
	250	Imp Pac Boundary 1-23-84-14	1-23-84-14 W6M	Boundary Lake	
	1017	Imp Pac Boundary 6-23-84-14	6-23-84-14 W6M	Boundary Lake	
	929	Imp Pac Boundary 14-23-84-14	14-23-84-14 W6M	Boundary Lake	
	997	Imp Pac Boundary 16-23-84-14	16-23-84-14 W6M	Boundary Lake	
	1036	Imp Pac Boundary 6-24-84-14	6-24-84-14 W6M	Boundary Lake	
	978	Imp Pac Boundary 8-24-84-14	8-24-84-14 W6M	Boundary Lake	
	1010	Imp Pac Boundary 14-24-84-14	14-24-84-14 W6M	Boundary Lake	
	979	Imp Pac Boundary 6-25-84-14	6-25-84-14 W6M	Boundary Lake	
	928	Imp Pac Boundary 8-25-84-14	8-25-84-14 W6M	Boundary Lake	
	1077	Imp et al Boundary 14-25-84-14	14-25-84-14 W6M	Boundary Lake	
	927	Imp Pac Boundary 6-26-84-14	6-26-84-14 W6M	Boundary Lake	
	966	Imp Pac Boundary 8-26-84-14	8-26-84-14 W6M	Boundary Lake	
	1111	Imp et al Boundary 14-26-84-14	14-26-84-14 W6M	Boundary Lake	
	861	Imp Pac Boundary 8-34-84-14	8-34-84-14 W6M	Boundary Lake	
	883	Imp Pac Boundary 14-34-84-14	14-34-84-14 W6M	Boundary Lake	
	833	Imp Pac Boundary 6-35-84-14	6-35-84-14 W6M	Boundary Lake	
	815	Imp Pac Boundary 8-35-84-14	8-35-84-14 W6M	Boundary Lake	
	805	Imp Pac Boundary 14-35-84-14	14-35-84-14 W6M	Boundary Lake	
	804	Imp et al Boundary 6-36-84-14	6-36-84-14 W6M	Boundary Lake	
	814	Imp et al Boundary 8-36-84-14	8-36-84-14 W6M	Boundary Lake	
	793	Imp et al Boundary 14-36-84-14	14-36-84-14 W6M	Boundary Lake	
	761	Imp et al Boundary 6-1-85-14	6-1-85-14 W6M	Boundary Lake	
	770	Imp et al Boundary 8-1-85-14	8-1-85-14 W6M	Boundary Lake	
	521	Imp et al Boundary 14-1-85-14	14-1-85-14 W6M	Boundary Lake	
	501	Imp et al Boundary 6-2-85-14	6-2-85-14 W6M	Boundary Lake	
	788	Imp Pac Boundary 8-2-85-14	8-2-85-14 W6M	Boundary Lake	
	493	Imp Pac Boundary 14-2-85-14	14-2-85-14 W6M	Boundary Lake	
	362	Imperial Pacific Boundary 6-3-85-14	6-3-85-14 W6M	Boundary Lake	

[1] Pool.

TABLE 6.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1965—*Continued*

Field	Well Authorization No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Boundary Lake	379	Imperial Pacific Boundary 8-3-85-14	8-3-85-14 W6M	Boundary Lake	
	363	Imperial Pacific Boundary 14-3-85-14	14-3-85-14 W6M	Boundary Lake	
	267	Imperial Pacific Boundary 16-4-85-14	16-4-85-14 W6M	Boundary Lake	
	1513	Imp Pac Boundary 16-9-85-14	16-9-85-14 W6M	Boundary Lake	
	1545	Imp Pac Boundary 3-10-85-14	3-10-85-14 W6M	Boundary Lake	
	360	Imperial Pacific Boundary 8-10-85-14	8-10-85-14 W6M	Boundary Lake	
	1495	Imp Pac Boundary 9-10-85-14	9-10-85-14 W6M	Boundary Lake	
	282	Imperial Pacific Boundary 6-11-85-14	6-11-85-14 W6M	Boundary Lake	
	769	Imp Pac Boundary 8-11-85-14	8-11-85-14 W6M	Boundary Lake	
	821	Imp Pac Boundary 14-11-85-14	14-11-85-14 W6M	Boundary Lake	
	759	Imp Pac Boundary 14-12-85-14	14-12-85-14 W6M	Boundary Lake	
	758	Imp Pac Boundary 6-13-85-14	6-13-85-14 W6M	Boundary Lake	
	1124	Imp Pac Boundary 6-14-85-14	6-14-85-14 W6M	Boundary Lake	
	848	Imp Pac Boundary 8-14-85-14	8-14-85-14 W6M	Boundary Lake	
	1037	Marathon Boundary 14-12-84-14	14-12-84-14 W6M	Boundary Lake	
	989	Marathon Boundary 6-13-84-14	6-13-84-14 W6M	Boundary Lake	
	1068	Marathon Boundary 8-13-84-14	8-13-84-14 W6M	Boundary Lake	
	1024	Mobil Boundary 6-10-84-14	6-10-84-14 W6M	Boundary Lake	
	1023	Mobil Boundary 8-10-84-14	8-10-84-14 W6M	Boundary Lake	
	895	Pacific Boundary 16-14-85-14	16-14-85-14 W6M	Boundary Lake	
	961	Pacific Boundary 16-15-85-14	16-15-85-14 W6M	Boundary Lake	
	982	Sinclair et al Boundary 6-3-84-14	6-3-84-14 W6M	Boundary Lake	
	941	Sinclair Boundary 8-3-84-14	8-3-84-14 W6M	Boundary Lake	
	969	Sinclair et al Boundary 14-3-84-14	14-3-84-14 W6M	Boundary Lake	
	942	Sinclair Boundary 16-3-84-14	16-3-84-14 W6M	Boundary Lake	
	841	Sinclair Boundary 14-11-84-14	14-11-84-14 W6M	Boundary Lake	
	865	Sinclair Boundary 16-11-84-14	16-11-84-14 W6M	Boundary Lake	
	803	Sinclair Boundary 6-14-84-14	6-14-84-14 W6M	Boundary Lake	
	866	Sinclair Boundary 8-14-84-14	8-14-84-14 W6M	Boundary Lake	
	755	Sinclair Boundary 14-15-84-14	14-15-84-14 W6M	Boundary Lake	
	780	Sinclair Boundary 6-22-84-14	6-22-84-14 W6M	Boundary Lake	
	742	Sinclair Boundary 8-22-84-14	8-22-84-14 W6M	Boundary Lake	
	794	Sinclair Boundary 14-22-84-14	14-22-84-14 W6M	Boundary Lake	
	802	Sinclair Boundary 6-27-84-14	6-27-84-14 W6M	Boundary Lake	
	743	Sinclair Boundary 8-27-84-14	8-27-84-14 W6M	Boundary Lake	
	853	Sinclair Boundary 14-27-84-14	14-27-84-14 W6M	Boundary Lake	
	590	Amerada Cr BC-B Boundary 14-18-85-13	14-18-85-13 W6M	Boundary Lake	
	563	Amerada Cr BC-C Boundary 14-20-85-13	14-20-85-13 W6M	Boundary Lake	
	591	Amerada Cr BC-C Boundary 6-29-85-13	6-29-85-13 W6M	Boundary Lake	
	771	Amerada Boundary 14-29-85-13	14-29-85-13 W6M	Boundary Lake	

629	Amerada Boundary Lake 14-13-85-14	14-13-85-14 W6M	Boundary Lake	
639	Amerada Boundary Lake 6-24-85-14	6-24-85-14 W6M	Boundary Lake	
608	Amerada Cr BC-D Boundary 8-24-85-14	8-24-85-14 W6M	Boundary Lake	
692	Amerada Boundary Lake 11-24-85-14	11-24-85-14 W6M	Boundary Lake	
918	Basin Boundary 6-17-86-13	6-17-86-13 W6M	Boundary Lake	
962	Basin Boundary 14-17-86-13	14-17-86-13 W6M	Boundary Lake	
618	Marathon Boundary 6-19-85-13	6-19-85-13 W6M	Boundary Lake	
632	Marathon Boundary 8-19-85-13	8-19-85-13 W6M	Boundary Lake	
635	Marathon Boundary 14-19-85-13	14-19-85-13 W6M	Boundary Lake	
898	Marathon Boundary 14-5-86-13	14-5-86-13 W6M	Boundary Lake	
949	Marathon Boundary 6-8-86-13	6-8-86-13 W6M	Boundary Lake	
604	Marathon Boundary 14-8-86-13	14-8-86-13 W6M	Boundary Lake	
646	Sun Boundary Lake 6-23-85-14	6-23-85-14 W6M	Boundary Lake	
652	Sun Boundary Lake 8-23-85-14	8-23-85-14 W6M	Boundary Lake	
643	Sun Boundary Lake 14-23-85-14	14-23-85-14 W6M	Boundary Lake	
1137	Texaco NFA Boundary 6-30-85-13	6-30-85-13 W6M	Boundary Lake	
1097	Texaco NFA Boundary 8-30-85-13	8-30-85-13 W6M	Boundary Lake	
1171	Texaco NFA Boundary 14-30-85-13	14-30-85-13 W6M	Boundary Lake	
183	Texaco NFA Boundary L 6-31-85-13	6-31-85-13 W6M	Boundary Lake	
1150	Texaco NFA Boundary 8-31-85-13	8-31-85-13 W6M	Boundary Lake	
167	Texaco NFA Boundary L 14-31-85-13	14-31-85-13 W6M	Boundary Lake	
101	Texaco NFA Boundary Lake 6-6-86-13 (1)	6-6-86-13 W6M	Boundary Lake	
972	Texaco NFA Boundary 8-6-86-13	8-6-86-13 W6M	Boundary Lake	
152	Texaco NFA Boundary L 14-6-86-13	14-6-86-13 W6M	Boundary Lake	
862	Texaco NFA Boundary 6-7-86-13	6-7-86-13 W6M	Boundary Lake	
953	Texaco NFA Boundary 8-7-86-13	8-7-86-13 W6M	Boundary Lake	
1100	Texaco NFA Boundary 14-7-86-13	14-7-86-13 W6M	Boundary Lake	
811	Texaco NFA Boundary 6-18-86-13	6-18-86-13 W6M	Boundary Lake	
995	Texaco NFA Boundary 8-18-86-13	8-18-86-13 W6M	Boundary Lake	
1116	Texaco NFA Boundary 14-18-86-13	14-18-86-13 W6M	Boundary Lake	9,892[1]
1074	Texaco NFA Boundary 6-19-86-13	6-19-86-13 W6M	Boundary Lake	
1049	Texaco NFA Boundary 8-19-86-13	8-19-86-13 W6M	Boundary Lake	
1123	Texaco NFA Boundary 14-19-86-13	14-19-86-13 W6M	Boundary Lake	
1050	Texaco NFA Boundary 6-30-86-13	6-30-86-13 W6M	Boundary Lake	
1167	Texaco NFA Boundary 8-30-86-13	8-30-86-13 W6M	Boundary Lake	
1482	Texaco NFA Boundary 16-30-86-13	16-30-86-13 W6M	Boundary Lake	
1073	Texaco NFA Boundary 14-22-85-14	14-22-85-14 W6M	Boundary Lake	
687	Texaco NFA Boundary Lake 6-25-85-14	6-25-85-14 W6M	Boundary Lake	
1539	Texaco NFA Boundary 8-25-85-14	8-25-85-14 W6M	Boundary Lake	
656	Texaco NFA Boundary Lake 14-25-85-14	14-25-85-14 W6M	Boundary Lake	
924	Texaco NFA Boundary 6-27-85-14	6-27-85-14 W6M	Boundary Lake	
845	Texaco NFA Boundary 8-27-85-14	8-27-85-14 W6M	Boundary Lake	
971	Texaco NFA Boundary 14-27-85-14	14-27-85-14 W6M	Boundary Lake	
857	Texaco NFA Boundary 8-34-85-14	8-34-85-14 W6M	Boundary Lake	
662	Texaco NFA Boundary Lake 6-36-85-14	6-36-85-14 W6M	Boundary Lake	
1058	Texaco NFA Boundary 8-36-85-14	8-36-85-14 W6M	Boundary Lake	
657	Texaco NFA Boundary Lake 14-36-85-14	14-36-85-14 W6M	Boundary Lake	

[1] Pool.

TABLE 6.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1965—*Continued*

Field	Well Authorization No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Boundary Lake	663	Texaco NFA Boundary Lake 6-1-86-14	6-1-86-14 W6M	Boundary Lake	
	1083	Texaco NFA Boundary 8-1-86-14	8-1-86-14 W6M	Boundary Lake	
	664	Texaco NFA Boundary Lake 14-1-86-14	14-1-86-14 W6M	Boundary Lake	
	860	Texaco NFA Boundary 16-1-86-14	16-1-86-14 W6M	Boundary Lake	
	829	Texaco NFA Boundary 6-12-86-14	6-12-86-14 W6M	Boundary Lake	
	1096	Texaco NFA Boundary 8-12-86-14	8-12-86-14 W6M	Boundary Lake	
	900	Texaco NFA Boundary 14-12-86-14	14-12-86-14 W6M	Boundary Lake	
	880	Texaco NFA Boundary 6-13-86-14	6-13-86-14 W6M	Boundary Lake	
	1101	Texaco NFA Boundary 8-13-86-14	8-13-86-14 W6M	Boundary Lake	
	952	Texaco NFA Boundary 14-13-86-14	14-13-86-14 W6M	Boundary Lake	
	885	Texaco NFA Boundary 6-24-86-14	6-24-86-14 W6M	Boundary Lake	
	1086	Texaco NFA Boundary 8-24-86-14	8-24-86-14 W6M	Boundary Lake	
	633	Texaco NFA Boundary Lake 14-24-86-14	14-24-86-14 W6M	Boundary Lake	
	1454	Amerada Boundary A6-24-85-14	6-24-85-14 W6M	Halfway	99
	736	Amerada Boundary 16-24-85-14	16-24-85-14 W6M	Halfway	96
	1368	Imp Pac Boundary 6-15-85-14	6-15-85-14 W6M	Boundary Lake	134
	667	Pacific Boundary Lake 11-14-85-14	11-14-85-14 W6M	Halfway	8
	895	Pacific Boundary 16-14-85-14	16-14-85-14 W6M	Halfway	102
	270	Pacific Boundary 8-15-85-14	8-15-85-14 W6M	Cadomin	79
	646	Sun Boundary Lake 6-23-85-14	6-23-85-14 W6M	Halfway	83
	1097	Texaco NFA Boundary 8-30-85-13	8-30-85-13 W6M	Halfway	56
	1720	Texaco NFA Boundary 6-29-86-13	6-29-86-13 W6M	Boundary Lake	35
	1482	Texaco NFA Boundary 16-30-86-13	16-30-86-13 W6M	Boundary Lake	20
	1798	Texaco NFA Boundary 16-21-85-14	16-21-85-14 W6M	Boundary Lake	150
	1786	Texaco NFA Boundary 6-28-85-14	6-28-85-14 W6M	Boundary Lake	118
	1680	Texaco NFA Boundary 8-28-85-14	8-28-85-14 W6M	Boundary Lake	152
	1751	Texaco NFA Boundary 14-28-85-14	14-28-85-14 W6M	Boundary Lake	145
	1543	Texaco NFA Boundary 16-28-85-14	16-28-85-14 W6M	Boundary Lake	143
	1767	Texaco NFA Boundary 6-33-85-14	6-33-85-14 W6M	Boundary Lake	127
	1717	Texaco NFA Boundary 8-33-85-14	8-33-85-14 W6M	Boundary Lake	140
	1558	Texaco NFA Boundary 8-25-86-14	8-25-86-14 W6M	Boundary Lake	86
Bulrush	1267	Union HB Sinclair Bulrush d-78-F	d-78-F/94-A-16	Halfway	23
	1629	Union HB Sinc Pac Bulrush d-88-F	d-88-F/94-A-16	Halfway	77
	1394	Union HB Sinc Pac Bulrush d-89-F	d-89-F/94-A-16	Halfway	26
	1582	Union HB Sinc Pac Bulrush d-98-F	d-98-F/94-A-16	Halfway	68
	1551	Union HB Sinc Pac Bulrush d-99-F	d-99-F/94-A-16	Halfway	118
Charlie Lake	269	Imp Pac Charlie 13-5-84-18	13-5-84-18 W6M	Gething	36
Currant	1700	Sinclair et al Currant d-5-C	d-5-C/94-A-16	Halfway	107
	1646	Sinclair et al Currant d-6-C	d-6-C/94-A-16	Halfway	29
	1752	Sinclair et al Currant b-15-C	b-15-C/94-A-16	Halfway	68

	1635	Sinclair et al Currant d-16-C	d-16-C/94-A-16	Halfway	161
	1590	Sinclair et al Currant d-17-C	d-17-C/94-A-16	Halfway	67
Fort St. John	34	Pacific Ft St John 3-14-83-18 (9)	3-14-83-18 W6M	Charlie Lake	46
	214	Pacific Ft St John 10-14-83-18 (76)	10-14-83-18 W6M	Charlie Lake	14
	171	Imp Pac Ft St John 9-19-83-18 (45)	9-19-83-18 W6M	Belloy	85
	225	Pacific Ft St John 1-23-83-18 (81)	1-23-83-18 W6M	Charlie Lake	23
	216	Pacific Ft St John 9-23-83-18 (78)	9-23-83-18 W6M	Charlie Lake	65
Milligan Creek	973	Union HB Milligan b-42-G	b-42-G/94-H-2	Halfway	
	409	Union HB Milligan Creek d-42-G	d-42-G/94-H-2	Halfway	
	435	Union HB Milligan Creek d-43-G	d-43-G/94-H-2	Halfway	
	909	Union HB Milligan b-52-G	b-52-G/94-H-2	Halfway	
	401	Union HB Milligan Creek d-52-G	d-52-G/94-H-2	Halfway	
	899	Union HB Milligan b-53-G	b-53-G/94-H-2	Halfway	
	398	Union HB Milligan Creek d-53-G	d-53-G/94-H-2	Halfway	
	402	Union HB Milligan Creek d-54-G	d-54-G/94-H-2	Halfway	
	826	Union HB Milligan b-62-G	b-62-G/94-H-2	Halfway	
	1001	Union HB Milligan d-62-G	d-62-G/94-H-2	Halfway	
	440	Union HB Milligan Creek d-63-G	d-63-G/94-H-2	Halfway	
	341	Union HB Milligan Creek d-64-G	d-64-G/94-H-2	Halfway	10,000[1]
	1182	Union HB Milligan c-72-G	c-72-G/94-H-2	Halfway	
	911	Union HB Milligan b-73-G	b-73-G/94-H-2	Halfway	
	248	Union HB Milligan Creek d-73-G	d-73-G/94-H-2	Halfway	
	436	Union HB Milligan Creek d-74-G	d-74-G/94-H-2	Halfway	
	1011	Union HB Milligan b-82-G	b-82-G/94-H-2	Halfway	
	875	Union HB Milligan b-83-G	b-83-G/94-H-2	Halfway	
	1014	Union HB Milligan d-84-G	d-84-G/94-H-2	Halfway	
	985	Union HB Milligan b-93-G	b-93-G/94-H-2	Halfway	
	1170	Union HB Milligan d-94-G	d-94-G/94-H-2	Halfway	
	1493	Union HB Milligan b-65-G	b-65-G/94-H-2	Halfway	
Peejay	1584	FPC Whitehall Peejay b-27-E	b-27-E/94-A-16	Halfway	
	1452	Medallion Mobil Peejay d-57-E	d-57-E/94-A-16	Halfway	
	981	Medallion AORCO Blair Peejay d 60-E	d-60-E/94-A-16	Halfway	
	1026	Medallion Ashland Peejay d-68-E	d-68-E/94-A-16	Halfway	
	902	Medallion Ashland Peejay d-69-E	d-69-E/94-A-16	Halfway	
	903	Medallion Ashland Peejay d-70-E	d-70-E/94-A-16	Halfway	
	1025	Medallion Ashland Peejay d-61-H	d-61-H/94-A-15	Halfway	
	990	Pacific SR CanDel Peejay d-81-H	d-81-H/94-A-15	Halfway	
	612	Pacific Sinclair Peejay d-18-E	d-18-E/94-A-16	Halfway	
	589	Pacific Sinclair Peejay d-28-E	d-28-E/94-A-16	Halfway	
	543	Pacific Sinclair Peejay d-29-E	d-29-E/94-A-16	Halfway	4,430[1]
	578	Pacific Sinclair Peejay d-38-E	d-38-E/94-A-16	Halfway	
	418	Pacific Sinclair Peejay d-39-E	d-39-E/94-A-16	Halfway	
	915	Pacific Sinclair Peejay d-47-E	d-47-E/94-A-16	Halfway	
	577	Pacific Sinclair Peejay d-48-E	d-48-E/94-A-16	Halfway	
	588	Pacific Sinclair Peejay d-49-E	d-49-E/94-A-16	Halfway	
	914	Pacific Sinclair Peejay d-58-E	d-58-E/94-A-16	Halfway	
	881	Pacific Sinclair Peejay d-59-E	d-59-E/94-A-16	Halfway	
	1329	Pacific SR CanDel Peejay d-79-E	d-79-E/94-A-16	Halfway	

[1] Pool.

TABLE 6.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1965—*Continued*

Field	Well Authorization No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Peejay	569	Pacific SR CanDel Peejay d-80-E	d-80-E/94-A-16	Halfway	
	954	Pacific SR West Cdn Peejay d-90-E	d-90-E/94-A-16	Halfway	
	1030	Pacific SR CanDel Peejay d-100-E	d-100-E/94-A-16	Halfway	
	1627	Pacific Sinclair Peejay d-21-H	d-21-H/94-A-15	Halfway	35
	1585	Pacific Sinclair Peejay d-31-H	d-31-H/94-A-15	Halfway	359
	1563	Pacific Sinclair Peejay d-32-H	d-32-H/94-A-15	Halfway	236
	1525	Pacific Sinclair Peejay d-33-H	d-33-H/94-A-15	Halfway	184
	1625	Baysel Peejay d-34-H	d-34-H/94-A-15	Halfway	38
	1632	Pacific Sinclair Peejay d-41-H	d-41-H/94-A-15	Halfway	129
	1514	Pacific Sinclair Peejay d-42-H	d-42-H/94-A-15	Halfway	82
	1497	Pacific Sinclair Peejay d-43-H	d-43-H/94-A-15	Halfway	188
	1515	CanDel SR Peejay d-44-H	d-44-H/94-A-15	Halfway	135
	1516	CanDel SR Peejay d-45-H	d-45-H/94-A-15	Halfway	119
	1678	CanDel SR Peejay d-51-H	d-51-H/94-A-15	Halfway	72
	1603	CanDel SR Peejay d-52-H	d-52-H/94-A-15	Halfway	98
	1498	CanDel SR Peejay d-53-H	d-53-H/94-A-15	Halfway	96
	1503	CanDel SR Peejay d-54-H	d-54-H/94-A-15	Halfway	131
	1507	CanDel SR Peejay d-55-H	d-55-H/94-A-15	Halfway	194
	1521	CanDel SR Peejay d-63-H	d-63-H/94-A-15	Halfway	66
	1483	CanDel SR Peejay d-64-H	d-64-H/94-A-15	Halfway	138
	1476	CanDel SR Peejay d-65-H	d-65-H/94-A-15	Halfway	169
	1512	Pacific SR CanDel Peejay d-66-H	d-66-H/94-A-15	Halfway	170
	1540	Pacific SR CanDel Peejay d-67-H	d-67-H/94-A-15	Halfway	144
	1562	Pacific SR CanDel Peejay d-68-H	d-68-H/94-A-15	Halfway	66
	1522	Pacific SR CanDel Peejay d-A74-H	d-74-H/94-A-15	Halfway	74
	1467	Pacific SR CanDel Peejay d-75-H	d-75-H/94-A-15	Halfway	109
	1478	Tenn Peejay d-76-H	d-76-H/94-A-15	Halfway	216
	1491	Tenn Peejay d-77-H	d-77-H/94-A-15	Halfway	95
	1505	Tenn Peejay d-78-H	d-78-H/94-A-15	Halfway	138
	1407	Pacific SR CanDel Peejay d-85-H	d-85-H/94-A-15	Halfway	79
	1461	Tenn Peejay d-86-H	d-86-H/94-A-15	Halfway	160
	1490	Tenn Peejay d-87-H	d-87-H/94-A-15	Halfway	116
	1474	Pacific SR CanDel Peejay d-95-H	d-95-H/94-A-15	Halfway	159
	1487	Baysel SR Peejay d-96-H	d-96-H/94-A-15	Halfway	74
	1538	Baysel SR Peejay d-97-H	d-97-H/94-A-15	Halfway	145
	725	Pacific SR West Cdn Peejay d-33-I	d-33-I/94-A-15	Halfway	5
	1764	Union HB Peejay d-22-E	d-22-E/94-A-16	Halfway	74
	1699	Union HB Peejay d-23-E	d-23-E/94-A-16	Halfway	274
	1694	Union HB Peejay d-24-E	d-24-E/94-A-16	Halfway	54
	1641	Union HB Peejay d-25-E	d-25-E/94-A-16	Halfway	82

	1718	CIGOL Mobil Peejay d-26-E	d-26-E/94-A-16	Halfway	150
	1639	CIGOL Peejay d-33-E	d-33-E/94-A-16	Halfway	101
	1690	CIGOL Mobil Peejay d-34-E	d-34-E/94-A-16	Halfway	188
	1706	CIGOL Mobil Peejay d-35-E	d-35-E/94-A-16	Halfway	42
	1575	CIGOL Peejay d-43-E	d-43-E/94-A-16	Halfway	84
	1643	CIGOL Mobil Peejay d-46-E	d-46-E/94-A-16	Halfway	99
	1737	Pacific SR CanDel Peejay b-67-E	b-67-E/94-A-16	Halfway	98
Rigel	1692	Monsanto IOE Rigel 6-19-87-16	6-19-87-16 W6M	Dunlevy	117
	1616	Monsanto IOE Rigel 11-19-87-16	11-19-87-16 W6M	Dunlevy	149
	1555	Monsanto Rigel 6-13-87-17	6-13-87-17 W6M	Dunlevy	242
Wildmint	840	Union HB Wildmint b-24-A	b-24-A/94-H-2	Halfway	1,566
	1226	Union HB Wildmint d-24-A	d-24-A/94-H-2	Halfway	
	919	Union HB Wildmint d-25-A	d-25-A/94-H-2	Halfway	
	1195	Union HB Wildmint b-34-A	b-34-A/94-H-2	Halfway	
	1685	Union HB Wildmint d-34-A	d-34-A/94-H-2	Halfway	
	810	Union HB Wildmint d-45-A	d-45-A/94-H-2	Halfway	
	1387	Union HB Wildmint b-46-A	b-46-A/94-H-2	Halfway	
	530	Union HB Wildmint d-46-A	d-46-A/94-H-2	Halfway	
	1458	Union HB Wildmint d-55-A	d-55-A/94-H-2	Halfway	
	945	Union HB Wildmint b-56-A	b-56-A/94-H-2	Halfway	
	584	Union HB Wildmint d-56-A	d-56-A/94-H-2	Halfway	
	1733	Union HB Wildmint b-66-A	b-66-A/94-A-16	Halfway	
	1743	Union HB Wildmint d-66-A	d-66-A/94-H-2	Halfway	
	1758	Union HB Wildmint b-76-A	b-76-A/94-H-2	Halfway	
	1566	Pacific SR CanDel Wildmint d-84-I	d-84-I/94-A-15	Halfway	108
	1289	Texcan Wildmint d-94-I	d-94-I/94-A-15	Halfway	167
	1191	Tenn Wildmint d-95-I	d-95-I/94-A-15	Halfway	47
	1121	Tenn Wildmint d-5-A	d-5-A/94-H-2	Halfway	70
	1750	Tenn Wildmint d-7-A	d-7-A/94-H-2	Halfway	308
	984	Union HB Wildmint d-15-A	d-15-A/94-H-2	Halfway	102
	963	Union HB Wildmint d-26-A	d-26-A/94-H-2	Halfway	51
Willow	449	Union HB Willow d-20-H	d-20-H/94-H-2	Bluesky-Gething	122
Other areas	1709	CanDel SR Weasel d-15-B	d-15-B/94-H-2	(3)	(3)
	1713	CanDel SR Weasel d-14-B	d-14-B/94-H-4	(3)	(3)
	1684	CIGOL Crush d-100-C	d-100-C/94-A-16	(3)	(3)
	1691	CIGOL Crush d-91-D	d-91-D/94-A-16	(3)	(3)
	1704	CIGOL Crush d-1-E	d-1-E/94-A-16	(3)	(3)
	1715	CIGOL Crush d-10-F	d-10-F/94-A-16	(3)	(3)
	1734	Dome Provo Weasel d-2-B	d-2-B/94-H-2	(3)	(3)
	1726	Dome Provo Weasel d-3-B	d-3-B/94-H-2	(3)	(3)
	1714	Monsanto Rigel 6-31-87-17	6-31-87-17 W6M	(3)	(3)
	1610	Pacific SR CanDel Osprey d-4-J	d-4-J/94-A-15	(3)	(3)
	1761	Pacific SR CanDel Weasel d-94-J	d-94-J/94-A-15	(3)	(3)
	1631	Sinclair Pacific Weasel d-30-A	d-30-A/94-H-2	(3)	(3)
	1644	Sinclair Pacific Weasel d-13-B	d-13-B/94-H-2	(3)	(3)
	1653	Tenn Beaverdam d-38-L	d-38-L/94-A-16	(3)	(3)
	1757	Tenn Ashland Weasel d-24-B	d-24-B/94-H-2	(3)	(3)

[3] Confidential at December 31, 1965.

TABLE 6.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1965—*Continued*

Field	Well Authorization No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Other areas	1637	Tenn Ashland Weasel d-25-B	d-25-B/94-H-2	([3])	([3])
	1689	Tenn Ashland Weasel d-26-B	d-26-B/94-H-2	([3])	([3])
	1794	Tenn Ashland Weasel d-34-B	d-34-B/94-H-2	([3])	([3])
	1601	Tenn Ashland Weasel d-35-B	d-35-B/94-H-2	([3])	([3])
	1662	Tenn Ashland Weasel d-36-B	d-36-B/94-H-2	([3])	([3])
	1655	Tenn Ashland Weasel d-45-B	d-45-B/94-H-2	([3])	([3])
	1679	Tenn Ashland Weasel d-46-B	d-46-B/94-H-2	([3])	([3])
	1688	Tenn Ashland Weasel d-56-B	d-56-B/94-H-2	([3])	([3])
	1657	Texcan Buckthorn d-71-D	d-71-D/94-A-16	([3])	([3])
	1636	Texcan Buckthorn d-80-C	d-80-C/94-A-16	([3])	([3])
	1698	Texcan Buckthorn d-81-D	d-81-D/94-A-16	([3])	([3])
	1600	Texcan Buckthorn d-90-C	d-90-C/94-A-16	([3])	([3])
	1598	Union HB Sinc Pac Crush b-9-F	b-9-F/94-A-16	([3])	([3])
	1783	Union HB Crush d-69-C	d-69-C/94-A-16	([3])	([3])
	1741	Union HB Sinc Pac Crush d-79-C	d-79-C/94-A-16	([3])	([3])
	1759	Union HB E Peejay d-72-D	d-72-D/94-A-16	([3])	([3])
	1784	Union HB Peejay d-73-D	d-73-D/94-A-16	([3])	([3])
	1722	Union HB E Peejay d-82-D	d-82-D/94-A-16	([3])	([3])
	1749	Union HB E Peejay d-83-D	d-83-D/94-A-16	([3])	([3])
	1708	Union HB E Peejay d-92-D	d-92-D/94-A-16	([3])	([3])
	1725	Union HB E Peejay d-93-D	d-93-D/94-A-16	([3])	([3])
	1721	Union HB E Peejay d-2-E	d-2-E/94-A-16	([3])	([3])
	1732	Union HB E Peejay d-3-E	d-3-E/94-A-16	([3])	([3])
	1736	Union HB E Peejay d-12-E	d-12-E/94-A-16	([3])	([3])
	1735	Union HB E Peejay d-13-E	d-13-E/94-A-16	([3])	([3])
	1519	Uno-Tex et al Stoddart 10-31-85-19	10-31-85-19 W6M	([3])	([3])

[1] Pool.
[3] Confidential at December 31, 1965.

TABLE 7.—POOL, PROJECT, AND UNIT M.P.R.'S AT DECEMBER 31, 1965

Field and Pool	Pool, Project, or Unit Name	Pool, Project, or Unit M.P.R. (Barrels per Day) and Date Approved	Revisions to Pool, Project, or Unit M.P.R. and Effective Date	Pool, Project, or Unit Area[1] (Acres)	Number of Producible Oil Wells	Number of Gas-injection Wells	Number of Water-injection Wells	Daily Average Gas Injected (M S.C.F.)	Daily Average Water Injected (Barrels)
Aitken Creek—Gething	(Union) Aitken Creek Gething Pool	582 (1-1-64)	874 (1-5-65)	1,049	5	1	----	1,248	----
Beatton River—Halfway	(Triad) Beatton River Triassic Pool	1,940 (15-10-63)	1,960 (1-9-64) 2,054 (1-7-65)	1,733	10	----	3	----	1,857
Blueberry—Mississippian	(Pacific) Blueberry Mississippian Pool	4,600 (29-4-63)	----	3,798	18	1	----	993	----
Boundary Lake—									
Boundary Lake	(Dome) Boundary Lake Waterflood Project No. 1	2,225 (22-7-64)	2,343 (1-10-64) 2,429 (1-10-65)	3,680	25	----	7	----	2,157
Boundary Lake	(Dome) Boundary Lake Waterflood Project No. 2	733 (1-4-65)	----	640	6	----	2	----	771
Boundary Lake	(Imperial) Boundary Lake Unit No. 1	18,488 (1-6-64)	18,818 (1-2-65) 18,887 (1-4-65) 19,090 (1-9-65)	25,280	134	----	23	----	20,404
Boundary Lake	(Texaco) Boundary Lake Unit No. 2	9,754 (1-5-65)	9,892 (1-10-65)	12,960	63	----	19	----	7,066
Milligan Creek—Halfway	(Union) Milligan Creek Halfway Sand Unit No. 1	4,000 (20-9-62)	5,000 (28-6-63) 10,000 (1-1-64)	3,298	21	1	8	2,604	14,423
Peejay—Halfway	(Pacific) Peejay Unit No. 1	2,018 (3-12-63)	4,430 (16-4-64)	4,370	22	----	3	----	2,841
Wildmint—Halfway	(Union) Wildmint Upper Halfway Pool	1,100 (1-12-63)	1,191 (1-10-64) 1,566 (16-12-65)	1,392[2]	13	1	----	3,537	----

[1] Areas shown to nearest acre.
[2] Sum of N.T.S. unit areas in which wells are located.

TABLE 8.—AUTHORIZED ABSOLUTE OPEN-FLOW POTENTIAL TESTS AND PRODUCTION RATE LIMITS TO DECEMBER 31, 1965

Field	Well Authorization No.	Well Name	Pool	Date of Test	A.O.F.P. (M S.C.F. per Day)	P.R.L. (M S.C.F. per Day)
Aitken Creek	400	Union Aitken a-53-L (3)	Gething	31-10-63	19,500	(1)
	1310	Union Aitken Creek d-45-L	Gething	24-10-64	56,000	(1)
	1338	Union Aitken d-25-L	Gething	19-10-64	34,250	(1)
Beg	539	Pacific et al Beg b-17-K	Baldonnel	19-7-65	6,355	2,000
	541	Pacific et al Beg d-10-G	Baldonnel	23-7-65	1,828	2,000
	711	Pacific et al Beg a-21-F	Baldonnel	23-7-65	658	2,000
	733	Pacific et al Beg d-64-F	Baldonnel	16-7-65	4,423	2,000
	740	Pacific et al Beg b-6-K	Baldonnel	20-7-65	2,384	2,000
	741	Pacific et al Beg b-84-F	Baldonnel	20-7-65	3,733	2,000
	747	Pacific et al Beg b-95-F	Baldonnel	20-7-65	6,050	2,000
	748	Pacific et al Beg b-42-F	Baldonnel	21-7-65	2,236	2,000
	749	Pacific et al Beg a-28-K	Baldonnel	16-7-65	4,429	2,000
	766	Pacific Pan Am Dome Beg a-4-D	Baldonnel	9-6-65	21,788	6,199
	806	Pacific Imperial Beg d-46-B	Baldonnel	18-5-65	2,689	2,000
	855	Pacific Pan Am Dome Beg d-15-D	Baldonnel	12-6-63	3,600	2,000
	1095	Pacific Imperial Beg d-57-B	Baldonnel	18-5-65	2,680	2,000
	1132	Pacific et al Beg b-82-L	Baldonnel	8-6-65	1,055	2,000
	1154	Pacific Imperial Beg d-35-B	Baldonnel	18-5-65	2,583	2,000
	1359	Pacific Imperial Beg c-24-B	Baldonnel	20-5-65	1,400	2,000
	541	Pacific et al Beg d-10-G	Halfway	21-7-65	14,990	3,856
	711	Pacific et al Beg a-21-F	Halfway	21-7-65	3,260	2,000
	733	Pacific et al Beg d-64-F	Halfway	19-7-65	4,616	2,000
	739	Pacific et al Beg b-A99-B	Halfway	21-7-65	4,899	2,000
	740	Pacific et al Beg b-6-K	Halfway	14-7-65	4,603	2,000
	741	Pacific et al Beg b-84-F	Halfway	19-7-65	2,812	2,000
	747	Pacific et al Beg b-95-F	Halfway	16-7-65	3,002	2,000
	748	Pacific et al Beg b-42-F	Halfway	29-8-61	2,100	2,000
	785	Pacific et al Beg b-59-K	Halfway	23-1-62		2,000[2]
	806	Pacific Imperial Beg d-46-B	Halfway	20-5-65	10,400	3,092
	1095	Pacific Imperial Beg d-57-B	Halfway	2-11-65	10,575	2,725
	1154	Pacific Imperial Beg d-35-B	Halfway	19-5-65	6,500	2,000
	1350	Pacific et al Beg b-88-B	Halfway	22-7-65	6,913	2,000
	1359	Pacific Imperial Beg c-24-B	Halfway	19-5-65	4,480	2,000
	1233	Richfield Sohio Beg d-77-B	Halfway	27-11-63	2,030	2,000
	1268	Richfield Sohio Beg d-13-B	Halfway	26-5-65	6,600	2,000
Beg West	620	Pacific et al W Beg a-79-F	Baldonnel	19-7-65	1,894	2,000
	622	Pacific et al W Beg c-84-C	Baldonnel	22-7-65	2,435	2,000
Bernadet	1106	West Nat et al Bernadet 8-1-88-25	Bluesky-Gething	13-8-65	1,140	2,000
Blueberry	70	West Nat et al Blueberry c-32-D	Dunlevy	22-12-58	285	2,000
	94	West Nat et al Blueberry d-A87-D	Dunlevy	6-7-65	1,237	2,000

	279	West Nat et al Blueberry 16-24-88-25	Dunlevy	8-7-65	2,239	2,000
	330	West Nat et al Blueberry a-29-K	Dunlevy	2-7-63	500	2,000
	357	West Nat et al Blueberry d-A50-K	Dunlevy	27-8-63	640	2,000
	581	West Nat et al Blueberry d-97-D	Dunlevy	6-7-65	3,283	2,000
	64	West Nat et al Blueberry d-87-D	Baldonnel	6-7-65	870	2,000
	71	West Nat et al Blueberry c-65-D	Baldonnel	7-7-65	825	2,000
	357	West Nat et al Blueberry d-A50-K	Baldonnel	1-11-62	183	2,000
	581	West Nat et al Blueberry d-97-D	Baldonnel	12-9-60	5,600	2,000
Blueberry East	103	West Nat et al E Blueberry b-38-C	Baldonnel	7-7-65	2,519	2,000
	331	West Nat et al E Blueberry b-36-C	Mississippian	28-10-58	3,256	2,000
Blueberry West	165	West Nat et al W Blueberry d-82-I	Dunlevy	7-7-65	518	2,000
	278	West Nat et al W Blueberry 2-20-88-25	Dunlevy	6-7-65	551	2,000
	241	West Nat et al W Blueberry d-19-L	Baldonnel	18-9-62	1,425	2,000
Boundary Lake	270	Pacific Boundary 8-15-85-14	Bluesky-Gething	27-9-62	830	2,000
	352	Pacific Boundary 12-10-85-14	Gething	26-5-65	10,990	3,660
	655	Pacific Boundary Lake A16-4-85-14	Gething	12-6-61	4,700	2,000
	799	Amerada Boundary 8-5-85-14	Dunlevy	27-10-61	11,200	2,800
	270	Pacific Boundary 8-15-85-14	Baldonnel	26-5-65	5,212	2,000
	667	Pacific Boundary Lake 11-14-85-14	Baldonnel	29-5-63	1,650	2,000
	652	Sun Boundary Lake 8-23-85-14	Baldonnel	28-6-65	13,990	3,498
	687	Texaco NFA Boundary Lake 6-25-85-14	Baldonnel	11-6-65	5,900	2,000
	1137	Texaco NFA Boundary 6-30-85-13	Baldonnel	10-6-65	3,600	2,000
	1501	Huber et al Boundary 6-4-87-13	Halfway	12-11-64	360	2,000
Boundary Lake North	1451	Texaco NFA Boundary 10-9-87-14	Halfway	10-12-64	25,000	6,250
Bubbles	464	Dome Basco Bubbles b-19-A	Baldonnel	22-6-65	4,332	2,000
	526	Dome Provo Bubbles c-20-A	Baldonnel	22-6-65	740	2,000
	674	McCoy Dome Bubbles b-A62-B	Baldonnel	28-6-65	4,053	2,000
	791	McCoy Dome Bubbles d-42-B	Baldonnel	29-6-65	3,152	2,000
	451	Pacific Imperial Bubbles b-33-I	Baldonnel	7-6-65	19,272	5,753
	462	Pacific Imperial Bubbles d-88-I	Baldonnel	8-6-65	36,740	11,766
	466	Pacific Imperial Bubbles b-44-I	Baldonnel	7-6-65	12,775	4,139
	478	Pacific Imperial Bubbles d-77-I	Baldonnel	8-6-65	4,656	2,000
	480	Pacific Imperial Bubbles b-66-I	Baldonnel	7-6-65	6,676	2,000
	615	Pacific Dome et al Bubbles d-99-I	Baldonnel	18-6-65	3,980	2,000
Buick Creek	1360	Altair W Mineral Buick c-32-C	Dunlevy	1-7-65	9,200	2,465
	457	Pacific Buick Creek b-4-B	Dunlevy	2-6-65	1,542	2,000
	469	Pacific Buick Creek c-14-B	Dunlevy	31-5-65	2,289	2,000
	1323	Pacific Buick a-85-I	Dunlevy	2-6-65	9,400	2,557
	744	Sun Buick c-16-B	Dunlevy	16-7-65	3,800	2,000
	756	Sun Buick d-19-B	Dunlevy	12-9-64	3,500	2,000
	818	Sun Buick d-11-C	Dunlevy	10-9-64	13,250	4,150
	45	Texaco NFA Buick Creek d-98-I (1)	Dunlevy	23-6-65	11,800	3,652
	65	Texaco NFA Buick Creek c-10-A (2)	Dunlevy	2-7-65	358	2,000
	96	Texaco NFA Buick Creek d-83-J (4)	Dunlevy	29-6-65	17,300	7,102

[1] P.R.L., not authorized.
[2] Interim.

TABLE 8.—AUTHORIZED ABSOLUTE OPEN-FLOW POTENTIAL TESTS AND PRODUCTION RATE LIMITS TO DECEMBER 31, 1965—*Cont'd*

Field	Well Authorization No.	Well Name	Pool	Date of Test	A.O.F.P. (M S.C.F. per Day)	P.R.L. (M S.C.F. per Day)
Buick Creek	110	Texaco NFA Buick Creek c-78-J (6)	Dunlevy	7-7-65	3,790	2,000
	728	Texaco NFA Buick d-93-J	Dunlevy	8-7-65	18,700	8,560
	787	Texaco NFA Buick d-96-I	Dunlevy	25-6-65	15,600	4,103
	1179	Texaco NFA Buick b-10-B	Dunlevy	2-7-65	3,440	2,000
	1213	Texaco NFA Buick c-40-B	Dunlevy	7-7-65	1,760	2,000
	96	Texaco NFA Buick Creek d-83-J (4)	Charlie Lake	30-6-65	2,070	2,000
Buick Creek East	1087	Texaco NFA E Buick c-80-D	Bluesky-Gething	13-8-65	1,200	2,000
	1286	Mic Mac et al E Buick d-17-D	Dunlevy	13-3-65	6,500	2,000
	295	Texaco NFA E Buick a-31-A	Dunlevy	4-3-65	18,750	4,794
	1087	Texaco NFA E Buick c-80-D	Dunlevy	13-8-65	3,330	2,000
	1088	Texaco NFA E Buick c-98-L	Dunlevy	14-8-65	3,710	2,000
	1185	Texaco NFA E Buick c-18-D	Dunlevy	14-8-65	2,620	2,000
	1508	Texaco NFA E Buick b-A46-A	Baldonnel	15-8-65	1,100	2,000
	1303	Whitehall E Buick b-61-A	Dunlevy	27-7-65	5,700	2,000
	1336	Whitehall E Buick c-34-A	Dunlevy	27-7-65	2,850	2,000
Buick Creek West	89	Pacific West Buick Creek b-78-C (2)	Dunlevy	1-6-65	3,144	2,000
	95	Pacific West Buick Creek c-14-C (3)	Dunlevy	19-7-62	5,100	2,956
	99	Pacific West Buick Creek d-95-K (4)	Dunlevy	31-5-65	6,017	2,712
	239	Pacific West Buick Creek c-2-E (6)	Dunlevy	4-6-65	5,870	2,000
	255	Pacific West Buick Creek b-91-D (9)	Dunlevy	1-6-65	3,061	2,000
	264	Pacific West Buick Creek c-5-C (11)	Dunlevy	31-5-65	2,678	2,000
	268	Pacific West Buick Creek d-89-C (12)	Dunlevy	1-6-65	1,760	2,000
	384	Pacific West Buick Creek d-17-C (17)	Dunlevy	4-6-65	21,045	7,660
	644	Pacific West Buick Creek a-78-C	Baldonnel	1-6-65	2,097	2,000
	85	Pacific West Buick Creek b-23-E (1)	Halfway	19-7-62	2,450	2,000
Clarke Lake	1528	Marathon Clarke a-65-G	Slave Point	9-2-65	24,000	6,000
	1071	Pacific Apache Clarke b-76-G	Slave Point	3-8-65	15,500	3,875
	1554	Pacific Imperial Clarke c-92-I	Slave Point	1-3-65	200,000	50,000
	1578	Pacific Apache Clarke a-61-F	Slave Point	22-3-65	182,000	45,500
	344	West Nat Imp Clarke Lake d-88-L	Slave Point	18-1-63	112,000	28,000
	397	West Nat Imp Clarke Lake c-94-L	Slave Point	14-1-63	35,600	8,900
	503	West Nat Imp Clarke Lake c-8-D	Slave Point	24-1-63	73,200	18,300
	505	West Nat et al Clarke c-78-I	Slave Point	16-2-60	135,000	33,750
	585	West Nat Imp Clarke Lake d-91-L	Slave Point	11-1-63	12,000	3,000
	688	West Nat et al Clarke b-70-I	Slave Point	23-1-63	48,500	12,125
	856	West Nat et al Clarke a-52-J	Slave Point	14-3-62	21,000	5,250
Dawson Creek	293	Pacific Sc Dawson Ck 1-15-79-15 (1)	Cadotte	5-11-58	2,288	2,000
	302	Pacific Sc Dawson Ck 3-22-79-15 (2)	Cadotte	30-7-65	1,180	2,000
	319	Pacific Sc Dawson Ck 13-14-79-15 (4)	Cadotte	2-10-62	3,050	2,000

Fort St. John	75	Pacific Ft St John A3-29-83-18 (31)	Cadomin	19–7–53	29,000	7,250
	67	Pacific Ft St John 4-32-83-18 (26)	Baldonnel A	10–5–65	840	2,000
	82	Pacific Ft St John 13-23-83-18 (34)	Baldonnel A	12–5–65	5,297	2,000
	194	Pacific Ft St John 13-14-83-18 (54)	Baldonnel A	6–5–64	2,900	2,000
	210	Pacific Ft St John 6-17-83-18 (72)	Baldonnel A	13–5–65	7,742	2,932
	233	Pacific Ft St John 16-8-83-18 (83)	Baldonnel A	13–9–65	2,558	2,000
	32	Pacific Ft St John 14-15-83-18 (7)	Baldonnel A/B	7–10–63	5,900	2,000
	76	Pacific Ft St John 14-22-83-18 (32)	Baldonnel A/B	12–5–65	4,788	2,000
	170	Pacific Ft St John 8-20-83-18 (43)	Baldonnel A/B	11–5–65	4,573	2,000
	185	Pacific Ft St John C3-29-83-18 (56)	Baldonnel A/B	11–5–65	3,401	2,000
	193	Pacific Ft St John B14-21-83-13 (62)	Baldonnel A/B	10–5–65	4,132	2,000
	212	Pacific Ft St John A6-16-83-18 (73)	Baldonnel A/B	12–5–65	4,289	2,000
	74	Pacific Ft St John 1-20-83-18 (30)	Halfway	11–5–65	3,853	2,000
	172	Pacific Ft St John 2-21-83-18 (46)	Halfway	12–5–65	5,494	2,640
	178	Pacific Ft St John A14-21-83-18 (51)	Halfway	10–5–65	5,392	3,198
	179	Pacific Ft St John B3-29-83-18 (52)	Halfway	11–5–65	4,900	2,371
	181	Pacific Ft St John 10-30-83-18 (53)	Halfway	10–5–65	2,578	2,000
	192	Pacific Ft St John A14-22-83-18 (61)	Halfway	29–7–60	2,650	2,000
	29	Pacific Ft St John 14-21-83-18 (4)	Belloy	10–5–65	1,112	2,000
	58	Pacific Ft St John 3-29-83-18 (23)	Belloy	11–5–65	3,898	2,000
Fort St. John Southeast	220	Pac Ft St John SE 10-31-82-17 (80)	Cadomin	27–5–65	975	2,000
	184	Pac Ft St John SE A4-10-83-17 (55)	Baldonnel A	11–5–64	3,125	2,000
	213	Pac Ft St John SE 13-2-83-17 (74)	Baldonnel A	25–5–65	4,218	2,000
	60	Pac Ft St John SE 10-33-82-17 (22)	Halfway	25–10–56	9,000	2,250
	174	Pacific Ft St John SE 7-3-83-17 (49)	Halfway	5–8–58	3,814	2,000
	191	Pac Ft St John SE A10-4-83-17 (60)	Halfway	25–5–65	2,014	2,000
	197	Pac Ft St John SE 16-3-83-17 (66)	Halfway	25–5–65	7,325	3,640
	202	Pac Ft St John SE 7-5-83-17 (69)	Halfway	18–6–57	2,050	2,000
	320	Pac Ft St John SE A10-10-83-17 (98)	Halfway	11–5–64	2,675	2,000
	42	Pac Ft St John SE 4-10-83-17 (12)	Belloy	21–7–61	5,700	2,000
	52	Pacific Ft St John SE 8-5-83-17 (20)	Belloy	1–10–53	4,980	2,000
	166	Pacific Ft St John SE 4-9-83-17 (44)	Belloy	26–5–65	7,800	4,314
	173	Pac Ft St John SE 10-4-83-17 (47)	Belloy	24–5–65	11,813	4,802
	201	Pac Ft St John SE 11-32-82-17 (68)	Belloy	25–5–65	5,086	2,392
	219	Pac Ft St John SE 10-10-83-17 (79)	Belloy	26–5–65	4,641	2,000
Gundy Creek	367	West Nat Gundy Creek d-2-G	Baldonnel	22–8–62	2,250	2,000
	253	West Nat Gundy Creek b-69-A	Baldonnel/Charlie Lake	15–4–59	5,000	2,000
Halfway	107	West Nat et al Halfway 5-1-87-25	Baldonnel	26–6–64	3,400	2,000
	351	West Nat et al Halfway 11-35-86-26	Baldonnel	29–10–58	8,200	2,086
	182	West Nat et al Halfway 8-11-87-25	Halfway	20–8–63	720	2,000
Highway	168	West Nat et al Highway b-3-I	Dunlevy	21–5–65	810	2,000
	112	Pacific Highway b-25-I (1)	Baldonnel	27–8–58	6,600	2,000
	180	Pacific Highway a-47-I (2)	Baldonnel	26–11–57	3,600	2,000
	229	Pacific Highway a-90-I (4)	Baldonnel	23–11–64	920	2,000
	274	Pacific Highway a-69-I (3)	Baldonnel	28–11–57	3,150	2,000
	229	Pacific Highway a-90-I (4)	Mississippian	21–5–65	9,454	2,631

TABLE 8.—AUTHORIZED ABSOLUTE OPEN-FLOW POTENTIAL TESTS AND PRODUCTION RATE LIMITS TO DECEMBER 31, 1965—*Cont'd*

Field	Well Authorization No.	Well Name	Pool	Date of Test	A.O.F.P. (M S.C.F. per Day)	P.R.L. (M S.C.F. per Day)
Jedney	1366	Pacific Imperial Jedney a-95-C	Gething	17–10–63	13,600	3,400
	382	Pacific Imp Jedney d-99-J	Baldonnel	16–6–65	2,225	2,000
	427	Pacific et al Jedney b-88-J	Baldonnel	26–5–64	23,900	7,176
	460	Pacific Imperial Jedney b-30-B	Baldonnel	15–6–65	4,164	2,000
	473	Pacific Imperial Jedney b-10-B	Baldonnel	27–5–64	27,500	7,769
	475	Pacific Imperial Jedney b-66-J	Baldonnel	15–6–65	9,520	2,823
	484	Pacific Imperial Jedney d-77-J	Baldonnel	15–6–65	2,517	2,000
	498	Pacific et al Jedney b-68-J	Baldonnel	15–7–65	2,546	2,000
	651	Pacific et al Jedney d-97-C	Baldonnel	16–6–65	12,430	3,241
	778	Pacific et al Jedney c-86-C	Baldonnel	14–6–65	2,512	2,000
	820	Pacific Imperial Jedney d-53-C	Baldonnel	7–6–65	2,412	2,000
	868	Pacific Imperial Jedney b-73-C	Baldonnel	14–6–65	2,247	2,000
	944	Pacific Pan Am Dome Jedney b-28-F	Baldonnel	16–6–65	2,088	2,000
	1054	Pacific Imperial Jedney b-99-H	Baldonnel	17–6–65	3,673	2,000
	1082	Pacific Imperial Jedney c-100-H	Baldonnel	17–6–65	2,357	2,000
	1129	Pacific Imperial Jedney c-78-H	Baldonnel	24–6–63	1,450	2,000
	1178	Pacific Imperial Jedney d-31-C	Baldonnel	7–6–65	3,172	2,000
	1375	Pacific Imperial Jedney d-44-C	Baldonnel	15–6–65	6,175	2,000
	1334	Skelly Jedney a-39-F	Baldonnel	24–7–65	3,950	2,000
	382	Pacific Imp Jedney d-99-J	Halfway	22–6–65	5,677	2,000
	453	Pacific Imperial Jedney d-42-C	Halfway	21–6–65	7,958	2,378
	461	Pacific Imperial Jedney a-65-J	Halfway	22–6–65	4,541	2,000
	475	Pacific Imperial Jedney b-66-J	Halfway	21–6–65	5,636	2,000
	484	Pacific Imperial Jedney d-77-J	Halfway	22–6–65	38,522	13,213
	751	Pacific et al Jedney d-97-C	Halfway	13–7–65	3,495	2,000
	691	Pacific Imperial Jedney b-84-C	Halfway	13–7–65	2,761	2,000
	778	Pacific et al Jedney c-86-C	Halfway	13–7–65	2,705	2,000
	779	Pacific et al Jedney a-17-F	Halfway	15–7–65	3,579	2,000
	820	Pacific Imperial Jedney d-53-C	Halfway	7–6–65	10,600	4,115
	868	Pacific Imperial Jedney b-73-C	Halfway	12–6–65	4,289	2,000
	944	Pacific Pan Am Dome Jedney b-28-F	Halfway	12–7–65	2,712	2,000
	1054	Pacific Imperial Jedney b-99-H	Halfway	14–7–65	14,000	3,826
	1082	Pacific Imperial Jedney c-100-H	Halfway	4–11–65	14,400	4,065
	1129	Pacific Imperial Jedney c-78-H	Halfway	13–7–65	15,206	4,562
	1152	Pacific Pan Am Dome Jedney c-8-F	Halfway	5–12–62	1,550	2,000
	1178	Pacific Imperial Jedney d-31-C	Halfway	17–6–65	5,600	3,207
	1183	Pacific Imperial Jedney c-57-H	Halfway	12–7–65	2,550	2,000
	1256	Pacific Imperial Jedney d-68-H	Halfway	3–11–65	5,760	2,000
	1366	Pacific Imperial Jedney a-95-C	Halfway	20–7–65	3,250	2,000
	1334	Skelly Jedney a-39-F	Halfway	24–7–65	2,150	2,000

Jedney West	1081	Pacific et al W Jedney b-84-K	Baldonnel	18-6-65	617	2,000
	1081	Pacific et al W Jedney b-84-K	Halfway	22-6-65	1,269	2,000
	1276	Pacific et al W Jedney b-6-C	Halfway	18-6-65	644	2,000
Kobes-Townsend	372	Pacific Kobes a-3-A (4)	Dunlevy	10-8-65	2,460	2,000
	489	Pacific Kobes b-24-A	Dunlevy	11-8-65	763	2,000
	496	Pacific Kobes b-82-I	Dunlevy	9-11-65	1,432	2,000
	141	Pacific Kobes d-94-I (1)	Charlie Lake	10-8-65	2,259	2,000
	177	Pacific Kobes b-35-A (1-A)	Charlie Lake	10-8-65	1,551	2,000
	251	Pacific Townsend d-21-G (A-2)	Charlie Lake	12-8-65	1,431	2,000
	299	Pacific Kobes c-73-I (2)	Charlie Lake	28-6-63	1,350	2,000
	314	Pacific Kobes a-99-A (B-1)	Charlie Lake	11-8-65	751	2,000
	141	Pacific Kobes d-94-I (1)	Halfway	12-11-65	13,110	3,422
	177	Pacific Kobes b-35-A (1-A)	Halfway	11-8-65	12,500	2,984
	164	Pacific Townsend a-20-H (A-1)	Mississippian	12-8-65	497	2,000
	314	Pacific Kobes a-99-A (B-1)	Mississippian	11-8-65	10,548	3,731
Kotcho Lake	404	West Nat Kotcho Lake c-67-K	Slave Point	13-2-60	825,000	206,250
Laprise Creek	1177	Amerada Laprise c-56-D	Baldonnel	20-7-65	5,720	2,000
	1337	Amerada Laprise a-7-E	Baldonnel	8-11-63	5,300	2,000
	1378	Amerada Laprise d-77-D	Baldonnel	20-7-65	7,500	2,000
	1468	Amerada Laprise d-55-D	Baldonnel	20-7-65	21,500	5,456
	1477	Amerada Laprise d-95-D	Baldonnel	3-11-65	......	2,000[2]
	327	Dome Basco Laprise a-35-H	Baldonnel	1-6-65	10,782	2,717
	474	Dome Basco Laprise Creek d-13-H	Baldonnel	20-6-65	6,372	2,000
	483	Dome Provo Laprise Creek b-2-H	Baldonnel	1-6-65	12,636	3,317
	490	Dome Basco Laprise Creek a-81-A	Baldonnel	12-6-65	6,501	2,000
	653	Dome Provo Laprise Creek d-91-A	Baldonnel	6-6-65	2,808	2,000
	654	Dome Provo Laprise Creek a-25-H	Baldonnel	5-6-65	3,652	2,000
	665	Dome Provo Laprise a-46-H	Baldonnel	8-6-65	4,234	2,000
	666	Dome Provo Laprise Creek a-33-H	Baldonnel	9-6-65	6,778	2,000
	809	Dome Provo Laprise d-91-H	Baldonnel	14-6-65	9,721	2,462
	837	Dome Provo Laprise a-81-H	Baldonnel	19-6-65	6,557	2,000
	1056	Dome Provo Laprise c-92-H	Baldonnel	16-6-65	9,154	2,373
	1225	Dome Provo Laprise c-70-E	Baldonnel	15-6-65	9,054	2,264
	1251	Dome Provo Laprise c-40-E	Baldonnel	1-7-65	17,747	4,568
	1445	Dome Provo Laprise a-52-H	Baldonnel	29-6-65	5,372	2,000
	516	Pacific Imperial Laprise d-68-E	Baldonnel	24-6-65	7,507	2,000
	551	Pacific Imperial Laprise c-78-E	Baldonnel	24-6-65	7,001	2,000
	650	Pacific Imperial Laprise c-56-E	Baldonnel	23-6-65	7,836	2,000
	659	Pacific Imperial Laprise b-44-E	Baldonnel	15-7-65	19,550	5,293
	670	Pacific Imperial Laprise d-55-E	Baldonnel	25-6-65	12,893	3,430
	678	Pacific Imperial Laprise a-46-E	Baldonnel	22-6-65	6,087	2,000
	690	Pacific Imperial Laprise a-33-E	Baldonnel	6-11-65	11,240	3,105
	715	Pacific Imperial Laprise a-22-E	Baldonnel	25-6-65	4,768	2,000
	1341	Pacific Imperial Laprise a-99-E	Baldonnel	24-6-65	11,250	2,906
	1488	Pacific Imperial Laprise a-49-E	Baldonnel	23-6-65	17,600	4,444

[2] Interim.

TABLE 8.—AUTHORIZED ABSOLUTE OPEN-FLOW POTENTIAL TESTS AND PRODUCTION RATE LIMITS TO DECEMBER 31, 1965—*Cont'd*

Field	Well Authorization No.	Well Name	Pool	Date of Test	A.O.F.P. (M S.C.F. per Day)	P.R.L. (M S.C.F. per Day)
Laprise Creek	1511	Pacific Imperial Laprise c-24-E	Baldonnel	24–11–64	3,400	2,000
	1371	Tenn Monsanto Laprise d-79-C	Baldonnel	20–7–65	6,600	2,000
	1392	Triad et al Laprise d-37-C	Baldonnel	27–12–63	5,700	2,000
Laprise Creek West	873	Dome CDP C&E W Laprise c-82-G	Baldonnel	3–6–65	2,250	2,000
Montney	119	Pac Sunray Montney 16-32-86-19 (3)	Bluesky-Gething	25–9–58	814	2,000
	104	Pac Sunray Montney 14-36-86-19 (2)	Charlie Lake	4–7–58	2,200	2,000
	289	Pac Sunray Montney 14-31-86-19 (5)	Halfway	26–7–61	2,250	2,000
	801	Pac White Rose Sec Montney 6-5-87-18	Halfway	14–5–65	2,833	2,000
Nig Creek	1139	Dome Provo Nig d-35-B	Baldonnel	26–7–65	6,996	2,000
	1004	Monsanto Nig d-13-B	Baldonnel	7–9–64	4,800	2,000
	1475	Monsanto Nig a-21-B	Baldonnel	11–8–64	6,150	2,000
	1728	Pacific Nig b-4-B	Baldonnel	5–10–65	3,370	2,000
	61	Texaco NFA Nig Creek (1) a-79-B	Baldonnel	2–8–65	19,750	5,210
	131	Texaco NFA Nig Creek (6) a-12-G	Baldonnel	18–6–65	11,200	2,957
	383	Texaco NFA Nig Creek (9) b-70-E	Baldonnel	9–8–65	20,000	5,179
	447	Texaco NFA Nig Creek b-2-G	Baldonnel	17–6–65	26,600	6,830
	456	Texaco NFA Nig Creek a-1-G	Baldonnel	21–6–65	14,400	3,794
	729	Texaco NFA Nig c-36-B	Baldonnel	6–8–65	6,900	2,000
	790	Texaco NFA Nig d-71-B	Baldonnel	15–6–65	2,950	2,000
	819	Texaco NFA Nig a-69-A	Baldonnel	15–6–65	1,760	2,000
	967	Texaco NFA Nig a-8-G	Baldonnel	27–7–65	35,000	9,012
	1161	Texaco NFA Nig c-90-B	Baldonnel	30–7–65	8,000	2,082
	1180	Texaco NFA Nig d-15-B	Baldonnel	4–8–65	10,100	2,608
	1654	Texaco NFA Nig c-6-H	Baldonnel	28–10–65	10,500	2,625
	1681	Texaco NFA Nig d-75-B	Baldonnel	31–10–65	7,200	2,000
	1707	Texaco NFA Nig c-14-H	Baldonnel	31–10–65	9,600	2,400
	1740	Texaco NFA Nig a-6-G	Baldonnel	10–11–65	12,500	3,125
	1373	West Nat Nig a-3-B	Baldonnel	8–7–65	3,742	2,000
	1613	Whitehall Nig b-6-B	Baldonnel	26–7–65	5,800	2,000
Parkland	153	Pacific Imp Parkland 6-29-81-15	Wabamun	3–6–65	27,653	7,577
	1153	Pacific Imp Parkland 10-28-81-15	Wabamun	3–6–65	9,800	2,575
Peejay	1502	Tenn Peejay d-88-H	Halfway	13–10–65	2,450	(1)
Petitot River	533	West Nat Petitot River b-1-D	Slave Point	11–2–60	185,000	46,250
Red Creek	93	Pacific Red Creek 5-27-85-21 (36)	Charlie Lake	27–5–65	3,308	2,000
	93	Pacific Red Creek 5-27-85-21 (36)	Halfway	27–5–65	2,434	2,000
Rigel	1372	Denison Rigel 6-31-87-16	Dunlevy	22–6–64	7,700	2,000
	1494	IOE Fina Rigel 11-11-88-18	Dunlevy	21–8–64	22,200	5,550
	130	Imp Fina Rigel 4-27-88-17	Dunlevy	11–8–65	6,000	2,000
	828	Imp et al Rigel 6-27-88-18	Dunlevy	10–8–65	16,250	4,221
	1032	Imp et al Rigel 6-30-88-17	Dunlevy	13–8–65	24,000	6,162

	1090	Imp Fina Rigel 6-10-88-17	Dunlevy	12–8–65	14,500	3,748
	1107	Imp et al Rigel 7-19-88-17	Dunlevy	10–8–65	18,000	4,599
	1118	Imp et al Rigel 6-21-88-18	Dunlevy	12–8–65	12,000	3,054
	1163	Imp et al Rigel 7-23-88-18	Dunlevy	10–8–65	8,000	2,032
	1187	Imp Fina Rigel 6-3-88-17	Dunlevy	12–8–65	21,200	5,830
	1208	Imp Fina Rigel 6-8-88-17	Dunlevy	10–8–65	4,400	2,000
	1465	Imp Fina Rigel 10-14-88-18	Dunlevy	9–8–65	13,500	3,399
	1354	Monsanto Rigel 6-36-87-17	Dunlevy	11–8–65	13,700	3,480
	1293	Pacific Rigel 6-35-87-17	Dunlevy	11–5–64	14,500	3,897
	1324	Sun Rigel 10-24-88-18	Dunlevy	15–1–65	7,000	2,000
	195	Texaco NFA Rigel 9-31–88-18 (10)	Dunlevy	11–8–65	13,600	4,046
	1222	Texaco NFA Rigel 10-29-88-18	Dunlevy	21–2–63	4,850	2,000
	1370	Texaco NFA Rigel a-28-K	Dunlevy	13–8–65	2,170	2,000
	1148	Whitehall Rigel 6-15-88-17	Dunlevy	12–8–65	54,000	15,538
	1365	Wintershall Rigel 10-34-87-17	Dunlevy	11–8–65	10,750	2,700
Snyder Creek	185	Union Snyder Creek a-28-K (1)	Dunlevy	7–11–63	2,300	2,000
Stoddart	244	Pacific Stoddart 4-24-86-20 (85)	Belloy	13–5–65	22,300	7,615
	262	Pacific Stoddart 2-13-86-20 (90)	Belloy	13–5–65	10,075	3,760
Stoddart West	1190	Pacific W Stoddart 11-10-86-20	Belloy	13–5–65	7,280	2,022
Yoyo	1431	Frontier Yoyo c-18-L	Pine Point	1–4–64	14,300	35,750
	1569	Placid Frontier Yoyo b-10-L	Pine Point	28–3–65	63,000	15,750
	1313	West Nat et al Yoyo b-24-L	Pine Point	16–1–64	146,000	36,500
	1405	West Nat Yoyo b-98-E	Pine Point	9–3–64	27,500	6,875
Other areas	410	Imp Fina Altares a-83-A	Bluesky-Gething	21–1–60	22,000	5,500
	641	Imp Pac Sunray Wargen c-58-C	Bluesky-Gething	5–10–60	14,500	3,625
	707	Union ROC Firebird d-89-C	Gething	1–3–63	14,000	3,500
	27	Pacific Airport 8-32-83-17 (3)	Cadomin	8–9–53	1,150	2,000
	1192	Texaco NFA N LaGarde 10-12-88-16	Dunlevy	10–2–63	3,270	2,000
	386	FPC Richfield Daiber c-76-D (1)	Baldonnel	9–1–59	10,000	2,500
	737	HB Cypress a-28-F	Baldonnel	20–11–61	30,000	7,500
	1326	HB Cypress d-87-C	Baldonnel	12–6–63	25,000	6,250
	1339	HB Cypress a-65-C	Baldonnel	1–8–63	11,200	2,800
	1335	Pan Am Dome Sikanni b-43-B	Baldonnel	25–9–63	5,500	2,000
	304	Sinclair Julienne a-50-D (B13-2)	Baldonnel	15–9–58	4,950	2,000
	1200	Tenn Osborn 6-35-87-15	Baldonnel	9–11–63	1,250	2,000
	1130	White Rose Sec Montney 10-29-86-18	Baldonnel	24–9–62	1,640	2,000
	62	Pacific Ft St John 12-7-84-18 (19)	Baldonnel A	17–7–53	2,100	2,000
	412	West Nat et al W Jeans a-22-B	Charlie Lake	15–5–59	5,050	2,000
	470	West Nat et al W Jeans b-10-A	Charlie Lake	19–9–60	2,650	2,000
	1194	Texaco NFA LaGarde 10-29-87-15	Boundary Lake	5–3–63	23,280	5,820
	176	Ft St John Petroleums Farrell a-9-L	Halfway	18–11–61	5,600	2,000
	35	Pacific Airport 12-34-83-17 (10)	Halfway	27–7–57	1,400	2,000
	47	Pacific Wilder 13-1-84-20 (14)	Halfway	1–12–53	5,500	2,000
	750	Pac Imp N Bubbles d-95-B	Halfway	8–8–61	2,500	2,000
	1271	Pacific SR CanDel W Dede b-45-K	Halfway	11–3–63	5,600	2,000

[1] P.R.L., not authorized.

TABLE 8.—AUTHORIZED ABSOLUTE OPEN-FLOW POTENTIAL TESTS AND PRODUCTION RATE LIMITS TO DECEMBER 31, 1965—*Cont'd*

Field	Well Authorization No.	Well Name	Pool	Date of Test	A.O.F.P. (M S.C.F. per Day)	P.R.L. (M S.C.F. per Day)
Other areas	1266	Pure et al W Milligan c-50-G	Halfway	11–3–63	14,000	3,500
	304	Sinclair Julienne a-50-D (B13-2)	Halfway	31–9–58	7,000	2,000
	658	Sinclair Pac Julienne Creek b-39-D	Halfway	24–6–61	4,000	2,000
	709	Sinclair Pacific Weasel d-50-A	Halfway	1–3–61	21,500	5,375
	348	Pacific S Ft Nelson b-96-B (1)	Mississippian	9–5–58	2,350	2,000
	468	Pacific Pocketknife c-37-L	Mississippian	19–7–60	26,600	6,650
	385	Sinclair et al Lily d-12-K (XB18-1)	Mississippian	23–4–59	24,900	6,225
	507	West Nat et al Jeans a-57-A	Mississippian	21–9–60	2,050	2,000
	926	Imp Junior c-98-C	Slave Point	21–3–62	90,000	22,500
	562	Pacific North Kotcho b-44-C	Slave Point	5–4–60	105,000	26,250
	877	Pan Am et al Dilly a-30-K	Slave Point	16–3–62	14,700	3,675
	704	Texaco NFA Tsea b-68-K	Slave Point	16–3–62	76,650	19,163
	677	West Nat Kathy b-30-F	Slave Point	15–2–61	148,000	37,000
	887	West Nat et al Yoyo a-74-H	Slave Point	21–3–62	185,000	46,250
	1147	West Nat Kotcho d-12-C	Slave Point	12–2–63	42,000	10,500
	1245	West Nat Cabin b-40-A	Slave Point	2–3–63	28,900	7,225
	1274	West Nat IOE S Clarke d-29-K	Slave Point	22–1–64	145,000	36,250
	1249	IOE Junior c-3-C	Slave Point/Sulphur Point	26–3–63	12,700	3,175
	1230	West Nat et al Yoyo b-29-I	Pine Point	20–1–64	3,500	2,000
	682	Pan Am Beaver River d-73-K	Nahanni	6–3–62	85,000	21,250

TABLE 9.—WELLS DRILLED AND DRILLING, 1965

Well Authorization No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1965 Footage	Status at Dec. 31, 1965
1824	Altair Penzl Tenaka d-11-D	Dec. 25, 1965			705	Drilling.
26	Altair et al Tenaka d-82-L	Oct. 27, 1965[1]	Dec. 6, 1965			Devonian Slave Point-Sulphur Point gas well.
1682	Altair FPC Wildmint b-22-A	July 6, 1965	July 18, 1965	3,639	3,639	Triassic Halfway gas well.
1608	Altair Sarcee C&E N Zeke c-20-D	Mar. 29, 1965	Apr. 29, 1965	4,845	4,845	Abandoned—dry.
1806	Amax et al Lynx d-25-A	Dec. 12, 1965	Dec. 26, 1965	4,238	4,238	Abandoned—dry.
1818	Apache et al Elm d-35-C	Dec. 20, 1965			3,885	Drilling.
1599	Ashland et al Donis d-2-F	Feb. 14, 1965	Feb. 24, 1965	3,883	3,883	Abandoned—dry.
1579	Atlantic Kyklo d-48-H	Jan. 25, 1965	Mar. 24, 1965	6,436	6,436	Abandoned—dry.
1542	Atlantic Tees c-15-J	Dec. 27, 1964			11,031	Drilling whipstocked hole; suspended 9-4-65 to 13-12-65.
1572	BA Shell Klua c-70-E	Jan. 19, 1965	Mar. 3, 1965	7,526	7,526	Abandoned—dry.
1819	Baysel SR CanDel Grouse d-100-G	Dec. 18, 1964			3,745	Drilling.
1658	Baysel SR CanDel Osprey d-93-G	May 25, 1965	June 4, 1965	3,861	3,861	Triassic Halfway oil well.
1779	Baysel SR CanDel Osprey d-15-J	Nov. 15, 1965	Nov. 29, 1965	3,927	3,927	Abandoned—dry.
1625	Baysel Peejay d-34-H	Mar. 21, 1965	Apr. 4, 1965	3,960	3,960	Triassic Halfway oil well.
1678	CanDel SR Nancy d-51-H	July 21, 1965	Aug. 1, 1965	3,910	3,910	Triassic Halfway oil well.
1603	CanDel SR Peejay d-52-H	Feb. 26, 1965	Mar. 14, 1965	3,893	3,893	Triassic Halfway oil well.
1713	CanDel SR Weasel d-14-B	Aug. 13, 1965	Aug. 21, 1965	3,850	3,850	Triassic Halfway oil well.
1709	CanDel SR Weasel d-15-B	Aug. 4, 1965	Aug. 12, 1965	3,900	3,900	Triassic Halfway oil well.
1776	Cdn Sup et al Inga 10-25-88-24	Nov. 10, 1965			7,053	Drilling.
1592	CDR et al Evergreen d-25-B	Jan. 31, 1965	Feb. 14, 1965	3,728	3,728	Abandoned—dry.
1466	C&E Helmet c-54-F	Mar. 28, 1964	Jan. 26, 1965	7,517	2,584	Abandoned—dry; suspended 31-3-64 to 20-12-64.
1595	C&E Sohio Med Kathy d-73-H	Feb. 2, 1965	Mar. 8, 1965	7,620	7,620	Abandoned—dry.
1789	CIGOL Triad Conroy a-70-H	Nov. 17, 1965	Dec. 1, 1965	3,500	3,500	Abandoned—dry.
1684	CIGOL Crush d-100-C	June 26, 1965	July 6, 1965	3,917	3,917	Triassic Halfway oil well.
1691	CIGOL Crush d-91-D	July 6, 1965	July 15, 1965	3,920	3,920	Triassic Halfway oil well.
1704	CIGOL Crush d-1-E	July 26, 1965	Aug. 3, 1965	3,910	3,910	Triassic Halfway oil well.
1715	CIGOL Crush d-10-F	Aug. 14, 1965	Aug. 22, 1965	3,920	3,920	Triassic Halfway oil well.
1727	CIGOL Mobil Peejay d-16-E	Sept. 5, 1965	Sept. 14, 1965	3,912	3,912	Abandoned—dry.
1718	CIGOL Mobil Peejay d-26-E	Aug. 26, 1965	Sept. 4, 1965	3,900	3,900	Triassic Halfway oil well.
1639	CIGOL Peejay d-33-E	Mar. 11, 1965	Mar. 19, 1965	3,860	3,860	Triassic Halfway oil well.
1690	CIGOL Mobil Peejay d-34-E	July 15, 1965	July 25, 1965	3,877	3,877	Triassic Halfway oil well.
1706	CIGOL Mobil Peejay d-35-E	Aug. 3, 1965	Aug. 13, 1965	3,872	3,872	Triassic Halfway oil well.
1730	CIGOL Mobil Peejay d-36-E	Sept. 15, 1965	Sept. 23, 1965	3,890	3,890	Abandoned—dry.
1575	CIGOL Peejay d-43-E	Jan. 20, 1965	Feb. 3, 1965	3,910	3,910	Triassic Halfway oil well.
1643	CIGOL Mobil Peejay d-46-E	Mar. 20, 1965	Apr. 1, 1965	4,004	4,004	Triassic Halfway oil well.
1804	CIGOL Mobil Peejay b-56-E	Dec. 8, 1965	Dec. 23, 1965	3,880	3,880	Abandoned—dry.
1664	CIGOL Mobil Peejay d-56-E	May 28, 1965	June 9, 1965	3,880	3,880	Triassic Halfway gas well.
1827	CIGOL et al Snowberry d-17-D	Dec. 30, 1965			1,588	Drilling.
1567	CIGOL Wildmint d-13-A	Jan. 7, 1965	Jan. 17, 1965	3,670	3,670	Triassic Halfway oil well.
1670	Dome Boundary 2-12-85-14	July 10, 1965	July 17, 1965	4,280	4,280	Triassic Boundary Lake oil well.
1671	Dome Boundary 4-12-85-14	July 7, 1965	July 14, 1965	4,270	4,270	Triassic Boundary Lake oil well.

[1] Resumed operations.

TABLE 9.—WELLS DRILLED AND DRILLING, 1965—*Continued*

Well Authorization No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1965 Footage	Status at Dec. 31, 1965
1675	Dome Boundary 10-12-85-14	June 17, 1965	June 24, 1965	4,303	4,303	Triassic Boundary Lake oil well.
1677	Dome Boundary 2-13-85-14	June 7, 1965	June 15, 1965	4,296	4,296	Triassic Boundary Lake oil well.
1669	Dome Boundary 2-26-85-14	July 3, 1965	July 18, 1965	4,295	4,295	Triassic Boundary Lake oil well.
1672	Dome Boundary 4-26-85-14	July 22, 1965	Aug. 2, 1965	4,335	4,335	Triassic Boundary Lake oil well.
1673	Dome Boundary 10-26-85-14	July 6, 1965	July 12, 1965	4,345	4,345	Triassic Boundary Lake oil well.
1674	Dome Boundary 12-26-85-14	June 6, 1965	June 16, 1965	4,364	4,364	Triassic Boundary Lake oil well.
1668	Dome Boundary 10-34-85-14	July 2, 1965	July 9, 1965	4,320	4,320	Triassic Boundary Lake oil well.
1747	Dome Boundary 12-34-85-14	Oct. 8, 1965	Oct. 17, 1965	4,320	4,320	Abandoned—dry.
1676	Dome Boundary 2-35-85-14	June 10, 1965	June 17, 1965	4,378	4,378	Triassic Boundary Lake oil well.
1667	Dome Boundary 10-35-85-14	June 26, 1965	July 4, 1965	4,439	4,439	Triassic Boundary Lake oil well.
1665	Dome Boundary 12-35-85-14	June 19, 1965	June 25, 1965	4,360	4,360	Triassic Boundary Lake oil well.
1666	Dome Boundary 2-3-86-14	June 18, 1965	June 27, 1965	4,380	4,380	Triassic Boundary Lake oil well.
1702	Dome Boundary 6-3-86-14	July 22, 1965	July 30, 1965	4,370	4,370	Triassic Boundary Lake oil well.
1628	Dome et al Helmet a-59-J	Mar. 2, 1965	Mar. 27, 1965	6,550	6,550	Abandoned—dry.
1710	Dome et al LaGarde 16-25-87-16	Aug. 8, 1965	Aug. 25, 1965	4,350	4,350	Abandoned—dry.
1734	Dome Provo Weasel d-2-B	Sept. 16, 1965	Sept. 29, 1965	3,760	3,760	Triassic Halfway oil well.
1726	Dome Provo Weasel d-3-B	Sept. 3, 1965	Sept. 15, 1965	3,825	3,825	Triassic Halfway oil well.
1584	FPC Whitehall Peejay b-27-E	Feb. 25, 1965	Mar. 10, 1965	3,910	3,910	Triassic Halfway oil well.
1586	FPC C&E Huber Snowberry d-88-D	Jan. 23, 1965	Feb. 4, 1965	3,577	3,577	Abandoned—dry.
611	Fraser Valley Chilliwack 14-19-26	Nov. 30, 1965	-------	-------	-------	Suspended.
1745	Frontier et al Evie b-88-H	Oct. 6, 1965	Nov. 29, 1965	7,590	7,590	Abandoned—dry.
1499	Gray Oil PRP NW Grizzly d-59-A	Nov. 22, 1964	Mar. 19, 1965	8,556	3,894	Finished drilling.
1561	HB Jonvan d-44-J	Jan. 15, 1965	Feb. 19, 1965	7,150	7,150	Abandoned—dry.
1772	Homestead Middleton d-60-J	Nov. 8, 1965	Nov. 25, 1965	4,012	4,012	Abandoned—dry.
1797	Huber et al Boundary 7-6-87-13	Dec. 3, 1965	Dec. 18, 1965	4,880	4,880	Abandoned—dry.
1787	Huber IOE Crush a-15-F	Nov. 17, 1965	Nov. 28, 1965	3,867	3,867	Abandoned—dry.
1774	Huber Amerada Fox a-88-D	Nov. 10, 1965	Nov. 27, 1965	4,000	4,000	Abandoned—dry.
1656	Huber Triad Weasel d-84-J	Mar. 29, 1965	Apr. 6, 1965	3,900	3,900	Abandoned—dry.
1593	Imp Fina Rigel 11-3-88-18	Jan. 30, 1965	Mar. 2, 1965	3,605	3,605	Lower Cretaceous Dunlevy gas well.
1576	IOE E Clarke b-6-A	Jan. 23, 1965	Apr. 3, 1965	7,700	7,700	Devonian Slave Point gas well.
1606	IOE Fox d-42-A	Feb. 4, 1965	Feb. 28, 1965	4,165	4,165	Abandoned—dry.
1765	IOE Fox d-67-D	Nov. 2, 1965	Nov. 14, 1965	3,990	3,990	Abandoned—dry.
1739	IOE Fina Rigel 16-24-87-17	Sept. 24, 1965	Oct. 5, 1965	3,740	3,740	Lower Cretaceous Dunlevy gas well.
1696	James PRP et al Grizzly c-2-A	July 26, 1965	Nov. 7, 1965	8,566	8,566	Abandoned—dry.
1609	Kewanee et al Osborn a-85-K	Feb. 9, 1965	Feb. 23, 1965	4,050	4,050	Abandoned—dry.
1528	Marathon Clarke a-65-G	Nov. 3, 1964	Jan. 18, 1965	6,758	103	Devonian Slave Point gas well.
1452	Medallion Mobil Peejay d-57-E	Feb. 6, 1965	Feb. 22, 1965	3,988	3,988	Triassic Halfway oil well.
1648	Medallion E Peejay d-21-E	Mar. 20, 1965	Mar. 29, 1965	3,955	3,955	Abandoned—dry.
1546	Monsanto et al Pingel 13-1-82-18	Dec. 8, 1964	Jan. 11, 1965	5,675	538	Abandoned—dry.
1651	Monsanto IOE Fina Rigel 8-18-87-16	Mar. 23, 1965	Apr. 5, 1965	3,625	3,625	Lower Cretaceous Dunlevy oil well.
1692	Monsanto IOE Fina Rigel 6-19-87-16	July 26, 1965	Aug. 7, 1965	3,650	3,650	Lower Cretaceous Dunlevy oil well.
1738	Monsanto Rigel 8-19-87-16	Sept. 26, 1965	Oct. 4, 1965	3,633	3,633	Abandoned—dry.

1616	Monsanto IOE Fina Rigel 11-19-87-16	Feb. 16, 1965	Feb. 26, 1965	3,763	3,763	Lower Cretaceous Dunlevy oil well.
1781	Monsanto Rigel 16-19-87-16	Nov. 22, 1965	Dec. 5, 1965	3,650	3,650	Lower Cretaceous Dunlevy oil well.
1660	Monsanto IOE Fina Rigel 16-11-87-17	May 9, 1965	May 19, 1965	3,700	3,700	Abandoned—dry.
1555	Monsanto Rigel 6-13-87-17	Dec. 24, 1964	Jan. 11, 1965	3,789	156	Lower Cretaceous Dunlevy oil well.
1812	Monsanto Rigel 14-30-87-17	Dec. 16, 1965	Dec. 23, 1965	3,395	3,395	Abandoned—dry.
1714	Monsanto Rigel 6-31-87-17	Aug. 8, 1965	Aug. 18, 1965	3,370	3,370	Lower Cretaceous Dunlevy oil well.
1731	Monsanto Rigel 8-31-87-17	Sept. 12, 1965	Sept. 22, 1965	3,536	3,536	Abandoned—dry.
1650	Pacific Airport 16-26-83-17	Mar. 28, 1965	May 2, 1965	5,142	5,142	Abandoned—dry.
1780	Pacific West Prod Big Beaver c-59-J	Nov. 17, 1965			7,192	Drilling.
1753	Pacific West Prod N Buick c-22-F	Oct. 26, 1965	Nov. 8, 1965	4,050	4,050	Lower Cretaceous Bluesky-Gething gas and Dunlevy gas well.
1799	Pacific West Prod N Buick b-44-F	Nov. 30, 1965	Dec. 22, 1965	3,991	3,991	Lower Cretaceous Dunlevy gas wel.
1830	Pacific West Prod N Buick b-86-F	Jan. 1, 1965			35	Drilling.
1578	Pacific Apache Clarke a-61-F	Jan. 20, 1965	Mar. 12, 1965	6,830	6,830	Devonian Slave Point gas well.
1554	Pacific Imperial Clarke c-92-I	Jan. 4, 1965	Feb. 20, 1965	6,390	6,390	Devonian Slave Point gas well.
1796	Pacific et al Clarke b-22-J	Dec. 4, 1965			6,380	Drilling.
1619	Pacific Imperial S Clarke b-60-K	Feb. 25, 1965	Apr. 6, 1965	7,126	7,126	Finished driling.
1712	Pacific SR CanDel Condor d-29-H	Aug. 11, 1965	Aug. 24, 1965	4,020	4,020	Abandoned—dry.
1777	Pacific SR CanDel Dede b-93-K	Nov. 11, 1965	Nov. 23, 1965	3,950	3,950	Abandoned—dry.
1614	Pacific SR CanDel Falcon d-99-K	Feb. 15, 1965	Mar. 1, 1965	3,836	3,836	Abandoned—dry.
1588	Pacific SF CanDel Harrier d-9-B	Jan. 28, 1965	Feb. 13, 1965	3,971	3,971	Abandoned—dry.
1697	Pacific SR CanDel Kestrel d-51-J	July 23, 1965	Aug. 4, 1965	3,780	3,780	Abandoned—dry.
1744	Pacific Nig a-9-A	Oct. 4, 1965	Oct. 18, 1965	4,478	4,478	Abandoned—dry.
1728	Pacific Nig b-4-B	Sept. 13, 1965	Sept. 28, 1965	4,383	4,383	Triassic Baldonnel gas well.
1711	Pacific Nig b-10-B	Aug. 8, 1965	Aug. 26, 1965	4,651	4,651	Abandoned—dry.
1610	Pacific SR CanDel Osprey d-4-J	Feb. 10, 1965	Feb. 26, 1965	3,835	3,835	Triassic Halfway oil well.
1642	Pacific SR CanDel Osprey d-5-J	Mar. 15, 1965	Mar. 27, 1965	3,886	3,886	Abandoned—dry.
1624	Pacific Sinclair Peejay d-8-E	Mar. 4, 1965	Mar. 20, 1965	3,940	3,940	Injection—water.
1626	Pacific Sinclair Peejay d-30-E	Mar. 14, 1965	Mar. 29, 1965	3,954	3,954	Abandoned—dry.
1661	Pacific Sinclair Peejay b-37-E	May 24, 1965	June 6, 1965	3,921	3,921	Injection—water.
1737	Pacific SR CanDel Peejay b-67-E	Sept. 28, 1965	Oct. 13, 1965	3,903	3,903	Triassic Halfway oil well.
1627	Pacific Sinclair Peejay d-21-H	Mar. 1, 1965	Mar. 13, 1965	3,958	3,958	Triassic Halfway oil well.
1585	Pacific Sinclair Peejay d-31-H	Jan. 26, 1965	Feb. 10, 1965	3,940	3,940	Triassic Halfway oil well.
1563	Pacific Sinclair Peejay d-32-H	Jan. 7, 1965	Jan. 21, 1965	3,952	3,952	Triassic Halfway oil well.
1632	Pacific Sinclair Peejay d-41-H	Mar. 3, 1965	Mar. 13, 1965	3,903	3,903	Triassic Halfway oil well.
1562	Pacific SR CanDel Peejay d-68-H	Jan. 11, 1965	Jan. 26, 1965	3,923	3,923	Triassic Halfway oil well.
1803	Pacific SR CanDel Peejay d-34-I	Dec. 5, 1965	Dec. 15, 1965	3,740	3,740	Abandoned—dry.
1817	Pacific et al Pesh c-72-J	Dec. 25, 1965			685	Drilling.
1816	Pacific Shekilie b-24-A	Dec. 27, 1965			643	Drilling.
1649	Pacific et al Sunrise 6-12-79-16	Mar. 24, 1965	Apr. 2, 1965	2,971	2,971	Abandoned—dry.
1748	Pacific SR CanDel Weasel d-4-B	Oct. 15, 1965	Oct. 26, 1965	3,874	3,874	Triassic Halfway oil well.
1791	Pacific SR CanDel Weasel d-5-B	Nov. 18, 1965	Dec. 7, 1965	3,136	3,136	Abandoned—junked.
1805	Pacific SR CanDel Weasel d-A5-B	Dec. 8, 1965	Dec. 20, 1965	3,900	3,900	Triassic Halfway oil well.
1829	Pacific SR CanDel Weasel d-83-J	Dec. 30, 1965			508	Drilling.
1761	Pacific SR CanDel Weasel d-94-J	Oct. 27, 1965	Nov. 9, 1965	3,870	3,870	Triassic Halfway oil well.
1566	Pacific SR CanDel Wildmint d-84-I	Jan. 12, 1965	Feb. 7, 1965	3,764	4,302	Triassic Halfway oil well; whipstocked hole.

TABLE 9.—WELLS DRILLED AND DRILLING, 1965—*Continued*

Well Authorization No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1965 Footage	Status at Dec. 31, 1965
1577	Pan Am Dome Medana c-26-H	Dec. 18, 1965			1,170	Drilling.
1621	Placid Frontier Gunnel c-98-L	Dec. 6, 1965			6,490	Drilling.
1570	Placid Louise c-80-L	Jan. 13, 1965	Mar. 1, 1965	7,375	7,375	Devonian Slave Point gas well.
1589	Placid Apache Sandy b-26-G	Jan. 28, 1965	Mar. 1, 1965	3,803	3,803	Abandoned—dry.
1634	Placid Frontier Yoyo d-95-H	Mar. 6, 1965			6,752	Drilling.
1569	Placid Frontier Yoyo b-10-L	Jan. 12, 1965	Mar. 15, 1965	7,290	7,290	Devonian Pine Point gas well.
1620	Richfield N Rigel a-27-I	Mar. 3, 1965	Mar. 13, 1965	3,665	3,665	Lower Cretaceous Dunlevy gas well.
1763	Richfield N Rigel d-33-I	Nov. 10, 1965	Nov. 24, 1965	4,355	4,355	Lower Cretaceous Dunlevy gas well.
1778	Sinclair et al Currant d-4-C	Nov. 11, 1965	Nov. 22, 1965	4,075	4,075	Abandoned—dry.
1700	Sinclair et al Currant d-5-C	July 21, 1965	Aug. 8, 1965	4,078	4,078	Triassic Halfway oil well.
1646	Sinclair et al Currant d-6-C	Mar. 27, 1965	Apr. 8, 1965	4,099	4,099	Triassic Halfway oil well.
1752	Sinclair et al Currant b-15-C	Oct. 20, 1965	Nov. 4, 1965	4,007	4,007	Triassic Halfway oil well.
1635	Sinclair et al Currant d-16-C	Mar. 5, 1965	Mar. 25, 1965	4,060	4,060	Triassic Halfway oil well.
1590	Sinclair et al Currant d-17-C	Jan. 29, 1965	Feb. 13, 1965	3,995	3,995	Triassic Halfway oil well.
1724	Sinclair et al Currant d-27-C	Sept. 2, 1965	Sept. 25, 1965	4,033	4,033	Triassic Halfway oil well.
1716	Sinclair et al Currant d-94-K	Aug. 12, 1965	Aug. 23, 1965	4,100	4,100	Abandoned—dry.
1695	Sinclair Pacific Mink d-78-A	July 13, 1965	Aug. 2, 1965	4,202	4,202	Abandoned—dry.
1564	Sinclair Pacific Mink d-88-A	Jan. 10, 1965	Jan. 28, 1965	4,225	4,225	Triassic Halfway gas well.
1795	Sinclair Weasel d-19-A	Nov. 24, 1965	Dec. 5, 1965	3,725	3,725	Abandoned—dry.
1631	Sinclair Pacific Weasel d-30-A	Feb. 27, 1965	Mar. 21, 1965	3,760	3,760	Triassic Halfway oil well.
1644	Sinclair Pacific Weasel d-13-B	Mar. 21, 1965	Apr. 6, 1965	3,845	3,845	Triassic Halfway oil well.
1790	Sinclair Pacific Weasel d-93-J	Nov. 26, 1965	Dec. 12, 1965	3,865	3,865	Triassic Baldonnel gas well.
1611	Sinclair Pacific Wolf d-83-B	Feb. 12, 1965	Feb. 27, 1965	4,110	4,110	Abandoned—dry.
1815	Sinclair Pacific Wolf d-93-B	Dec. 15, 1965			4,080	Drilling.
1813	Sinclair et al Wolverine d-22-F	Dec. 13, 1965	Dec. 23, 1965	3,927	3,927	Abandoned—dry.
1587	Sinclair et al Wolverine d-25-G	Feb. 15, 1965	Feb. 25, 1965	3,880	3,880	Abandoned—dry.
1832	Sinclair et al Wolverine a-59-G	Dec. 30, 1965			505	Drilling.
1602	Socony Mobil Sierra c-78-C	Feb. 5, 1965	Mar. 28, 1965	6,949	6,949	Devonian Pine Point gas well.
1553	Socony Mobil Sierra a-79-C	Jan. 26, 1965	Feb. 1, 1965	730	730	Abandoned—junked.
1659	Socony Mobil Sierra c-91-D	Apr. 4, 1965	June 4, 1965	7,619	7,619	Devonian Pine Point gas well.
1775	Sun Texaco W Willow d-95-B	Nov. 15, 1965	Nov. 27, 1965	3,744	3,744	Triassic Halfway gas well.
1746	Tenn Sun Beaverdam d-37-L	Oct. 9, 1965	Oct. 17, 1965	3,830	3,830	Triassic Halfway gas well.
1653	Tenn Beaverdam d-38-L	Mar. 25, 1965	Apr. 4, 1965	3,845	3,845	Triassic Halfway oil well.
1802	Tenn Beaverdam d-39-L	Dec. 2, 1965	Dec. 9, 1965	3,820	3,820	Triassic Halfway oil well.
1769	Tenn Sun Beaverdam d-48-L	Nov. 7, 1965	Nov. 18, 1965	3,830	3,830	Abandoned—dry.
1580	Tenn Cdn-Sup et al Inga 13-7-88-23	Jan. 16, 1965	Apr. 14, 1965	7,405	7,405	Triassic Charlie Lake gas well.
1757	Tenn Ashland Weasel d-24-B	Oct. 26, 1965	Nov. 4, 1965	3,870	3,870	Triassic Halfway oil well.
1637	Tenn Ashland Weasel d-25-B	Mar. 10, 1965	Mar. 24, 1965	3,925	3,925	Triassic Halfway oil well.
1689	Tenn Ashland Weasel d-26-B	July 13, 1965	July 21, 1965	3,980	3,980	Triassic Halfway oil well.
1703	Tenn Ashland Weasel d-27-B	July 24, 1965	July 31, 1965	3,990	3,990	Triassic Halfway gas well.
1794	Tenn Ashland Weasel d-34-B	Nov. 23, 1965	Dec. 1, 1965	3,835	3,835	Triassic Halfway oil well.

1601	Tenn Ashland Weasel d-35-B	Feb. 15, 1965	Mar. 5, 1965	3,860	3,860	Triassic Halfway oil well.
1662	Tenn Ashland Weasel d-36-B	June 7, 1965	June 17, 1965	3,942	3,942	Triassic Halfway oil well.
1809	Tenn Ashland Weasel b-44-B	Dec. 10, 1965	Dec. 18, 1965	3,855	3,855	Triassic Halfway oil well.
1655	Tenn Ashland Weasel d-45-B	Mar. 26, 1965	Apr. 7, 1965	3,890	3,890	Triassic Halfway oil well.
1679	Tenn Ashland Weasel d-46-B	June 18, 1965	June 27, 1965	3,930	3,930	Triassic Halfway oil well.
1688	Tenn Ashland Weasel d-56-B	July 4, 1965	July 12, 1965	3,900	3,900	Triassic Halfway oil well.
1750	Tenn Wildmint d-7-A	Oct. 19, 1965	Oct. 26, 1965	3,800	3,800	Triassic Halfway oil well.
1798	Texaco NFA Boundary 16-21-85-14	Nov. 29, 1965	Dec. 9, 1965	4,400	4,400	Triassic Boundary Lake oil well.
1786	Texaco NFA Boundary 6-28-85-14	Nov. 13, 1965	Nov. 26, 1965	4,350	4,350	Triassic Boundary Lake oil well.
1680	Texaco NFA Boundary 8-28-85-14	June 26, 1965	July 7, 1965	4,340	4,340	Triassic Boundary Lake oil well.
1751	Texaco NFA Boundary 14-28-85-14	Oct. 20, 1965	Oct. 29, 1965	4,295	4,295	Triassic Boundary Lake oil well.
1767	Texaco NFA Boundary 6-33-85-14	Oct. 31, 1965	Nov. 10, 1965	4,260	4,260	Triassic Boundary Lake oil well.
1717	Texaco NFA Boundary 8-33-85-14	Aug. 12, 1965	Aug. 22, 1965	4,300	4,300	Triassic Boundary Lake oil well.
1810	Texaco NFA Boundary 4-34-85-14	Dec. 17, 1965			4,301	Drilling.
1720	Texaco NFA Boundary 6-29-86-13	Aug. 24, 1965	Sept. 2, 1965	4,400	4,400	Triassic Boundary Lake oil well.
1558	Texaco NFA Boundary 8-25-86-14	Dec. 30, 1964	Jan. 12, 1965	4,388	3,869	Triassic Boundary Lake oil well.
1607	Texaco NFA Currant a-3-C	Feb. 8, 1965	Feb. 25, 1965	4,074	4,074	Triassic Halfway gas well.
1755	Texaco Texcan Lynx d-40-A	Nov. 5, 1965	Nov. 19, 1965	4,235	4,235	Abandoned—dry.
1681	Texaco NFA Nig d-75-B	July 4, 1965	July 25, 1965	4,359	4,359	Triassic Baldonnel gas well.
1762	Texaco NFA Nig a-77-B	Oct. 31, 1965	Nov. 19, 1965	4,360	4,360	Triassic Baldonnel gas well.
1740	Texaco NFA Nig a-6-G	Oct. 6, 1965	Oct. 30, 1965	4,400	4,400	Triassic Baldonnel gas well.
1793	Texaco NFA Nig c-76-G	Nov. 22, 1965	Dec. 13, 1965	4,450	4,450	Abandoned—dry.
1654	Texaco NFA Nig c-6-H	Mar. 27, 1965	June 12, 1965	4,362	4,362	Triassic Baldonnel gas well.
1707	Texaco NFA Nig c-14-H	Aug. 4, 1965	Aug. 26, 1965	4,290	4,290	Triassic Baldonnel gas well.
1742	Texaco NFA Nig c-33-H	Oct. 4, 1965	Oct. 22, 1965	4,265	4,265	Triassic Baldonnel gas well.
1557	Texaco NFA Redeye a-72-I	Jan. 2, 1965	Jan. 20, 1965	3,925	3,925	Abandoned—dry.
1565	Texaco NFA Tsea c-54-K	Jan. 8, 1965	Feb. 14, 1965	7,476	7,476	Abandoned—dry.
1571	Texaco NFA S Wargen a-100-G	Jan. 25, 1965	Feb. 26, 1965	4,323	4,323	Abandoned—dry.
1754	Texaco Texcan Wolf b-35-B	Oct. 18, 1965	Nov. 1, 1965	4,220	4,220	Abandoned—dry.
1760	Texaco Woodrush d-95-H	Oct. 30, 1965	Nov. 8, 1965	3,685	3,685	Abandoned—dry.
1636	Texcan Buckthorn d-80-C	Mar. 7, 1965	Mar. 30, 1965	3,939	3,939	Triassic Halfway oil well.
1600	Texcan Buckthorn d-90-C	Feb. 5, 1965	Feb. 28, 1965	3,915	3,915	Triassic Halfway oil well.
1683	Texcan Buckthorn d-61-D	June 25, 1965	July 15, 1965	3,950	3,950	Triassic Halfway oil well.
1657	Texcan Buckthorn d-71-D	Mar. 31, 1965	Apr. 13, 1965	3,940	3,940	Triassic Halfway oil well.
1698	Texcan Buckthorn d-81-D	July 16, 1965	Aug. 4, 1965	3,949	3,949	Triassic Halfway oil well.
1792	TGS Sun Falls a-64-B	Dec. 14, 1965			2,547	Drilling.
1701	Triad et al Arrow d-3-K	July 23, 1965	Aug. 2, 1965	3,765	3,765	Abandoned—dry.
1552	Triad Beatton b-58-J	Dec. 23, 1964	Jan. 15, 1965	3,785	715	Triassic Halfway oil well.
1560	Triad et al Beatton d-42-K	Jan. 24, 1965	Feb. 7, 1965	3,740	3,740	Abandoned—dry.
1604	Triad W Beatton a-40-K	Feb. 22, 1965	Mar. 5, 1965	3,438	3,438	Lower Cretaceous Bluesky-Gething oil well.
1638	Triad W Beatton d-55-K	Mar. 8, 1965	Mar. 18, 1965	3,747	3,747	Abandoned—dry.
1591	Triad Sohio Elder c-82-D	Feb. 10, 1965	Feb. 20, 1965	3,930	3,930	Abandoned—dry.
1807	Triad Dev-Pal Laprise c-38-D	Dec. 19, 1965			4,294	Drilling.
1437	Triad Uno-Tex Nogah c-78-H	Feb. 10, 1964	Feb. 16, 1965	6,750	4,355	Abandoned—dry; suspended 12–3–64 to 10–1 65.
1517	Triad BP Sukunka a-43-B	Oct. 18, 1964	Sept. 14, 1965	10,808	4,108	Triassic Schooler Creek gas well.
1825	Union HB Beaverdam d-64-L	Dec. 28, 1965			2,638	Drilling.

TABLE 9.—WELLS DRILLED AND DRILLING, 1965—*Continued*

Well Authorization No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1965 Footage	Status at Dec. 31, 1965
1596	Union Tenneco Beaverdam d-68-L	Jan. 30, 1965	Feb. 12, 1965	3,790	3,790	Abandoned—dry.
1630	Union Birch d-99-E	Feb. 28, 1965	Mar. 26, 1965	4,000	4,000	Triassic Baldonnel gas well.
1629	Union HB Sinc Pac Bulrush d-88-F	Mar. 1, 1965	Mar. 27, 1965	3,784	3,784	Triassic Halfway oil well.
1582	Union HB Sinc Pac Bulrush d-98-F	Jan. 15, 1965	Jan. 27, 1965	3,804	3,804	Triassic Halfway oil well.
1623	Union HB Bulrush d-100-F	Mar. 1, 1965	Mar. 9, 1965	3,845	3,845	Abandoned—dry.
1597	Union HB Sinc Pac Bulrush d-9-K	Jan. 29, 1965	Feb. 11, 1965	3,790	3,790	Triassic Halfway gas well.
1783	Union HB Crush d-69-C	Nov. 21, 1965	Dec. 2, 1965	4,060	4,060	Triassic Halfway oil well.
1741	Union HB Sinc Pac Crush d-79-C	Oct. 5, 1965	Oct. 13, 1965	3,970	3,970	Triassic Halfway oil well.
1633	Union HB Sinc Pac Crush d-88-C	Mar. 4, 1965	Mar. 14, 1965	3,978	3,978	Abandoned—dry.
1773	Union HB Sinc Pac Crush d-96-C	Nov. 7, 1965	Nov. 21, 1965	4,060	4,060	Abandoned—dry.
1820	Union HB Sinc Pac CIGOL Crush d-98-C	Dec. 18, 1965			3,608	Drilling.
1785	Union HB Sinc Pac Crush d-99-C	Dec. 2, 1965	Dec. 9, 1965	3,980	3,980	Triassic Halfway oil well.
1598	Union HB Sinc Pac Crush b-9-F	Feb. 3, 1965	Feb. 15, 1965	4,005	4,005	Triassic Halfway oil well.
1581	Union HB Currant d-19-C	Jan. 19, 1965	Jan. 30, 1965	4,080	4,080	Abandoned—dry.
1768	Union HB Currant d-28-C	Dec. 2, 1965	Dec. 11, 1965	4,040	4,040	Triassic Halfway oil well.
1594	Union et al Donis b-24-F	Jan. 29, 1965	Feb. 12, 1965	3,895	3,895	Abandoned—dry.
1784	Union HB Peejay d-73-D	Nov. 16, 1965	Nov. 30, 1965	3,990	3,990	Triassic Halfway oil well.
1771	Union HB Peejay d-84-D	Nov. 5, 1965	Nov. 15, 1965	3,975	3,975	Abandoned—dry.
1764	Union HB Peejay d-22-E	Oct. 29, 1965	Nov. 6, 1965	3,935	3,935	Triassic Halfway oil well.
1699	Union HB Peejay d-23-E	Aug. 18, 1965	Aug. 25, 1965	3,925	3,925	Triassic Halfway oil well.
1694	Union HB Peejay d-24-E	July 15, 1965	July 23, 1965	3,845	3,845	Triassic Halfway oil well.
1641	Union HB Peejay d-25-E	Mar. 11, 1965	Mar. 23, 1965	3,965	3,965	Triassic Halfway oil well.
1652	Union HB Peejay b-54-E	Mar. 26, 1965	Apr. 4, 1965	3,955	3,955	Triassic Halfway gas well.
1759	Union HB E Peejay d-72-D	Oct. 26, 1965	Nov. 4, 1965	4,000	4,000	Triassic Halfway oil well.
1722	Union HB E Peejay d-82-D	Sept. 25, 1965	Oct. 3, 1965	3,981	3,981	Triassic Halfway oil well.
1749	Union HB E Peejay d-83-D	Oct. 15, 1965	Oct. 24, 1965	3,988	3,988	Triassic Halfway oil well.
1708	Union HB E Peejay d-92-D	Aug. 8, 1965	Aug. 17, 1965	3,960	3,960	Triassic Halfway oil well.
1725	Union HB E Peejay d-93-D	Sept. 5, 1965	Sept. 13, 1965	3,996	3,996	Triassic Halfway oil well.
1721	Union HB E Peejay d-2-E	Aug. 27, 1965	Sept. 4, 1965	3,955	3,955	Triassic Halfway oil well.
1732	Union HB E Peejay d-3-E	Sept. 15, 1965	Sept. 24, 1965	3,990	3,990	Triassic Halfway oil well.
1756	Union HB E Peejay d-4-E	Dec. 10, 1965	Dec. 18, 1965	3,985	3,985	Abandoned—dry.
1736	Union HB E Peejay d-12-E	Sept. 27, 1965	Oct. 6, 1965	3,945	3,945	Triassic Halfway oil well.
1735	Union HB E Peejay d-13-E	Oct. 17, 1965	Oct. 24, 1965	3,960	3,960	Triassic Halfway oil well.
1723	Union HB E Peejay d-14-E	Sept. 2, 1965	Sept. 12, 1965	3,948	3,948	Abandoned—dry.
1617	Union HB E Peejay b-51-E	Feb. 15, 1965	Feb. 25, 1965	3,798	3,798	Abandoned—dry.
1568	Union HB Skwat d-83-J	Jan. 15, 1965	Jan. 27, 1965	3,715	3,715	Abandoned—dry.
1559	Union HB Spruce d-84-E	Dec. 31, 1964	Jan. 13, 1965	3,895	3,378	Abandoned—dry.
1693	Union et al Weasel d-37-B	July 13, 1965	July 24, 1965	4,002	4,002	Abandoned—dry.
1811	Union et al Weasel d-57-B	Dec. 13, 1965	Dec. 23, 1965	3,960	3,960	Triassic Halfway oil well.
1685	Union HB Wildmint d-34-A	July 4, 1965	July 11, 1965	3,691	3,691	Triassic Halfway oil well.
1766	Union HB Wildmint d-35-A	Nov. 2, 1965	Nov. 14, 1965	3,792	3,792	Triassic Halfway oil well.

1618	Union HB Wildmint d-37-A	Feb. 18, 1965	Feb. 27, 1965	3,820	3,820	Abandoned—dry.
1808	Union HB Wildmint d-44-A	Dec. 12, 1965	Dec. 21, 1965	3,666	3,666	Injection—water.
1705	Union HB Wildmint b-54-A	July 29, 1965	Aug. 7, 1965	3,725	3,725	Triassic Halfway gas well.
1782	Union HB Wildmint b-55-A	Nov. 24, 1965	Dec. 1, 1965	3,800	3,800	Triassic Halfway oil well.
1733	Union HB Wildmint b-66-A	Sept. 13, 1965	Sept. 26, 1965	3,800	3,800	Triassic Halfway oil well.
1743	Union HB Wildmint d-66-A	Oct. 8, 1965	Oct. 15, 1965	3,781	3,781	Triassic Halfway oil well.
1800	Union HB Wildmint b-75-A	Dec. 3, 1965	Dec. 10, 1965	3,765	3,765	Abandoned—dry.
1758	Union HB Wildmint b-76-A	Oct. 25, 1965	Nov. 1, 1965	3,810	3,810	Triassic Halfway oil well.
1788	Union HB Wildmint b-86-A	Nov. 15, 1965	Nov. 22, 1965	3,783	3,783	Triassic Halfway gas well.
1615	Union HB Woodrush d-75-H	Feb. 14, 1965	Feb. 25, 1965	3,765	3,765	Abandoned—dry.
1556	Uno-Tex Kewanee Stoddart 8-31-85-19	Jan. 3, 1965	Feb. 5, 1965	6,436	6,436	Abandoned—dry.
1663	West Nat et al Aitken d-30-L	June 9, 1965	June 21, 1965	4,398	4,398	Abandoned—dry.
1469	West Nat et al Highway b-36-I	June 29, 1964	Feb. 11, 1965	12,561	454	Abandoned—dry.
1573	Whitehall et al W Beatton d-11-L	Feb. 5, 1965	Feb. 13, 1965	3,406	3,406	Abandoned—dry.
1613	Whitehall Nig b-6-B	Mar. 2, 1965	Mar. 25, 1965	4,377	4,377	Triassic Baldonnel gas well.
1770	Whitehall Stoddart 6-17-86-19	Nov. 16, 1965	Dec. 21, 1965	6,090	6,090	Permo Carboniferous Belloy gas well.
1826	Williamson HB CDR Chinchaga b-44-A	Dec. 31, 1965		——	247	Drilling.

TABLE 10.—OIL AND GAS FIELDS DESIGNATED AS AT DECEMBER 31, 1965

Field	Date Designated	Date(s) Revised	Field Location	Pool(s)	Number of Wells Capable of Production	Discovery Well(s)	Pool(s) Discovered
Aitken Creek	Feb. 15, 1960	Jan. 1, 1961 Oct. 1, 1963	N.T.S. 94-A-13	3	8	Union Aitken Creek b-42-L, oil Union Aitken Creek a-53-L, gas	3 3
Beatton River	Aug. 7, 1959	Jan. 1, 1962	N.T.S. 94-H-2	9	12	Triad Beatton River b-38-J, oil Triad Beatton d-60-J, gas	9 9
Beatton River West	Aug. 7, 1959	Jan. 1, 1962 Oct. 1, 1964	N.T.S. 94-H-2	2	8	Triad West Beatton River d-39-K, oil	2
Beg	July 1, 1961	Jan. 1, 1962 Apr. 1, 1962 July 1, 1962 Apr. 1, 1963 Apr. 1, 1964	N.T.S. 94-B-16, 94-G-1, 94-G-8	6, 9	33	Pacific et al Beg b-17-K, gas Pacific et al Beg d-10-G, gas	6 9
Beg West	Apr. 1, 1962	Oct. 1, 1963	N.T.S. 94-G-1	6	3	Pacific et al W Beg a-79-F, gas	6
Bernadet	Oct. 1, 1963		Tp. 87, 88, R. 24, 25, W. of 6th M. Tp. 87, 88, R. 24, 25, W. of 6th M.	2	1	West Nat et al Bernadet 8-1-88-25, gas	2
Blueberry	Feb. 7, 1958	Dec. 22, 1958 Feb. 15, 1960 May 27, 1960 Oct. 1, 1961 Jan. 1, 1963	N.T.S. 94-A-12, 94-A-13 Tp. 88, R. 25, W. of 6th M.	5, 6, 7, 11	31	West Nat et al Blueberry c-32-D (2), gas West Nat et al Blueberry d-87-D (1), gas West Nat et al Blueberry a-61-L, gas West Nat et al Blueberry d-82-L (11), oil	5 6 7 11
Blueberry East	Dec. 22, 1958		N.T.S. 94-A-13	6, 9, 11	2	West Nat et al E Blueberry b-38-C (7), gas West Nat et al E Blueberry b-36-C (17), gas	6, 9 11
Blueberry West	Feb. 7, 1958	July 1, 1961	N.T.S. 94-A-12, 94-B-9, 94-B-16 Tp. 88, R. 25, W. of 6th M.	5, 6	3	West Nat et al W Blueberry d-82-I (9), gas West Nat et al W Blueberry d-19-L (12), gas	5 6
Boundary Lake	Oct. 30, 1956	Feb. 7, 1958 Aug. 7, 1959 Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1961 July 1, 1961 Jan. 1, 1962 Apr. 1, 1962 Oct. 1, 1962 Oct. 1, 1963 Oct. 1, 1964 Jan. 1, 1965 Oct. 1, 1965	Tp. 84, 85, 86, 87, R. 13, W. of 6th M. Tp. 83, 84, 85, 86, R. 14, W. of 6th M. Tp. 84, R. 15, W. of 6th M.	2, 3, 5, 6, 7, 8, 9	269	Pacific Boundary 8-15-85-14, gas Pacific Boundary 12-10-85-14, gas Amerada Boundary 8-5-85-14, gas Texaco NFA Boundary L 6-6-86-13 (1), oil Sun Boundary Lake 6-23-85-14, oil Texaco NFA Boundary 16-31-86-13, gas	2, 6 3 5 8 9 9
Boundary Lake North	Jan. 1, 1965		Tp. 87, R. 14, W. of 6th M.	9	3	Texaco NFA N Boundary 7-3-87-14, gas	9

Bubbles	Nov. 24, 1959	Feb. 15, 1960 May 27, 1960 Jan. 1, 1961	N.T.S. 94-G-1, 94-G-8, 94-H-4	6	13	Pacific Imperial Bubbles b-33-I, gas	6
Buick Creek	Feb. 7, 1958	Aug. 7, 1959 Jan. 1, 1961 July 1, 1961 Oct. 1, 1961 Jan. 1, 1963 July 1, 1963 Oct. 1, 1963 Jan. 1, 1965	N.T.S. 94-A-11, 94-A-14	5, 7	20	Texaco NFA Buick Creek d-98-I (1), gas Texaco NFA Buick Creek d-83-J (4), gas	5 7
Buick Creek East	Jan. 1, 1963	Apr. 1, 1963 Oct. 1, 1963 July 1, 1964 Jan. 1, 1965	N.T.S. 94-A-10, 94-A-11, 94-A-14, 94-A-15	2, 5	13	Texaco NFA E Buick c-80-D, gas Decalta et al E Buick c-74-A, oil Texaco NFA E Buick a-31-A, gas	2 5 5
Buick Creek West	Feb. 7, 1958	Jan. 6, 1959 Feb. 15, 1960 Jan. 1, 1963	N.T.S. 94-A-11, 94-A-14	3, 5, 6, 9	15	Pacific West Buick Creek c-2-E (6), gas Pacific W Buick Creek c-83-K (13A), oil Pacific West Buick Creek b-78-C (2), gas Pacific West Buick Creek d-58-C (8), gas Pacific West Buick Creek b-23-E (1), gas	3 5 5 6 9
Bulrush	July 1, 1964	Apr. 1, 1965	N.T.S. 94-A-16	9	6	Union HB Sinclair Bulrush d-78-F, oil Union HB Sinc Pac Bulrush d-9-K, gas	9 9
Charlie Lake	Jan. 1, 1961		Tp. 84, R. 18, W. of 6th M.	3	1	Imp Pac Charlie 13-5-84-14, oil	3
Clarke Lake	Feb. 15, 1960	May 27, 1960 Jan. 1, 1961 Apr. 1, 1962 Apr. 1, 1965	N.T.S. 94-J-9, 94-J-10, 94-J-15, 94-J-16	13	12	West Nat et at Clarke Lake c-47-J, gas	13
Currant	Oct. 1, 1965		N.T.S. 94-A-9, 94-A-16	9	10	Sinclair et al Currant d-17-C, oil Union HB Sinc Pac Currant d-37-C, gas	9 9
Dawson Creek	Feb. 7, 1958		Tp. 79, R. 15, W. of 6th M.	1	4	Pacific Sc Dawson Ck 1-15-79-15 (1), gas	1
Fort St. John	Aug. 22, 1955	Feb. 7, 1958 Feb. 15, 1960 Jan. 1, 1961	Tp. 83, R. 18, W. of 6th M.	4, 6, 7, 9, 10	28	Pacific Ft St John A3-29-83-18 (31), gas Pacific Ft St John 14-15-83-18 (7), gas Pacific Ft St John 3-14-83-18 (9), oil Pacific Ft St John 1-20-83-18 (30), gas Imp Pac Ft St John 9-19-83-18 (45), oil Pacific Ft St John 14-21-83-18 (4), gas	4 6 7 9 10 10
Fort St. John Southeast	Feb. 7, 1958		Tp. 82, 83, R. 17, W. of 6th M.	4, 6, 9, 10	15	Pac Ft St John SE 10-31-82-17 (80), gas Pac Ft St John SE A4-10-83-17 (55), gas Pac Ft St John SE 10-33-82-17 (22), gas Pac Ft St John SE 4-10-83-17 (12), gas	4 6 9 10
Gundy Creek	Feb. 7, 1958	Jan. 6, 1959	N.T.S. 94-B-16	6	4	West Nat Gundy Creek c-80-A, gas	6
Halfway	Dec. 22, 1958		Tp. 86, 87, R. 25, W. of 6th M.	6, 9	3	West Nat et al Halfway 5-1-87-25, gas West Nat et al Halfway 8-11-87-25, gas	6 9
Highway	Feb. 7, 1958		N.T.S. 94-B-16	5, 6, 11	6	West Nat et al Highway b-3-I, gas Pacific Highway b-25-I (1), gas Pacific Highway a-90-I (4), gas	5 6 11

TABLE 10.—OIL AND GAS FIELDS DESIGNATED AS AT DECEMBER 31, 1965—*Continued*

Field	Date Designated	Date(s) Revised	Field Location	Pool(s)	Number of Wells Capable of Production	Discovery Well(s)	Pool(s) Discovered
Jedney	Aug. 7, 1959	Nov. 24, 1959 Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1961 Apr. 1, 1963 Oct. 1, 1963	N.T.S. 94-G-1, 94-G-8	3, 6, 9	43	Pacific Pan Am Dome Jedney c-8-F, gas Pacific et al Jedney b-88-J, gas Pacific Imp Jedney d-99-J, gas	3 6 9
Jedney West	July 1, 1964		N.T.S. 94-G-1, 94-G-8	6, 9	3	Pacific et al W Jedney b-84-K, gas	6, 9
Kobes-Townsend	Dec. 22, 1958	Feb. 15, 1960	N.T.S. 94-B-8, 94-B-9	5, 7, 9, 11	12	Pacific Kobes a-3-A (4), gas Pacific Kobes d-94-I (1), gas Pacific Townsend a-20-H (A-1), gas	5 7, 9 11
Kotcho Lake	Apr. 1, 1962		N.T.S. 94-I-14	13	3	West Nat Kotcho Lake c-67-K, gas	13
Laprise Creek	Feb. 15, 1960	Jan. 1, 1961 Apr. 1, 1961 Apr. 1, 1963 Jan. 1, 1964 Apr. 1, 1964	N.T.S. 94-G-8, 94-H-4, 94-H-5	6	35	Dome Basco Laprise Ck a-35-H, gas	6
Laprise Creek West	July 1, 1962		N.T.S. 94-G-8	6	2	Dome CDP C&E W Laprise c-82-G, gas	6
Milligan Creek	Feb. 7, 1958	Aug. 7, 1959 Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1962 July 1, 1963	N.T.S. 94-H-2	9	23	Union HB Milligan Creek d-73-G, oil Whitehall et al Milligan d-75-G, gas	9 9
Montney	Feb. 7, 1958	Jan. 6, 1959 Jan. 1, 1962	Tp. 87, R. 18, W. of 6th M. Tp. 86, 87, R. 19, W. of 6th M.	2, 7, 9	4	Pac Sunray Montney 16-32-86-19 (3), gas Pac Sunray Montney 14-36-86-19 (2), gas Pac Sunray Montney 14-31-86-19 (5), gas	2 7 9
Nig Creek	Aug. 7, 1959	Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1961 Jan. 1, 1962 Apr. 1, 1962 Apr. 1, 1965 July 1, 1965	N.T.S. 94-A-13, 94-H-4	6	25	Texaco NFA Nig Creek a-79-B (1), gas	6
Parkland	Feb. 7, 1958	July 1, 1963	Tp. 81, R. 15, W. of 6th M.	12	2	Pacific Imp Parkland 6-29-81-15, gas	12
Peejay	Feb. 15, 1960	May 27, 1960 Jan. 1, 1961 Jan. 1, 1962 Apr. 1, 1962 July 1, 1965 Oct. 1, 1965	N.T.S. 94-A-15, 94-A-16	9	71	Pacific Sinclair Peejay d-39-E (B8-3), oil Pacific SR West Cdn Peejay d-52-I, gas	9 9
Peejay West	Jan. 1, 1963		N.T.S. 94-A-15	9	2	Pacific SR West Cdn W Peejay d-54-G, oil	9

Petitot River	Apr. 1, 1961		N.T.S. 94-P-12, 94-P-13	13	3	West Nat Petitot River d-24-D, gas	13
Red Creek	Feb. 7, 1958	Aug. 7, 1959 Feb. 15, 1960	Tp. 85, R. 21, W. of 6th M.	7, 9	2	Pacific Red Creek 5-27-85-21 (36), gas	7, 9
Rigel	Oct. 1, 1962	Jan. 1, 1963 Apr. 1, 1963 Jan. 1, 1964 Oct. 1, 1964 Oct. 1, 1965	N.T.S. 94-A-10 Tp. 87, 88, R. 16, W. of 6th M. Tp. 87, 88, R. 17, W. of 6th M. Tp. 88, R. 18, W. of 6th M. Tp. 88, R. 19, W. of 6th M.	5	35	Monsanto Rigel 6-13-87-17, oil Imp Fina Rigel 4-27-88-17, gas	5 5
Snyder Creek	Apr. 1, 1961		N.T.S. 94-A-14	5	1	Union Snyder Creek a-28-K (1), gas	5
Stoddart	Jan. 6, 1959	Feb. 15, 1960 April 1, 1965	Tp. 86, R. 19, 20, W. of 6th M.	10	5	Pacific Stoddard 4-24-86-20 (85), gas	10
Stoddart West	Apr. 1, 1964		Tp. 86, R. 20, W. of 6th M.	10	1	Pacific W Stoddart 11-10-86-20, gas	10
Wildmint	Jan. 1, 1962	July 1, 1962 Jan. 1, 1963 Apr. 1, 1964	N.T.S. 94-A-15, 94-H-2	9	28	Union HB Wildmint d-46-A, oil Tenn Wildmint d-4-A, gas	9 9
Willow	July 1, 1963		N.T.S. 94-H-2	2, 9	3	Union HB Willow d-20-H, oil Union HB Willow b-10-H, gas	2 9
Yoyo	Apr. 1, 1965		N.T.S. 94-I-13, 94-I-14	13	4	West Nat et al Yoyo b-24-L, gas	13

Numerical list of pools:—

1. Lower Cretaceous Cadotte sandstone.
2. Lower Cretaceous Bluesky-Gething sandstone.
3. Lower Cretaceous Gething sandstone.
4. Lower Cretaceous Cadomin sandstone.
5. Lower Cretaceous Dunlevy sandstone.
6. Triassic Baldonnel carbonate (includes Baldonnel A and B of Fort St. John area).
7. Triassic Charlie Lake sandstone and carbonate.
8. Triassic Boundary Lake carbonate.
9. Triassic Halfway sandstone.
10. Permian Belloy carbonate.
11. Mississippian Rundle carbonate.
12. Upper Devonian Wabamun carbonate.
13. Middle Devonian Slave Point carbonate.

TABLE 11.—NUMBER OF PRODUCING AND PRODUCIBLE WELLS AT DECEMBER 31, 1965[1]

Field and Pool	Oil Wells		Natural-gas Wells	
	Producing	Producible	Producing	Producible
Aitken Creek field—				
Gething	5	5	----	----
Gething	----	----	3	3
Field totals	5	5	3	3
Beatton River field—Halfway	10	11	----	1
Beatton River West field—Bluesky-Gething	6	8	----	----
Beg field—				
Baldonnel	----	----	12	17
Halfway	----	----	13	16
Field totals	----	----	25	33
Beg West field—Baldonnel	----	----	2	3
Bernadet field—Bluesky-Gething	----	----	1	1
Blueberry field—				
Dunlevy	----	----	4	6
Baldonnel	----	----	1	4
Charlie Lake	----	----	----	2
Mississippian	19	19	----	----
Field totals	19	19	5	12
Blueberry East field—				
Baldonnel	----	----	1	1
Mississippian	----	----	----	1
Field totals	----	----	1	2
Blueberry West field—				
Dunlevy	----	----	2	2
Baldonnel	----	----	----	1
Field totals	----	----	2	3
Boundary Lake field—				
Bluesky-Gething	----	----	----	2
Gething	----	----	1	2
Cadomin	----	1	----	----
Dunlevy	----	----	----	1
Baldonnel	----	----	5	6
Boundary Lake	219	248	----	----
Halfway	5	7	----	2
Field totals	224	256	6	13
Boundary Lake North field—Halfway	----	----	----	3
Bubbles field—Baldonnel	----	----	8	13
Buick Creek field—				
Dunlevy	----	----	15	19
Charlie Lake	----	----	----	1
Field totals	----	----	15	20
Buick Creek East field—				
Bluesky-Gething	----	----	----	2
Dunlevy	----	1	8	10
Field totals	----	1	8	12
Buick Creek West field—				
Gething	----	----	----	1
Dunlevy	----	----	7	9
Dunlevy	----	2	----	----
Baldonnel	----	----	1	2
Halfway	----	----	----	1
Field totals	----	2	8	13
Bulrush field—Halfway	3	5	----	1
Charlie Lake field—Gething	----	1	----	----
Clarke Lake field—Slave Point	----	----	8	12
Currant field—Halfway	5	7	----	3
Dawson Creek field—Cadotte	----	----	1	4

[1] Each zone of a multiple completion is counted as one well.

TABLE 11.—NUMBER OF PRODUCING AND PRODUCIBLE WELLS AT DECEMBER 31, 1965[1]—*Continued*

Field and Pool	Oil Wells		Natural-gas Wells	
	Producing	Producible	Producing	Producible
Fort St. John field—				
Cadomin	......	......	......	2
Baldonnel A	......	......	4	6
Baldonnel A/B	......	......	5	6
Charlie Lake	4	4	......	1
Halfway	......	......	5	6
Belloy	......	1	2	2
Field totals	4	5	16	23
Fort St. John Southeast field—				
Cadomin	......	......	1	1
Baldonnel A	......	......	1	2
Halfway	......	......	2	6
Belloy	......	......	4	6
Field totals	......	......	8	15
Gundy Creek field—				
Baldonnel	......	......	......	3
Baldonnel/Charlie Lake	......	......	......	1
Field totals	......	......	......	4
Halfway field—				
Baldonnel	......	......	1	2
Halfway	......	......	......	1
Field totals	......	......	1	3
Highway field—				
Dunlevy	......	......	1	1
Baldonnel	......	......	......	4
Mississippian	......	......	1	1
Field totals	......	......	2	6
Jedney field—				
Gething	......	......	......	2
Baldonnel	......	......	16	19
Halfway	......	......	20	22
Field totals	......	......	36	43
Jedney West field—				
Baldonnel	......	......	1	1
Halfway	......	......	1	2
Field totals	......	......	2	3
Kobes-Townsend field—				
Dunlevy	......	......	3	3
Charlie Lake	......	......	5	5
Halfway	......	......	2	2
Mississippian	......	......	1	2
Field totals	......	......	11	12
Kotcho Lake field—Slave Point	......	......	......	3
Laprise Creek field—Baldonnel	......	......	30	35
Laprise Creek West field—Baldonnel	......	......	......	2
Milligan Creek field—Halfway	21	22	......	1
Montney field—				
Bluesky-Gething	......	......	......	1
Charlie Lake	......	......	......	1
Halfway	......	......	1	2
Field totals	......	......	1	4
Nig Creek field—Baldonnel	......	......	20	25
Parkland field—Wabamun	......	......	2	2
Peejay field—Halfway	56	66	......	5
Peejay West field—Halfway	......	2	......	......
Petitot River field—Slave Point	......	......	......	3
Red Creek field—				
Charlie Lake	......	......	1	1
Halfway	......	......	1	1
Field totals	......	......	2	2

[1] Each zone of a multiple completion is counted as one well.

TABLE 11.—NUMBER OF PRODUCING AND PRODUCIBLE WELLS AT DECEMBER 31, 1965[1]—*Continued*

Field and Pool	Oil Wells		Natural-gas Wells	
	Producing	Producible	Producing	Producible
Rigel field—Dunlevy	3	5	17	30
Snyder Creek field—Dunlevy	.....	.....	1	1
Stoddart field—Belloy	.....	.....	3	5
Stoddart West field—Belloy	.....	.....	1	1
Wildmint field—Halfway	14	26	.....	2
Willow field—				
Bluesky-Gething	1	1	.....	.....
Halfway	.....	.....	.....	2
Field totals	1	1	.....	2
Yoyo field—Pine Point	.....	.....	.....	4
Other areas—				
Cadotte	.....	.....	.....	5
Notikewin	.....	.....	.....	1
Bluesky-Gething	.....	2	.....	8
Gething	.....	.....	1	2
Cadomin	.....	.....	.....	1
Dunlevy	1	1	.....	12
Jurassic-Triassic	.....	.....	.....	1
Baldonnel	.....	1	.....	.....
Baldonnel	.....	.....	1	29
Baldonnel A	.....	.....	.....	2
Charlie Lake	.....	.....	.....	7
Boundary Lake	1	1	.....	1
Halfway	.....	.....	.....	23
Halfway	39	49	.....	3
Permo-Carboniferous	.....	.....	.....	3
Belloy	.....	1	.....	4
Mississippian	.....	.....	.....	11
Kiskatinaw	.....	.....	.....	1
Slave Point	.....	.....	.....	19
Slave Point/Sulphur Point	.....	.....	.....	3
Pine Point	.....	.....	.....	4
Nahanni	.....	.....	.....	2
Areas totals	41	55	2	142
Totals	412	497	248	530

[1] Each zone of a multiple completion is counted as one well.

Table 12.—Monthly Crude-oil Production by Fields and Pools, 1965

(Quantities in barrels.)

Field and Pool	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Aitken Creek field—													
Gething	21,867	20,152	20,646	18,202	15,657	26,112	28,104	27,367	26,181	27,055	23,346	30,084	284,773
Gething[1]					2,524	1,065	425	1,357	2,090	2,852	2,933	2,994	16,240
Field totals	21,867	20,152	20,646	18,202	18,181	27,177	28,529	28,724	28,271	29,907	26,279	33,078	301,013
Beatton River field—Halfway	37,950	36,416	35,010	43,007	38,476	47,129	51,489	51,281	59,023	58,479	56,588	58,800	573,648
Beatton River West field—Bluesky-Gething	7,758	7,776	9,730	11,861	11,164	10,961	11,227	11,343	11,175	10,768	7,551	10,445	121,759
Blueberry field—													
Dunlevy		2	140	84	57								283
Dunlevy[1]	23	26	21	25	24	24	22	17	23	23	23	23	274
Baldonnel[1]													
Mississippian	88,071	81,053	87,077	82,367	86,091	80,744	84,175	83,563	78,376	80,347	79,563	76,784	988,211
Mississippian[1]													
Field totals	88,094	81,081	87,238	82,476	86,172	80,768	84,197	83,580	78,399	80,370	79,586	76,807	988,768
Boundary Lake field—													
Boundary Lake	454,456	384,920	447,046	424,070	438,858	450,464	466,305	447,912	409,205	442,004	439,104	445,316	5,249,660
Halfway	5,008	6,947	8,016	6,957	9,161	5,371	6,421	6,094	5,442	6,746	6,200	6,414	78,777
Field totals	459,464	391,867	455,062	431,027	448,019	455,835	472,726	454,006	414,647	448,750	445,304	451,730	5,328,437
Buick Creek field—Dunlevy[1]	1,216	953	1,479	949			1,146	1,267	2,269	2,060	1,971	1,825	15,135
Bulrush field—Halfway	5,394	6,038	5,568	9,041	9,415	1,572	5,207	5,239	4,243	6,236	1,597	3,821	63,371
Charlie Lake field—Gething					179	88	236	80	145	157			885
Currant field—Halfway			1,992	5,912	3,163	8,673	7,152	12,092	12,513	10,760	14,158	10,326	86,741
Fort St. John field—Charlie Lake	2,207	2,023	6,194	257	206	1,007	1,306	1,860	1,761	1,965	1,925	2,248	22,959
Halfway field—Halfway			817	249									1,066
Milligan Creek field—Halfway	131,015	134,047	153,146	154,383	171,810	169,244	185,768	193,188	194,877	212,815	210,964	254,767	2,166,024
Peejay field—Halfway	203,799	187,342	223,631	249,269	237,252	221,294	241,788	241,101	250,239	230,064	237,763	246,563	2,770,105
Rigel field—Dunlevy					1,954	4,447	7,759	10,021	10,335	10,052	8,114	6,871	59,553
Snyder Creek field—Dunlevy[1]											69		69
Wildmint field—Halfway	43,612	32,841	42,383	41,830	38,427	37,801	37,278	33,627	38,906	37,376	35,551	39,932	459,564
Willow field—Bluesky-Gething	1,777	1,487	2,447	2,922	2,657	2,490	1,925	1,871	1,982	2,034	1,984	2,479	26,055
Other areas—													
Dunlevy								813	2,328	3,299	1,718	972	9,130
Charlie Lake[1]								64					64
Boundary Lake								1,783	5,302			1,950	9,035
Halfway		52	10,694	15,628	18,708	18,463	29,776	44,239	52,243	76,797	88,492	121,905	476,997
Belloy	1,303	1,394	2,421	1,080	1,998	2,034	2,159	2,031	1,946	2,028	1,838	1,929	22,161
Areas totals	1,303	1,446	13,115	16,708	20,706	20,497	31,935	48,930	61,819	82,124	92,048	126,756	517,387
Totals	1,005,456	903,469	1,058,458	1,068,093	1,087,781	1,088,983	1,169,668	1,178,210	1,170,604	1,223,917	1,221,452	1,326,448	13,502,539

[1] Field condensate.

Table 13.—Monthly Natural-gas Production by Fields and Pools, 1965

(Quantities in M s.c.f.)

Field and Pool	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Aitken Creek field—Gething					36,256	13,460	3,238	6,963	22,762	10,246	9,616	11,426	113,967
Beg field—													
Baldonnel	618,299	574,705	525,178	551,021	508,499	305,142	284,167	548,526	445,154	444,713	468,771	530,344	5,804,519
Halfway	692,331	650,197	733,445	675,314	533,622	425,613	288,314	591,251	559,433	564,247	585,667	645,832	6,945,266
Field totals	1,310,630	1,224,902	1,258,623	1,226,335	1,042,121	730,755	572,481	1,139,777	1,004,587	1,008,960	1,054,438	1,176,176	12,749,785
Beg West field—Baldonnel	26,872	26,380	32,312	28,322	26,280	3,896	11,399	34,146	28,927	27,741	26,778	29,455	302,508
Bernadet field—Bluesky-Gething	27,526	23,523	28,254	25,774	26,862	15,890	5,583	15,085	22,460	22,148	19,612	16,216	248,933
Blueberry field—													
Baldonnel	42,017	24,270	21,380	22,747	38,802	36,196	75,559	66,699	67,683	29,651	15,818	18,773	459,595
Charlie Lake			2,145										2,145
Field totals	42,017	24,270	23,525	22,747	38,802	36,196	75,559	66,699	67,683	29,651	15,818	18,773	461,740
Blueberry East field—Baldonnel	32,595	32,656	33,089	28,404	26,197			3,171	13,208	28,985	29,775	30,686	258,766
Blueberry West field—Dunlevy	12,601	11,206	12,585	11,904	11,905	10,950	12,317	12,364	11,526	11,809	11,145	11,991	142,303
Boundary Lake field—													
Gething	61,064	57,907	60,577	51,951	50,457	56,030					42,565	57,236	437,787
Baldonnel	128,257	138,507	199,869	212,421	232,146	118,224					118,149	176,918	1,324,491
Field totals	189,321	196,414	260,446	264,372	282,603	174,254					160,714	234,154	1,762,278
Bubbles field—Baldonnel	693,419	597,895	684,665	627,863	431,870	513,059	767,606	631,554	660,639	739,436	681,754	599,984	7,629,744
Buick Creek field—													
Dunlevy	1,155,609	947,587	1,073,128	879,376	562,579	372,831	791,847	197,590	1,100,398	1,098,974	944,304	1,025,077	10,149,300
Charlie Lake	18,997	15,971	16,650	8,270					5,129	9,149	9,005		83,171
Field totals	1,174,606	963,558	1,089,778	887,646	562,579	372,831	791,847	197,590	1,105,527	1,108,123	953,309	1,025,077	10,232,471
Buick Creek East field—													
Bluesky-Gething			1,546	5,298	5,169	4,689	7,838	10,247	6,647	12,028	3,141		56,603
Dunlevy	171,137	170,830	202,736	196,154	232,827	306,171	212,767	359,154	303,008	303,770	291,950	293,733	3,044,237
Field totals	171,137	170,830	204,282	201,452	237,996	310,860	220,605	369,401	309,655	315,798	295,091	293,733	3,100,840
Buick Creek West field—													
Dunlevy	430,451	393,025	403,229	377,554	325,568	352,825	320,447		299,550	371,444	199,227	387,010	3,860,330
Baldonnel	43,814	38,937	41,928	39,888	35,294	36,485	34,116		35,434	38,071	19,200	35,576	398,743
Field totals	474,265	431,962	445,157	417,442	360,862	389,310	354,563		334,984	409,515	218,427	422,586	4,259,073
Clarke Lake field—Slave Point	76,120	281,333	284,864	37,678	9,662	7,131	8,855	1,515,730	2,642,700	3,704,771	4,194,170	4,683,860	17,446,874
Dawson Creek field—Cadotte	24,764	20,078	22,929	14,837	22,273	23,624	20,383	21,459	23,957	22,789	18,916	16,810	252,819

Fort St. John field—													
Baldonnel A	154,470	147,394	149,228	91,789	94,540	57,351	153,172	128,541	69,113	52,225	74,397	161,781	1,334,001
Baldonnel A/B	273,355	190,934	177,720	190,197	173,046	147,328	198,789	187,652	176,312	128,252	34,222	251,712	2,129,519
Halfway	246,496	131,837	142,467	127,132	105,517	65,436	101,365	113,009	77,020	79,908	48,925	197,130	1,436,242
Belloy	58,045	27,306	34,009	23,806	21,183	33,336	35,777	31,568	39,849	36,637	13,260	56,043	410,819
Field totals	732,366	497,471	503,424	432,924	394,286	303,451	489,103	460,770	362,294	297,022	170,804	666,666	5,310,581
Fort St. John Southeast field—													
Cadomin	27,437	15,501	13,026	13,666	2,977	1,457	1,788					5,781	81,633
Baldonnel A	52,410	40,016	42,334	42,347	35,442	24,266	36,983	45,047	38,425	40,486	28,503	44,721	470,980
Halfway	109,809	72,674	80,869	77,684	62,261	50,915	83,783	80,565	64,061	94,253	51,743	83,808	912,425
Belloy	414,416	325,366	417,479	421,219	368,804	322,226	346,981	314,797	297,984	347,740	296,191	351,801	4,225,004
Field totals	604,072	453,557	553,708	554,916	469,484	398,864	469,535	440,409	400,470	482,479	376,437	486,111	5,690,042
Halfway field—Baldonnel	28,520	30,795	32,867	16,320	17,313	13,261	12,301				7,892	27,380	186,649
Highway field—													
Dunlevy	383								16,020	19,052	17,437	17,021	69,913
Mississippian	15,404	31,802		54,865	2,498	59,138	2,218	17,800	48,739		26,789	40,191	299,444
Field totals	15,787	31,802		54,865	2,498	59,138	2,218	17,800	64,759	19,052	44,226	57,212	369,357
Jedney field—													
Baldonnel	1,223,778	1,109,885	1,133,212	1,029,731	1,098,539	861,080	975,972	668,539	515,662	686,920	541,376	1,064,232	10,908,926
Halfway	1,045,368	1,004,225	1,088,581	921,395	951,716	875,524	681,950	621,398	454,816	563,275	594,453	1,022,751	9,825,452
Field totals	2,269,146	2,114,110	2,221,793	1,951,126	2,050,255	1,736,604	1,657,922	1,289,937	970,478	1,250,195	1,135,829	2,086,983	20,734,378
Jedney West field—													
Baldonnel	20,707		13,972	17,008	16,634	11,696	12,650	16,157		11,031	1,642	14,578	136,075
Halfway	18,472		16,510	17,547	24,982	15,293	11,806	14,087		12,310	2,042	19,273	152,322
Field totals	39,179		30,482	34,555	41,616	26,989	24,456	30,244		23,341	3,684	33,851	288,397
Kobes-Townsend field—													
Dunlevy	116,692	94,559	104,725	99,541	97,814	54,477	13,563	72,116	73,122	105,686	99,239	102,603	1,034,137
Charlie Lake	122,664	222,957	91,154	71,318	63,706	48,133	39,663	77,592	75,314	255,972	114,384	109,426	1,292,283
Halfway	282,624	205,863	219,070	216,726	228,415	143,413	67,084	334,702	248,735	207,305	233,645	256,667	2,644,249
Mississippian	135,663	12,487	149,765	149,461	133,325	79,053	61,566	136,762	132,058	11,236	128,454	143,812	1,273,642
Field totals	657,643	535,866	564,714	537,046	523,260	325,076	181,876	511,172	529,229	580,199	575,722	612,508	6,134,311
Laprise Creek field—Baldonnel	1,712,849	1,569,998	1,717,557	1,531,832	1,478,982	1,344,897	1,233,775	1,394,802	1,507,401	1,663,574	1,631,349	1,690,597	18,477,613
Laprise Creek West field—Baldonnel		14,774	8,319										23,093
Montney field—Halfway	4,321	17,884	35,214	35,056	36,209	9,067	22,663	41,332	6,557	8,874	32,899	23,736	273,812
Nig Creek field—Baldonnel	1,435,454	1,326,603	1,191,151	887,291	648,302	676,349	868,092	687,228	735,959	1,321,551	1,246,378	1,427,089	12,451,447
Parkland field—Wabamun	466,344	378,588	394,739	347,962	347,962	340,305	386,691	350,318	195,609	90,607	156,048	303,105	3,758,278
Red Creek field—													
Charlie Lake	34,516	18,940	12,394	42,200	41,385	30,139	44,977	13,456			2,498	17,906	258,411
Halfway	16,732	34,942	18,319	24,791	23,753	53,478	25,110	9,560				13,809	220,494
Field totals	51,248	53,882	30,713	66,991	65,138	83,617	70,087	23,016			2,498	31,715	478,905
Rigel field—Dunlevy	1,330,558	1,096,292	1,155,991	1,034,684	751,022	507,545	682,864	820,862	530,467	1,286,350	1,276,208	1,182,561	11,655,404
Snyder Creek field—Dunlevy	16,211	19,098	21,906	18,009	15,339	15,049	755	15,761	21,818	21,664	19,766	19,951	205,327

TABLE 13.—MONTHLY NATURAL-GAS PRODUCTION BY FIELDS AND POOLS, 1965—*Continued*

(Quantities in M s.c.f.)

Field and Pool	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Stoddart field—Belloy	467,576	346,570	371,503	342,651	365,390	348,489	336,644	327,256	258,385	128,678	291,787	417,801	4,002,730
Stoddart West field—Belloy	103,731	74,256	75,487	58,426	42,252	40,217	63,969	65,047	50,843	41,653	59,293	69,955	745,129
Other areas—													
Gething												33,865	33,865
Dunlevy										96,000			96,000
Baldonnel												117,959	117,959
Charlie Lake								3,017					3,017
Slave Point	78,410	40,626											119,036
Areas totals	78,410	40,626						3,017		96,000		151,824	369,877
Totals	14,269,288	12,607,179	13,290,077	11,699,430	10,365,576	8,831,134	9,347,387	10,492,910	11,882,884	14,751,211	14,720,383	17,859,972	150,117,431

NOTE.—Table 13 shows gas production from gas wells only and does not include associated gas.

TABLE 14.—SUMMARY OF DRILLING AND PRODUCTION STATISTICS, 1965

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Well authorizations—													
Issued	37	27	31	4	15	12	17	18	18	25	35	37	276
Cancelled			1	1	2	2	1	2					
Wells spudded	34	26	32	1	3	13	27	16	16	24	31	34	257
Rigs operated during month	33	38	32	17	7	13	16	14	12	15	23	28	47[1]
Rigs operating at month's end	30	21	17	2	5	5	11	5	6	14	14	23	
Development footage	49,923	30,017	66,020	7,455	13,484	48,438	100,173	53,511	62,305	74,813	73,813	78,427	658,379
Exploratory outpost footage	38,214	74,344	56,319	5,347	3,324	4,954	7,525	16,411		11,429	49,064	38,926	305,857
Exploratory wildcat footage	43,942	46,716	14,753	7,134	1,018	360	752	799		4,220	7,455	11,766	138,915
Total footage drilled	132,079	151,077	137,092	19,936	17,826	53,752	108,450	70,721	62,305	90,462	130,332	129,119	1,103,151
Wells abandoned	6	22	12	3	2	2	1	7	4	3	15	12	89
Service wells			1			1						1	3
Finished drilling wells			1	1									2
Oil wells completed	7	9	13	8		9	16	14	9	10	10	11	116
Producible oil wells	411	401	411	421	422	433	448	459	469	481	488	497	
Producing oil wells	342	340	351	361	357	361	378	392	384	394	409	412	
Production in barrels	1,005,456	903,469	1,058,458	1,068,093	1,087,781	1,088,983	1,169,668	1,178,210	1,170,604	1,223,917	1,221,452	1,326,448	13,502,539
Average daily production	32,434	32,267	34,144	35,603	35,090	36,299	37,731	38,007	39,020	39,481	40,715	42,789	36,993
Gas wells completed	2	3	8	3		3	3	2	2	4	6	4	40
Producible gas wells	492	495	500	504	504	507	509	512	515	517	523	530	
Producing gas wells	236	229	235	228	226	214	205	200	220	222	230	248	
Production in M s.c.f.	15,924,601	14,086,746	15,152,878	13,384,135	12,207,839	10,612,871	11,251,534	12,457,050	13,785,236	16,181,631	16,588,232	19,881,667	171,514,420
Average daily production	513,697	503,098	488,802	446,138	393,801	353,762	362,953	401,840	459,508	521,988	552,941	641,344	469,903

[1] Rigs operated during 1965.

NOTE.—Each zone of a multiple completion is counted as one well.

TABLE 15.—MONTHLY CRUDE-OIL DISPOSITION, 1965

(Quantities in barrels.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Field													
Production—													
Crude oil	1,004,217	902,490	1,056,958	1,067,119	1,085,233	1,087,894	1,168,075	1,175,505	1,166,222	1,218,982	1,216,456	1,321,606	13,470,757
Field condensate[1]	1,239	979	1,500	974	2,548	1,089	1,593	2,705	4,382	4,935	4,996	4,842	31,782
*Plant condensate[1]	5,608	4,632	6,347	6,193	5,838	4,955	5,090	4,991	3,358	5,033	5,140	6,036	63,221
Totals	1,011,064	908,101	1,064,805	1,074,286	1,093,619	1,093,938	1,174,758	1,183,201	1,173,962	1,228,950	1,226,592	1,332,484	13,565,760
Opening inventory	37,988	28,642	33,778	33,496	36,130	37,088	37,038	35,143	44,430	41,873	31,998	38,388	37,988
Injection oil recovered	563	118	100	———	———	512	———	———	846	———	———	———	2,139
Other oil receipts	10,082	8,807	27,807	10,574	7,868	12,733	12,168	22,079	28,637	16,249	22,311	23,319	202,634
Losses and adjustments	———	———	1,010	408	673	−1,049	2,154	−185	487	−22	69	173	3,718
Transfers and well-head sales	8,769	8,659	26,590	7,598	3,131	12,195	10,856	18,255	24,722	13,168	20,618	20,822	175,383
Field deliveries to transporters	1,015,854	898,518	1,060,055	1,068,746	1,091,842	1,092,370	1,172,036	1,173,292	1,177,424	1,237,932	1,216,945	1,323,109	13,528,123
Plant deliveries to transporters	6,432	4,713	5,339	5,474	4,883	3,717	3,775	4,631	3,369	3,996	4,881	4,308	55,518
Closing inventory	28,642	33,778	33,496	36,130	37,088	37,038	35,143	44,430	41,873	31,998	38,388	45,779	45,779
Reporting adjustment	982	946	2,030	591	2,950	−2,445	1,638	−376	−107	235	−1,053	−332	5,059
Transporters													
Receipts—													
B.C. crude	1,021,304	902,285	1,063,364	1,073,629	1,093,775	1,098,532	1,174,173	1,178,299	1,180,900	1,241,693	1,222,879	1,327,749	13,578,582
B.C. plant condensate	50,160	60,428	50,364	60,349	31,211	30,037	41,066	30,957	22,026	31,074	42,572	33,562	483,806
Opening inventory	1,084,498	1,131,832	1,011,499	1,140,744	1,172,866	1,100,675	1,148,419	1,195,153	1,161,847	1,120,896	1,243,482	1,279,651	1,084,498
Losses and adjustments	−5,071	8,448	4,386	−1,750	−1,410	−10,274	−2,582	16,682	4,775	1,026	12,110	2,914	29,254
Deliveries—													
B.C. refineries	973,470	1,021,477	924,184	1,018,859	1,004,480	949,509	976,785	1,058,109	1,053,371	863,094	711,695	631,365	11,186,398
Export[2]	55,091	51,789	55,545	84,747	194,107	141,590	194,302	167,771	185,731	286,061	505,477	455,283	2,377,494
Other	640	1,332	368	———	———	———	———	———	———	———	———	190	2,530
Total deliveries	1,029,201	1,074,598	980,097	1,103,606	1,198,587	1,091,099	1,171,087	1,225,880	1,239,102	1,149,155	1,217,172	1,086,838	13,566,422
Closing inventory	1,131,832	1,011,499	1,140,744	1,172,866	1,100,675	1,148,419	1,195,153	1,161,847	1,120,896	1,243,482	1,279,651	1,551,210	1,551,210
Reporting adjustment	6	———	1	190	−2,630	−261	———	———	610	3,314	———	———	1,230
B.C. Refineries													
Receipts—													
B.C. crude	973,464	1,021,477	924,183	1,018,669	1,007,110	949,770	976,785	1,058,109	1,052,761	859,780	711,695	631,365	11,185,168
Alberta crude	2,111,379	1,717,270	1,666,856	1,434,034	888,689	1,351,206	1,261,817	1,668,604	1,656,560	1,393,136	1,472,542	1,328,781	17,981,072
Opening inventory	663,575	700,233	788,178	771,932	743,188	782,128	599,741	765,372	712,252	846,612	901,580	954,473	663,575
Losses and adjustments	−1,377	−352	11	−204	−5	−1,689	159	−916	−1,447	−378	−305	338	−6,165
Refinery runs	3,049,562	2,651,154	2,607,274	2,481,651	1,856,864	2,485,052	2,072,812	2,780,749	2,576,408	2,198,326	2,131,649	2,162,196	29,053,697
Closing inventory	700,233	788,178	771,932	743,188	782,128	599,741	765,372	712,252	846,612	901,580	954,473	752,085	752,085

[1] For complete summary of condensate production and disposition *see* Table 17.
[2] Refers to British Columbia production.
* Refers to condensate collected and produced at a plant in a field.

TABLE 16.—MONTHLY NATURAL-GAS DISPOSITION, 1965

(Quantities in M s.c.f.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Field													
B.C. production—													
Wet gas	13,702,060	11,927,180	12,587,545	11,298,953	9,985,679	8,460,074	8,931,458	8,605,403	9,020,618	10,933,044	10,351,249	12,856,197	128,659,460
Dry gas	567,228	679,999	702,532	400,477	379,897	371,060	415,929	1,887,507	2,862,266	3,818,167	4,369,134	5,003,775	21,457,971
Associated gas	1,655,313	1,479,567	1,862,801	1,684,705	1,842,263	1,781,737	1,904,147	1,964,140	1,902,352	1,430,420	1,867,849	2,021,695	21,396,989
Totals	15,924,601	14,086,746	15,152,878	13,384,135	12,207,839	10,612,871	11,251,534	12,457,050	13,785,236	16,181,631	16,588,232	19,881,667	171,514,420
Flared	652,629	569,583	739,382	875,120	729,013	780,996	963,830	977,360	962,937	893,614	481,866	929,216	9,555,546
Lease use	103,113	105,087	118,380	76,511	77,564	73,880	138,783	27,798	10,810	79,506	78,499	26,755	916,686
Gas used for drilling	———	———	———	32,024	32,837	29,640	71,701	64,497	61,369	4,111	21,071	100,219	417,469
Metering difference	73,885	−18,777	314,811	128,127	19,864	−24,164	62,577	−70,664	−4,636	251,080	65,630	261,370	1,059,103
To gas-injection system	217,883	208,832	213,140	164,708	427,070	319,125	183,993	244,309	240,155	159,478	475,339	326,472	3,180,504
Delivered to gathering system	14,877,091	13,222,021	13,767,165	12,107,645	10,921,491	9,433,394	9,830,650	11,213,750	12,514,601	14,793,842	15,465,827	18,237,635	156,385,112
Reporting adjustment	15,155	−69,963	27,825	−193,233	−33,134	29,260	−118,536	60,264	96,359	46,531	152,488	10,918	23,934
Gas-gathering System													
Received from B.C. producers	14,861,936	13,291,984	13,739,340	12,300,878	10,954,625	9,404,134	9,949,186	11,153,486	12,418,242	14,747,311	15,313,339	18,226,717	156,361,178
Line loss and metering difference	10,584	23,975	−245	———	———	———	———	———	———	———	254	−636	33,932
Delivered to—													
Gas plants	14,333,215	12,778,011	13,300,623	11,901,260	10,581,405	9,033,708	9,529,191	10,773,591	12,191,014	14,617,606	15,113,481	17,880,539	152,033,644
Transporters	490,122	398,093	416,540	362,463	341,285	363,295	406,680	371,941	219,228	113,707	175,989	319,148	3,978,491
Distributors	28,015	91,905	22,422	37,155	31,935	7,131	13,315	7,954	8,000	15,998	23,615	27,666	315,111
Gas Plants													
Receipts from gathering system	14,333,215	12,778,011	13,300,623	11,901,260	10,581,405	9,033,708	9,529,191	10,773,591	12,191,014	14,617,606	15,113,481	17,880,539	152,033,644
Plant fuel	270,543	299,947	312,957	280,150	254,044	253,170	327,361	420,821	401,966	440,130	447,158	525,050	4,233,297
Processing shrinkage	642,420	564,178	564,290	529,616	476,777	444,167	448,185	401,280	431,409	485,501	417,508	559,383	5,964,714
Plant waste and metering difference	745,915	530,977	410,208	420,914	333,724	47,032	234,306	394,986	149,514	405,320	484,548	609,007	4,766,451
Flared residual gas	27,723	24,916	21,935	11,450	732	22,104	17,057	173,237	302,084	395,658	541,243	556,662	2,094,801
Flared natural gas	11,294	1,497	7,769	6,821	19,211	28,555	2,643	23,834	2,467	13,555	12,324	6,851	136,821
Marketable residual gas	12,635,320	11,356,496	11,983,464	10,652,309	9,496,917	8,238,680	8,499,639	9,359,433	10,903,574	12,877,442	13,210,700	15,623,586	134,837,560
Reporting adjustment	1,877	28	———	———	———	———	1	———	———	———	1	———	1,907
Transporters													
Receipts—													
Residual gas from plants	12,190,458	10,959,292	11,517,788	10,180,767	9,004,560	7,763,645	8,013,897	8,900,150	10,532,985	12,440,664	12,600,058	15,163,269	129,267,533
Associated gas from G.G.S.	442,985	397,176	465,676	471,542	492,357	475,035	485,741	459,283	370,589	436,778	610,641	460,317	5,568,120
Dry gas from gathering system	490,122	398,093	416,540	362,463	341,285	363,295	406,680	371,941	219,228	113,707	175,989	319,148	3,978,491
Alberta dry gas	3,118,369	2,451,916	2,637,289	2,466,752	2,274,565	2,242,208	2,453,472	2,064,633	1,648,290	2,092,111	2,498,522	2,544,729	28,492,856
Totals	16,241,934	14,206,477	15,037,293	13,481,524	12,112,767	10,844,183	11,359,790	11,796,007	12,771,092	15,083,260	15,885,210	18,487,463	167,307,000

TABLE 16.—MONTHLY NATURAL-GAS DISPOSITION, 1965—*Continued*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Transporters—Continued													
Reporting adjustment	741,135	414,170	312,981	258,116	325,421	−1,569,939	152,605	320,544	229,911	426,428	383,874	520,681	2,515,927
Deliveries to B.C. distributors—													
Northeast	304,008	272,512	225,519	162,082	135,968	101,813	98,745	104,171	155,435	174,864	250,562	294,316	2,279,995
Interior	1,323,040	1,172,504	1,131,360	783,860	575,395	632,249	628,233	563,778	721,754	903,170	1,372,834	1,586,567	11,394,744
Lower Mainland	4,795,656	3,804,783	3,873,696	3,823,684	2,886,686	2,506,250	2,464,026	2,831,407	3,753,980	4,498,854	4,712,777	6,011,634	45,963,433
Totals	6,422,704	5,249,799	5,230,575	4,769,626	3,598,049	3,240,312	3,191,004	3,499,356	4,631,169	5,576,888	6,336,173	7,892,517	59,638,172
Deliveries to export—													
B.C. gas	7,383,703	7,123,567	8,049,261	6,947,060	6,690,712	7,631,534	6,318,484	6,609,506	6,936,969	7,872,917	7,757,761	8,755,888	88,077,362
Alberta gas[1]	1,694,392	1,418,941	1,444,476	1,506,722	1,498,585	1,542,276	1,697,697	1,366,601	973,043	1,207,027	1,407,402	1,318,377	17,075,539
Total deliveries	15,500,799	13,792,307	14,724,312	13,223,408	11,787,346	12,414,122	11,207,185	11,475,463	12,541,181	14,656,832	15,501,336	17,966,782	164,791,073
Reporting adjustment	−3,185	−5,199	36	22	−41	1,147	1,468	20	20	28	41	49	−5,594
B.C. Distributors													
Received from transporters	6,425,889	5,254,998	5,230,539	4,769,604	3,598,090	3,239,165	3,189,536	3,499,336	4,631,149	5,576,860	6,336,132	7,892,468	59,643,766
Received from gathering system	28,015	91,905	22,422	37,155	2,640	1,841	2,341	2,609	6,712	9,611	15,701	18,533	239,485
Losses and adjustments	63,220	153,164	215,944	−55,119	10,441	−52,689	−35,328	139,691	400,733	193,312	370,777	360,310	1,764,456
Deliveries to consumers—													
Residential	2,674,022	2,174,339	1,867,155	1,721,828	1,214,006	693,797	464,891	373,905	575,112	965,916	1,525,323	2,165,885	16,416,179
Commercial	956,446	796,451	690,861	618,329	398,668	259,188	203,218	184,058	243,156	366,614	547,922	788,479	6,053,390
Industrial	2,760,216	2,222,949	2,479,001	2,521,721	1,977,615	2,340,710	2,559,096	2,804,291	3,418,860	4,060,629	3,907,811	4,596,327	35,649,226
Total sales	6,390,684	5,193,739	5,037,017	4,861,878	3,590,289	3,293,695	3,227,205	3,362,254	4,237,128	5,393,159	5,981,056	7,550,691	58,118,795

[1] Does not include Alberta natural gas carried by Alberta Natural Gas Co.'s pipe-line and exported at Kingsgate, B.C.

TABLE 17.—MONTHLY NATURAL-GAS LIQUIDS AND SULPHUR DISPOSITION, 1965

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Condensate/Pentanes Plus													
Production (bbl.)													
Field	1,239	979	1,500	974	2,548	1,089	1,593	2,705	4,382	4,935	4,996	4,842	31,782
Plant	87,027	82,964	91,916	80,960	74,463	71,923	71,018	68,312	71,100	79,089	73,944	94,713	947,429
Opening inventory	16,545	33,368	27,029	40,411	30,221	36,192	33,709	16,463	20,364	26,481	26,715	29,197	16,545
Losses and adjustments	−1,591	−2,649	−2,086	−4,307	−3,270	−3,897	−4,179	−7,136	−8,725	−5,102	−3,930	−2,123	−48,995
To transporters	6,432	4,713	6,349	5,805	7,285	5,695	4,626	7,243	7,793	9,554	9,184	9,354	84,033
Closing inventory	33,368	27,029	40,411	30,221	36,192	33,709	16,463	20,364	26,481	26,715	29,197	35,410	35,410
Sales—													
British Columbia—													
Northeast B.C. refineries	16,032	27,158	25,321	30,067	35,344	42,823	46,882	35,492	48,022	47,284	28,271	51,757	434,453
Local sales	410	632	86	210	470	837	1,462	480	249	980	361	792	6,969
Export	50,160	60,428	50,364	60,349	31,211	30,037	41,066	31,037	22,026	31,074	42,572	33,562	483,886
Total sales	66,602	88,218	75,771	90,626	67,025	73,697	89,410	67,009	70,297	79,338	71,204	86,111	925,308
Butane													
Production (bbl.)													
Plant	41,762	37,863	38,343	33,717	34,886	34,201	36,873	43,831	45,046	40,759	45,818	44,891	477,990
Refinery	8,924	10,452	7,611	4,385	8,325	9,605	6,412	16,691	7,318	5,237	979	7,506	93,535
Opening inventory	6,038	7,206	5,430	5,975	4,902	5,264	5,890	8,276	18,219	16,633	13,340	9,098	6,038
Plant fuel	3,546	8,824	9,315	15,621	15,419	9,398	1,754	6,337	8,580	4,224	1,211	5,384	89,613
Losses and adjustments	5,259	6,065	4,520	1,471	−1,485	5,730	6,850	8,648	9,042	6,647	8,131	6,325	67,203
Gas enrichment	18,348	16,431	16,596	9,401	11,899	11,478	7,326	10,005	17,115	18,857	19,757	11,175	168,388
Closing inventory	7,206	5,430	5,975	4,902	5,264	5,890	8,276	18,219	16,633	13,340	9,098	9,913	9,913
Sales—													
British Columbia	21,858	16,072	10,487	12,682	16,432	16,086	14,856	18,104	15,282	13,671	20,425	20,622	196,577
Alberta					584	488	311		162	161			1,706
Export	507	2,789	4,491				9,802	7,485	3,769	5,729	1,515	8,076	44,163
Total sales	22,365	18,861	14,978	12,682	17,016	16,574	24,969	25,589	19,213	19,561	21,940	28,698	242,446
Propane													
Production (bbl.)													
Plant	39,263	30,206	30,333	25,443	24,890	24,349	28,138	32,062	31,184	30,468	27,720	34,720	358,776
Refinery	26,819	25,063	24,595	20,413	19,865	22,650	20,167	17,364	19,528	21,608	32,674	25,791	276,537
Opening inventory	10,377	12,634	10,669	10,944	8,748	9,896	10,229	11,254	13,849	15,031	13,294	13,852	10,377
Plant fuel	507	3,780	2,828	358	5,376	6,883	1,882	4,831	4,288	351		224	31,308
Losses and adjustments	14,064	11,316	13,578	12,809	7,940	6,378	2,320	751	3,981	4,026	4,915	1,564	83,642
Gas enrichment						65	29						94
Closing inventory	12,634	10,669	10,944	8,748	9,896	10,229	11,254	13,849	15,031	13,294	13,852	16,116	16,116

TABLE 17.—MONTLHY NATURAL-GAS LIQUIDS AND SULPHUR DISPOSITION, 1965—*Continued*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Propane—Continued													
Sales—													
British Columbia	47,420	39,878	36,235	33,484	26,988	26,782	23,161	29,501	34,058	36,677	45,625	49,245	429,054
Alberta	312	511	494	695	659	2,247	549	511	2,203	3,201	4,037	5,728	21,147
Yukon	951	1,358	1,335	701	883	1,105	1,023	1,237	1,065	1,103	1,524	1,108	13,393
Export	571	391	183	5	1,761	3,206	18,316	10,000	3,935	8,455	3,735	378	50,936
Total sales	49,254	42,138	38,247	34,885	30,291	33,340	43,049	41,249	41,261	49,436	54,921	56,459	514,530
Sulphur													
Production (short tons)	6,644	5,209	5,573	5,957	5,673	4,912	4,051	3,340	3,237	3,709	3,424	5,568	57,297
Opening inventory	93,135	93,361	95,817	96,157	94,271	94,021	92,357	83,048	79,082	72,538	69,587	62,846	93,135
Losses and adjustments						1	8						9
Closing inventory	93,361	95,817	96,157	94,271	94,021	92,357	83,048	79,082	72,538	69,587	62,846	61,638	61,638
Sales—													
British Columbia	1,335	853	1,220	1,523	1,498	1,408	1,570	1,410	550	1,200	1,097	1,487	15,151
Export	5,083	1,900	4,013	6,320	4,425	5,167	11,782	5,896	9,231	5,460	9,068	5,289	73,634
Total sales	6,418	2,753	5,233	7,843	5,923	6,575	13,352	7,306	9,781	6,660	10,165	6,776	88,785

Table 17 includes British Columbia production only.

TABLE 18.—MONTHLY GROSS VALUES OF CRUDE OIL, NATURAL GAS, NATURAL-GAS LIQUIDS, AND SULPHUR TO PRODUCERS, 1965

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Crude oil	$2,133,557	$1,888,063	$2,240,676	$2,254,604	$2,325,585	$2,328,747	$2,493,524	$2,504,323	$2,511,548	$2,652,205	$2,604,988	$2,826,716	$28,764,536
Natural gas	1,374,374	1,231,591	1,301,754	1,153,711	1,030,353	905,632	941,791	1,024,869	1,153,842	1,348,053	1,379,919	1,647,366	14,493,255
Products—													
Natural gas liquids[1]	$67,410	$69,761	$70,326	$60,063	$59,391	$71,224	$79,840	$84,131	$62,339	$67,931	$70,480	$80,975	$843,871
Sulphur	9,710	5,525	5,889	7,162	6,212	4,678	3,821	3,124	2,822	3,708	3,334	6,474	62,459
Totals	$77,120	$75,286	$76,215	$67,225	$65,603	$75,902	$83,661	$87,255	$65,161	$71,639	$73,814	$87,449	$906,330
Total values	$3,585,051	$3,194,940	$3,618,645	$3,475,540	$3,421,541	$3,310,281	$3,518,976	$3,616,447	$3,730,551	$4,071,897	$4,058,721	$4,561,531	$44,164,121

[1] Includes condensate/pentanes plus, propane, and butane, but does not include oil from Boundary Lake Gas Conservation Plant, which is included under crude-oil values.
NOTE.—This statement includes amendments received up to April 20, 1966.

TABLE 19.—NATURAL-GAS PIPE-LINES, 1965

Company	Source of Natural Gas	Transmission-lines		Compressor Stations		Present Daily Capacity (M S.C.F.)	Gathering and Distribution Lines		Areas Served by Distributers
		Size (In.)	Mileage	Number	Horse-power		Size (In.)	Mileage	
British Columbia Hydro and Power Authority	Westcoast Transmission Co. Ltd.	30	38.6	....	....	528,000	....	2,805	Lower Mainland of British Columbia.
		24	14.1	....	....	....	....	....	
		20	43.2	....	....	....	....	....	
		18	37.2	....	....	....	....	....	
		16	21.2	....	....	....	....	....	
		12	77.5	....	....	....	....	....	
Columbia Natural Gas Ltd.	Alberta Natural Gas Co. Ltd.	6	37.7	....	....	17,130	8	1.7	Cranbrook, Fernie, Kimberley, Chapman Camp, Creston, Marysville.
		4	11.2	....	....	....	6	2.4	
		3	27.7	....	....	....	4	6.4	
		2	0.5	....	....	....	3	13.2	
							2	25.8	
							1¼	28.5	
Gas Trunk Line of British Columbia Ltd.	Beg field	....	....	....	....	....	16	27.4	To Westcoast Transmission Co. Ltd.
							6⅝	6.9	
	Boundary Lake field	....	....	....	....	....	16	31.4	
							6⅝	1.77	
	Jedney and Bubbles fields	....	....	....	....	....	12¾	31.5	
							10¾	7.0	
	Laprise Creek field	....	....	....	....	....	12¾	23.8	
	Nig Creek	....	....	....	....	....	16	28.3	
Inland Natural Gas Co. Ltd.	Westcoast Transmission Co. Ltd.	12	152.8	....	....	54,700	8	12.2	Hudson Hope, Chetwynd, Prince George, Cariboo, Okanagan, and West Kootenay areas.
		10	116.0	....	....	....	6	18.2	
		8	15.6	....	....	....	4	66.1	
		6	34.1	....	....	....	3	35.0	
		4	75.5	....	....	....	2	315.2	
		3	0.8	....	....	....	1½	20.8	
		2	13.6	....	....	....	1¼	28.9	
		1¼	0.1	....	....	....	....	....	
Northland Utilities (B.C.) Ltd.	Peace River Transmission	....	9.4	....	....	10,200	....	54.0	Dawson Creek, Pouce Coupe, and Rolla.
Plains Western Gas & Electric Co. Ltd.	Westcoast Transmission Co. Ltd.	6	0.3	....	....	....	4	7.1	Fort St. John, Aennofield, and Taylor.
		4	10.8	....	....	....	3	1.7	
		3	5.7	....	....	....	2	23.8	
		2	0.9	....	....	....	1¼	0.1	
Sun Oil Co. Ltd. (high-pressure system)	Blueberry field	—	....	....	....	....	6	2.4	To Westcoast Transmission Co. Ltd.
							4	4.6	
							3	10.7	
							2	6.2	

Sun Oil Co. Ltd. (low-pressure system)	Blueberry field	...	...	2	1,495	15,000	10¾	2.7	To Westcoast Transmission Co. Ltd.
							8⅝	4.9	
							6⅝	2.8	
							4½	0.6	
							3½	1.6	
Sun Oil Co. Ltd.	Buick Creek field	...	...	1	495	15,00	8	1.5	To Westcoast Transmission Co. Ltd.
							6	1.0	
							4	1.2	
	Rigel field	...	...	...	...	...	3½	1.2	To Westcoast Transmission Co. Ltd.
Westcoast Transmission Co. Ltd.	McMahon Plant and 26-in. line from Alberta	30	646.6	10	113,840	665,000	...	...	To Plains Western Gas & Electric Co. Ltd., Inland Natural Gas Co. Ltd., British Columbia Hydro and Power Authority, and export to United States.
	Alberta	26	32.5	...	...	215,000	...	...	
	Alaska Highway system	...	...	...	...	...	26	37.5	
							20	19.3	
							18	17.9	
							12¾	9.9	
	Blueberry West field	...	...	...	...	...	8⅝	6.7	
	Boundary Lake field	...	...	...	...	...	16	0.5	
	Buick Creek field	...	...	...	...	...	10¾	5.6	
	Buick Creek East field	...	...	...	...	...	8⅝	6.6	
	Buick Creek West field	...	...	1	1,980	...	20	16.2	
	Clarke Lake field	...	...	...	...	...	16	8.2	
	Dawson Creek field	...	...	...	...	...	8⅝	5.4	
	Fort St. John field	...	...	1	2,640	...	18	7.8	
							10¾	0.9	
							8⅝	0.7	
	Fort St. John Southeast field	...	...	...	...	...	12¾	4.0	
	Fort Nelson plant	30	220.75	...	...	325,000	...	...	
	Gundy Creek field	...	...	...	...	...	10¾	6.1	
	Kobes-Townsend field	...	...	1	6,000	...	12¾	18.9	
							8⅝	5.5	
	Montney field	...	...	...	...	...	4½	7.4	
	Parkland field	...	...	...	...	...	8⅝	6.6	
	Red Creek field	...	...	...	...	...	4½	2.9	
	Rigel field	...	...	...	...	...	12¾	9.6	
							10¾	10.3	
	Stoddart field	...	...	...	...	...	8⅝	6.3	
Western Natural Gas Co. (high-pressure system)	Blueberry field	...	...	1	207	3,000	6	2.4	To Westcoast Transmission Co. Ltd.
							4	4.6	
							3	10.7	
							2	6.2	
Western Natural Gas Co. (low-pressure system)	Blueberry field	...	...	1	1,495	15,000	10¾	2.7	To Westcoast Transmission Co. Ltd.
							8⅝	4.9	
							6⅝	2.8	
							4½	0,6	
							3½	1.6	

TABLE 20.—GAS-PROCESSING PLANTS, 1965

Operator	Location	Fields Served	Plant Type	Date on Stream	Plant Capacity, Thousand M S.C.F./Day		Natural-gas Liquids	Residual Gas to—
					In	Out		
Gas Trunk Line of British Columbia Ltd.	N.W. ¼ Sec. 10, Tp. 85, R. 14, W. of 6th M. (Boundary Lake Area)	Boundary Lake	Inlet separator, M.E.A. absorption treating, condensate stabilization	1962	10	9.5	Condensate	Westcoast Transmission Co. Ltd.
Imperial Oil Ltd.	S.E. ¼ Sec. 2, Tp. 85, R. 14, W. of 6th M.	Boundary Lake	Inlet separator, M.E.A. absorption treating, glycol absorption dehydration, combined refrigeration and oil absorption natural-gas liquid recovery, distillation	1964	17	15	Pentanes plus propane, butane	Westcoast Transmission Co. Ltd.
Pacific Petroleums Ltd.	Taylor	All B.C. producing gas-fields except Parkland, Clarke Lake, Dawson Creek, and Boundary Lake	Inlet separator, M.E.A. treating dry dessicant, dehydration oil absorption, distillation	1957	435	400	Condensate/pentanes plus	Westcoast Transmission Co. Ltd. and Plains Western
Westcoast Transmission Co. Ltd.	Lot 2683, P.R.D.	Clarke Lake	Potassium carb. M.E.A. treating absorption	1965	200	170	———	Westcoast Transmission Co. Ltd.

TABLE 21.—SULPHUR PLANTS, 1965

Name	Location	Raw Material	Principal Product	Date on Production	Capacity (Long Tons per Day)
Jefferson Lake Petrochemical Co. of Canada Ltd.	Taylor	Hydrogen sulphide	Sulphur	1957	300

TABLE 22.—CRUDE-OIL PIPE-LINES, 1965

Company	Fields Served	Size and Mileage of Main and Lateral Lines		Pumping Stations		Present Capacity (Bbl./Day)	Gathering Mileage	Throughput (Bbl./Day)	Storage Capacity (Bbl.)
		Size (In.)	Mileage	Number	Capacity (Bbl./Day)				
B.C. Oil Transmission Co. Ltd.	Aitken Creek, Blueberry	8⅝ 12¾	62.8 2.2	1	12,000	12,000	37.4	3,525	74,800
Trans-Prairie Pipelines Ltd.	Beatton River, Beatton River West, Boundary Lake, Bulrush, Currant, Milligan Creek, Osprey, Peejay, Weasel, Wildmint, Willow	4½ 6⅝ 8⅝	45.6 24.3 103.0	1 2	36,000 28,000	52,000[1] 28,000[2]	62.9	33,629	160,000
Western Pacific Products and Crude Oil Pipelines Ltd.		12	505	6	45,000	45,000	......	32,680	556,000

[1] Boundary Lake.
[2] Terminal to Western Pacific Products and Crude Oil line.

TABLE 23.—CRUDE-OIL REFINERIES, 1965

Name	Location of Refinery	Type of Refinery	Date of First Operation	Source of Crude	Crude-oil Capacity (Bbl. per Calendar Day)	Storage Capacity (Bbl.)	Cracking-plant Units	Cracking Capacity (Bbl. per Calendar Day)	Other Units
The British American Oil Co. Ltd.[1]	Kamloops	Comp.	1954	B.C.	5,000	495,000	Catalytic-fluid	1,600	Catalytic polymerization, catalytic reformer, naphtha hydrogen treater, distillate hydrogen treater, merox.
The British American Oil Co. Ltd.	Port Moody	Comp.	1958	B.C. and Alberta	18,000	1,500,000	Catalytic-fluid	8,480	Catalytic reformer, distillate desulphurization, alkylation-sulphuric acid.
Imperial Oil Ltd.	Ioco	S.C.A.	1915	B.C. and Alberta	32,000	2,918,000	Catalytic-fluid	9,000	Catalytic polymerization, powerformer.
Shell Oil Co. of Canada Ltd.	Shellburn	Comp.	1932	B.C. and Alberta	21,000	2,455,300	Catalytic-fluid	6,000	Catalytic polymerization, platformer, vacuum flashing, solvent fractionation distillate hydrotreater.
							Thermal visbreaking	3,000	
Standard Oil Co. of British Columbia Ltd.	North Burnaby	Comp.	1936	B.C. and Alberta	18,000	1,451,700	Catalytic-fluid	8,100	Catalytic polymerization, catalytic reformer, lube-oil blending plant, asphalt.
Pacific Petroleums Ltd.	Taylor	Comp.	1957, 1961	B.C.	6,500	450,000	Catalytic-fluid	2,300	Alkylation, asphalt, pentane splitter, platformer, unifiner, H.D.S. unit.

[1] Figures for British American are stream-day capacities.
Symbols: S.C.A.—skimming, cracking, and asphalt; Comp.—complete.

Inspection of Lode Mines, Placer Mines, and Quarries

By J. W. Peck, Chief Inspector of Mines

CONTENTS

FATAL ACCIDENTS

During 1965 there were 10 fatal accidents connected with lode mines, placer mines, and quarries. This compares with the average for the past 10 years of 10.0.

The following table shows the mines at which fatal accidents occurred during 1965, with comparative figures for 1964:—

Mine or Place	Location	Number of Fatal Accidents	
		1965	1964
Bralorne	Bralorne	1	—
Boss Mountain	100 Mile House	1	—
Brynnor	Ucluelet	1	2
Cariboo Gold Quartz	Wells	1	1
Cassiar	Cassiar	—	1
Coast Copper	Port McNeill	1	—
Craigmont	Merritt	—	3
Dolly Varden	Alice Arm	—	1
Giant Mascot	Hope	1	—
Glacier Gulch	Smithers	1	—
Grouse Creek (placer)	Wells	1	—
H.B.	Salmo	1	—
Horn Silver	Keremeos	—	1
Jedway	Jedway	—	1
Jersey	Salmo	—	1
South Gold	Stewart	1	—
Sullivan	Kimberley	—	2
Texada	Vananda	—	1
Wellington	Retallack	—	1
Totals		10	15

In addition to the above, 26 men were killed in the Granduc avalanche disaster, three on mine road construction, and one on a mine television installation.

The following table classifies fatal accidents as to cause and location:—

Cause	Number	Location
Fall of rock	3	Underground.
Haulage	3	Underground. (one on surface).
Explosives	1	Underground.
Vehicles	1	Surface.
Run of muck	1	Surface.
Helicopter	1	Surface.
Total	10	

A description of all fatal accidents follows. The accidents to Wesolowski, Jacques, Morris, and McKee are not classified as mining fatalities.

Janos Mungenast, aged 45, single, and employed as a trackman at the Cariboo Gold Quartz mine, was asphyxiated about 1.45 p.m. January 15, 1965, when he was crushed between a locomotive and a post on the 3250 level of the mine.

There were no witnesses to the accident. Mungenast had been detailed by the shiftboss to do repair work on the 3250 level about 1,600 feet from the shaft station. Apparently on his arrival at the station at about 1.30 p.m. he found a battery locomotive and five loaded cars of waste left there earlier in the shift by a mining crew because the shaft pocket was full at that time. Mungenast found the pocket had been pulled and must have decided to dump the loaded cars and use the train to transport his tools. At about 1,450 feet from the station it would appear two cars became derailed and Mungenast reversed the locomotive to drag the cars back on the track. Mungenast was found by two miners at 1.50 p.m. lying outside the locomotive and caught by it against a post. This would infer he was leaning out of the locomotive and was caught by the post when the locomotive jumped the track. The miners freed Mungenast and one went for help. Artificial respiration was applied until the doctor arrived to pronounce death. It was later determined that death was due to asphyxiation.

The inquest was held on January 18th. The jury returned a verdict of accidental death with no blame attached to anyone. It recommended " that in all future drifts and crosscuts there be at least one foot clearance from loci to nearest obstruction on both sides. In future all Jurors be shown the site of the accident."

Karl Wesolowski, aged 39 and employed as a driller by A. C. McEachern Limited, road contractor for Granduc Mines Limited, was killed by a fall of rock at approximately 11 a.m., April 15, 1965.

The accident took place on a new rock face on the road being built to the south of Troy Camp, 16 miles north of Stewart. Wesolowski and his partner were operating an air-trac drill under a rock face while drilling off a six-hole slash. Five 45-foot holes had been completed and Wesolowski was drilling the last hole when his partner saw a piece of rock fall from 15 to 20 feet above. He shouted a warning, but the rock hit Wesolowski as he started to look up, and drove his head into the drilling-machine. It was estimated the rock weighed about 40 pounds, but it broke up on impact. Both men were wearing safety hats. There was immediate help after the accident, and Wesolowski was removed to Troy Camp, where a first-aid man was in attendance. The doctor arrived soon after by helicopter from Stewart and pronounced death.

Wesolowski was an experienced miner both in underground and open-pit mining. The job foreman had also visited the working-place a short time previous to the accident, and the rock face was reported good but with some gravel sloughing. The air-trac drill which Wesolowski was operating required that he stand on the left side of the machine and close to the hole as the steel was run out. This placed him close to the rock face with no freedom of movement.

The autopsy revealed the head was crushed out of shape with fracture of the frontal and parietal bones. The severity of this was sufficient to have resulted in complete and immediate disfunction of the brain, with death due to suffocation and circulatory collapse.

The inquest was held in Stewart on April 20, 1965. The jury found no blame attached to any person or persons but " strongly recommended that all air tracs be equipped with controls at the rear."

Theophilus George Wood, aged 54, married, and employed as a mechanic at the Boss Mountain mine of Brynnor Mines Limited, was fatally injured when crushed between a locomotive and a man-car outside the mine portal about 8.15 a.m., June 6, 1965.

The mine was idle on June 6th (a Sunday), but two mechanics and Wood were detailed to service the underground equipment. The two mechanics planned to use a 3½-ton Atlas battery locomotive and a man-car for the trip underground. One mechanic, who had previous experience, operated the locomotive. Wood had started work June 1st and had no previous underground experience. Prior to the trip underground it was necessary to do some switching in order to position the locomotive ahead of the man-car. This job had nearly been completed. Immediately prior to the accident the locomotive was at a point approximately 2 feet from the man-car, in the yard, and about 75 feet from the portal. Wood was positioned beside the track, with the main part of his body between the locomotive and man-car, and intended to couple the locomotive to the man-car. The motorman intended to move the locomotive back toward the man-car so that they could be coupled, and apparently put the controller to the first notch. When the locomotive did not move he put the controller to the second notch. The motor moved rapidly backward and caught Wood between the motor and man-car, crushing him about the chest. Wood, apparently, straightened up and fell backward away from the tracks.

The accident occurred about 8.15 a.m. The first-aid attendant was called, and the first-aid treatment given included mouth-to-mouth resuscitation. At 9.30 a.m. the injured man was transported to the Williams Lake hospital about 121 miles away, but he expired at about 10.45 a.m. before the hospital was reached. Oxygen was given en route. It was later determined that the deceased died of shock and hæmorrhage due to crushing injury of the chest.

The accident took place on a curved portion of the track. The clearance would be only 7 inches on the inside of the curve when the locomotive and car were coupled and *nil* when the draw-bar was not properly coupled. This hazard had been recognized, and the mine crews had been instructed to couple man-cars by pushing them into position by hand. The mechanical crew had not been so instructed.

The inquest was held at 100 Mile House on June 10, 1965. A verdict of accidental death was rendered with no recommendations.

Lloyd Steele, aged 37, married, and employed as a diamond driller for Canadian Longyear Limited at the Glacier Gulch property of American Metal Climax, Inc., near Smithers, was instantly killed on June 8, 1965, when his body was severed by the rotating wing of a descending helicopter.

The helicopter was a Sikorsky S-55 registered as CF JJK and was being operated by Okanagan Helicopters Limited on charter for American Metal Climax, Inc.

The flight was from Smithers to diamond-drill site No. 37, 6 miles northwest of Smithers in Glacier Gulch, at 5,000 feet elevation on Hudson Bay Mountain. The aircraft was certified by the Department of Transport, Government of Canada, to carry a pay load of 2,391 pounds, but on this particular flight the cargo and passenger weight was 1,550 pounds. The load consisted of three passengers, a pilot, some lumber, two cargo nets, some slings, and some tools, all stowed within the hull, and a full 45-gallon drum of hydraulic oil slung in a cargo net below the aircraft.

At diamond-drill site No. 37 were Lloyd Steele and two helpers, Stewart Brian McDonald and John Baron. At this site the snow had been removed to bedrock in a square area 14 by 14 feet and 6 feet deep, and in this pit the crew was assembling equipment for a diamond-drill set-up. A small tractor-type snowblower had been used to help remove the snow, and it was now rigged with slings and lanyards for removal by the helicopter.

The pilot of the helicopter had been instructed to take a 45-gallon drum of oil to the drill-site, and he planned to land this barrel in the snow next to the pit. He hovered the craft and released the load. The aircraft then rose, and the pilot applied power to rise and turn away. The aircraft, however, settled to the ground due either to a down draft or loss of power. It then tipped over into the drill pit and the whirling blades, with a swing diameter of 46 feet, struck the men in the pit. Steele was cut in two below the ribs, McDonald lost both legs above the knees, and Baron was knocked unconscious.

There were three passengers in the plane, and one of these, Paul Jarosch, provided the necessary first aid. The doctor was summoned from Smithers by radio-telephone, and he arrived by air in 30 minutes. Baron had recovered consciousness and suffered no ill effects. McDonald was transferred to the Smithers hospital and later to Vancouver. Jarosch suffered several broken ribs.

The inquest jury returned a verdict of accidental death and recommended "that a properly trained person should direct any helicopter before any cargo can be released by the pilot when ground personnel is in close proximity to the loading or unloading area and that all ground personnel should be properly instructed as to their duties and safety precautions."

Richard Lionel Cyr, aged 19, single, and employed as a driver at the Kennedy Lake mine of Brynnor Mines Limited, was instantly killed when crushed by the front-end loader he was driving when it overturned on June 29, 1965, at about 2.40 p.m.

On the day of the accident, Cyr was working on the day shift and was detailed to operate a Hough Model L 65 front-end loader fitted with a 2½-cubic-yard bucket. His job was to load gravel at a small pit on a road known as 401 Branch Road. The gravel was loaded into two trucks. He completed his shift just after 2.30 p.m., and then started to drive his vehicle back to the garage. A surveyor's helper was working on 401 Branch Road at the time, and he observed Cyr driving his loader southward down the road. According to this witness, Cyr came over the brow of a hill about 60 feet from the gravel pit and then advanced down a 10 per cent grade. He was driving the loader in the reverse position, with the bucket in the rear, as these machines are easier to steer in this position. Cyr was looking back over his right shoulder and veered over to the edge of the road on his left. When his back wheel was on the extreme edge of the road he stopped, possibly with the idea of going forward to straighten up. Before he could do this, however, the shoulder of the road gave way and the loader turned over as it went down a 7-foot bank immediately below the road. Cyr was crushed under the machine. The witness ran down to the company office to get help. However, when Cyr's body was released it was evident that he had been killed instantly.

At the point where the accident occurred the road was over 20 feet wide and the surface was quite even. On the west side of the road there was a gravel bank which sloped down fairly steeply into a small gravel pit by the roadside. As a result of the accident, the fibreglass cab was demolished and the steering wheel and column were bent hard against the operator's seat. There was no evidence that the machine was in any way mechanically defective at the time of the accident. The machine was less than a year old and the maintenance record book indicated regular maintenance. The brakes had been relined on May 5th. These are compressed-air-operated hydraulic brakes, and they were apparently functioning properly. The evidence also indicated nothing wrong with the steering.

The deceased had been employed at this property for about six months. He had operated heavy equipment such as an ore-hauler and also had experience with front-end loaders. He was considered to be a careful and reliable operator.

The inquest was held at Tofino on June 30, 1965. The jury returned a verdict of accidental death with no riders or recommendations.

Robert Percy Cochrane, aged 25, single, and employed as a miner at the Coast Copper mine of The Consolidated Mining and Smelting Company of Canada, Limited, was fatally crushed by a falling slab of rock at about 2.50 p.m. on July 6, 1965.

On the day of the accident Cochrane and his helper were working at the north face of the 5319 stope. As the attitude of the ore is quite flat (in this case about 30 degrees), it is recovered by open stope mining with face slashing. Pillars are left where required for support or when ore is absent. The section of the stope in which the accident occurred was comparatively small in relation to other stope areas in the vicinity. It was approximately 100 feet long and had an average width of 25 feet.

It was established that the two men on arriving at the north face of the stope checked its face and the hangingwall for loose ground. A crack was noted in the hangingwall about 15 feet from the face, and this area was barred down of loose rock.

At 9.15 a.m. the shiftboss arrived in the stope on his routine inspection. He noticed the open crack in the back and asked the two men if they had scaled that section. They advised him they had, but he obtained the scaling-bar and attempted to bar this section down further. Other than chipping at the edge of the crack, he could bring nothing down. He then checked a large area in the upper end of the stope looking for any further cracking, but could find none. Both he and the two men presumed the cracked portion was keyed into the west wall, but he instructed the men to get another scaling-bar and, using two at one time, endeavour to bring this section down. The shiftboss also cautioned the men to keep out from under the area until they were satisfied it was safe. The two men informed the shiftboss they would bring another scaling-bar down from the 5500 level when they brought down the drilling-steel. However, it was later learned that no scaling-bar was available at this storage supply, but that one could have been borrowed from a nearby stope.

Cochrane and his helper drilled off and loaded a slash on the north face and stored their equipment in a slight bay in the west wall of the stope, about 40 feet down from the drilled area. The men were then waiting for the general blasting time when Cochrane noticed a small piece of loose rock over his head. He got the scaling-bar, intending to bring this loose piece down. His helper was too close and stepped back about 6 feet toward the west wall. As soon as Cochrane touched the back, a slab about 20 feet long, 6 feet wide, and 2 feet thick fell from the back.

The slab broke while falling, struck the muck pile, and slid down about 10 feet. The front portion pinned Cochrane to the ground and west wall. The back portion did not slide as far but did knock the helper to the ground, where his hat and lamp came off. The helper got up and, hearing Cochrane groan, went to his aid but found the slab too big to move. He then went to another stope and called the two miners there for help and continued to the winze station to phone for the first-aid attendant and the shiftboss. Either at the time of the cave-in or while going for help, the helper had received a severe cut to the palm of his right hand.

Cochrane was removed from under the slab, but at no time was there any indication of life, and when he was brought to the surface he was pronounced dead by the attending doctor. Following an autopsy, the doctor advised that death had been almost instantaneous as a result of multiple crush injuries about the chest and head.

The inquest was held at Alert Bay on July 9th. The jury found the deceased was performing normal duties and that no blame was attached to anyone.

Donald Bernard Golding, aged 45, single, and employed as a miner by Grouse Creek Mines Limited, was smothered by a run of sand at the placer workings of the company near Barkerville on August 23, 1965.

The accident took place on the surface of this underground placer mine. One of the underground workings had caved through the surface, and this had created a pit or depression in which water had collected. It had been decided to drive a tunnel through the rim of the pit for drainage purposes, and it was while the portal was being established that the accident occurred.

Golding was the lead hand in the drainage tunnel and had had previous experience at similar work underground. He was assisted by one man. On the day of the accident two square sets had been placed, one against the wall of the pit and the other 2½ feet back, and these had been partially lagged. The lagging was being driven ahead. Just prior to the accident Golding was inside the timber at the face, digging out to advance the lagging which was being driven ahead by his partner, who was standing on the northeast side of the portal. A sandslide started from the west side of the pit; the helper was able to jump clear, but Golding apparently had his foot caught in the flowing sand when he started back and he was buried by the slide.

The helper was able to obtain assistance, which was nearby, and Golding's body was uncovered 25 to 30 minutes after the accident. There was no sign of life. The doctor arrived 10 minutes later and pronounced death.

The inquest was held at Wells on August 25th. The jury returned a verdict of accidental death with no blame attached to anyone.

Mervin Lorne Frame, aged 28, married, and employed at the H.B. mine of The Consolidated Mining and Smelting Company of Canada, Limited, was instantly killed when his head was crushed between two ore cars about 3.20 p.m. on August 31, 1965.

On the day of the fatality Frame was operating chutes on the main haulage level of the mine to fill a nine-car ore train. The locomotive was a 48-horsepower Ruston diesel and the cars were 5-ton Granby cars equipped with automatic couplers. Just previous to the accident an ore car had become derailed at the chute and the train was uncoupled at this car. The first part of the train was moved back to a siding about 200 feet away, and it was here that the accident took place. It became necessary to couple two cars on a part of the siding where there was a curve, and for this purpose Frame stood on the inside of the curve to signal the motorman. The first attempt to couple the cars was unsuccessful. Frame then signalled the motorman to pull ahead 2 feet while he adjusted the couplings, then stood back and signalled him to back up. However, just as the motorman backed up Frame leaned forward, presumably to make some adjustment to the couplings, and was then caught between the door linkage of the two cars. Help was quickly obtained, but death must have occurred very quickly due to the crushing injuries to the skull.

The inquest was held at Salmo on September 14th. The jury found no blame attached to anyone and made no recommendations.

Fernand Jacques, aged 38, single, and employed as a tractor operator by Frontier Construction Development, was fatally injured on September 10, 1965, when the tractor he operated cascaded 500 feet down a ravine from a road that was being built for British Columbia Molybdenum Ltd. near Alice Arm.

The tractor was a new Caterpillar D-8, equipped with a U-blade and an extra-heavy steel canopy over the operator. Jacques, who was an experienced operator, was the only one to use this tractor. The method of road construction was that of building a 12- to 14-foot-wide tote-road one-quarter to one-half mile ahead of the crew of an air-trac drill and bulldozer tractor. Other equipment followed to complete the rock work, road-widening, and surfacing. The tote-road at the point of accident was 12 to 14 feet wide and composed of dirt, rock, and clay, on the side of the narrow rock ravine. The low side of the road dropped 6 feet abruptly to rock below and the high side of the road was a 12-foot clay bank. Jacques had been blading off the clay from the bank and levelling off the roadway. He worked the loosened clay with his fixed U-blade tractor to the edge of the road and pushed it over the side down into the ravine by nosing and turning the tractor to push the blade load over the side of the road. The tote-road at this point had been built by Jacques 10 days previous to the accident. On the morning of the 10th of September, a section of the dirt road, 14 by 5 feet, gave way, and it is thought to have caved under the weight of the tractor and allowed the tractor to tumble down the ravine. No one saw the accident. A nearby worker heard a noise like a large rock being pushed over the edge of the road, and then silence. Upon investigation the caved section of the road was seen, and later the body of the deceased was found well down the ravine. There was no sign of life. The doctor's report was that death was due to multiple injuries. There were massive abrasions, both lower legs were fractured, and the chest was crushed.

The tractor was found down the hill beyond the body and upside down. The safety canopy over the operator was found close by the tractor also upside down. It was not crushed but had sheared off its mounting next to the tractor.

The Coroner's jury found no blame attached to anyone. There was a recommendation that in similar situations the use of " a U-blade caterpillar should not be used."

Ralph Bruce Morris, aged 22, single, and employed as a miner by Bralorne Pioneer Mines Limited, received fatal injuries on September 15, 1965, when hit by flyrock from a blast detonated on surface.

Morris, together with two other miners and a shiftboss, was engaged in digging holes at about the 6,000-foot elevation on the easterly slope of Green Mountain about 5 miles from Bralorne for the purpose of erecting a television transmitting antenna. Two holes had been dug as footings for two 45-foot poles; one hole had been completed, but the second hole, measuring 2 by 2½ feet, encountered a rock at a depth of about 30 inches. This rock required blasting. The shiftboss placed a charge of four sticks of 70 per cent Cilgel to break up the rock. Apparently the ground to either side of the rock had been dug away, and one stick of explosive was placed in a crack more or less underneath the rock. The remaining three sticks were placed to one side and on top of the rock. A fuse about 3½ feet long was used. Warnings were given and the fuse was then lit. Morris and another workman positioned themselves about 130 feet from the blast, more or less behind some trees. The shiftboss and the other workman were positioned in the open about 150 feet from the blast. When the blast occurred, flyrock was scattered in the area of the four men. The workman near Morris heard a number of pieces of rock hit the trees near him, and then a rock, possibly as large as a baseball, hit Morris's hard hat, knocking it off. Morris fell unconscious and help was summoned. There was very little bleeding. Good first aid was rendered, and Morris was taken to the Bralorne hospital, to arrive about 1 hour later. Air transportation was then provided to Vancouver, but Morris died in the hospital at 9.10 without regaining consciousness.

Morris suffered two skull fractures, one on top of the head and the other on the left forward part of the head. The hard hat he was wearing was relatively undamaged after the accident. Thus it appeared that the energy from the blow was transmitted by the hat to the head; the hat probably touched the skull at the top and back as well as slightly behind and above the left temple. Examination of the area in the general vicinity where the four men were positioned revealed at least two dozen rock fragments of varying sizes up to about 4 pounds. Thus it was readily apparent that none of the four men was safe from the blast. Small trees cannot usually be considered as safe protection. All men involved were experienced blasters.

No inquest was held.

Alfred Abdonijah Phillips, aged 60, married, and self-employed as a miner at his South Gold Mine property near Stewart, was instantly killed on November 3, 1965, by a drift round blast as he was retreating from the face.

Phillips and his partner were working in a small sub-level at the bottom of a 16-foot winze located 200 feet from the mine portal. A round of 22 holes had been completed and then loaded with 40 per cent Forcite and 6-foot tape fuse. Phillips began to light the round with a carbide light while his partner stood on the ladder leading to the adit level above. Phillips experienced difficulty in igniting the shots and began retrimming some of the fuse. His partner returned to the face and assisted in the igniting with his carbide light, but during this time he stated that they should leave. After another eight fuses had been lit Phillips decided to leave, and both retreated the 12 feet to the winze and began climbing the ladder. The partner was ahead, and when he reached the top the first shot fired, blowing off his hard hat and extinguishing his lamp. Phillips was below and received the full impact of the first cut hole.

Between shot one and shot three the partner recovered his hat and relit his lamp. He received no answer on calling to Phillips. The ladder was down and another 15 shots had yet to detonate. He thus left the mine and arranged for help from a nearby mine. This arrived in 1 hour, and in about another hour the body was recovered. The cause of death was determined as being from rapid and severe blood loss from multiple soft, extensive tissue wounds.

The fuse, caps, and explosive that remained on site were checked and found to be in satisfactory order. The inquest jury stated as follows:—

" We believe that the accident resulted from neglect in blasting procedure in that no timing device, such as a timing fuse half the length of the shortest fuse, was employed.

" We feel that the deceased should have allowed longer fuses to permit the people present to get entirely clear, especially in a confined space such as the subdrift involved."

Garry Norman McKee, aged 23, single, and employed as a truck-driver for J. & J. Trucking Limited, a sub-contractor at Western Mines Limited, met instant death on December 2, 1965, at about 7.45 p.m. when the truck which he was driving plunged off a bridge approach and into Myra Creek.

McKee was driving a truck containing 7½ cubic yards of fill, which was to be moved about 1 mile from the loading-site to where road ballast was required. The gravel road approaches the single-lane log bridge across Myra Creek on a slight down-grade with a slow right curve, and on crossing the bridge curves slowly to the left. It was estimated that no difficulty would be experienced in steering while travelling at speeds up to 20 miles per hour. Owing to the soft nature of the newly constructed road-bed, truck speeds were kept to less than 10 miles per hour and loads down to two-thirds truck capacity. McKee was driving a 1965 Mack truck which, according to the mechanic's records, had been in use about five months and had been well serviced. The driver of the previous shift advised that the truck had been in good operating order.

Just prior to 8 p.m. McKee's truck was observed in Myra Creek. The dump box had broken loose from the frame and slid forward ahead of the truck body. In so doing it had completely sheared off the cab. From the tire tracks it was apparent that no attempt had been made to turn the truck to the right at the bridge approach, and the truck had left the road at this point. Before the truck could be removed from the creek-bed, a flood occurred, washing both parts downstream along with the driver. McKee's body was found and removed from the creek on December 7th, while the truck was removed as soon as the flood abated. Considerable further damage had been done to the truck, but nothing was found to be wrong with the steering or braking systems.

McKee had received multiple gross injuries, any of which the doctor advised would have caused instantaneous death. These included a crushed skull, a crushed chest, and amputation of both lower limbs.

The inquest jury returned a verdict of accidental death with blame attached to no one. It recommended:—

(1) "Brow or burl logs be installed both on all bridges and on either side of the approaches to them offering some protection to any vehicle that strays from the bed.

(2) "Warning signs to be installed at dangerous corners, bridges, etc., on industrial roads.

(3) "Reflectors to be installed at all bridge approaches."

Wilfred Cluff, aged 24, married, and employed as a scraper operator by Giant Mascot Mines Limited, was instantly killed on December 8, 1965, when crushed by rock in a draw point above a scraper drift.

Cluff and another scraper operator were assisting each other in bringing down a hang-up in a draw point above a scraper drift. The two men entered the draw point and, standing on loose muck, attempted to place a bulldoze charge, consisting of 12 sticks of 1¾- by 16-inch explosive, about 8 to 10 feet above the scraper drift. Shortly after the charge was placed, but just before it was to be lit, some muck came down. The scraper operator, who had been standing beside Cluff and well within the draw point, was knocked down into the scraper drift, suffering minor injuries. Cluff was pinned about the head and shoulders between the wall and a rock measuring about 2 by 3 by 5 feet and weighing an estimated 3 tons.

The injured scraperman obtained help, and a doctor arrived on the scene from Hope. Death was determined as instantaneous due to a crushed skull. There were also injuries to the upper portion of the body.

The inquest jury brought in a verdict of accidental death with no blame attached to anyone.

It should be noted that the *Metalliferous Mines Regulation Act* requires that no person shall enter such draw points for the purpose of releasing hang-ups without the permission of the shiftboss. The shiftboss, in this case, was unaware that a hang-up had occurred.

Calder S. Smith, aged 53, married, and employed as a miner by Bralorne Pioneer Mines Limited, was suffocated by a fall of ground in a stope about 12.15 p.m. on December 22, 1965.

The scene of the accident was in a shrinkage stope which averaged about 10 feet in width. About 40 holes had been drilled, and Smith and his partner were preparing to load them with Amex II when a quantity of rock, estimated at 6 tons, fell from the hangingwall and buried the deceased. The partner, who had been about 20 feet away, summoned help, but it took 30 to 40 minutes to uncover Smith. There was no sign of life. When the doctor arrived and attended Smith at the accident scene, he carried out resuscitative measures. There was no response, and Smith was pronounced dead at 1.30 p.m. Cause of death was determined as asphyxia, although there were contributory factors such as brain damage and compound fracture of left tibia and fibula.

Investigation of the accident scene indicated that the fall of rock came from the hangingwall immediately below the face, which was about 14 feet below the level above. It was noted that the fall of rock came from a slip extending into the hangingwall. The slip probably was not apparent prior to the accident. Smith's partner indicated that he heard a bang or report. This may have been caused by the falling rock or it may have been an indication of a rock burst or release in pressure. However, it was apparent that there was probably a considerable increase in pressure on the rock remaining between the stope and the drift above as the stope approached the drift.

The inquest brought in a verdict of accidental death with no blame attached to anyone and no recommendations.

The Granduc Avalanche Disaster

A special report was issued by the Chief Inspector on March 25, 1965. It is repeated here with some up-dating as a result of information gained later *re* missing bodies.

The Site

On Thursday, February 18, 1965, at about 10 o'clock in the morning, an avalanche passed over the Portal Camp of Granduc Mines Limited and caused the loss of 26 lives and total destruction of a portion of that camp.

The camp is located on the headwaters of the Leduc River, 24 miles north 30 degrees west of the village of Stewart. It is built on a glacial moraine near the junction of the north and south forks of the Leduc Glacier. A small depression lies between the camp and Granduc Mountain, from which the avalanche came. This depression is on the average about 25 feet below the camp elevation and is 150 feet wide. The general slope of the ground in the camp area is 10 degrees down toward the portal of the adit and then a descent of 16 degrees for 800 feet into the headwaters of the Leduc River. The distance from the camp to the foot of Granduc Mountain, from whence the avalanche originated, is 3,000 feet, with a slope of 13 degrees in favour of the avalanche. It was expected the camp would be in operation for about three years, during which time the new adit, about 300 feet lower in

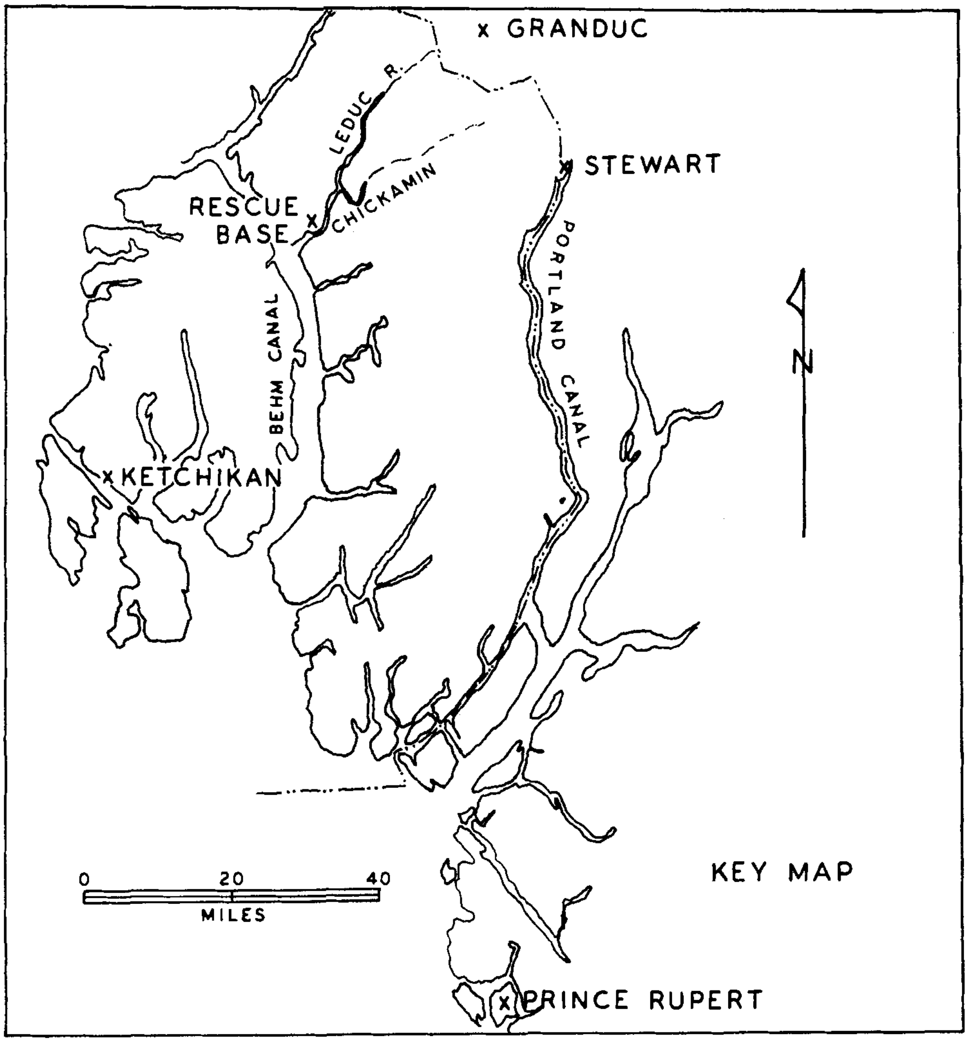


Figure 37. Index map, Granduc mine area.

elevation, would be driven to the Granduc mine workings, about a mile distant, and then continued to meet the adit to be driven from Tide Lake, 11½ miles away.

The Avalanche

In the camp proper were four 40-man bunk-houses, a large recreation hall, warehouse, a first-aid building, and a temporary hospital, as well as a small helicopter hangar with a workshop. There were 10 other small buildings in this area. After the avalanche, only the bunk-houses, the mine office, the warehouse, the first-aid building, and the temporary hospital were left intact. Between the camp and the portal of the adit was a new mine dry. This building was demolished by the avalanche. At the portal of the adit were a large power-house and compressor building, a large workshop, and the former mine dry, which was being used for a temporary storehouse. These buildings were also demolished by the avalanche. The snow spilled over the portal of the adit but did not block it.

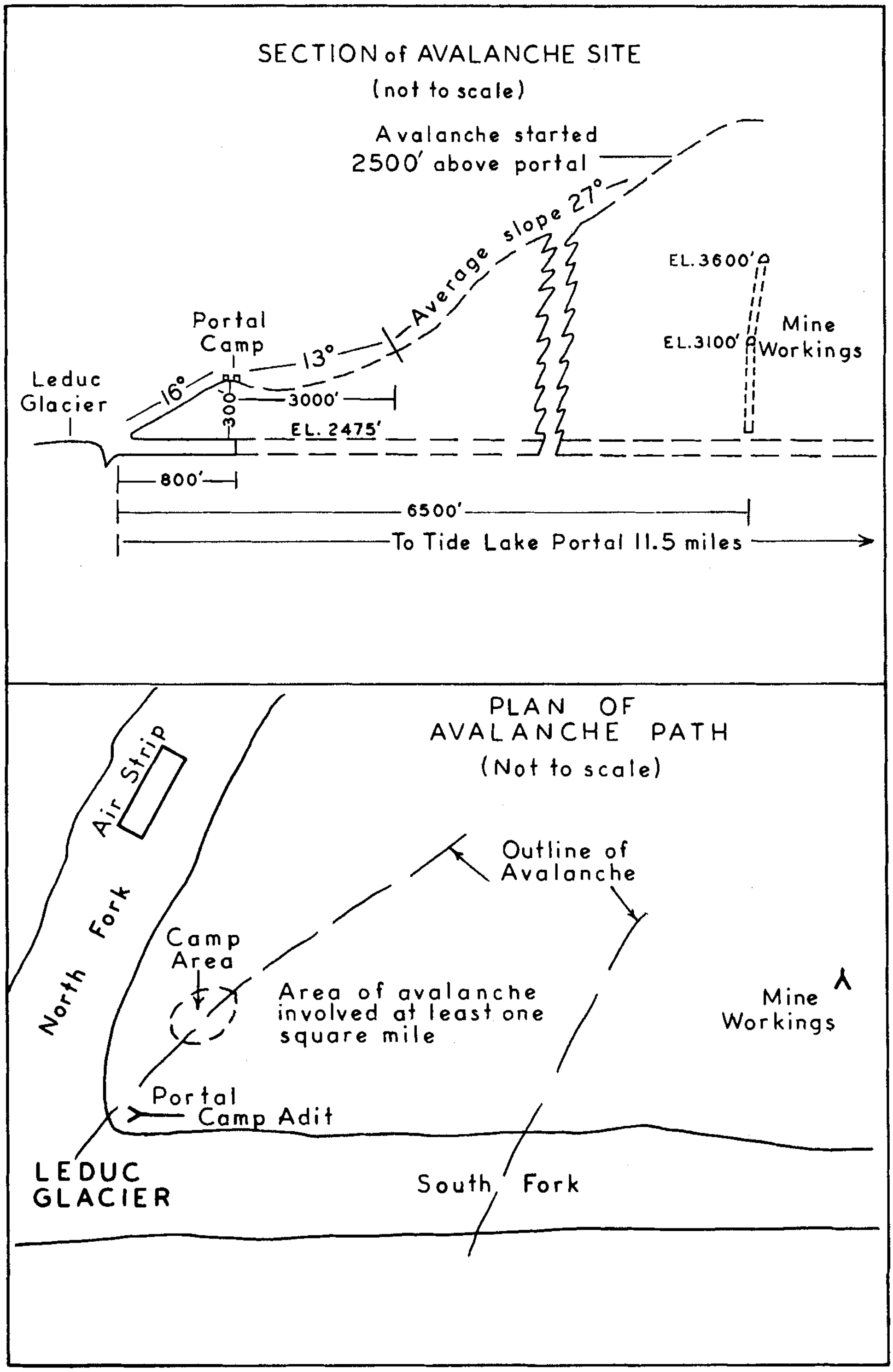
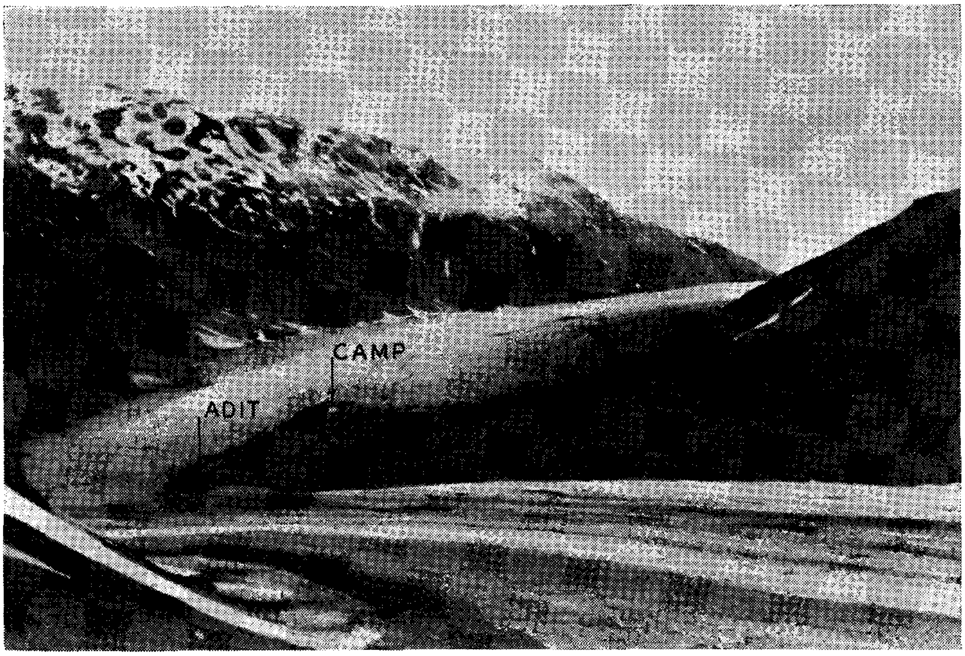


Figure 38. Granduc avalanche-site. Sketch plan and section of Portal camp area.
Not to scale.



Granduc Portal camp-site (arrow) between North and South Leduc glaciers. Buildings at adit level just visible—portal of adit is hidden. (Photo taken August 14, 1964.)

The avalanche or snowslide, when it struck the camp, immediately destroyed the camp power. Within minutes auxiliary power was connected to the radio transmitter and a distress signal was sent to the Stewart mine office. The camp survivors commenced rescue operations without delay over the devastated area. Dr. H. B. Veasey, the Stewart area medical practitioner, was at the Portal Camp at the time. He and the first-aid attendant were in the first-aid building at the time of the avalanche and were unharmed. They were able to assist in rescue, receive the injured, and give medical aid to those requiring treatment. Later they arranged priorities for the evacuation of the injured.

The 21 men underground at the time of the slide were working in the adit. None of these men was injured and all were available for rescue work. As soon as the mine shiftboss realized what had happened, he organized them into small rescue groups of two, three, and four men. At the time of the disaster there were 15 men working outside the portal and in the general area. All were buried by the avalanche. The mine shiftboss, who had been on surface recently, knew the positions of all of those men, and he set his parties to work with some degree of hope at the seemingly impossible task. Of the 15 men in the portal area, six were found alive and nine were dead on recovery. All but one were found fairly quickly.

Because most of the survivors in the camp area were in various states of shock and those in the bunk-houses were unaware of the severity of the avalanche, organization of rescue work was slow and not as well organized as in the portal area. However, it was most fortunate that so many were helped from their snow imprisonment by those who were not entombed or injured. At least a dozen men were in the coffee-shop and kitchen buildings and were buried when these buildings were swept away. Carpenters, mechanics, tractor operators, and general labourers were working at their tasks in the slide path, and most of these were caught.

There were 154 men in the camp, and of this number 94 were on day shift. Of the day shift, 21 were safe underground and at least five were in the safe area of the camp where the buildings were untouched by the avalanche. This left 68 exposed to the danger of the avalanche, and of these 42 were saved. Three of those saved were in the portal area and saw the approach of the avalanche in time to take self-preservation measures.

The Dead

Name and Occupation	Employer
Anderson, Craig F., trackman	Granduc Mines Limited.
Burdick, Andrew, mechanic	Granduc Mines Limited.
Clausen, John S., mechanic	Granduc Mines Limited.
Crawford, C.	Sentinel Construction Co. Ltd.
Currie, R.	Sentinel Construction Co. Ltd.
Davis, Aldege, welder	Granduc Mines Limited.
Fekete, Vilma, labourer	Granduc Mines Limited.
Geiger, George	Hard Metals Co. Ltd.
Lloyd, Robert J., power-house operator	Granduc Mines Limited.
McKinnon, Donald	Sentinel Construction Co. Ltd.
McLeod, S.	Sentinel Construction Co. Ltd.
McNulty, Jerimiah, labourer	Granduc Mines Limited.
Matiowski, Wayne, labourer	Granduc Mines Limited.
Nitsos, C., labourer	Granduc Mines Limited.
Olson, Ivan Orein, tractor operator	Granduc Mines Limited.
Palmer, C. A., miner	Granduc Mines Limited.
Paulson, Arthur, mechanic	Granduc Mines Limited.
Rose, Reginald Blake, labourer	Granduc Mines Limited.
Rose, Rodney L., labourer	Granduc Mines Limited.
Rose, Roth Franklin, labourer	Granduc Mines Limited.
Schack, Ulrich, labourer	Granduc Mines Limited.
Scott, James Alexander, leader	Granduc Mines Limited.
Shannon, Dalton, electrical foreman	Granduc Mines Limited.
Soltesz, Steve, labourer	Granduc Mines Limited.
Tellam, John A., mechanic	Granduc Mines Limited.
Orlaw, Herman, carpenter	Sentinel Construction Co. Ltd.

The cause of death was given as suffocation, but for some of the deceased there was further contribution to death due to fracture of the skull or neck. In one case, loss of blood from amputation of a leg was given as contribution to death. Most of the dead were found the first day or in the day or two following. One body was found on March 3rd, March 8th, March 10th, March 18th, two on May 8th, and one on June 18th.

The Injured

A total of 20 men received injuries ranging from bruises to fractured arms and legs. Three were employees of Sentinel Construction Co. Ltd., two worked for General Catering Limited, one for Bordeau-Braden Diamond Drilling Ltd., while the remainder were with Granduc Mines Limited. Several suffered from shock and loss of circulation after being trapped up to 3 hours. One man, E. Myllyla, a carpenter working for Sentinel Construction Co. Ltd., was rescued after being buried for over three days. He suffered from severe frostbite on hands and feet but was recovering satisfactorily on March 15, 1965.

The Rescue and Evacuation

The distress signal sent to the Stewart office of Granduc Mines Limited was heard by the Alaska State Police. The call was immediately relayed directly to the Prince Rupert Divisional Commander of the Royal Canadian Mounted Police. By this time the information was the property of the Canadian and American news services and was immediately released as a news flash. This brought immediate response from many quarters. Governor Egan of Alaska offered his help, and the British Columbia Civil Defence activated " aid to civil power " to bring in the armed forces. Lieutenant-Colonel Mathews, of the Queen's Own Rifles of Canada, was appointed co-ordinator, and he prepared to bring to the scene an army group from Chilliwack, an R.C.A.F. helicopter from Comox, the Snow Mountaineer Rescue Squad from Vancouver, plus the use of the Alaska State ferry " Taku." Co-operation was also established with the services of the Royal Canadian Mounted Police and the District Inspector of Mines.

The Department of Mines and Petroleum Resources was, of course, involved in the rescue from the time of the first news flash. Headquarters at Victoria and the District Inspector's office at Prince Rupert worked closely with the Granduc management to ensure that the action taken had the best possibility of success. Both the Inspector of Mines and the Department's mine-rescue and first-aid instructor from Kamloops were on site early and remained throughout the evacuation and search. The Minister, Deputy Minister, and Chief Inspector also made a visit to the scene of the tragedy as soon as was possible.

The management of Granduc had reacted swiftly on receipt of the news. Normal access to the mine is by air from Stewart, but the area was fogged in, as it had been for two days previous. There was a possibility that the weather would be better from the Alaska side, and hence arrangements were made for a base to be set up at the mouth of the Chickamin River, and helicopters were dispatched to that point. In the meantime a ground rescue party of tractors started on its way from the closest road camp, and although it took three days to cover the 34 miles, it could have been the only means of rescue if the camp had remained " socked in." By late afternoon on the day of the disaster the rescue operation was well on its way via the Chickamin River base. The Ketchikan Volunteer Rescue Squad sent many of its members to the scene, and these experienced men contributed a great deal in the evacuation of the Granduc survivors, as well as in the search for victims. The United States Coast Guard, acting on a request from the Minister of Mines and Petroleum Resources, sent its vessel " Cape Roman " to the mouth of the Chickamin to be used as a radio and evacuation base, and a large helicopter was also dispatched to handle stretcher cases. One helicopter started up toward the mine with Dr. Wilson from Ketchikan aboard, but foul weather forced a landing below the Leduc glacier about 1 mile from the Portal Camp. The Alaska State Police also arrived on site to expedite any border crossing problems.

On the morning of February 19th the weather cleared sufficiently for one return helicopter flight to be made from Stewart, where Lieutenant-Colonel Mathews had made his headquarters, using the Alaska ferry " Taku." The weather then closed in, and no more rescue work could be done from Stewart. A shuttle service of helicopters took all but essential personnel from the Portal Camp to the Chickamin rescue base, and then planes and boats ferried them to Ketchikan. The following day, army personnel were able to move into the camp to continue the search for survivors.

The search for survivors was complicated by the mass of debris that was mixed with snow. Buildings had been demolished to splinters so that bits of wood, paper, metal, and clothing were scattered everywhere. Rescue dogs were brought in but were not of much assistance as everything in the disaster area contained human scent, which set a dog to digging erratically. The use of probes again turned up more material. Bulldozers were then put to work, and these, working along with a probing crew, did most of the difficult search. E. Myllyla (*see* The Injured) in all probability would not have been found in time to save his life if a bulldozer had not been used. Throughout most of the search and rescue the weather was bad, in that visibility was limited because of snow or cloud. An icy wind blew most of the time. The housing and feeding of men became difficult because most of the camp's comfortable facilities had been affected by the avalanche. Nevertheless, rescue efforts persisted, with up to 55 men involved, until February 24th when the army group was withdrawn. The search was reactivated a few days later using a smaller crew of Granduc personnel.

The Cause

A snowslide and avalanche control consultant, M. M. Atwater, of Tahoe City, Calif., was engaged by Granduc Mines Limited to investigate the cause of the avalanche. He suggested the following:—

There were abnormally low temperatures during the winter. High winds during the winter transported snow into the slide area and formed hard slab snowpack. In February large quantities of new snow and soft slab snow modified by wind were deposited upon the old unstable snow base. The sudden increase in pressure commenced a chain reaction. The pressure collapsed the old hard slab under-layer of snow. The collapse caused a movement of snow in the top section of the snowfield, which cascaded over the cliff side. The centre section of the mountain snowfield was released by the impact. The bottom section of the mountain snowfield now added itself to the torrent. The combined mass, falling 2,500 feet vertically, developed enough speed on a frictionless surface to run over the camp-site with enough power to destroy it. It is estimated that the mass of moving snow which struck the camp contained 50,000 tons travelling over 100 miles per hour. It has been classified as a " Climax Avalanche." This type of avalanche is rare as conditions are seldom present in the correct order. It does not normally repeat itself for years, but then again it could happen twice in one winter. It is emphasized that the set of conditions which could cause such an avalanche do not develop over a single night nor in a single storm. The build-up can be recognized, and there are methods of breaking the sequence and destroying the conditions necessary to the formation of this type of avalanche.

The Inquest

On March 4, 1965, an inquest was held at Stewart into the deaths of 20 men whose bodies had been found prior to that date. The jury returned the following verdict:—

" We the Jury, find that the deceased met their death due to an act of God, namely an avalanche which passed over the Granduc Portal Camp on February 18th, 1965. We find no blame can be attached to any person or persons, either directly or indirectly, in the catastrophe. We recommend that either this camp site be abandoned during the winter months or precautions taken to prevent the build-up of snow on the slopes immediately above the Camp."

Observations

The Granduc disaster was the worst tragedy in the history of mining in British Columbia since the explosion in 1930 in the No. 4 mine of Coalmont Collieries Limited near Princeton, when 45 men lost their lives.

Snowslides have taken their toll over the years, but in one's and two's, except that in 1935 at the Taseko Motherlode mine, north of the Bridge River district, the connected bunk and cook house was demolished by a snowslide which killed the entire crew of seven men. There was also a rock and snow slide at Britannia in 1915 which killed 57 persons.

The tragedy of avalanches is in the timing. In so many cases it is a matter of chance that persons are in the path of their fury. In the Granduc case it was 10 a.m., the middle of the morning, when the largest number possible were in the slide path doing many things—carpentry, electrical and mechanical work, general labouring, even on a coffee break. If it had been night-time, most of the men would have been in the bunk-houses, which were relatively untouched, or they would have been safe underground. Perhaps no more than half a dozen men would have been exposed.

Tribute should be paid to the generous response of individuals and organizations who immediately responded on hearing of the disaster. Aid came from so many sources and it was given without thought of reward or the danger involved. The people directly involved in the avalanche helped each other, and there must have been many acts of courage which went unnoticed. There was hardship but no complaining. It is also a credit to the rescue teams that such a large number were evacuated under very difficult conditions, without a single injury being suffered by either the rescued or the rescuers.

Conclusions

The inquest verdict is concurred with. It is possible that a trained snow observer with several years' experience in the area could have forecast trouble for the present camp location. However, there had been observations of the area since discovery of the copper showing in 1952, and these observations revealed little to cause apprehension for the site chosen for the present work. The former site from which the orebody was developed was in a very exposed area, being on a steep slope above the south fork of Leduc glacier. For this development the mine plant was put underground and the crews lived in small buildings placed out in the centre of the glacier. No snowslide or avalanche had ever reached this living site in previous winters, but at some time during the 1964/65 winter an avalanche buried the main portal and swept over the glacier, well past where the buildings had formerly been placed. Destruction would have been total. Thus the present winter was most unusual in that conditions occurred which had little similarity to those of past winters. Evidence now available indicates that the snow in the area had become unstable, with little cohesion within itself, either because of abnormally low temperatures, which created ice crystals deep in the snow, or because of freezing rains which formed thin layers. Then a February storm dumped a large quantity of fresh snow on top of this unstable base, with further loading by wind deposition. The collapse was not thought caused by any underground blast but rather by simple overloading. In any event, the collapse was total and involved the whole snowpack over an area about 1 mile square. The whole slide area was so extensive that only hindsight could determine the path.

Future Action

In respect to the jury's recommendation *re* future work, there is good evidence that the present area in front of the portal is unsafe during the winters but that part of the living-site has natural protection. Thus to enable winter work to proceed the Department obtained the advice of N. C. Gardner, a snow consultant who is on avalanche control for the Department of Northern Affairs and Natural Resources in the Rogers Pass area of the Trans-Canada Highway. With Mr. Gardner's and Mr. Atwater's recommendations in mind, the district Inspector of Mines laid down the following conditions for work to proceed:—

(*a*) For the balance of the present winter:—

(1) There will be no work in the area adjacent to the portal. There will be no men exposed in this area until the snow has receded and the ground is bare on the slope above the portal.

(2) A trained observer and snow operations supervisor must be on site at all times. Camp weather conditions, weather bureau forecasts, and avalanche and snow conditions are to be recorded and reported daily to camp management and work supervisors.

(3) The snow above the whole camp area on all sides is to be stabilized by recognized safe bombing methods.

(4) A diversion wall of debris and snow is to be built on the Granduc Mountain side of the present undamaged buildings. It is to be bulldozed clear after every snowfall.

(*b*) For future winters:—

(1) Mound retards are to be in place between the camp and Granduc Mountain to effectively dampen any avalanche.

(2) A permanent diversion wall in lieu of the temporary one in (4) above is to be built.

(3) All camp buildings are to be behind this diversion and to be constructed with the long axis parallel to the present avalanche path. The front or exposed ends of these buildings are to be slope bulkheaded. All roofs must be able to withstand the snow load.

(4) Access to the portal must be by a covered recessed travelway or equivalent. Such a travelway must be well lighted and ventilated.

(5) There shall be no exposed buildings at the portal. All plans for these, either surface or underground, need the approval of the Department.

(6) An effective artillery or other weapon shall be obtained and used to artificially stabilize a snow slope as required.

(7) As in (*a*) (2), the presence of a trained observer is a necessity.

FATAL ACCIDENTS AND ACCIDENTS INVOLVING LOSS OF TIME

Ten fatal accidents and 377 accidents involving a loss of time of over three days were reported to the Department. These were investigated and reported on by the Inspectors of Mines.

The following three tables classify these accidents as to cause, occupation, and as to the parts of the body injured. The fourth table lists all fatal and compensable accidents which occurred in lode mines over a 10-year period and relates these accidents to the number of persons employed.

Accidents Causing Death or Injury Classified as to Cause

Cause	Number of Accidents	Percentage of Total
Atmosphere	2	0.5
Explosives	9	2.3
Falls of ground	70	18.2
Falls of persons	88	22.7
Lifting and handling material	36	9.3
Machinery and tools	87	22.5
Transportation	18	4.6
Miscellaneous	77	19.9
Totals	387	100.0

Accidents Causing Death or Injury Classified as to the Occupation of Those Injured

Occupation	Number of Accidents	Percentage of Total
Underground—		
Chutemen	6	1.5
Haulagemen	18	4.6
Miners	112	28.9
Helpers	8	2.2
Timbermen	11	2.8
Mechanics, electricians, etc.	10	2.6
Miscellaneous	13	3.3
Surface—		
Mechanics, electricians, repairmen	41	10.6
Mill and crusher workers	24	6.2
Carpenters	5	1.3
Miners and drillers	48	12.4
Vehicle drivers	31	8.0
Miscellaneous	60	15.6
Totals	387	100.0

Accidents Causing Death or Injury Classified as to the Parts of the Body

Location	Number of Accidents	Percentage of Total
Head and neck	17	4.4
Eyes	18	4.6
Trunk	114	29.5
Upper extremities	97	25.1
Lower extremities	96	24.8
General	45	11.6
Totals	387	100.0

COMPENSABLE AND FATAL ACCIDENTS RELATED TO PERSONS EMPLOYED

Year	Number of Accidents	Number of Persons Employed	Frequency per 1,000 Persons
1956	615	6,507	94
1957	535	5,678	94
1958	396	4,353	91
1959	310	4,316	72
1960	395	4,389	90
1961	338	3,993	85
1962	429	4,872	88
1963	521	5,025	104
1964	547	5,400	101
1965	559	5,522	101

DANGEROUS OCCURRENCES

Forty dangerous occurrences were reported as required by section 9 of the *Metalliferous Mines Regulation Act* and were investigated by the Inspectors of Mines. This compares with 24 reported for 1964.

Of these occurrences, 12 were connected with hoisting, 7 with fires, 6 with explosives, 7 with subsidence or slides, 5 with trucks, 2 with electricity, and 1 with poisons.

On January 3, 1965, at the Mammoth mine of Johnsby Mines Limited a fire destroyed an ore bin adjacent to the main adit.

On January 25, 1965, at the Jedway open-pit iron mine an ore truck ran away on a down-grade and collided with a passenger vehicle. There was damage to the vehicle but no injuries were suffered.

Sometime during February, 1965, at the Porter Idaho mine of Cassiar Consolidated Mines Limited, the camp, which was built in 1929, was destroyed by an avalanche during the winter shut-down of operations.

On February 1, 1965, at the Craigmont open-pit mine, a 35-ton ore truck slid out of control on icy roads, went over the perimeter, and rolled 40 feet down the bank. The driver was able to abandon the vehicle in time.

On February 13, 1965, at the Coast Copper mine, a loaded material skip, which was suspended below the muck skip, broke loose and dropped 1,100 feet to the bottom of the 40-degree inclined shaft. Apparently the material skip had become lodged for some reason at point of least clearance in the shaft during descent, and when it broke free the sudden shock load was sufficient to break the cables attaching it to the muck skip above.

On February 17, 1965, at the Lynx mine of Western Mines Limited, two men in a drift heading were injured when one of the holes exploded while the round was being ignited. Tape fuse was being used, and difficulty had been experienced in getting the fuses to ignite.

On February 19, 1965, at the Horn Silver mine, a fire of unknown origin destroyed the change-house.

On February 20, 1965, at the Jedway open-pit iron mine, a tractor operator received minor injuries when the tractor he was operating rolled down a bank due to a collapse of the outside edge of the bench.

On March 17, 1965, at the Bralorne mine, a skip was damaged and the hoisting-rope kinked when a rock fell down the shaft during the ore-hoisting cycle.

On March 20, 1965, at the Jedway open-pit iron mine, a quarry truck backed over a bank during the dumping procedure and fell 450 feet to the bottom of the waste dump. The driver jumped clear.

On May 1, 1965, at the Merry Widow mine of Empire Development Company Limited, the jig-back aerial tramway ran out of control, which resulted in a bursting of the armature winding of the drive motor and caused minor damage to the upper terminal.

On May 8, 1965, at the Yreka mine of Minoca Mines Ltd., a fire destroyed the cook-house building.

On May 21, 1965, on the Granduc access road, a workman received minor injuries from flyrock when a small amount of explosive was detonated by the bulldozer blade of a tractor.

On May 28, 1965, at the Merry Widow mine of Empire Development Company Limited, a workman received facial injuries from flyrock as a result of a blast on surface.

On May 31, 1965, at the Merry Widow mine of Empire Development Company Limited, the jig-back aerial tramway ran out of control, which resulted in the breakage of the 1-inch-diameter haulage rope.

On June 3, 1965, at the Bethlehem mine, a short section of the tailings dam ruptured, and this released all the water impounded behind the dam, but with negligible damage.

On June 4, 1965, at the Britannia mine, a workman suffered eye injuries when a missed hole exploded prematurely during a reblasting procedure.

On June 15, 1965, at Granisle Copper Limited, two men were burned and a boat destroyed when a fire took place on a boat used to transport men on Babine Lake.

On July 1, 1965, at the Britannia mine, an overwind in the No. 8 shaft caused damage to the sheave-wheel as well as to the muck skip.

About July 19, 1965, at the Sunro mine of Cowichan Copper Co. Ltd., an oil fire took place in the underground transformer room while the transformers were being dried out as part of the rehabilitation programme necessitated by the mine being flooded. The resultant smoke filled the mine for two days.

On July 24, 1965, at the Endako concentrator, a repairman received splashes on his face and clothing from a solution containing cyanide while he was working on a reagent pump. He collapsed and became unconscious but was revived by amyl nitride antidote and oxygen therapy.

On August 11, 1965, at the Hurley River Mines Ltd. prospect in the Stewart area, two men were injured and trapped when they fell into a crevasse on a glacier but fortunately were rescued in time.

On August 16, 1965, at the Britannia mine, the hoisting-rope kinked in the Victoria shaft when slack was paid out as a result of a cage sticking in the shaft.

On September 9, 1965, at the Dodger adit of Canadian Exploration Limited, a cave of 35 tons destroyed the portal timber and blocked the mine entrance.

On September 14, 1965, at the Britannia mine, a skip became jammed in the No. 8 shaft due to a broken guide.

On September 28, 1965, at Wesfrob Mines Limited, a 110-volt lighting plant was allowed to feed back into a power-shovel main electrical system. An electrician was rendered unconscious while making repairs on the shovel.

On October 1, 1965, at the Reeves MacDonald mine, several shaft sets were damaged and two men were injured when a timber skip being hoisted behind a muck skip in the No. 3 inclined shaft left the rails and smashed into the side of the shaft.

On October 25, 1965, at the Cassiar open-pit asbestos mine, a slide of some 7 million tons of material from the 6270 dump came down the east side of Troutline

Creek valley, crossed the creek, and continued 300 feet vertically up the west side. The slide path was 1 mile long horizontally and the difference in elevation between the top and the bottom was 2,250 feet. Half a mile of mine access road was demolished. One tram-line tower was completely destroyed, including the concrete foundation, and another was damaged. The multi-pole power-line structures on either side of the ravine were wiped out, as were the telephone-lines, control cable, and both track ropes. The access road along the tram-line was obliterated. There was structural damage to No. 2 Divide Station and the Tension Station. Twenty buckets, carriages, and bridles were lost. Apparently the slide was caused by several factors, including water seepage, the slope of the ground on which the dump was built, and the amount of material on the dump.

On October 26, 1965, at the Giant Mascot mine, two men suffered injuries from flying rock particles when an explosion occurred in or near a hole which was being drilled.

On October 27, 1965, at the underground placer mine of Grouse Creek Mines Limited, a level 45 feet below the shaft collar caved and filled with wet sand and gravel.

On October 29, 1965, at the Reeves MacDonald mine, several guides and shaft sets were severely damaged when a loaded skip came out of the guides while being hoisted.

On November 12, 1965, at the Britannia mine, 15 sticks of explosives were detonated by sympathetic detonation. They had been placed within 20 feet of where two miners had set off a blast of four holes loaded with 25 sticks of explosives. No one was hurt, but the men guarding the blast were blown off their feet and a number of timber sets were damaged. One miner had his blasting certificate suspended for two months.

On November 15, 1965, on the Granduc access road, a trailer camp occupied by the mine-road construction crew was totally destroyed by fire.

On November 16, 1965, at the Silbak Premier mine, a fire totally destroyed the assay office.

On November 19, 1965, at the H.B. mine of The Consolidated Mining and Smelting Company of Canada, Limited, the safety catches engaged the descending cage in the shaft and 100 feet of hoisting-rope was allowed to pile up on top of the cage.

On November 30, 1965, at the Britannia mine, the safety catches of the cage in the No. 7 shaft engaged as the cage was being lowered through a newly installed set of guides. A considerable amount of hoisting-rope was paid out, and this resulted in a kink which had to be removed by cutting a portion off the end of the rope.

On December 3, 1965, at the Kingfisher mine of Empire Development Company Limited, a workman suffered spinal injuries when struck by a flow of fine muck which was forced out of a draw point by the pressure of water which had collected above.

On December 9, 1965, at the Cassiar open-pit mine, the driver of a truck lost control and jumped clear just before the truck left the road to roll 150 feet down the slope.

On December 11, 1965, at the Britannia mine, there was damage to the skip and guides in the No. 8 shaft when the hoistman lowered the skip into the muck spill doors which had previously been closed across the shaft.

On December 29, 1965, at the Boss Mountain mine, a foreman and later an electrician suffered electrical flash burns while working on 550-volt switchgear.

PROSECUTIONS

Two prosecutions were instituted under the *Metalliferous Mines Regulation Act,* as follows:—

The manager of Central Gravel Supplies Mission Limited, being the person in charge at a gravel pit off Wilkinson Road, Comox, and at which work was discontinued in October, 1964, was charged under section 11 that he did fail up to May 4, 1965, to cause all pits and openings dangerous by reason of their depth and other conditions to be fenced or otherwise protected against inadvertent access to the satisfaction of the Inspector. Further it was charged that the manager did up to May 4, 1965, fail to carry out a written order issued by the Inspector of Mines under section 7(1) that the aforesaid gravel pit be made safe. The hearing was held in Courtenay on May 28, 1965, at which the defendant pleaded guilty. He was fined $100 on the first count and $200 on the second.

The manager in charge of the contract operation at the View Talc mine, on the Salmo–Creston highway, was charged that he unlawfully employed men without proper supervision contrary to section 20(1); unlawfully operated a gasoline engine too close to a shaft contrary to section 21, Rule 5(*b*); and unlawfully allowed a skip to be lowered from an unclutched drum contrary to section 21, Rule 146(*b*). The offences took place on or about December 13, 1965, and the hearing was held in Nelson on December 21, 1965. The defendant pleaded guilty to the three charges and was fined a total of $150.

BLASTING CERTIFICATE SUSPENSIONS

There were violations of the provisions of the *Metalliferous Mines Regulation Act* in regard to the use of explosives and blasting procedure. Blasting certificates of nine offenders were suspended for periods varying from one to six months. The offences were not guarding a blast properly, returning too soon after blasting, not examining a face properly, and leaving unused explosives about a working-place.

EXPLOSIVES USED IN MINES

The table below shows the quantities, in pounds, of explosives and ammonium nitrate used in mines and quarries (other than coal) in British Columbia in 1961, 1962, 1963, 1964, and 1965:—

	1961	1962	1963	1964	1965
High explosives	7,280,000	4,522,619	4,072,000	5,200,000	6,043,000
Slurries (Hydromex)	2,116,000	2,013,850	1,770,000	2,100,000	2,830,000
Amex II	169,000	2,429,550	2,639,000	2,900,000	3,140,000
N.C.N. (C.M. & S. Co., Ltd.)	———	(1)	(1)	2,023,000	2,593,000
Ammonium nitrate	2,647,000	5,921,690	8,900,860	10,100,000	10,544,000

1 Figures for 1962 and 1963 were included in the totals for ammonium nitrate.

The quantities of all explosives used in 1965 increased over those used in 1964. The do-it-yourself explosive of ammonium nitrate and fuel oil (AN/FO), first introduced in 1957, showed its first levelling off in annual consumption after several years of spectacular increases. In 1961 and 1962 respectively, commercial forms of AN/FO, Amex II, and N.C.N. of The Consolidated Mining and Smelting Company of Canada, Limited, were permitted underground and rapidly replaced standard explosives. One serious problem with AN/FO is in the packaging, as the oil in the explosive has a tendency to separate out either by migration or evaporation.

Any decrease in the oil content may create excessive amounts of oxides of nitrogen fumes on detonation. Thus the use of AN/FO explosives is contingent on a permit being obtained from the Chief Inspector of Mines, Victoria. For those operators who wish to blend their own ammonium nitrate and fuel-oil, written permission must be obtained from the Chief Inspector of Explosives, Ottawa.

DUST CONTROL AND VENTILATION

The dust and ventilation conditions at the different operations in the mining industry were surveyed by the Silicosis Control Inspectors of the Department. Excerpts from the report of the Senior Inspector, R. J. Craig, follow:—

One hundred inspections of dust conditions were made, as follows: 70 surveys were made at the operations of 45 underground mines, 14 surveys were made at the operations of 9 open-pit mines, 5 surveys were made at the operations of 3 rock quarries, 3 surveys were made at the operations of 2 limestone quarries, 5 surveys were made at the operations of 4 gravel pits, 2 surveys were made at the operation of 1 asbestos mine, and 1 survey was made at the operation of 1 coal company.

The certificates of fitness for workmen employed by mining, construction, and diamond-drill companies in mining operations were checked against the payroll list to determine if the regulations pertaining to these were being followed. No one is allowed to work in a dust-exposure occupation at these operations unless he has had a current medical examination and X-ray.

Three different instruments are used for sampling the various types of dust. The konimeter is used to sample rock dust at the underground and open-pit mines and plants, at the rock and limestone quarries, and at crushing operations in gravel pits. It gives a relative dust count of insoluble rock dust between one-half and 10 microns in size. The midget impinger is used to sample asbestos dust and fibre according to standards set by the Quebec asbestos industry. It gives a relatively lower count than the konimeter but also collects asbestos fibre. The long running thermal precipitator is used for sampling coal dust according to standards set by the National Coal Board in Great Britain. Coal dust between 1 and 5 microns in size that is precipitated is counted under the microscope.

Surveys were made of the dust concentration in the atmosphere in underground mines, at open pits and quarries, in crushing plants, gravel plants, and assay grinding-rooms. Measurements of the ventilation and observation of the condition of exhaust systems and other measures relative to the prevention, suppression, and elimination of dust were made. Recommendations and advice were given for improvements which it was considered would help to lower the dust concentration. A summary of the conditions found follows:—

(1) One hundred surveys of the dust concentrations were made at 64 operations during 1965. The surveys were made at lode mines, both underground and open pit, rock quarries and gravel pits, asbestos and coal mines.

(2) It is not known what concentration of dust is safe to breathe without causing silicosis. This varies with the type and size of dust, the exposure time, and the physiology of the workman exposed. Certain threshold limit values have been adopted in various countries, depending upon the method of sampling and the type of dust. In British Columbia the figure of 300 particles per c.c., as determined with the konimeter, is used as a level of dust concentration that can be obtained under good conditions of ventilation and dust control. The konimeter gives a count of insoluble rock dust but does not distinguish the percentage of free silica particles.

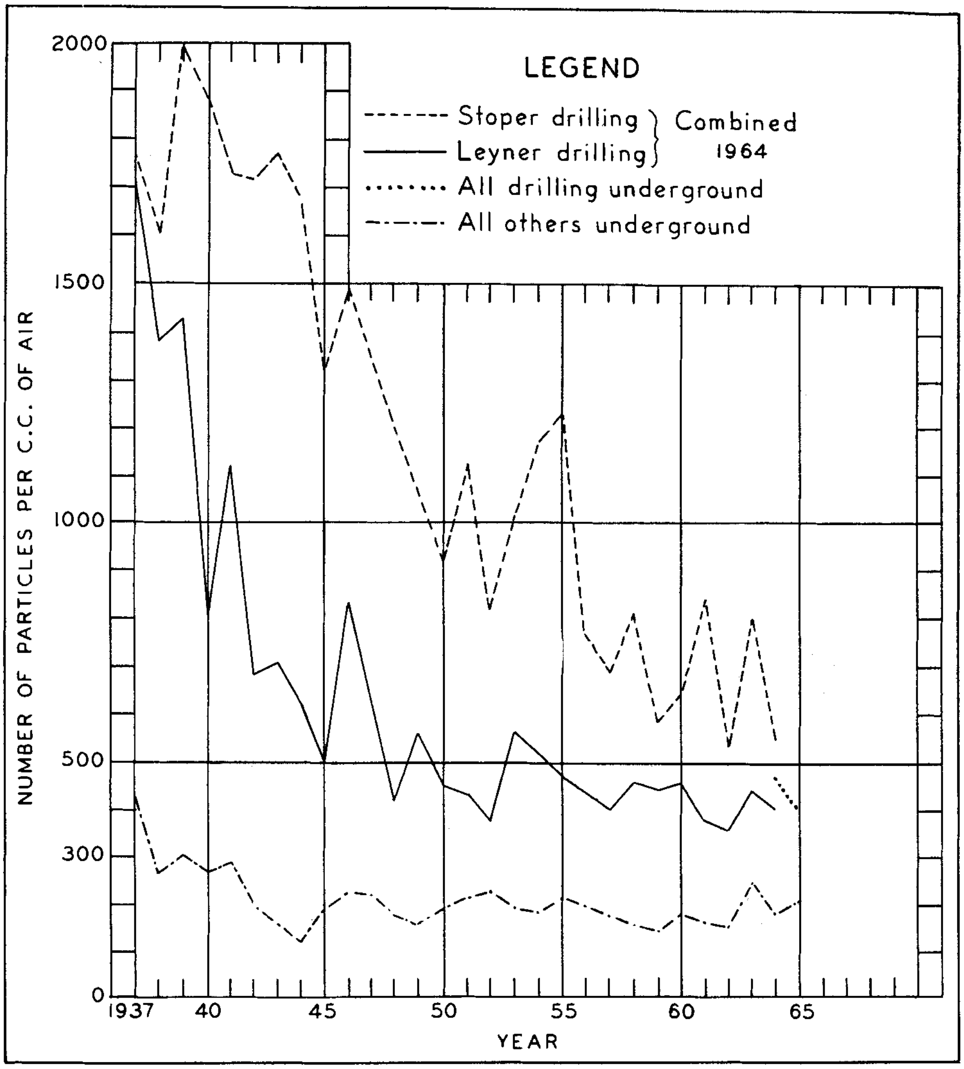


Figure 39. Average underground dust counts obtained each year since 1937.

For asbestos dust, 5 million particles per cubic foot as obtained with the midget impinger is the accepted standard. For coal dust other than anthracite, 850 particles per c.c. between 1 and 5 microns in size as measured with the thermal precipitator is the accepted standard.

(3) Drilling operations have shown consistently higher dust concentrations than other mining operations, and for this reason they are separated from the general mine average. Only 34 per cent of the surveys at drilling locations underground showed averages of less than 300 particles per c.c. of air. The vented-type fronthead machine has been tried out in the mines and has not proved entirely successful. Auxiliary ventilation to dilute the dust produced by the machine appears to be the best practice. The ventilation not only improves conditions during drilling, but also during mucking and blasting.

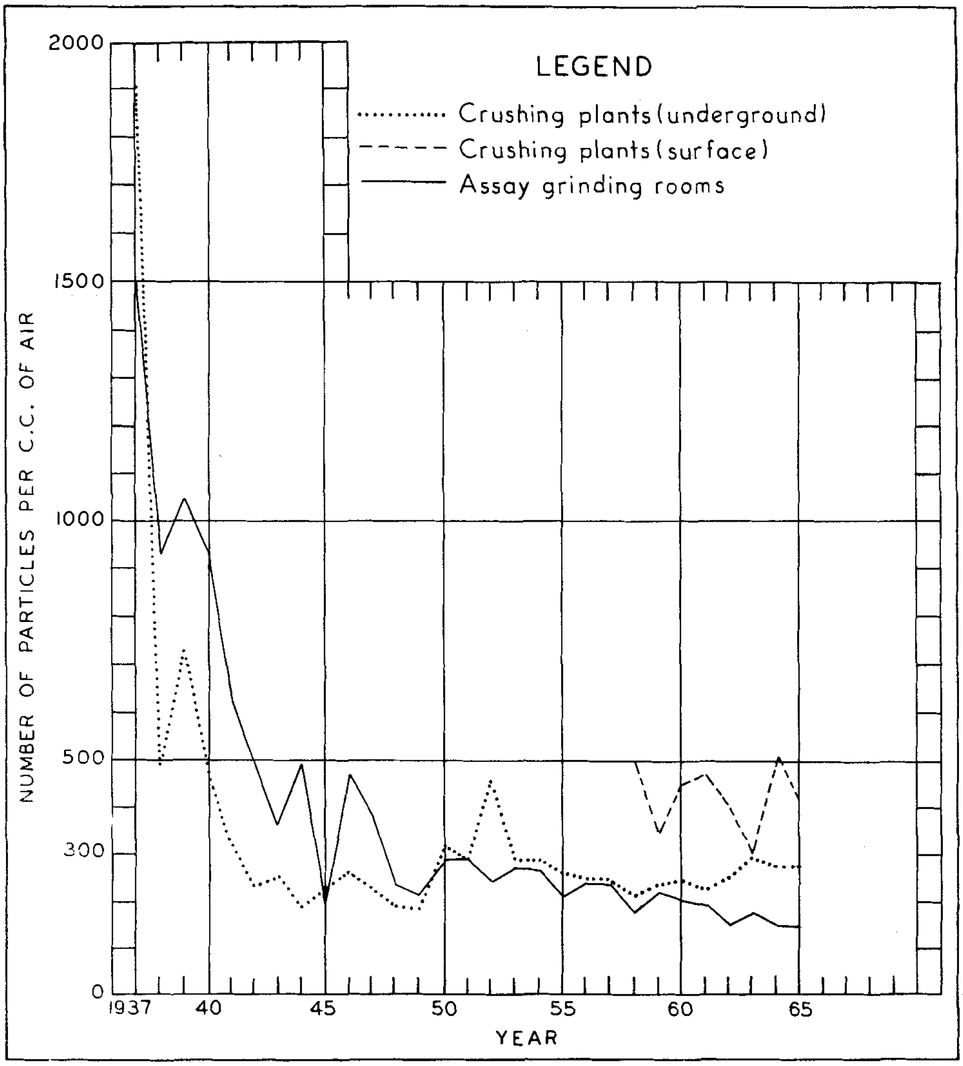


Figure 40. Average crushing and grinding dust counts obtained each year since 1937.

(4) At all other underground locations, 71 per cent of the surveys showed averages of less than 300 particles per c.c. of air. These samples represent the locations where most of the men work underground. The results show a regression from former years, indicating that more attention must be given to dust control.

(5) At crushing plants for underground mines, 57 per cent of the surveys showed less than 300 particles per c.c. of air. Exhaust systems are used in all of the plants to collect the dust from the discharge of the crushers, screens, and belt transfers.

(6) At open-pit operations the results of the dust surveys were as follows: At drilling operations in pit, 64 per cent of surveys showed less than 300 particles per c.c. of air; at all other operations in pit, 100 per cent of surveys showed less than 300 particles per c.c. of air; at crushing plants, 29 per cent of surveys showed less than 300 particles per c.c. of air.

(7) Eighty-two per cent of the surveys made in assay grinding-rooms gave averages of less than 300 particles per c.c. of air.
(8) At rock and limestone quarries and in gravel crushing plants, 80 per cent of the surveys showed less than 300 particles per c.c. of air.
(9) In the asbestos mill, 86 per cent of the samples taken were within the limit for asbestos dust of 5 million particles per cubic foot.
(10) In a survey of dust conditions at a coal company, only one location was found to be above the limit of 8.5 particles per c.c. of air between 1.0 and 5.0 microns in size.
(11) Certificates of fitness were checked at the mines, and more than 95.2 per cent were found to be in good order.
(12) Figures 39 and 40 are graphs showing the median of all the averages in various operations in the lode mines obtained each year since 1937.

SHIFTBOSS CERTIFICATES

The *Metalliferous Mines Regulation Act*, as amended in March, 1960, requires that every person employed underground be under the daily supervision of an official who is the holder of a shiftboss certificate issued under this Act. An applicant for a shiftboss certificate is required to pass an examination on the *Metalliferous Mines Regulation Act* and general safe working practices. He must have three years' practical experience or one year plus a degree in mining engineering. He must also be the holder of a mine-rescue certificate and a first-aid certificate. A fee of $5 is charged for the examination.

The Board of Examiners may grant provisional certificates under such conditions as the Board considers advisable. During 1965, 109 provisional certificates were issued, but the life of these was limited to six months rather than two years, as had been the practice in previous years. Examinations for permanent certificates were held at the following places: Wells, Merritt, Victoria, Hope, Lynx mine, Nelson, Vancouver, Prince Rupert, Osoyoos, Toby Creek, Cranbrook, Britannia Beach, Bralorne, Benson Lake, Boss Mountain, and Ucluelet. Eighty men received certificates, as follows:—

Cert. No.	Name	Date	Cert. No.	Name	Date
261	Harold A. Armour	11-1-65	285	Kjell Sandberg	3-6-65
262	Stanley James Pedley	12-1-65	286	John D. Wilkins	23-6-65
263	Robert Hugh Cameron	12-1-65	287	Clark Bellingham	23-6-65
264	Thomas Stuart Campbell	12-1-65	288	Ernest Grams	5-7-65
265	Eric William Charles Erickson	12-1-65	289	William Frederick Price	12-7-65
266	Arvid Ingvald Osing	12-1-65	290	George E. Sodja	12-7-65
267	Kenneth Joseph Mackay	12-1-65	291	Andrew George Ditto	13-7-65
268	Alvin Ohnstad	12-1-65	292	James H. McAusland	15-7-65
269	Roy Patterson Easton	12-1-65	293	Henry G. Oelfke	23-8-65
270	Donald Legault	15-1-65	294	Arpad Fustos	25-8-65
271	Willard B. Swaren	9-2-65	295	Dennis Ralph Parsons	30-8-65
272	George James Kalmakav	10-2-65	296	Walter Herbert Borth	30-8-65
273	Robert James Dealy	10-2-65	297	John Toften	30-8-65
274	Michael Paul Zubernick	15-3-65	298	Jack Keller	30-8-65
275	Harry Bruce Johnston	30-3-65	299	John Paul Rozek	30-8-65
276	Allan Percy Brooks	5-4-65	300	John Hum	1-9-65
277	Leon Roy	23-4-65	301	Elmer Mauno Pelto	7-9-65
278	John E. Millette	5-5-65	302	Richard Lofstrom	8-9-65
279	Henry George W. Wood	5-5-65	303	William George Knutsen	8-9-65
280	Daryl A. Fry	5-5-65	304	John Michael Mulvey	8-9-65
281	Ronald F. Emery	5-5-65	305	Ian Patterson	15-9-65
282	Harold May	5-5-65	306	Hans John Roehricht	28-9-65
283	Frederick M. Raleigh	26-5-65	307	James Wayne Murton	28-9-65
284	Leonard Kenneth Post	3-6-65	308	Alfred Mark Cawston	28-9-65

Cert. No.	Name	Date	Cert. No.	Name	Date
309	Barry Woodin	30-9-65	325	Magiel Fryters	24-11-65
310	Roy Clark	20-10-65	326	Owen E. Bradley	24-11-65
311	James Greer	20-10-65	327	Douglas Lyle Coley	24-11-65
312	Murray Louis Croteau	20-10-65	328	John H. Hachey	24-11-65
313	Robert J. Colthorp	20-10-65	329	Ronald Stard	24-11-65
314	John Fortais	20-10-65	330	Harold Kinakin	24-11-65
315	James Arthur Richardson	28-10-65	331	Edward A. Lawrence	24-11-65
316	Peter M. Stiles	16-11-65	332	William A. Morris	24-11-65
317	James F. Bristow	19-11-65	333	Gerard St. Germaine	24-11-65
318	Donald A. Brown	19-11-65	334	Tom Stephens Smith	24-11-65
319	Kenneth A. R. Smith	19-11-65	335	Januz Sztyler	24-11-65
320	Gerald W. Klein	19-11-65	336	William Van Staalduinen	24-11-65
321	Kelson G. Collins	24-11-65	337	William Lange	24-11-65
322	Harvey S. Rielly	24-11-65	338	Robert McD. Purdy	22-12-65
323	Benjamin Cyril Ramage	24-11-65	339	Harold Lloyd Dickie	22-12-65
324	Oscar Andrew Fred Johnsen	24-11-65	340	Dean C. Bell	22-12-65

MINE RESCUE, SAFETY, AND FIRST AID

The promotion of mine rescue and first aid continued on a high level throughout 1965. Four mine-rescue stations were maintained, with an instructor qualified in mine rescue and first aid available at each station. Each station is equipped with sufficient self-contained oxygen breathing apparatus to maintain two mine-rescue teams of six men each should any emergency in nearby mines arise. There are also sets of mine-rescue equipment maintained at various mines, either on loan from the Department or owned by the mine. In 1965 Department-owned equipment totalled 60 McCaa 2-hour apparatus and 44 Chemox 1-hour apparatus, while that owned by mining companies totalled 56 McCaa's and 75 Chemox's. Each station also has auxiliary equipment, such as all-service masks, self-rescuers, gas-detectors, inhalators, and a complete set of first-aid equipment. The district instructor makes a periodic check of mine-rescue and first-aid equipment at mines in his district.

The station at Nanaimo was re-established after the closure of the Cumberland station in 1963. It had been in existence from 1912 to 1951, but in 1963 the building was not found suitable and a mobile unit was purchased to operate from the Courthouse. Mine-rescue or first-aid classes were held at the Coast Copper, Brynnor, Britannia, Texada, Zeballos Iron, Western, and Empire Development mines. Assistance was also given at the Peace River dam project to maintain the training instituted by this project as an aftermath of a methane explosion which occurred in 1964. A total of 94 men was trained in mine rescue in the district, and in addition 81 men took refresher courses. Help and advice were given to the British Columbia Forest Service, to the Elk Falls company, and to the Cedar fire department. A mine-rescue display was shown at the Nanaimo fall fair.

The Kamloops station is a mobile unit which has operated from Kamloops since 1961. Service is given over a wide area in central British Columbia from the International Boundary to the Yukon border. Assistance in mine-rescue and first-aid training as well as inspection of equipment was given at the Bulkley Valley, Canam Copper, Giant Mascot, Boss Mountain, Utica, and Cassiar Asbestos mines. The instructor spent one week in February helping in the recovery operations necessitated by the Granduc avalanche disaster, where 26 men lost their lives.

The Nelson station is also a mobile unit which services the West Kootenay area. Mine-rescue or first-aid classes were held at the Bluebell, Canadian Exploration, H.B., Reeves MacDonald, Phoenix Copper, and Cork Province mines. Assistance was given to the Trail and Nelson fire departments in the use and care of breathing apparatus. The instructor also assisted in three road accidents.

The mine-rescue station at Fernie is maintained principally to serve the coal mines in the area, but assistance in mine-rescue training is also given to personnel of the Sullivan and Mineral King mines. First-aid classes had a total of 51 persons, while a total of 33 men were trained in mine rescue. There were no emergency calls during 1965 for the mine-rescue apparatus, but three requests for oxygen were promptly complied with.

A certificate of competency in mine-rescue work is granted to each man who takes the training course and passes the examination set by the Department. For those who take a refresher course, a sticker is given for attachment to the certificate. All mine-rescue men are also entitled to a hat emblem. In 1965, in addition to the regular teams in training, 196 men took the course and were granted certificates as listed below. This is the highest number granted in one year since the issuing of certificates in 1913.

Certificate No.	Name	Where Trained	Certificate No.	Name	Where Trained
3712	Lloyd Edward Johnston	Britannia Beach.	3756	Phill B. Williams	Giant Mascot.
3713	Malcolm Cameron Watson	Coast Copper.	3757	Norman Joseph Dircks	Giant Mascot.
3714	Roderick William Neill	Coast Copper.	3758	Ron Sutherland	Giant Mascot.
3715	John William Morris	Coast Copper.	3759	Lawrence Cheveldieff	Phoenix.
3716	Leon Roy	Coast Copper.	3760	Boyd Hardwicke	Phoenix.
3717	Phillip Clark MacLellan	Coast Copper.	3761	James Paxton	Phoenix.
3718	Toni Arthur Johnston	Coast Copper.	3762	Albert John Johnstone	Phoenix.
3719	Lou Earl Johnston	Coast Copper.	3763	Norman Varabioff	Phoenix.
3720	Angus Eric Ingram	Coast Copper.	3764	William Papove	Phoenix.
3721	Gerald Joseph Gagnon	Coast Copper.	3765	Ralph Brinley Blayney	Sullivan mine.
3722	Michael James Cannon	Coast Copper.	3766	Herbert John Cross	Sullivan mine.
3723	Gerald Leo Roy	Coast Copper.	3767	Adolf Leopold Ederer	Sullivan mine.
3724	John P. Kingsbury	Empire mine.	3768	William Joseph Hanson	Sullivan mine.
3725	Thomas Osadvik	Reeves MacDonald.	3769	Leonard Gahaird Hunt	Sullivan mine.
3726	John Edward Brown	Reeves MacDonald.	3770	Edward Augustus Herron	Sullivan mine.
3727	John MacKave	Reeves MacDonald.	3771	Donald Robert Martin	Sullivan mine.
3728	Robert Franklin Gehue	Reeves MacDonald.	3772	Percy Kenneth Mellor	Sullivan mine.
3729	Donald N. MacPherson	Reeves MacDonald.	3773	William Denzil McCormick	Sullivan mine.
3730	Victor Curley	Portage Mountain.	3774	Elmer Mauno Pelto	Sullivan mine.
3731	Edmond Alfred Cote	Portage Mountain.	3775	George Frederick Wanuk	Sullivan mine.
3732	Frank Lorne Wilson	Portage Mountain.	3776	Frederick Henry Wilkinson	Sullivan mine.
3733	Robert Earl Saar	Portage Mountain.	3777	John Duncan Wilkins	Sullivan mine.
3734	Steve Mikolcevic	Portage Mountain.	3778	Rolf Elstad	Sullivan mine.
3735	Elijah L. Murphy	Portage Mountain.	3779	Geza Gabriel Cooke	Sullivan mine.
3736	Harvey M. Thornton	Portage Mountain.	3780	George Fulton Matheson	Sullivan mine.
3737	Justus G. Jobe	Portage Mountain.	3781	Edward Herbert Holt	Sullivan mine.
3738	Alexander Barisich	Portage Mountain.	3782	Kenneth Nicholas Wocknitz	Sullivan mine.
3739	Anthony Semenuk	Portage Mountain.	3783	Alastair David MacPhail	Sullivan mine.
3740	Leonard J. Perry	Portage Mountain.	3784	David Wesley Henderson	Sullivan mine.
3741	Charles A. Robertson	Portage Mountain.	3785	James Jenkins	Sullivan mine.
3742	George Noel Hutchinson	Portage Mountain.	3786	Sergio Pasin	Mineral King.
3743	Tadeusz Grzegorczyk	Portage Mountain.	3787	Richard Hugh McMillan	Mineral King.
3744	Samuel Slobodian	Portage Mountain.	3788	Alfred Raymond Hawks	Mineral King.
3745	George S. Bosnich	Hope.	3789	Istvan Rovak	Mineral King.
3746	Ernest Stanley Ellis	Bulkley Valley.	3790	Romeo Guerino Berdusco	Michel mine.
3747	Lloyd Gething	Bulkley Valley.	3791	Howard Bruce Rankin	Michel mine.
3748	Seymour Patrick Baker	Bulkley Valley.	3792	Eugene William Lucky	Michel mine.
3749	Jerry Olson	Telkwa.	3793	Victor Arthur Caldwell	Michel mine.
3750	James H. Goss	Giant Mascot.	3794	Frederick John Caldwell	Michel mine.
3751	Robert L. Harrison	Giant Mascot.	3795	Wallace Clayton Dixon	Michel mine.
3752	Daryl A. Fry	Giant Mascot.	3796	A. Robert Chrisp	Brynnor (Kennedy Lake).
3753	Clinton A. Martindale	Giant Mascot.	3797	Rudolf Goeders	Brynnor (Kennedy Lake).
3754	Garfield R. D. Klyne	Giant Mascot.	3798	John Hum	Fry & Associates.
3755	Joseph Franciscus Kalfics	Giant Mascot.	3799	Tyyko Robert Lujanen	Fry & Associates.

Certificate No.	Name	Where Trained
3800	David Jerome Mitchell	Fry & Associates.
3801	Henry Gustav Oelfke	Fry & Associates.
3802	David Oye	Brynnor (Kennedy Lake).
3803	Maurice Page	Brynnor (Kennedy Lake).
3804	Jack Rieger	Brynnor (Kennedy Lake).
3805	James Arthur Richardson	Fry & Associates.
3806	Jens Zimmerman	Brynnor (Kennedy Lake).
3807	Gabriel Juteau	Fry & Associates.
3808	Andrew George Ditto	Estella.
3809	William Robert Steenson	Cominco.
3810	Alvin G. Westbrook	Boss Mountain.
3811	Fenand J. Belanger	Boss Mountain.
3812	Henry Graham Emms	Boss Mountain.
3813	Albert J. Skiffington	Boss Mountain.
3814	John J. Miklushichak	Boss Mountain.
3815	Harvey V. Proctor	Boss Mountain.
3816	Michael Thomas Hamilton	Boss Mountain.
3817	Stephen Lychowid	Boss Mountain.
3818	Kelson G. Collins	Boss Mountain.
3819	Barry A. Yon	Boss Mountain.
3820	Robert Torrance Wilkins	Boss Mountain.
3821	Nelson John Fraser	Boss Mountain.
3822	Robert Richard Schwartz	Boss Mountain.
3823	Bernard F. Hartinger	Boss Mountain.
3824	Ernest Klava	Boss Mountain.
3825	Charles E. Fraser	Boss Mountain.
3826	Donald Keith Sinclair	Boss Mountain.
3827	James Reginald MacKay	Boss Mountain.
3828	Jack M. Shaw	Boss Mountain.
3829	Leo John Leino	Boss Mountain.
3830	Morley Earl Willmore	Boss Mountain.
3831	Robert A. Charette	Boss Mountain.
3832	Elmer G. Jacobson	Boss Mountain.
3833	Philip Stanley Bedell	Canadian Exploration.
3834	Coburn Colwell	Canadian Exploration.
3835	Grantley A. Davidson	Canadian Exploration.
3836	John Henry Hachey	Canadian Exploration.
3837	Darwin Nai-Yiu Law	Canadian Exploration.
3838	William Morris	Canadian Exploration.
3839	Joe Staszuk	Canadian Exploration.
3840	Gerard St. Germain	Canadian Exploration.
3841	William W. Thomson	Canadian Exploration.
3842	Ralph G. Wilson	Canadian Exploration.
3843	John Wilson Abernethy	Portage Mountain.
3844	Alfred Baron	Portage Mountain.
3845	Howard Besse	Portage Mountain.
3846	Joseph G. Bohemier	Portage Mountain.
3847	Eddy Crook	Portage Mountain.
3848	Roger Caron	Portage Mountain.
3849	Clayton Campbell	Portage Mountain.
3850	Douglas Fairburn	Portage Mountain.
3851	Brian Cameron Forster	Portage Mountain.
3852	Gordon H. Godby	Portage Mountain.
3853	Albert Hockney	Portage Mountain.
3854	Gordon Hunter	Portage Mountain.
3855	Louis Holejsousky	Portage Mountain.
3856	Michael H. Hoskins	Portage Mountain.
3857	Paul Jacob	Portage Mountain.
3858	Drago Jankovic	Portage Mountain.
3859	Matyas Kubicsek	Portage Mountain.
3860	Edward Lefurgy	Portage Mountain.
3861	Don H. Long	Portage Mountain.
3862	Sinclair McNicol	Portage Mountain.
3863	Michael McLaughlin	Portage Mountain.
3864	Alexander Mann	Portage Mountain.
3865	Ralph Murphy	Portage Mountain.
3866	Ralph Milks	Portage Mountain.
3867	John Moor	Portage Mountain.
3868	Karl Meinardus	Portage Mountain.
3869	Lee Meunier	Portage Mountain.
3870	Joachim Mohr	Portage Mountain.
3871	Victor Nordal	Portage Mountain.
3872	Henry J. Poczynek	Portage Mountain.
3873	John Potvin	Portage Mountain.
3874	Urban Radeschnig	Portage Mountain.
3875	James Oren Reilly	Portage Mountain.
3876	William Swabb	Portage Mountain.
3877	James Symons	Portage Mountain.
3878	John Steinback	Portage Mountain.
3879	Robert W. Strain	Portage Mountain.
3880	Larry Sperling	Portage Mountain.
3881	Jurgen Schmidt	Portage Mountain.
3882	Mike Storozuk	Portage Mountain.
3883	Albert Edward Sage	Portage Mountain.
3884	William Tettolowski	Portage Mountain.
3885	Boris Trauner	Portage Mountain.
3886	William Thomas Wilson	Portage Mountain.
3887	Douglas H. P. Watt	Portage Mountain.
3888	Murray Croteau	Britannia.
3889	John O. Wolf	Britannia.
3890	Yvon Essiambre	Britannia.
3891	Marcel Begin	Britannia.
3892	James McFadden	Britannia.
3893	Andrew John Paulsen	Boss Mountain.
3894	Ambrose Bronis Kuiack	Boss Mountain.
3895	John Torbic	Portage Mountain.
3896	Michael John Williams	Coast Copper.
3897	Real Levasseur	Coast Copper.
3898	Victor Peter Roms	Coast Copper.
3899	Brian Wayne Thompson	Coast Copper.
3900	Dennis Roland Plante	Coast Copper.
3901	Joseph Roland Lafrance	Coast Copper.
3902	Frank Kollar	Coast Copper.
3903	Gillis Fortier	Coast Copper.
3904	Frederick Neill	Coast Copper.
3905	Robert Ernest Mills	Coast Copper.
3906	John Bolton	Coast Copper.
3907	Michael Hojw	Coast Copper.
3908	William Gordon Clarke	Dept. of Mines and Pet. Res.

The mine safety associations in different centres of the Province, sponsored by the Department of Mines and Petroleum Resources and aided by company officials, safety supervisors, Inspectors of Mines, and mine-rescue instructors, continued to promote mine-rescue, first-aid, and safety education in their respective districts.

The Bridge River Valley Mine Safety Association held its 23rd annual competition at Bralorne on May 1, 1965. This was mainly a first-aid meet with events for juniors and seniors. The senior event had good spectator appeal in that injuries were sustained from the collapse of a scaffold. The winner of this event was a team captained by C. Simons. There were two teams in the mine-rescue event, which was won by a team captained by H. Corrigan.

The Vancouver Island Mine Safety Association held its 51st annual competition at Nanaimo on May 29, 1965. Two teams competed in the mine-rescue event—one each from Texada iron and Coast Copper mines. The winning team was from the Texada iron mine and was captained by D. Legault.

The West Kootenay Mine Safety Association held its 19th competition at Nelson on June 5, 1965. Seven teams took part in the mine-rescue event—two each from the Bluebell and Canadian Exploration mines and one each from H.B., Phoenix Copper, and Reeves MacDonald mines. A Bluebell team captained by B. Ramage took first place.

The Central British Columbia Mine Safety Association held its 17th annual competition at Kamloops on June 12, 1965. Five teams took part in the mine-rescue event—one each from Bethlehem Copper, Giant Mascot, Craigmont, Bralorne, and Cariboo Gold Quartz mines. The Giant Mascot team captained by R. Emery took first place.

The East Kootenay Mine Safety Association held its 44th annual competition at Fernie on June 19, 1965. Five teams took part in the mine-rescue event—two each from the Sullivan mine and the Michel Colliery, and one from the Mineral King mine. A Sullivan team captained by C. Kinrade took first place.

At all four preceding meets, competitions were held in first-aid as well as mine-rescue work. In these competitions, events were held for women and juniors. There were entries in these competitions from industries and organizations not necessarily connected with mining.

The 10th Provincial mine-rescue competition was held at Nanaimo on June 26, 1965. The winning teams from Nanaimo, Nelson, Kamloops, and Fernie competed for a trophy and silver trays. The event was won by the Sullivan team of The Consolidated Mining and Smelting Company of Canada, Limited, captained by C. Kinrade. The team also won a silver cup which has been donated by the International Union of Mine, Mill and Smelter Workers for annual competition for mine-rescue teams from metalliferous mines. In conjunction with this competition, the Workmen's Compensation Board sponsored the ninth Provincial men's first-aid competition, and teams competed which had won local events at Nanaimo, Nelson, Kamloops, Fernie, Vancouver, Victoria, and Terrace. The winning team was from the Vancouver city police, captained by G. W. Carson.

JOHN T. RYAN TROPHY

The John T. Ryan safety trophies were set up in 1941 to promote safety in coal and metal mines. Administration of the awards is by the Canadian Institute of Mining and Metallurgy. In 1963 changes were made in the competition rules which required of the metalliferous mines that sufficient calendar years be submitted by each entering mine to complete 1,000,000 man-hours. In 1965 the definition of an accident was altered to include all injuries which involved a loss of time of more than three calendar days not including the day of the accident. In 1965 the regional trophy for metalliferous mines was won by the Bluebell mine of The Consolidated Mining and Smelting Company of Canada, Limited, with an accident frequency of 7.1 per 1,000,000 man-hours.

In coal-mining the Michel Colliery of Crows Nest Industries Limited won the regional trophy with an accident frequency of 75.8 per 1,000,000 man-hours.

WEST KOOTENAY MINE SAFETY ASSOCIATION TROPHY

The West Kootenay Mine Safety Association in 1951 donated a safety trophy for annual competition in order to encourage and promote safety in small mines. At first the trophy was restricted to mines in the West Kootenay area, but in 1956 this restriction was removed.

The award is made to the mine having the lowest accident rate and working a total of from 2,500 to 30,000 shifts per year, one-third of these having been worked underground. An accident is taken as one which involved more than three days' loss of time.

In 1965 the award was won by the Reeves MacDonald mine.

SAFETY COMPETITION, OPEN-PIT MINES AND QUARRIES

In 1961 the Department of Mines and Petroleum Resources instituted a safety competition for the open-pit and quarry industry and put up awards and a trophy for annual competition. In 1965 an additional trophy was put up so that there were two competitions—the "A" group for those pits and quarries having under 200,000 man-hours per year, and the " B " group for those over 200,000 man-hours per year. An accident is taken as one which has been determined as compensable by the Workmen's Compensation Board. For those operations which amass over 15,000 man-hours ending in the competition year, certificates of achievement are given when no compensable accidents occur during this period.

In 1965 the "A" trophy was won by three quarries, each with accident frequency of zero—the Mary Hill sand and gravel quarry of Ocean Cement Limited, the limestone quarry of Lafarge Cement of North America Ltd., and the limestone quarry of Ideal Cement Company Limited. The " B " trophy was won by the Cassiar Asbestos Corporation Limited with an accident frequency of 2.8 per million man-hours. Thirteen quarries received certificates of achievement, three of these being those mentioned for the "A" trophy above and the other 10 as follows: Cobble Hill quarry of the B.C. Cement Division of Ocean Cement Limited, Abbotsford Gravel Sales Ltd., Highland Sand and Gravel Division of Ocean Cement Limited, Imperial Limestone Limited, Ivan A. McKay operation at the Phoenix mine, Langley gravel pit of Deeks-McBride Ltd., Pitt River quarry of Ocean Cement Limited, Pooley Bros. operation at the Endako mine, Producers Sand and Gravel Division of Ocean Cement Limited, and Routledge Gravel Ltd.

Coal

By Robert B. Bonar, Deputy Chief Inspector of Mines

CONTENTS

PRODUCTION

The gross output in short tons of the coal mines of the Province for 1965 was 1,106,672 tons, a decrease of 14,815 tons or 1.32 per cent from 1964. A total of 334,537 tons came from strip mines at Michel Colliery and Coleman Collieries.

The Vancouver Island District production was 42,326 tons, a decrease of 22,064 tons or 34.27 per cent from 1964.

There were no operating mines in the Nicola-Princeton District during 1965.

The Northern District production was 5,900 tons, a decrease of 911 tons or 13.37 per cent from 1964.

The East Kootenay District production was 1,058,446 tons, an increase of 8,160 tons or 0.78 per cent over 1964.

Output and per Capita Production, 1965

Colliery and Mine	Gross Output Mined during Year (Tons)	Days Worked	Total Number of Employees	Daily Output per Employee (Tons)	Yearly Output per Employee (Tons)	Number of Employees Underground	Daily Output per Underground Employee (Tons)	Yearly Output per Underground Employee (Tons)
Tsable River Colliery	41,065	242	71	2.39	568	53	3.20	775
Midan Mine	419	120	1	3.49	419	1	3.49	419
Loudon No. 6 Mine	260	164	1	1.58	260	1	1.58	260
Lewis No. 2 Mine (Timberlands)	344	105	2	1.64	172	2	1.64	172
Undun No. 4 Mine	238	200	1	1.19	238	1	1.19	238
Bulkley Valley Collieries	5,900	241	11	2.22	536	8	3.05	737
Michel Colliery (underground)	723,909	234	552	5.60	1,311	339	9.12	2,135
Michel Colliery (strip)	199,347	254	—	—	—	—	—	—
Coleman Collieries (strip)	135,190	—	10	—	13,519	—	—	—

District Output and per Capita Production, Underground Mines, 1965

District	Gross Output Mined during Year (Tons)	Total Number of Employees at Producing Collieries	Yearly Output per Employee (Tons)	Number of Men Employed Underground in Producing Collieries	Yearly Output per Underground Employee (Tons)
Vancouver Island	42,326	76	557	58	730
Northern	5,900	11	536	8	737
East Kootenay	723,909	552	1,311	339	2,135
Whole Province	772,135	639	1,208	405	1,907

Output per Man-shift, Underground Mines, 1956–65

Year	Man-shifts[1]	Tonnage	Average per Man-shift (Tons)
1956	307,821	1,100,434	3.57
1957	226,536	945,848	4.17
1958	204,148	728,722	3.56
1959	171,608	646,788	3.77
1960	210,254	766,581	3.66
1961	213,962	877,085	4.10
1962	160,418	805,051	5.02
1963	170,287	866,481	5.09
1964	158,638	960,999	6.05
1965	149,695	772,135	5.16

[1] Includes both surface and underground workers.

COLLIERIES OF BRITISH COLUMBIA, 1965—PRODUCTION AND DIISTRIBUTION, BY COLLIERIES AND BY DISTRICTS (SHORT TONS)

Mine	Gross Output	Washery Refuse	Net Output	Used under Companies' Boilers, etc.	Used in Making Coke	Stocks: On Hand First of Year	Stocks: On Hand Last of Year	Stocks: Added To	Stocks: Taken From	Sales: In Canada	Sales: In U.S.A.	Sales: Elsewhere	Sales: Total Sales	Total Coal Sold and Used[1]
Vancouver Island District														
Comox Mining Company Ltd.—Tsable River Colliery	41,065	......	41,065	......	......	12,595	23,836	11,241	......	29,824	......	......	29,824	29,824
Midan mine	419	......	419	......	......	......	......	......	......	419	......	......	419	419
Loudon No. 6 mine	260	......	260	......	......	......	......	......	......	260	......	......	260	260
Lewis No. 2 mine (Timberlands)	344	......	344	......	......	......	......	......	......	344	......	......	344	344
Undun No. 4 mine	238	......	238	......	......	......	......	......	......	238	......	......	238	238
Totals, Vancouver Island District	42,326	......	42,326	......	......	12,595	23,836	11,241	......	31,085	......	......	31,085	31,085
Northern District														
Bulkley Valley Collieries	5,900	......	5,900	......	......	......	......	......	......	5,900	......	......	5,900	5,900
East Kootenay District														
Crows Nest Industries Ltd.—Michel Colliery (underground and strip)	923,256	156,220	767,036	15,314	205,929	52,195	22,477	......	29,718	171,820	998	402,693	575,511	796,754
Coleman Collieries—Tent Mountain mine (strip)	135,190	18,166[2]	117,024	......	......	......	......	......	......	117,024	......	......	117,024	117,024
Totals, East Kootenay District	1,058,446	174,386	884,060	15,314	205,929	52,195	22,477	......	29,718	288,844	998	402,693	692,535	913,778
Coal														
Grand totals for Province	1,106,672	174,386	932,286	15,314	205,929	64,790	46,313	11,241	29,718	325,829	998	402,693	729,520	950,763
Coke														
Crows Nest Industries Ltd.—Michel Colliery	157,496	......	157,496	......	......	16,319[3]	6,544	......	9,775	96,059	71,212	......	167,271	......

[1] Includes coal used in making coke and coal used under stationary and locomotive boilers, etc.
[2] Estimated.
[3] Includes 7,000-ton adjustment to stockpile.

Collieries of British Columbia, 1965—Men Employed, Distribution by Collieries and by Districts

Mine	Supervision and Clerical			Miners			Helpers			Labourers			Mechanics and Skilled Labour			Total Men Employed		
	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.
Vancouver Island District																		
Comox Mining Company Ltd.—Tsable River Colliery	4	3	7	37	—	37	—	—	—	12	11	23	—	4	4	53	18	71
Midan mine	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	1	—	1
Loudon No. 6 mine	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	1	—	1
Lewis No. 2 mine (Timberlands)	—	—	—	2	—	2	—	—	—	—	—	—	—	—	—	2	—	2
Undun No. 4 mine	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	1	—	1
Totals, Vancouver Island District	4	3	7	42	—	42	—	—	—	12	11	23	—	4	4	58	18	76
Northern District																		
Bulkley Valley Collieries	2	1	3	4	—	4	2	—	2	—	1	1	—	1	1	8	3	11
East Kootenay District																		
Crows Nest Industries Ltd.—																		
Michel Colliery (underground)	28	48	76	138	—	138	—	—	—	155	121	276	18	44	62	339	213	552
Michel Colliery (strip)[1]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coleman Collieries Ltd.—Tent Mountain mine (strip)	—	1	1	—	—	—	—	—	—	—	7	7	—	2	2	—	10	10
Totals, East Kootenay District	28	49	77	138	—	138	—	—	—	155	128	283	18	46	64	339	223	562
Grand totals for Province	34	53	87	184	—	184	2	—	2	167	140	307	18	51	69	405	244	649

[1] Removal of overburden and coal by contractor.

NOTE.—U.=underground; A.=above ground; T.=total.

Coal-preparation Plants

There were no changes or additions to existing coal-preparation plants at the various collieries in 1965. For full details of plants *see* 1954, 1962, and 1964 Annual Reports.

Coke-making

Coke is made at only one plant in the Province, that of the Michel Colliery, Crows Nest Industries Limited, Fernie.

LABOUR AND EMPLOYMENT

In 1965, 649 persons were employed in and about the coal mines of the Province, a decrease of 64 from 1964. Because of the five-day week in force throughout the Province and the legal holidays, the maximum number of working-days at the larger mines was 242. In the Vancouver Island District the Tsable River mine worked 242 days. In the East Kootenay District the Michel Colliery worked 234 days.

COMPETITION FROM COAL PRODUCED OUTSIDE OF BRITISH COLUMBIA

In 1965 the shipment of Alberta coal, briquettes, and char to British Columbia totalled 276,608, 3,137, and 23,165 tons respectively.

The following table shows the amount of Alberta coal brought into British Columbia during the past 10 years:—

Year	Short Tons	Year	Short Tons
1956	860,329	1961	321,909
1957	672,527	1962	283,651
1958	532,911	1963	262,433
1959	437,118	1964	261,990
1960	379,668	1965	276,608

Of the 729,520 tons of British Columbia coal marketed, 152,806 tons was sold for domestic and industrial use in Alberta, Saskatchewan, Manitoba, and Ontario; 998 tons was exported to the United States; and 402,693 tons was exported to Japan.

The amount sold for domestic and industrial use in the Province was 173,023 tons.

ACCIDENTS IN AND AROUND COAL MINES

In 1965 there were two fatal accidents, the same number as occurred in 1964. The number of fatal accidents per 1,000 persons (underground and strip-mine personnel) employed was 3.08, compared with 2.80 in 1964, 1.33 in 1963, 0.00 in 1962, 6.37 in 1961, 0.00 in 1960, 1.89 in 1959, 0.00 in 1958, 1.45 in 1957, and 4.39 in 1956.

The number of fatal accidents per 1,000,000 gross tons of coal (underground and strip-mine coal) produced was 1.87 compared with 1.71 in 1964.

The following tables classify the accidents in coal mines in 1965:—

Accidents Classified as to Occupation

Occupation	Number of Accidents	Percentage of Accidents
Underground—		
Miners	30	25.87
Drillers and facemen	27	23.28
Haulage and conveyor men	26	22.41
Trackmen and mechanics	6	5.18
Supervisors	6	5.18
Timbermen	5	4.31
Coal-cutters	5	4.31
Miscellaneous	3	2.58
Surface—		
Shops	2	1.72
Surface	—	—
Preparation and coke-ovens	6	5.17
Miscellaneous	—	—
Totals	116	100.00

Accidents Classified as to Cause

Cause	Number of Accidents	Percentage of Accidents
Fall of ground	24	20.68
Fall of material and flying material	8	6.90
Lifting and handling equipment and material	30	25.87
Machinery and tools	25	21.55
Slipped and tripped	20	17.24
Falling off staging and platforms	5	4.31
Miscellaneous	4	3.45
Totals	116	100.00

Accidents Classified as to Injury

Injury	Number of Accidents	Percentage of Accidents
Head and neck	12	10.35
Eyes	4	3.45
Trunk	36	31.03
Back	17	14.65
Arms	4	3.45
Hands and fingers	15	12.93
Legs	24	20.69
Feet	4	3.45
Toes	—	—
Totals	116	100.00

COMPENSABLE[1] ACCIDENTS, INCLUDING FATAL ACCIDENTS RELATED TO TONS MINED AND MEN EMPLOYED IN AND ABOUT COAL MINES

Year	Number of Accidents	Number of Persons Employed	Frequency per 1,000 Persons	Tons Mined (Gross)	Tons Mined per Accident
1956	385	1,366	282	1,589,398	4,129
1957	340	1,380	246	1,221,766	3,593
1958	214	1,086	197	882,962	4,126
1959	189	1,056	179	757,628	4,009
1960	235	1,182	198	844,500	3,593
1961	219	942	232	1,018,832	4,652
1962	134	776	173	912,837	6,812
1963	135	748	180	965,809	7,154
1964	134	713	188	1,121,487	8,369
1965	116	649	179	1,106,672	9,540

[1] Compensable accident means an injury causing a loss of more than three days work not including the day of the accident.

In 1965 there were two fatal accidents at the mines in the Province, both of which occurred underground.

John Grabowski, aged 41, single, and employed as a miner at the Balmer South mine of Crows Nest Industries Limited, was fatally injured by a fall of rock and coal at about 8 p.m. on February 18, 1965.

The accident occurred at the intersection of a room and crosscut, both about 16 feet wide and 9 feet high. Three-piece timber sets in this area were about 2 feet apart. Entrance to the crosscut and to the working-place opposite the crosscut was formed by erecting a bridge-stick and removing the legs of the collars supported by the bridge-stick. The deceased was one of a continuous-miner crew, and at the time of the accident was assisting other members of the crew to erect a set of timbers at the face of the new roadway that had been started opposite the crosscut and had been advanced about 11 feet. Suddenly the bridge-stick forming the entrance to the new working-place broke, causing the whole intersection to collapse. Grabowski was trapped beneath the cave while another workman was caught at the edge. The cave was of large dimension, and it was estimated over 80 tons of rock and coal fell from the roof. The continuous miner was not working at the time of the accident but it was completely buried. Rescue operations were immediately begun with the release of Grabowski's partner, who suffered a dislocated hip and fractured leg. Grabowski was not recovered until 10.30 p.m. It was the doctor's opinion that death was due to asphyxiation.

The bridge-stick, the failure of which caused the accident, was 20 feet long, 18 feet 6 inches between notches, and 14 inches in diameter. It had been erected the day before the accident. There apparently was no warning other than a loud crack when the bridge-stick broke.

Bennett Komenac, aged 43, married, and employed as a continuous-miner operator in the Balmer South mine of Crows Nest Industries Limited, was fatally injured on September 22, 1965, by a fall of rock.

On the day of the accident, Komenac and six other men, including the fireboss, were engaged in driving a development heading with a Joy CM-4 continuous miner. The heading was approximately 17 feet wide, and because of the dip of the seam was 6 feet high on the low side of the working-place and 15 feet high on the upper side. The supports consisted of three-piece timber sets, with lagging set above the collars at distances varying from 3 to 4 feet apart. The method of mining was to mine the coal in a series of 5-foot " bites " and load into a shuttle car, which in turn delivered it to a belt-conveyor system. Timber was brought in and set after each cut, the jib of the miner being used to lift the collar up to the roof, whereupon the legs on the set were then placed into position. Just previous to the accident a wedge of coal on the high side of the heading had been blasted down and the coal loaded out. The miner was then used to lift the collar into position and the low-side leg set. Then Komenac and two other workmen began to put up the high-side leg when a fall of rock occurred which struck Komenac on the head and shoulders, fatally injuring him.

After the accident it was found that a piece of rock, approximately 24 inches long, 11 inches wide, and 5 inches thick had fallen away from a slip in the roof.

EXPLOSIVES

The following table shows the quantity of explosives used in underground coal mines in 1965, together with the number of shots fired, tons of coal produced per pound of explosive used, and the average number of pounds of explosive per shot fired (these quantities include all the explosives used for breaking coal and rock in coal mines):—

Vancouver Island District

Colliery	Quantity of Explosives Used (Lb.)	Coal Mined (Tons)	Total Number of Shots	Average Tons per Pound of Explosives Used	Average Pounds of Explosives per Shot Fired
Tsable River Colliery (Comox Mining Company Limited)	30,500	41,065	32,500	1.34	0.94
Midan mine	100	419	100	4.19	1.00
Loudon No. 6 mine	300	260	430	0.87	0.70
Lewis No. 2 mine (Timberlands)	500	344	340	0.69	1.47
Undun No. 4 mine	150	238	200	1.52	0.75
Totals for district	31,550	42,326	33,570	1.34	0.94

Northern District

Bulkley Valley Collieries	6,000	5,900	2,100	0.98	2.85

East Kootenay District

Michel Colliery	28,108	723,909	21,560	25.75	1.30

Province

Totals for Province	65,658	772,135	57,230	11.76	1.15

Quantity of Different Explosives Used

	Lb.
Monobel of different grades	63,856
Permissible rock powder	1,802
Total	65,658

MACHINE-MINED COAL

In 1965 mining-machines produced approximately 582,654 tons or 75.46 per cent of the total output from underground mining. A total of 334,537 tons of strip-mined coal was removed by mechanical means.

SAFETY LAMPS

There were 583 safety lamps in use in the mines of the Province. Of this number, 529 were approved electric lamps, mostly of the Wheat type.

Approved Safety Lamps—Electric and Flame

The following is a list of approved safety lamps, electric and flame:—

The Wolf lamp, flame type.

The Koehler lamp, flame type.

The Edison electric lamp (cap) under Approval No. 18 of the United States Bureau of Mines, and all Edison lamps up to and including Model M-S, carrying the Approval 6D-34 of the United States Bureau of Mines, and Mines and Technical Surveys, Canada, Certificate 39-2 Coal Mines.

The Wheat electric lamp and having Approval No. 20, as issued by the United States Bureau of Mines.

The Wheat electric lamp and having Approval No. 6D-30, as issued by the United States Bureau of Mines.

The Wolf electric lamp, No. 830c.

The electric lamp manufactured by the Portable Lamp and Equipment Company, under Approval No. 27 of the United States Bureau of Mines.

M.S.A. single-cell trip lamp, carrying United States Bureau of Mines Approval No. 1009, approved for use on haulage trips in mines.

The Davis M.L. model pneumatic electric lamp.

ELECTRICITY

Electricity is used for various purposes on the surface and underground at three collieries. A total of 14,584 horsepower was used in and about these mines. Detailed information as to how and where this power was used is given in the report of the Senior Electrical Inspector of Mines.

INSPECTION COMMITTEES

The provisions of the *Coal Mines Regulation Act,* section 65, General Rule 19, require that an inspection committee of workmen shall inspect the mine regularly on behalf of the workmen and make a true report of the conditions found. In all the larger mines of the Province this rule is fully observed, and copies of the report are sent to the Inspectors for the district. The work of these committees is valuable and assists in furthering the interests of safety at the various mines.

COAL DUST

The danger of accumulations of coal dust on the roadways and in the working-places is fully realized, and as a rule the regulations regarding the control of coal dust are adequately carried out. Large quantities of limestone dust are used continually in the larger mines to combat this hazard. It is used in the roadways, working-places, and for the tamping of shots.

Dust samples are taken regularly from roof, sides, and floor of mine roadways and analysed. The reports of the analyses are forwarded to the District Inspector each month.

DIESEL LOCOMOTIVES

Since August, 1950, diesel locomotives have been permitted in coal mines in British Columbia.

MILLISECOND DELAY DETONATORS

In February, 1951, an amendment to the *Coal Mines Regulation Act* was passed to allow, with permission of the Chief Inspector, more than one shot to be fired at one time in any coal mine or district of a mine. For further details *see* 1954 Annual Report.

DANGEROUS OCCURRENCES

On May 3, 1965, traces of carbon monoxide ranging from 0.01 to 0.13 per cent were round in the workings of the Upper "A" South mine, Michel Colliery. The workmen were withdrawn immediately, and no one was injured. Subsequent investigation disclosed that the gases were escaping from an old area of workings in the adjoining "A" West mine, which was abandoned and sealed off in 1963 because of suspected gob heating. Further mining operations in the Upper "A" South mine were discontinued. The ventilation was reversed to clear the contaminated area so that a large quantity of mine equipment could be salvaged before the mine was abandoned.

On June 11, 1965, a short rubber insulated flexible electric cable on the cutting-head of a continuous miner was squeezed and damaged between the motor frame and traction gear reducer while the machine was operating at the face of a pillar extraction in the No. 1 Incline section, "A" North mine, Michel Colliery. A flash occurred but no one was injured, and the electrical controls isolated the current from the machine immediately. The cable was an integral part of the machine, and it is suspected that it was too long.

On June 16, 1965, the coupling plug of a trailing cable used for supplying power to a new hoist on the No. 1 slope, Balmer South mine, Michel Colliery, ruptured and blew apart when the circuit was first energized. A flash occurred but no one was injured, and the isolating controls functioned immediately. It is suspected that moisture had entered the plug before it was connected to the hoist control.

On August 20, 1965, an ignition of methane gas occurred at the face of the No. 5 incline, Balmer South mine, Michel Colliery, during the operation of a continuous miner. It is suspected that a small pocket of gas had accumulated near the roof and was ignited by a spark or sparks caused by the machine picks coming in contact with the rock roof.

On November 11, 1965, at about 5.30 p.m., smoke was observed to be issuing from the fan-house at the Tsable River mine, Comox Mining Company Limited. Investigation showed that the oil-filled compensator (starting switchgear) was on fire. The oil had run out of the compensator and was burning on the floor of the fan-house, thereby damaging the fan motor. The building, being fireproof, was not damaged.

On December 10, 1965, the main surface fan-house of the abandoned Upper "A" South mine, Michel Colliery, was completely destroyed by fire of unknown origin. The damage was confined to the building as the fan and other equipment had been removed earlier in the year.

On December 15, 1965, a shuttle-car electric trailing cable was damaged in a crosscut off No. 3 Incline, "A" North mine, Michel Colliery, when it was struck by a run-away roll of conveyor belting which was being unloaded on the incline above. A flash occurred but no one was injured, and the isolating controls functioned immediately.

BUMPS AND OUTBURSTS

There were no bumps or outbursts reported from any of the coal mines in the Province during 1965.

PROSECUTIONS

There were no prosecutions reported from any of the coal mines in the Province during 1965.

SUPERVISION OF COAL MINES

During 1965 eight companies operated mines, employing 405 men underground. In the supervision of underground employees there were 2 managers, 10 overmen, and 31 firebosses, or approximately 1 official for every 9 men.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS

First-, Second-, and Third-class Certificates and Mine Surveyors' Certificates

The Board of Examiners, formed on July 10, 1919, consists at present of R. B. Bonar, Deputy Chief Inspector of Mines, chairman and secretary; A. R. C. James, Inspector of Mines, member; and D. R. Morgan, Inspector of Mines, member.

The examinations are held at least one a year and more often if necessary. Examinations were held at the Victoria centre on May 20, 1965.

The total number of candidates at these examinations were as follows: First-class certificate, one (passed). The successful candidate was Irving Morgan.

All officials, before engaging in multiple blasting with millisecond delay detonators, are required to obtain a permit to do so from the Board of Examiners (Coal-mine Officials). This permit is issued only after the applicant has successfully passed oral and practical examinations in such work.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act provides that every coal-miner shall be the holder of a certificate of competency as such. Examinations are held as circumstances warrant in coal-mining districts, and no certificate is granted where the candidate fails to satisfy the Board as to his fitness, experience in a coal mine, and a general working knowledge of the English language.

During 1965, 10 candidates were successful in obtaining coal-miners' certificates. In addition to the certificates granted above, substitute certificates were issued to those who had lost their original certificates.

The Board of Examiners desires to thank the different coal-mining companies for use of their premises for the holding of examinations where necessary.

NOTES ON COAL MINES

VANCOUVER ISLAND INSPECTION DISTRICT

By R. B. Bonar

The gross output of coal from the Vancouver Island Inspection District was 42,326 tons, a decrease of 22,064 tons or 34.27 per cent from the 1964 output. Only one large mine, the Tsable River mine, is now in production on the Island. Operations in the once important Nanaimo coalfield are now restricted to four very small mines, providing employment for no more than five men. These mines operate in outcrops, pillars, and barriers left during earlier working.

The Island coal-mining industry has suffered a rapid decline in the past few years. Production has declined over 85 per cent since 1951. This condition has resulted from loss of markets due to competition from other fuels, high cost of production, and from the depletion of economic reserves in the Nanaimo and Comox coalfields.

The annual mine-rescue and first-aid meet organized by the Vancouver Island Mine Safety Association was held at Nanaimo on Saturday, May 29th. Two teams, one from Coast Copper mine and one from Texada mine, participated in the mine-rescue competition, and a very high standard of performance was maintained. The winning team was the Texada mine team, captained by D. Legault.

Nanaimo (49° 123° S.W.)

Midan Mine

The present operation was opened up by a slope started to the left of the old Chambers No. 5 mine slope to recover a fair-sized pillar of coal left from previous working of the old Extension Colliery. The pillar was skipped on the low side to form a haulage road. Total production in 1965 was 419 tons over a working period of 120 days with a crew of one man. Working conditions were found to be satisfactory in the course of inspections. No accidents were reported.

Lewis Mine

Glyn Lewis, operator and fireboss. The property comprises two small mines operating in the Wellington seam in a small area of outcrop coal that was left when No. 8 mine was abandoned by Canadian Collieries (Dunsmuir) Limited. The seam outcrops on the side of a ridge parallel to and immediately south of the Nanaimo River valley at an elevation of 540 feet above sea-level. The coal measures dip southward at 8 degrees. The two mines are one-third of a mile apart.

The new mine, which commenced production in May, 1951, is in Range 1, Section 2, of the Cranberry district. It operates in an area of coal outcrop about 1 acre in extent, which is bounded on the west by a thrust fault that also forms the western boundary of the old No. 8 mine. The seam is 6 feet thick, including two thin rock bands.

The coal is blasted off the solid and hand-loaded into cars which are hauled to the surface by a small hoist driven by a gasoline-operated engine. A shaker screen sorts the coal into lump, nut, and pea sizes. Total production in 1965 was 344 tons over a working period of 105 days with a crew of two men. Working conditions were found to be satisfactory and no accidents were reported.

Undun No. 4 Mine J. Unsworth, operator and fireboss. This new mine was started near the portal of the Undun No. 3 mine and is driven in the opposite direction, to the south, in an endeavour to contact an outcrop pillar of coal suspected to have been left in the earlier working of this area. The pillar was encountered, and a skip is being taken off the inside to form a haulage road.

NORTH WELLINGTON (49° 124° S.E.)

Loudon No. 6 Mine R. B. Carruthers, operator and fireboss. This mine is about 1 mile southeast of Wellington and has been opened up by a flat-dipping slope driven in a small area of outcrop coal in the No. 2 Upper Wellington seam adjacent to the old No. 9 mine workings. The top is blasted off the solid and stowed. The bottom 20 inches to 2 feet of coal is broken up with light shots and hand-loaded into cars which are hauled to the surface by a small gasoline-powered hoist. Production in 1965 amounted to 260 tons over a working period of 164 days with a crew of one man. Working conditions were found to be satisfactory during the course of inspections, and no accidents were reported.

COMOX (49° 124° N.W.)*

Comox Mining Company Limited.—S. J. Lawrence, president; G. Dutfield, vice-president; P. F. Grundy, secretary. Head office address, P.O. Box 8, Union Bay, B.C.

Tsable River Mine.—S. J. Lawrence, manager; James Cochrane, overman.

In 1965 production continued to be from previously unworked areas and from pillars left in former workings in the vicinity of No. 3 and No. 4 left levels. In November, preparations were made to mine the pillar on the left side of No. 3 right counterlevel. The water level in the abandoned section of the mine was maintained at a point 150 feet below No. 4 right level by means of an electrically driven turbine pump.

Production in 1965 was 41,065 tons, a 34.5-per-cent decline from the 1964 production. The working force declined during the year from 90 men in January to 52 men in December. In the present working area of the mine, the seam contains several rock bands of varying thickness and relative position; this has considerably increased the problem of mining an adequate tonnage of clean coal. Joy loaders and a coal-cutter have been used to some extent, but most of the coal has been hand-loaded onto shaker conveyors. Electric multiple blasting with millisecond delay detonators is used throughout the mine.

First-aid arrangements were maintained at a satisfactory standard, and sufficient mine-rescue equipment was stationed at the mine in readiness for emergencies.

Conditions were usually found satisfactory in the course of inspections.

EAST KOOTENAY INSPECTION DISTRICT

By D. R. Morgan

The gross production of coal from the East Kootenay Inspection District during 1965 was 1,058,446 tons, an increase of 8,160 tons or 0.78 per cent more than was produced in 1964. There were two companies in operation, and most of the activities were directed to the Michel Colliery, which is owned and operated by Crows Nest Industries Limited (formerly The Crow's Nest Pass Coal Company

* By A. R. C. James.

Limited). The colliery produced 923,256 tons, a decrease of 55,979 tons or 5.72 per cent from 1964. The remainder of the production was obtained by Coleman Collieries Limited, operating a large strip mine on the interprovincial boundary on Tent Mountain, near Corbin. These workings are on both sides of the British Columbia-Alberta border and are worked from the Alberta side. The production of coal from the British Columbia side during 1965 was 135,190 tons, an increase of 64,139 tons or 90.27 per cent more than was produced by the same operation in 1964. A third company, Pacific Coal Limited, conducted an exploration programme on a coal property in the Morrissey Creek area southeast of Fernie during part of 1965, and stockpiled a small quantity of development coal outside the portals of a number of prospect adits, but did not enter into production.

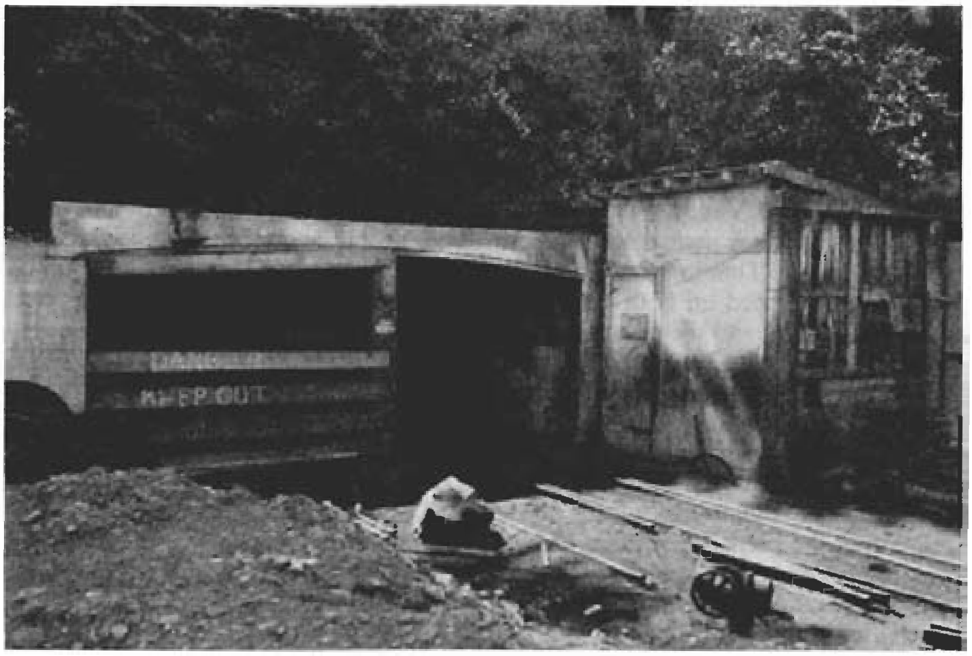
The accident statistics at Michel Colliery during 1965 showed an increase in severity and decrease in frequency rates. Two workmen were fatally injured, both by falls of rock and coal underground, and six other accidents also classified as serious were reported and investigated, four of which were caused by falls of rock and two by transportation. This was a reduction of three from the total number of serious accidents reported in 1964. Minor accidents resulting in the loss of one or more working days totalled 105, of which 90 occurred underground and 15 on the surface, a reduction of 17 accidents. Six dangerous occurrences were reported at the Michel Colliery, and are reported more fully in another part of this report under the heading of "Dangerous Occurrences." No accidents or dangerous occurrences were reported from the British Columbia side of the stripping operation on Tent Mountain or the exploration work at Morrissey.

The East Kootenay Mine Safety Association held its 44th annual mine-rescue and first-aid competitions at Fernie on June 19th, and the various contests were well attended. Five six-man teams from Fernie, Michel, Kimberley, and the Mineral King mine from Toby Creek entered the mine-rescue competition, and the Department of Mines and Petroleum Resources trophy was won by the Sullivan mine team captained by C. S. Kinrade. The Men's Open competition in the first-aid events was won by the Crows Nest Industries Lumber Division, captained by William Greenbank, Jr. Both teams represented the East Kootenay District at the Provincial competitions held at Nanaimo on June 26th, and the mine-rescue team was successful in winning this competition for the second year in succession.

Crows Nest Industries Limited

Thomas F. Gleed, president, 2000 Washington Building, Seattle, Wash.; J. E. Morris, vice-president, Mines, Fernie; W. R. Prentice, vice-president, Sales and Executive, Fernie; J. L. Cleeve, vice-president, Finance, and secretary-treasurer, Fernie. This company, formerly known as The Crow's Nest Pass Coal Company Limited, changed its name in November, 1965, owing to growing interests in the lumber, oil, and gas industries. The company has conducted large-scale coal-mining operations in the Crowsnest Pass area of the East Kootenay District since 1897, and its present operations are confined to the Michel Colliery. The coal is sold on the industrial market, and a large quantity is exported to Japan. A large amount of fines is also utilized in the making of coke, and the coke is sold in various part of Western Canada and the United States. The operations are directed from a head office in Fernie.

Michel Colliery.—(49° 114° N.W.) Vans H. Hulbert, manager; Irving Morgan, senior overman; Paul Kusnir, safety and personnel officer; Harry Corrigan, afternoon-shift overman.



One of the main rock tunnels in the south side of the Michel syncline, boarded up after 65 years of production.

Rock tunnel being driven to develop No. 10 seam. Balmer No. 2 mine on the north side of the Michel syncline. (Matthews Photo Lab, Calgary.)

The colliery is at Michel, 24 miles northeast of Fernie, and is situated on the Crowsnest branch of the Canadian Pacific Railway. It is a large colliery, and has been in operation since 1899. The present workings include four underground mines, three stripping operations, and a modern by-product plant which is located on the colliery site. Under early development also are a number of prospect adits, which are being driven from the outcrops of the various seams, and two new rock tunnels which are being driven to develop a large area of virgin coal, on the north side of the Michel Valley. The mines, with the exception of the one developed in the No. 10 seam, are named according to the seam that is worked and the direction of development. That in the No. 10 seam is known as the Balmer mine. The mines have been developed on both sides of the valley. They are worked by the room-and-pillar system, and the pillars are generally extracted on the retreat. The workings are highly mechanized, and a very high percentage of the coal is mined by continuous miners. Most of the equipment is operated by electricity. It is of the flameproof type, and has been approved for use in coal mines. Transportation on most of the main levels and mine entries is by diesel and battery locomotives. On the surface the production from all the mines is trucked to a modern preparation plant located on the colliery-site, where it is cleaned and treated for marketing. A description of the preparation plant has been given in past Annual Reports.

The underground operations are under the direct supervision of 5 overmen and 23 firebosses. A brief description of the operations follows.

"A" North Mine.—John Whittaker, overman; Roger Girou, Frank McVeigh, Albert Littler, Harry Sanders, Michael Mihalynuk, and Harvey Travis, firebosses.

This mine is in "A" seam and is on the north side of the Michel Valley, approximately half a mile east of the preparation plant. The mine was opened in 1951, and is entered by means of two pairs of main levels which have been driven from the outcrop and follow the strike of the seam. The seam is 12 feet thick, where normal, but is very irregular and faulty. It dips at an angle of 15 to 20 degrees in a southwesterly direction, and is overlain by a moderately strong shale roof. The workings are panelled, and the coal is mined by continuous miners. A description of the workings has been given in past Annual Reports.

The mine averaged a daily production of 1,450 tons during 1965 with a crew of 80 men. There were two continuous miners in operation, and most of the production was obtained by the development and extraction of pillars in the No. 1 Incline district, above No. 1 level. The remainder was obtained by the development of the main levels, and the opening of a new district which is known as the No. 3 Incline district, and is located above the inner end of No. 1 level. The whole cycle of operations was carried out by the continuous miners, and a very rapid rate of extraction was made. The development rooms were driven on level course, and the pillars were extracted by angling extraction roadways into the pillars while retreating from the rooms. Systematic timbering and rock bolting were rigidly enforced and adequate pillars were left to support the roof. Some difficulties were experienced at times owing to faults and other geological disturbances, but in general a high percentage of extraction was made. The coal is loaded into shuttle cars and fast-moving belt conveyors. It is transferred to central loading points on No. 1 level and loaded into 10-ton-capacity bottom-dumping cars. The cars are taken from the mine by diesel and battery locomotives and dumped into a large storage bin on the surface near the portal of the lower level, from where it is trucked to the preparation plant. Total development at the mine during 1965 was 20,390 feet.

The mine is ventilated by a 100-horsepower electrically driven axivane fan which delivers 85,000 cubic feet of air per minute to the mine workings at a 2½-inch water gauge. The fan is located near the entrance to No. 2 level, and the upper and lower parts of the mine are ventilated as two separate splits. Normally the ventilation is exhausted in the mine, but the fan is reversed in the winter to prevent the water-courses in the lower part of the mine from freezing. Large auxiliary fans and synthetic tubing are used in conjunction with the operation of the continuous miners to maintain an adequate amount of ventilation at the face of the working-places and contend with the rapid advancement of the roadways. The conditions in general were found to be satisfactory during the course of inspection, but a great deal of difficulty was experienced owing to poor roof conditions on some of the roadways in the No. 1 Incline district. Roof bolting was introduced to reinforce the timber supports, and proved to be satisfactory.

Balmer South Mine.—Henry Eberts, overman; Kenneth Kniert, Robert Taylor, John Krall, William Verkerk, Robert Doratty, Henry Parsons, Joseph Serek, Michael Tymchuk, Sidney Hughes, Thomas Taylor, James Walsh, and Arnold Webster, firebosses.

This mine is in No. 10 seam, and is being developed to work a large area of virgin coal on the south side of the Michel Valley. The mine portals are 1 mile west of the preparation plant, and the workings are entered by means of three levels which have been driven from the outcrop of the seam, near creek-level. The seam is 40 feet thick, of good quality, and is overlain by a moderately strong shale roof. The seam pitches at an angle of 30 degrees in an easterly direction, and the main roadways are driven in close contact with the roof. The mine was opened in 1960. It is one of the major operations at the colliery at the present time, and a description of the workings has been given in past Annual Reports.

The mine averaged a daily production of 1,500 tons during 1965 with a crew of 145 men. There were four continuous miners in operation, and most of the activities were directed to the development and extraction of pillars in the No. 1 Incline district, which was carried out in a similar manner to that described in the "A" North mine. Other activities were directed to the development of the three levels and a new area of slope workings which is being developed below the No. 1 level. All the production was mined by continuous miners. Systematic timbering was enforced, and a very rapid rate of extraction was made. The production from the No. 1 Incline district and the main levels was transported via shuttle cars and fast-moving belts to various bins and loading points on No. 1 level, from where it is loaded into 10-ton-capacity bottom-dumping cars, which are taken to the surface by battery locomotive. That from the slope workings is transported directly to the surface by belt conveyors. At the surface the whole production is dumped into a large storage bin and later trucked to the preparation plant. The total development completed at the mine during 1965 was 23,890 feet.

The mine is ventilated by a 100-horsepower electrically driven axivane fan which delivers 75,000 cubic feet of air per minute to the mine workings at a 3.3-inch water gauge. Large auxiliary fans are also used with each of the continuous miners to ventilate the faces of the working-places, where they are operating to contend with the rapid rate of extraction. The conditions in general were found to be satisfactory, with the exception of an ignition of gas at the face of one of the continuous-miner working-places which injured six members of the working crew. This occurrence is reported more fully in another part of the report under the heading of "Dangerous Occurrences." Two workmen were also fatally injured by falls of rock and coal. These are reported more fully under "Fatal Accidents."

Upper "A" South Mine.—William Davey, overman. This mine, operating in an area of "A" seam coal from the inner end of the main rock tunnels on the south side of the Michel Valley, was abandoned in October, 1965, owing to leakages of gases from a sealed fire area in an adjoining mine and a suspected gob fire in the mine itself. Details of the two incidents are described in another part of this report under "Dangerous Occurrences." A description of the workings has been given in past Annual Reports.

The mine was opened in 1960. It was one of the major operations at the colliery for several years, and was the last working to be developed and operated from the two main rock tunnels, which have been in use since the commencement of the colliery. The abandonment of the mine has resulted in the closure of the main rock tunnels for the time being, but it is possible they may be used at a later date for another development.

No. 1 Mine.—William Davey, overman. This mine, which was operated in No. 1 seam and developed from the two main rock tunnels on the south side of the Michel Valley, was abandoned in January, 1965, owing to excessive water in the lower workings and depletion of the coal reserves in the remainder of the workings. The equipment was withdrawn and the workings allowed to flood.

The mine was an old working which had been abandoned in 1938, and reopened in 1963 to recover a large area of pillars left by the former working. A description of the workings has been given in past Annual Reports.

No. 1 North Mine.—Harry Corrigan, overman; Benjamin Volpatti, Stanley Menduk, and Thomas Krall, firebosses.

This mine, operating in the No. 1 seam, was opened in October, 1965, to develop an area of coal on the north side of the Michel Valley. The main portal is at an elevation of 5,200 feet, and can be reached by means of a 3½-mile mining-roadway leading from the preparation plant. The seam is 11 feet thick, dips at an angle of 15 degrees in a southwesterly direction, and is overlain by a moderately strong shale roof. The workings are entered by three main levels, which have been driven from the outcrop and follow the strike of the seam.

The mine averaged a daily production of 350 tons with a crew of 30 men during the short period it operated in 1965. All the production was mined by a continuous miner, and the machine was used to develop the levels from the outcrop. Systematic timbering was rigidly enforced, and where necessary roof bolts were used to reinforce the timbers. The coal is loaded onto shuttle cars and fast-moving belts and is transported to a bin on the surface by a series of belt conveyors, from where it is later loaded and trucked to the preparation plant. The total development at the mine in 1965 was 3,320 feet.

The mine at present is ventilated by a small electrically driven centrifugal fan which is located at the portal of the No. 1 level and delivers 20,000 cubic feet of air per minute to the mine workings at a 2-inch water gauge. Auxiliary fans are also used to ventilate the face of the working-places during the operation of the continuous miner. The conditions in general were found to be satisfactory during the course of inspections.

Balmer No. 2 (Prospect No. 22) Mine.—Hall Chamberlin, overman. This mine was started in June, 1965, to prospect and develop an area of coal in the No. 10 seam on Baldy Mountain, 4 miles northwest of Michel, but operations were suspended in November owing to the main levels encountering a large fault. An effort was made to drill through the fault to determine its intensity, but this work was postponed for the winter owing to freezing conditions. The portals are at an elevation of 5,200 feet. They are adjacent to the No. 4B pit at the Baldy strip mine, and are reached by the strip-mine road. The coal is 40 feet thick, dips at an angle of 15 to 20 degrees in a southwesterly direction, and is overlain by a moderately hard shale roof. The workings are entered by two levels which have been driven from the outcrop by a continuous miner, and are driven along the line of strike in close contact with the hangingwall of the seam. The coal is loaded onto a shuttle car and transported to the surface by fast-moving belts and later trucked to the preparation plant.

The mine averaged a daily production of 425 tons during the period it was in operation in 1965. There were 56 men employed, and most of the activities were directed to the development of the two levels. Total development in 1965 was 4,340 feet, and each of the levels was driven a distance of 1,900 feet before encountering the fault. The mine is ventilated by a small electrically driven centrifugal fan which is located at the portal of No. 1 level and delivers 20,000 cubic feet of air per minute to the mine workings at a 1.5-inch water gauge. Auxiliary fans are also used in conjunction with the operation of the continuous miner. These quantities were found to be sufficient for the present need of the mine workings, and conditions in general were found to be satisfactory during the course of inspections, with the exception of bad roof conditions in the proximity of the fault.

Prospect Tunnels and Exploration.—Michael Mihalnuk and Louis Schlippa, firebosses. These tunnels are being driven as part of an intensive exploration programme conducted by the company to drill and prospect a number of known seams on the mountainsides in the vicinity of the colliery. The main activities in 1965 were directed to the north side of the valley. Nine prospect tunnels were driven from the outcrop of the No. 10 seam, totalling 1,650 feet, and four tunnels in the No. 7 seam, totalling 410 feet. Several large samples of coal were taken from each of the tunnels and shipped for testing. In addition, 23 holes were drilled from the surface on the same side of the mountain, totalling 15,320 feet. Most of the holes were drilled to the No. 10 seam, which is the lowest seam being worked in the coal measures. The drilling was by contract under the direction of J. J. Crabb, chief geologist.

Balmer North Mine.—Harry Corrigan, overman; Andrew Davey, Roger Pasiaud, and Richard Hughes, firebosses.

This development was started in September, 1965, and includes two large rock tunnels which are being driven to intersect and develop a large area of virgin coal in the No. 10 seam on the north side of Michel Valley. It is expected to become a major operation, and present intentions are to develop a limited amount of workings on the west side of the McKay fault and extensive workings on the east side. The tunnels are being driven at an elevation of 3,850 feet; the portals are in close proximity to the colliery railway siding, and are approximately 1 mile west of the preparation plant. The rock tunnels are being driven under contract. Total development in 1965 was 1,100 feet, each of the tunnels having been driven 550 feet. The ultimate distance before reaching the seam is 1,250 feet. Conditions in general were found to be satisfactory during the course of inspections.

During 1965, 26,306 pounds of Monobel No. 4, 1,802 pounds of CXL-ite, and 21,586 electric detonators were used at the colliery for coal and rock blasting. No misfired shots were reported.

Four hundred and thirty-seven tons of limestone dust was used for the application of inert dust on the roadways of the various mines to minimize the coal-dust hazard and for tamping shots. Monthly dust samples were taken at all the mines and analysed. The samples were found to be above the minimum requirements needed for incombustible content.

Monthly examinations of workings were made at all the mines by the miners' inspection committees, and regular safety meetings were held each month at the colliery office. The various report books kept at the mines in compliance with the *Coal Mines Regulation Act* were examined periodically and found to be in order.

"A" South Strip Mine.—Vans H. Hulbert, manager; George Lancaster, foreman. This operation is on Sparwood Ridge, 2 miles southwest of Michel. It is at an elevation of 5,500 feet and can be reached by means of a 4-mile private road leading from the preparation plant. The mine was opened in 1961. It is being worked to mine a large area of "A" seam coal outcropping on the mountainside above the underground workings of the Upper "A" South and "A" West mines. The coal is 30 feet thick, of good quality, and pitches at an angle of 35 degrees in a westerly direction. Most of the overburden was removed in 1961. The work is carried out on a contract basis.

The mine produced 185,876 tons of coal during 1965 with a crew of four men. Most of the activities were directed to the loading of coal, and a minor amount of rock work was done on the northern extension to the pit. The coal is mined in 15-foot lifts. It is loaded by power-shovel, and trucked to the preparation plant by means of the private road that was built to the No. 3 highway at Michel in 1964 and extended to the preparation plant in 1965. Operations were carried out on a two-shift basis. The coal reserves in the pit are rapidly nearing depletion.

Baldy Strip Mine.—Vans H. Hulbert, manager; George Lancaster, foreman. This mine is on Baldy Mountain, 4 miles northwest of Michel. It is at an elevation of 5,000 feet and can be reached by means of a private road leading from the preparation plant. The coal is 40 to 60 feet thick, of good quality, and dips at an angle of 25 to 30 degrees in an easterly direction. The seam is believed to be the No. 10 seam. It can be traced for several miles, and the company has operated several pits along the outcrop since 1948. The present activities are confined to No. 4B pit. It was opened in 1960, and is being worked on a contract basis. Removal of overburden was completed in 1961.

The mine produced 7,069 tons of coal in 1965 with a crew of one shovel operator in the pit and three truck-drivers for transporting the coal to the preparation plant. The operation was considerably restricted owing to the present state of the coal market. It was confined to a single-shift basis, and the mine was idle for several long periods. It is estimated there was approximately 60,000 tons of coal exposed in the pit at the end of 1965.

" C " Seam Strip Mine.—Vans H. Hulbert, manager; George Lancaster, foreman. This mine is on Natal Ridge, 2 miles northeast of Michel, and was opened in November, 1965, to operate an area of Upper and Lower " C " seam coals outcropping on the mountainside. The mine is at an elevation of 5,600 feet. It can be reached by means of a private road leading from the preparation plant. The upper seam is 7 feet thick, and the lower 11 feet. They are separated by 9 feet of rock. The seams pitch at an angle of 15 to 20 degrees in a southwesterly direction.

The mine produced 6,402 tons of coal in 1965 with a crew of four men. Most of the activities were directed to the removal of the overburden and loading coal from the upper seam. The coal was loaded by power-shovel and trucked to the preparation plant.

Preparation Plant.—The plant is on the colliery-site and is located near to the entrances of the old rock tunnels on the south side of the valley. It has been in operation since 1938 but was considerably modernized in later years. A description has been given in past Annual Reports. There were no major alterations in 1965.

By-product Plant.—This plant is adjacent to the preparation plant. It has been in operation for many years, and a description has been given in past Annual Reports. The operations were confined to the Curran-Knowles ovens in 1965, and the plant produced 142,468 tons of coke, 15,028 tons of breeze (coke fines), and 941,502 gallons of tar.

Coleman Collieries Limited

(49° 114° N.W.) William Goodwin, mine superintendent. The coal-mining activities of this company in the East Kootenay District are confined to a large stripping operation on the interprovincial boundary on Tent Mountain, near Corbin. Most of the operations are on the Alberta side, but large quantities of coal have been produced from the British Columbia side during the past 14 years, where the seams and operations extend into this Province. The property is at an elevation of 7,000 feet. It can be reached by means of a private road leading from the No. 3 highway at Crowsnest Lake. The roadway is 10 miles long and is on the Alberta side. A description of the property has been given in past Annual Reports.

The production of coal from the British Columbia side during 1965 was 135,190 tons. There were 14 men employed, including the truck-drivers, and most of the activities were directed to the No. 4 pit, which has been in operation since 1954. The coal in this pit is in the form of a synclinal basin, and is over 100 feet thick in parts. It is mined in 15-foot lifts, loaded by power-shovel, and trucked to the company's preparation plant at Coleman. The conditions in general were found to be satisfactory during the course of inspections, with the exception of a large rockslide which occurred from a bolted portion of the hangingwall on the east side of the pit. Most of the slide was on the Alberta side, but a new portion of roadway had to be built in order to enter the extension of the pit into this Province.

Pacific Coal Limited

(49° 114° S.W.) Registered office, 540, 1070 Douglas Street, Victoria. This company has conducted an exploration programme on Crown land in the vicinity of Morrissey Creek, southeast of Fernie, since 1964. The activities in 1965 were rather restricted and were confined to the first and last parts of the year. Drilling was continued during the first two months, and two holes, totalling 1,000 feet, were completed. A number of coal samples were hydraulicked from each of the holes and shipped for testing. Operations were then not resumed until October, when a party of men opened and drove two prospect tunnels in two of the seams in the lower coal measures. There were four men employed, and they completed 203 feet of drifting and 120 feet of crosscutting. Several large samples of coal from the prospect tunnels were shipped for testing. The operations were suspended toward the end of December.

NICOLA-PRINCETON INSPECTION DISTRICT

By David Smith

There was no coal production in 1965 in the Nicola-Princeton District. Imperial Metals and Power Ltd. continued testing, using local coal in conjunction with magnetite ore from the Lodestone Mountain deposits near Princeton, studying feasibility of producing sponge iron locally.

NORTHERN INSPECTION DISTRICT

By David Smith

The coal mines of the Northern District produced a total of 5,900 tons of coal in 1965. The output is sold entirely on the domestic market, which limits all operations to seasonal work.

No accidents and no dangerous occurrences were reported in this district in 1965. There were no prosecutions.

Peace River (56° 122° S.E.)

King Gething Mines.—This property is on Lot 1039, 12 miles west of Hudson Hope. In 1965, due to lack of markets, the mine remained closed.

Telkwa (54° 127° N.E.)

Bulkley Valley Collieries Limited Company office, Telkwa. J. D. Carnahan, general manager; L. Gething, superintendent; P. Baker and E. Ellis, fire-bosses. This property is on Goat Creek, a tributary of Telkwa River, about 7 miles southeast of Telkwa. Total production in 1965 was 5,900 tons. The mine closed in March, a skeleton crew was maintained to carry out routine work, and operations were resumed in September. Pillars are now being extracted in the northwest part of the mine; there will be enough coal recovered to complete the season. The new entry to the south of the present mine is now in coal, and a crosscut has been completed to connect to the belt conveyor servicing the tipple. An average crew of nine men was employed.

Bowron River (53° 121° N.W.)

Northern Coal Mines Ltd. Registered office, 285—17th Street, West Vancouver. A. J. Garraway, manager. This company holds Coal Licence No. 148 covering Lot 9592 and parts of Lots 9591 and 9593, which lie in the vicinity of the Bowron River, about 30 miles due east of Prince George. In 1964 a drift was driven in a northwest direction from the southwest crosscut. In 1965 a slope measuring 9 by 12 feet was started in the seam cut by this drift and is reported to have been sunk a distance of 250 feet. This slope was not visited as it had been permitted to fill with water. Surface diamond drilling continues. A total of 10 holes was drilled.

The company is considering the recovery of resin which occurs within the coal seam. Bulk sampling is being carried out.

A crew of seven men was employed. Permitted explosives and short-period delay detonators were used for blasting rock and coal. General working conditions were found to be satisfactory in the course of inspections. No accidents or unusual occurrences were reported. Coal produced in 1965 has been stockpiled.

Inspection of Electrical Equipment and Installations at Mines, Quarries, and Well Drilling Rigs

By L. Wardman, Senior Electrical Inspector

ELECTRIC POWER

In 1965 electric power was used by 39 mining companies in operations at 43 lode mines and 3 collieries. Thirty-three metallurgical concentrators were operated during the year. Electric power was also used at 22 structural-material and industrial-mineral mines and quarries. Forty-seven drilling rigs were operated in the Province during the year.

Lode-metal Mines

Four concentrators were not operated during the year, and one small concentrator was dismantled and removed from the property. Three concentrators were built. Two, the construction of which was commenced last year, were completed and two were renovated. At seven properties use of electric power was discontinued. At nine other properties the use of electric power was commenced.

Power Plants

The kilovolt-ampere capacity of mining-company-owned power plants that operated in 1965 was as follows:—

Prime Mover	Generator Kva. Capacity
Diesel engines	35,820
Hydro	3,870
Total	39,690

The electric power generated by these plants amounted to 63,508,000 kilowatt-hours. The power purchased from public utilities and from the generating division of The Consolidated Mining and Smelting Company of Canada, Limited, amounted to 404,146,500 kilowatt-hours. The total amount of power consumed at lode mines was 467,654,500 kilowatt-hours.

A general breakdown of the connected load at the operating mines was as follows:—

Equipment	Horsepower
Hoists (incline and shaft)	8,141
Hoists (scraper)	8,830
Fans (mine ventilating)	7,254
Pumps (mine)	8,004
Rectifiers and M.G. sets	9,085
Air compressors	22,319
Crushing	19,593
Sink float	2,000
Grinding	32,172
Concentrating	26,057

Conveyors	3,050
Pumps (mill and fresh water)	15,262
Shovels and rotary drills	2,050
Workshops	2,938
Miscellaneous	6,605
Total	173,360

In addition to electrically powered equipment, there was in use approximately 13,980 horsepower of prime movers driving direct-connected or belt-connected equipment as follows:—

Prime Mover	Horsepower
Diesel engines	12,530
Hydro	1,450
Total	13,980

On the haulage systems there were in use 132 battery locomotives, 97 trolley locomotives, and 25 diesel locomotives.

Structural-material and Industrial-mineral Mines and Quarries

As in 1964, electric power was used at 22 structural-material and industrial-mineral mines and quarries. Power is purchased from public utilities for all except three of these operations. At the three operations, company-owned plants of 5,616 kilovolt-amperes produced 19,213,475 kilowatt-hours of power, and this added to 12,797,448 kilowatt-hours of purchased power gives a total of 32,010,923 kilowatt-hours consumed during the year.

A general breakdown of the connected load was as follows:—

Equipment	Horsepower
Hoists and aerial tram	292
Hoists (scraper)	530
Fans	103
Pumps	1,091
Rectifiers and M.G. sets	38
Air compressors	737
Electric drills and shovels	584
Crushing, rock reject, and drying	5,571
Conveyors	3,368
Screens	767
Milling	4,030
Workshops	356
Miscellaneous	1,841
Total	19,308

At these properties there was in addition direct-driven equipment totalling 5,560 horsepower.

One battery locomotive was in use for underground haulage.

Coal Mines

Three collieries, the same number as in 1964, were in operation. The distribution of the connected load was as follows:—

	Horsepower	
Surface—		
Air compressors	2,800	
Ventilating	250	
Hoisting	915	
Haulage	15	
Coal washing and screening	2,119	
Pumping	65	
Coke production	1,573	
Miscellaneous	1,165	
Total		8,902
Underground—		
Ventilation	319	
Pumping	215	
Air compressors	600	
Coal-cutters	150	
Continuous miners	2,200	
Shuttle cars	780	
Loading	130	
Conveying	1,102	
Hoisting	175	
Miscellaneous	12	
Total		5,683
Total for surface and underground		14,585

Three battery locomotives and one diesel locomotive were in use for surface and underground haulage.

A total of 40,915,890 kilowatt-hours of electric power was used for mining and coal-processing during the year.

ELECTRICAL INSTALLATIONS

LODE MINES

Unuk River (56° 130° S.E.)

Granduc Mines Limited

In February of 1965 a snowslide destroyed the power-house located at the Leduc portal. Details of this disaster are given elsewhere in the report. A camp was built during the summer at Tide Lake to provide accommodation and house equipment for driving an 11.6-mile tunnel to the mine. Two 500-kw. and two 400-kw., 2,300-volt, 3-phase, 60-cycle, diesel-driven generators supply power for scraper hoists, ventilating fans, M.G. sets, pumps, air compressors, workshops, and camp. The connected load was as follows:—

	Horsepower
Scraper hoists	130
Ventilating fans	130
M.G. sets	225
Pumps	20
Air compressors	930
Workshops	150
Miscellaneous	100
Total	1,685

Haulage in the tunnel was provided by two combination battery-trolley locomotives and two diesel locomotives.

Salmon River (56° 130° S.E.)

Silbak Premier Mines Limited.—A flotation section was installed in the mill, adding 35 horsepower to the connected load. An assay office was built and wired for power and lighting. This building later burned down.

Moresby Island (52° 132° N.E.)

Tasu (Wesfrob Mines Limited) A temporary camp was built to house the construction crew during construction of the townsite on Gowing Island and mill, shops, and power plant on Moresby Island. A causeway was built with waste rock from the mine between Moresby and Gowing Islands to provide easy communication.

The following diesel-driven generating units were installed for temporary power during the construction period: One 30-kw. 3-phase 220/110-volt generator at construction-site, one 75-kw. 3-phase 208/110-volt generator at camp-site, one 50-kw. 3-phase 208/110-volt generator at camp-site, one 28-kw. 3-phase 220/110-volt generator at lower-portal mine-site, one 100-kw. 3-phase 220/110-volt generator at upper-portal mine-site, one 100-kw. 3-phase 440-volt generator at pit shop garage.

A 150-B electric shovel driven by 748-kw. 4,160-volt independent power plant was installed in No. 3 pit. Electric power is carried to the shovel by means of a short overhead line and a shielded trailing cable.

The following dangerous occurrence took place on August 27th:—

While the electric shovel was down for repairs, the switches on the shovel were pulled and a small 110-volt lighting plant was connected to the lighting circuit to provide lighting. Somehow during the course of repairs the lighting switch was closed, energizing the lighting transformer, which in turn energized the collector rings at high voltage. During the course of repair, a repairman came in contact with the collector rings and received a shock which knocked him unconscious for a period of time.

Harriet Harbour (52° 131° S.W.)

Jedway Iron Ore Limited.—A magnetic separator requiring 100 horsepower was added to the mill. A 550-volt power-line was run to the 475 adit for a mine fan and miscellaneous equipment.

Endako (54° 125° S.E.)

Endako Mines Ltd. A crushing plant and mill was built and put into operation in May. Power is supplied at 6,900 volts by the British Columbia Hydro and Power Authority. A 15,000-kva., 3-phase, 69,000–4,160-volt transformer steps the voltage down for distribution to the mine and plant. A 1,250-kva. 4,160-volt diesel-driven generator was installed to supplement the hydro power and also to supply essential power in event of a line outage.

The crushing equipment consists of one primary crusher and four secondary crushers driven by five 400-horsepower 4,160-volt motors.

The grinding equipment consists of three ball mills and three rod mills driven by six 1,250-horsepower 4,160-volt motors, and three regrind mills driven by three 200-horsepower 550-volt motors.

The flotation section consists of 15 banks of 18 flotation cells each. Other equipment consists of feeders, pumps, filters, etc. This equipment is driven by 480- and 550-volt motors ranging in horsepower from fractional to 150 horsepower.

Six banks of pole-platform-mounted 4,160–600-volt transformers supply the 550-volt motors. Two similar banks supply the 550-volt crushing-plant motors.

Two pumping-stations were installed on the fresh-water line from Francois Lake. Three pumps driven by 150-horsepower 550-volt motors were installed at each station. Adequate space was left in each building to install a fourth pump when required. A 4,160-volt power-line and two 4,160–550-volt transformer stations were built to supply power to the motors. An almost identical pumping system was installed to pump reclaimed water from the tailings pond.

A 4,160-volt power-line was built to the pit to supply electric shovels and drills.

Bridge River (50° 122° N.W.)

Bralorne Pioneer Mines Limited

The Empire shaft signalling system was improved by the installation of new signal pull switches and junction boxes. A locomotive-battery-charging station on the 800 level was rewired. The pumping-stations on 1400 level and 2600 level, Crown shaft, were moved and reinstalled.

A cablevision system was installed for the benefit of the townsite personnel.

Big Timothy (Takomkane) Mountain (52° 120° S.W.)

Brynnor Mines Limited (Boss Mountain Division).—The concentrator built in 1964 was put into operation. A dangerous occurrence took place when the crusher foreman and later an electrician suffered electrical flash burns while working on 550-volt switchgear. Both men suffered some second-degree burns.

Highland Valley (50° 120° S.W.)

Bethlehem Copper Corporation Ltd.

The capacity of the concentrator was increased to 10,000 tons per day by the installation of the following: A cone crusher driven by a 300-horsepower motor; two screens driven by a 25- and a 40-horsepower motor respectively; three conveyors driven by a 60-, a 25-, and a 15-horsepower motor respectively; a Synctron vibrating feeder; six cleaner cells driven by two 25- and one 15-horsepower motors; two tailings thickeners driven by 5-horsepower motors; three tailings pumps driven by three 50-horsepower motors; two fresh-water well pumps driven by a 100- and a 50-horsepower motor respectively; and one fresh-water booster pump. The capacity of three feeders, one screen, and five conveyors was increased to take the larger load of ore.

The three main 2,500-kva. transformers were replaced with three 5,000/6,667-kva. transformers, also a pole-mounted substation consisting of three 75-kva. 4,160–575-volt transformers was built.

Merritt (50° 120° S.W.)

Craigmont Mines Limited

A 3,000-c.f.m. compressor driven by a 550-volt 3-phase 600-horsepower motor was installed in the compressor building. Substation No. 2, supplying compressor motors, was rebuilt, and three 333-kva. 4,160–600-volt transformers were installed to carry an increased load. An extension was built to the compressor building to house the new compressor.

An addition was built to the dry building, and the 15-kva. transformer supplying this building was replaced with a 25-kva.

An addition was built to the mine office, but the electrical work was not completed.

HEDLEY (49° 120° S.E.)

North American Mineral Recovery Limited.—A small plant consisting of a repulper driven by a 2-horsepower motor, a screen driven by a 1-horsepower motor, and two pumps driven by 5-horsepower motors was installed on the bank of the Similkameen River to reclaim values from the Nickel Plate tailings.

KEREMEOS (49° 119° S.W.)

Horn Silver (Utica Mines Ltd.)

Five mine buildings were built, providing an office, warehouse, dry and lamp-charging room, shop, and power-house. A 32-kva. 3-phase diesel-driven generator supplies lighting and power. Three small pumps requiring a total of 8 horsepower are in use in the mine. Three battery locomotives are in use for mine haulage.

PHOENIX (49° 118° S.W.)

Phoenix Copper Company Limited

A drying plant was installed in the mill, consisting of the following: A feed conveyor and a conveyor to dry storage each driven by a 1-horsepower motor, a rotary drier driven by a 7½-horsepower motor, and a fan driven by a 2-horsepower motor. An addition was made to the workshop and the electrical wiring was reorganized.

ASPEN CREEK (49° 117° S.E.)

H.B. (The Consolidated Mining and Smelting Company of Canada, Limited).—A transformer station was constructed in a dead-end turnout 3300 level about 300 feet from the portal. It houses three 75-kva. 2,300–575-volt transformers, also primary and secondary switchgear. It is supplied by an overhead transmission-line and P.I.L.C. S.W.A. cable in the 3300 level adit.

IRON MOUNTAIN (49° 117° S.E.)

Canadian Exploration Limited

Electrical work during the year consisted mainly of the exchange and relocation of equipment to accommodate the change in underground load requirements. The transformers in the D4200 portal substation were replaced with three 15-kva. 2,300–440-volt and one 15-kva. 2,300–110–220-volt transformers. This station is now fed from the Dodger mine feeder instead of the underground crushing-plant feeder.

The 150-kva. dry-type transformer in the crushing plant was exchanged with the transformers in No. 414 substation to increase its capacity to 150 kva.

The capacity of substation No. 425 was increased by the addition of two 75-kva. transformers.

The capacity of the machine-shop substation at J4000 portal was increased by installing two 200-kva. transformers from the tungsten-mill substation.

A new 300-ampere 600-volt service and a new 200-ampere 230-volt service was installed in the machine-shop addition.

Ainsworth (49° 116° N.W.)

Blue Star Mines Limited

The Yale Lead & Zinc Mines mill was purchased in 1964, and during 1965 was rehabilitated. The crushing equipment from the Kootenay-Florence mill was obtained to replace that which had been removed. The mill was ready for operation by midsummer.

Nelway (49° 117° S.E.)

Reeves MacDonald Mines Limited

A scraper hoist powered by a 37-horsepower motor was installed on the 240 level, also a 15-horsepower motor generator set for charging locomotive batteries. Haulage on the 240 level is by means of a Jeffery battery locomotive. A 5.9-horsepower fan was installed in the O'Donnell drift.

Riondel (49° 116° N.W.)

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited).—Two 48-inch fans, each driven by a 100-horsepower motor, were installed on the surface at the Comfort mine. To supply the fan motors, 2,500 feet of 6,900-volt transmission-line was built and three 75-kva. 6,900–575-volt transformers and switchgear were installed. A small switchroom was built to accommodate the switchgear. Additional electric heating units were installed in the main dry and hospital.

Keen Creek (49° 117° N.E.)

Cork Province (London Pride Silver Mines Ltd.)

Several improvements were made in the mine electrical installation as follows: A 400-ampere gutter box and a 750-watt floor heater were installed in the hoistroom. A gutter box was also installed at No. 6 level station. Automatic liquid level and sequence control has been installed for the mine pumps. A 7-horsepower booster pump was installed to feed the 40-horsepower pump at the dam on No. 8 level.

In the sampling-room a 3-horsepower motor was installed on the crusher and a 2-horsepower motor was installed on the pulverizer.

In the mill a 5-horsepower motor was installed on the tailings pump, a 1-horsepower motor on the thickener, and a 3-horsepower motor on the thickener pump.

A 200-ampere service was installed in the shop for testing equipment, and welding-plug receptacles were installed in the mill, crushing plant, and shop.

Slocan Lake (49° 117° N.E.)

Johnsby Mines Limited.—To provide facilities for handling custom ore, a crusher driven by a 75-horsepower motor was installed. An addition was built to the mine dry at Mammoth No. 12 level and wired for lighting.

Red Deer Valley Coal Company, Limited

The old Van Roi concentrator building was taken over and equipment installed as follows: The crushing plant consists of a jaw crusher driven by a 20-horsepower motor; a cone crusher driven by a 30-horsepower motor; three conveyors driven by 5-, 2-, and 1½-horsepower motors respectively; and two fans driven by 3- and 5-horsepower motors respectively.

The concentrating section consists of a ball mill driven by a 50-horsepower motor; a classifier driven by a 5-horsepower motor; three zinc cells, each driven by a 7½-horsepower motor; three lead cells, each driven by a 3-horsepower motor; and a conditioner driven by a 5-horsepower motor.

The filtering section consists of a lead-concentrate thickener tank driven by a 5-horsepower motor; a diaphragm pump driven by a 3-horsepower motor; a vacuum pump and two other pumps, each driven by a 7½-horsepower motor; and a filter driven by a ¾-horsepower motor.

SPRINGER CREEK (49° 117° N.E.)

Meteor (Cultus Explorations Ltd.).—All electrical and mechanical equipment was removed from the property.

KIMBERLEY (49° 115° N.W.)

Sullivan (The Consolidated Mining and Smelting Company of Canada, Limited).—A 900-kva. 66,000–2,300-volt transformer station on the surface was moved closer to the mine ventilating-fan loads to reduce voltage drop on the 2,300-volt lines. The following work was in progress at the end of the year:—

At the No. 41 shaft two 300-horsepower fan motors and four natural-gas boilers were being installed to heat mine ventilating air.

Two 300-horsepower ventilating-fan motors were being installed at the No. 42 shaft.

The 150-horsepower motor on the fan at the No. 24 shaft will be replaced with a 300-horsepower motor.

Three 200-kva. 2,300–575-volt transformers in 3959 drift substation are being replaced by two 300-kva. transformers.

A 6,900-volt load-interrupter switch is under installation in the 3800 level crushing chamber and 1,500 feet of 6,900-volt cable will be run to the 3959 drift substation.

In the concentrator, 17 motors ranging from one-quarter to 75 horsepower were installed. Two of these replace two removed from the flotation section and zinc drier. Two 25-kva., two 15-kva., and one 10-kva. transformers were installed for lighting on the tertiary floor, in the large dry, steam plant, reagent control section, and in the lower yard.

Six rebuilt switchboards were installed, one in each of the following places: Steam plant, tripper floor, pipe-shop, compressor-room, tool-room, and the sand-blasting shed.

TOBY CREEK (50° 116° S.E.)

Mineral King (Aetna Investment Corporation Limited).—A 150-horsepower C.I.R. double-drum hoist was installed on No. 9 level, also two sump pumps driven by 25-horsepower motors. This equipment is supplied with power through 1,600 feet of No. 2/0 A.W.G. 2,300-volt cable from the No. 7 level to the No. 9 level, where it is stepped down to 440 volts by means of three 75-kva. 2,300–440-volt transformers.

HOWE SOUND (49° 123° N.E.)

Britannia (The Anaconda Company (Canada) Ltd.)

In the mine a 150-kva. 6,900–440-volt transformer was moved from the 2800 level to the 3500 level. Two 75-kva. 6,900–440-volt transformers were installed on the 2700 level at No. 4 shaft. Other work consisted of returning equipment which had been removed from the mine during the shut-down to its original place.

TEXADA ISLAND (49° 124° N.W.)

Texada Mines Ltd.—A 450-kw. transformer bank was installed underground, and the electrical system was extended to new headings.

BENSON RIVER (50° 127° S.E.)

Empire Development Company Limited

A crushing plant was built at the portal of the tunnel to the underground mine. It consists of a jaw crusher driven by a 200-horsepower motor and two conveyors, each driven by 15-horsepower motors. A jig-back type tram driven by a 200-horsepower motor was installed between the mine and the concentrator. It is provided with controls for automatic operation.

Two air compressors driven by two 125-horsepower motors were installed at the mine portal.

Two banks of three 100-kva. 2,300–440-volt transformers were installed at the portal to supply the above-mentioned equipment.

Approximately 2,500 feet of overhead line was run to the open pit, and three 15-kva. 2,300–460-volt transformers were installed to supply a 25-horsepower pump in the pit.

A fan driven by a 15-horsepower motor was installed underground.

Alterations were made in the power-house to accommodate a 150-kva. diesel-driven generator.

Dangerous Occurrences.—On May 1, 1965, the jig-back tram overspeeded and, when the post brake on the headsheave was applied, skidded the haulage rope over the now stationary sheave, destroying the liner. Overspeeding was caused by an inexperienced operator leaving the controls on manual and starting the tram as if it were on automatic control, thus the motor was not brought into service for regenerative braking. Later the tram was moved to position the skips at the terminals and the cable slipped on the bare sheave, allowing the bucket to hit the upper terminal and bend some structure members.

On May 31, 1965, the jig-back tram, while under automatic control, ran through the high-speed zone with no braking effect. The emergency stop button was pressed, but too late to prevent the bucket from hitting the upper terminal with sufficient force to break the cable and allow the bucket to run down the track cable until it was derailed by a section of the rope it was trailing. Some damage was done, but it was not sufficient to affect the operation of the tram.

Coast Copper Company Limited

A 938-kva. 600-volt diesel-driven generator was installed in the compressor-house. In the mine new distribution centres were installed at the lower-level stations in No. 2 winze. A Mancha ANX/battery locomotive and an Atlas type Q 4.5-ton battery locomotive were added to the mine haulage equipment.

ZEBALLOS (50° 126° S.W.)

Zeballos Iron Mines Limited.—A 40-horsepower surface tram was installed between the mine and mill for transportation of men only.

QUATSINO (50° 127° N.E.)

Yreka (Minoca Mines Ltd.)

A power plant, compressor plant, concentrator, and tram were built. The power plant consists of three 300-kw. 440-volt Waukesha diesel-electric units. The compressor plant consists of a 1,000-c.f.m. compressor driven by a 200-horsepower motor and a 600-c.f.m. compressor driven by a 125-horsepower motor.

The main equipment in the crushing plant consists of a jaw crusher and a cone crusher, each driven by 60-horsepower motors; a screen driven by a 3-horsepower motor; and five conveyors driven by four 5- and one 3-horsepower motors.

The grinding section consists of a 7- by 5-foot ball mill driven by a 175-horsepower motor; a 5- by 5-foot ball mill driven by a 50-horsepower motor; and a conveyor and a classifier, each driven by 2-horsepower motors.

The flotation section consists of seven flotation cells driven by seven 5-horsepower motors.

Other equipment consists of a regrind mill driven by a 30-horsepower motor, thickener, filter, and pumps.

The overhead tram is driven by a 37½-horsepower motor at the lower terminal. The tram may be controlled from either terminal, as is convenient. The buckets and man cars are permanently attached to the running cable. When hauling ore the tram runs by gravity and is controlled by a hydraulic brake.

Buttle Lake (49° 125° N.W.)

Western Mines Limited

A 2,400-volt power-line was run from the power-house to the camp and sawmill to supply light and power. Three 37½-kva. and one 15½-kva. 2,400–220–110-volt transformers supply lighting for the camp and sawmill. Three 37½-kva. 2,400–440-volt transformers supply power to the sawmill.

Sayward (50° 125° S.W.)

Iron Mike (Orecan Mines Ltd.).—A concentrator was built and put into service in the summer. The complete installation is as follows:—

The power plant consists of three generators driven by three diesels. These units are installed in a large trailer.

The crushing plant consists of a jaw crusher driven by a 100-horsepower motor, a cone crusher driven by a 125-horsepower motor, a screen driven by a 3-horsepower motor, and three conveyors driven by one 5-horsepower and two 3-horsepower motors.

The concentrating plant consists of a rod mill driven by a 200-horsepower motor, a wet screen driven by a 2-horsepower motor, a three-drum magnetic separator driven by three 2-horsepower motors, a magnetic filter driven by a 2-horsepower motor, a vacuum pump driven by a 50-horsepower motor, three conveyors driven by two 3-horsepower and one 7½-horsepower motors, and a drum feeder driven by a 1-horsepower motor.

Kennedy Lake (49° 125° S.E.)

Brynnor Mines Limited (Kennedy Lake Division)

The development of the underground workings continued throughout the year and the following electrical equipment was installed: On the No. 3 level a 600-volt distribution centre was installed to supply and control power to distribution panels on Nos. 2 and 4 levels, equipment on No. 3 level, and the crusher on the crusher level below No. 4 level. Three pumps driven by three 350-horsepower 2,300-volt motors were installed below No. 3 level. Two locomotive-battery-charging stations have also been installed.

On the surface a new mine dry and change-room, a new mine office, and a steel-shop have been built and wired. A modified substation has been built at the hoist-room, and stand-by power-lines have been erected.

JORDAN RIVER (48° 124° S.E.)

Sunloch and Gabbro (Cowichan Copper Co. Ltd.) The underground concentrator, which had been damaged when the mine was flooded, was rehabilitated and returned to service. A dangerous occurrence took place when the oil-filled transformers took fire while being dried out. All 12 transformers in the vault were completely destroyed. The smoke produced made it impossible to enter the mine for two days. Two 1,200-kva. transformers were installed to replace the ones destroyed.

STRUCTURAL-MATERIAL AND INDUSTRIAL-MINERAL MINES AND QUARRIES

MCDAME (59° 129° S.W.)

Cassiar Asbestos Corporation Limited Equipment installed in the mill added 385 horsepower to the mill load. Of this load, 170 horsepower is secondary crushing equipment and 134 horsepower is collecting equipment. At the mine 22 horsepower was added to the dust-collecting load in the rock-reject plant. An air compressor driven by a 50-horsepower motor was installed at the mine crusher. Equipment installed in the mine drier added 13 horsepower to the connected load. Equipment removed decreased the connected load by 42 horsepower, thus the increase in connected load was 396 horsepower for mining and milling purposes.

SPILLIMACHEEN (50° 116° N.E.)

Baroid of Canada, Ltd.—A vacuum pump driven by a 25-horsepower motor was installed.

KILGARD (49° 122° S.E.)

Clayburn-Harbison Ltd.—A new fire-clay adit was driven, and a 100-ampere 440-volt service was installed to supply a 15-horsepower hoist, signals, and lighting. A 15-kva. transformer steps the power down to 110 for lighting.

VANANDA (49° 124° N.W.)

Imperial Limestone Company Limited A British Columbia Hydro and Power Authority power-line was run to Spratt Bay to supply power to a crushing plant which is being installed. The plant will consist of three crushers, each driven by a 75-horsepower motor, and conveyors and screen requiring 25 horsepower.

COAL MINES

TELKWA (54° 127° N.E.)

Bulkley Valley Collieries Limited.—A new crusher driven by a 15-horsepower motor was installed, and separate disconnecting switches were installed for all motors on the bunker.

COMOX (49° 124° N.W.)

Comox Mining Company Limited A dangerous occurrence took place on November 11th, when the oil-filled starting compensator for the fan motor caught fire. The fire was observed at 5.30 p.m. and was extinguished shortly after by the Union Bay Volunteer Fire Department.

The burning oil had run out of the compensator on to the floor of the fan-house and had damaged the fan motor.

East Kootenay (49° 114° S.W.)

Michel Colliery (Crows Nest Industries Limited). — In 1965 "A" South mine was closed and removal of equipment was commenced. Development work was begun on No. 1 Seam Prospect and No. 22 Prospect, No. 10 Seam. In October and November the following equipment was installed in No. 1 Seam:—

Equipment	Horsepower
Ventilating fan	33
Pump	5
Compressor	100
Continuous miner	225
Shuttle car	105
Two conveyors	45
Miscellaneous surface	20
Total	533

During the summer the following equipment was installed in No. 22 Prospect:—

Equipment	Horsepower
Ventilating fans	43.0
Tugger hoist	6.5
Compressor	100.0
Total	149.5

A continuous miner, a shuttle car, and conveyors were installed to drive the roadways in No. 22 Prospect, after which they were moved to No. 1 North and Balmer South mine as required.

The following dangerous occurrences took place:—

On June 11th at 6 p.m., in "A" North mine, an electric arc occurred when the right-side cutting-head motor cable was pinched between the motor frame and traction-gear reducer.

On June 16th, in the Balmer South mine, moisture in the trailing-cable plug insulator caused a phase to phase-fault when power was supplied to the hoist motor, resulting in open arcing as the plug was blown apart.

On July 20th, on the surface at "A" North mine timber-yard, to move a Borecut miner, under repair, a temporary electrical connection was made to a disconnecting switch. When the repairs were completed, the repairman, upon closing the switch to move the Borecut, received flash burns from arcing in the switch.

On November 16th at approximately 9.15 p.m., in the Balmer South mine, the trailing cable supplying No. 843 Joy continuous miner was run over and crushed by the shuttle car. No open sparking was reported.

On November 18th at approximately 10 p.m., in the Balmer South mine, the cable supplying the gathering-head motor, on Joy continuous miner No. 843, was crushed between the frame of the machine and a large rock. No open sparking was reported.

On December 6th at 9.30 a.m., in No. 1 Seam North, the trailing cable supplying No. 7 shuttle car, while being back-lashed, was caught under the shuttle-car bumper and crushed. No open sparking was reported.

On December 6th at 3.10 p.m., in Balmer South mine, the trailing cable supplying No. 4 shuttle car, while being back-lashed, was caught under the shuttle-car bumper and crushed. No open sparking was reported.

On December 6th at 9 p.m., in No. 1 North mine, the cable supplying No. 7 shuttle car, while being back-lashed, was caught under the shuttle-car bumper and crushed. No open sparking was reported.

On December 15th at 11.30 a.m., in "A" North mine incline, a roll of new conveyor belt, while being moved to storage, came loose from its fastenings and rolled down the incline crushing No. 3 shuttle-car cable against a rib post. No open sparking was reported.

On December 17 at 6 a.m., in Balmer South mine, the trailing cable on a Joy flexible belt was pulled from the gland on the plug connector, when insufficient slack was allowed while the belt was being trammed. No open sparking was observed.

Lode-metal Deposits Referred to in the 1965 Annual Report

The names of the properties are arranged alphabetically within five areas. Each area consists of the mining divisions listed below. The table shows the principal metals produced or indicated in the deposits in 1965:—

Northern British Columbia.—Atlin, Liard.

Central British Columbia.—Cariboo, Clinton, Omineca.

Coast and Islands.—Alberni, Nanaimo, New Westminster, Skeena, Vancouver, Victoria.

South Central British Columbia.—Greenwood, Kamloops, Lillooet, Nicola, Osoyoos, Similkameen, Vernon.

Southeastern British Columbia.—Fort Steele, Golden, Nelson, Revelstoke, Slocan, Trail Creek.

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Antimony	Cobalt	Page
Northern British Columbia																				
AC, PC	Liard	57° 131° S.W.			3									3						40
A-L	Liard	58° 129° S.W.	3		3	3	3													16
ANT	Liard	58° 128° S.W.			3															16
Alberta	Liard	57° 131° S.E.	3	3	3															36
Alsek	Atlin	59° 137° N.W.			3														3	8
Amy	Atlin	59° 130° N.E.		3		3	3													10
Ann, Su	Liard	57° 131° S.W.			3															38
Anty	Atlin	58° 133° N.E.																3		9
Bing	Liard	58° 132° S.E.			3															17
Bird	Liard	57° 130° S.W.			3									3						40
Bron	Liard	56° 131° N.E.			3	3	3													43
CW	Liard	57° 131° S.E.			3															31
Chuck and Cheta	Liard	57° 127° N.E.			3															16
Churchill	Liard	58° 125° S.E.			3															12
Copper Canyon	Liard	57° 131° S.E.			3															34
E and L	Atlin	56° 130° N.W.			3								3							43
G.J.	Liard	57° 130° N.E.			3															43
Galore Creek	Liard	57° 131° S.E.			3															24
Horn	Liard	57° 131° S.E.			3															31
JW	Liard	57° 131° S.W.			3															32
Jay, C.	Liard	57° 131° S.E.	3	3	3															36
June, Stikine	Liard	58° 129° S.W.			3															15
Joan and M.B.	Liard	57° 131° S.W.			3															34
Joy	Liard	58° 129° S.E.			3									3						16
Limpoke	Liard	57° 131° N.W.			3									3						18
McDame, Belle, Bar, Yellowjack, etc.	Liard	59° 129° S.E.		3		3	3													14
MH	Liard	57° 131° N.W.								3										18
May	Liard	58° 129° S.W.			3															16
Molly	Atlin	59° 134° S.E.												3						8
New Taku Mines	Atlin	58° 133° N.W.		3		3	3											3		9
OP	Liard	57° 131° S.W.			3															34
Poke	Liard	57° 131° N.W.			3															18
QC	Liard	57° 130° N.E.			3															41
Rex, Sal, Rum	Liard	57° 131° S.W.			3															36
S.C.	Liard	57° 131° S.W.			3															40
SF	Liard	57° 130° N.E.		3																41

Shipping Mines.—(1) Metal contributed at least 10 per cent of gross value of the shipment. (2) Metal contributed less than 10 per cent of the shipment. Production for 1965 is listed in Table XIV.

Non-shipping Mines.—(3) Metal present, indicated by assay or mineralogical determination.

Lode-metal Deposits Referred to in the 1965 Annual Report—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Antimony	Cobalt	Page
***Northern British Columbia*—Cont'd**																				
Sil (Taku River)	Atlin	58° 133° N.E.		3		3	3													9
Sil (Split Creek)	Liard	57° 131° S.W.			3															36
Silver, Barber	Atlin	59° 133° N.W.			3	3	3													8
Snow, Cobra	Liard	59° 129° S.E.		3		3	3													12
Stikine East and Stikine North (BIK)	Liard	57° 131° S.E.			3															29
Storie	Liard	59° 129° S.W.												3						12
Thorn, Club, Kay	Liard	58° 132° N.W.	3	3	3									3						17
Zohini, Arn	Atlin	58° 133° N.E.		3		3	3											3		10
Central British Columbia																				
A	Omineca	54° 127° S.W.			3															76
AT	Omineca	53° 126° S.W.		3	3															88
Aly	Omineca	54° 125° S.E.												3						136
Andy, Scott, Enco, Molly	Omineca	53° 124° N.W.												3						138
Astlais, Ast, Billie, Al, Ralph, Ben, Tie	Omineca	54° 126° N.W.			3									3						73
Aurum	Cariboo	53° 121° S.W.	1	2																139, 241
"B"	Omineca	54° 127° S.E.			3															80
Barr, Lybdenum	Omineca	54° 126° N.E.												3						80
Berg	Omineca	53° 127° N.W.			3									3						87
B.I.	Cariboo	52° 122° N.E.		3	3															140
BJ	Cariboo	52° 121° N.W.			3															140
Blackjack	Omineca	55° 124° N.E.												3						106
Boom and Frankie	Omineca	55° 125° S.E. and N.E.			3									3						105
Boss Mountain	Cariboo	52° 120° S.W.												1						141, 241
CAFB	Omineca	53° 127° S.E.												3						88
CIN	Omineca	54° 124° N.E.															3			113
Calex	Omineca	54° 124° S.E.															3			112
Code	Omineca	54° 127° S.E.		3		3	3													81
Copper Ridge	Omineca	54° 125° S.E.												3						138
Cronin	Omineca	54° 126° N.W.	2	1		1	1		2											73, 241
Endako	Omineca	54° 125° S.E.												1						136, 241
French Peak	Omineca	54° 127° N.E.	2	1		1														241
Fubar	Cariboo	53° 122° N.E.			3															139
Glacier Gulch	Omineca	54° 127° N.E.												3						74
Granisle	Omineca	54° 126° N.E.			3															93
Haut, BI	Omineca	55° 126° S.E.			3															104
Hom	Clinton	51° 124° S.W.	3	3																143
Hony, Bee, Ell, Liza, Barbs, Mel	Omineca	54° 128° S.E.												3						72
Huber	Omineca	54° 126° N.W.												3						75
J.B., Molly, HM	Omineca	54° 128° N.E.												3						70
Jen, Beaver, Pete	Omineca	53° 124° N.W.												3						138
Jumbo	Omineca	53° 127° S.W.												3						87
KE, LO	Cariboo	52° 121° S.E.			3															141
KH	Clinton	51° 123° S.E.			3									3						142
KO	Omineca	54° 124° S.W.			3									3						138
K, S	Omineca	54° 125° S.E.												3						135
Ketza, Jen, Rum	Omineca	54° 126° N.E.			3															103
Klondike, Star	Omineca	54° 126° S.W.			3									3						80
Len	Omineca	54° 126° N.W.		3	3		3													74
Lucky Luke	Omineca	54° 128° N.E.	3		3															70
Lucky Ship	Omineca	54° 127° S.E.												3						84
Lustdust	Omineca	55° 125° N.E.		3		3	3											3		105
MAG, STHUF	Omineca	54° 126° N.E.			3															103
MM	Clinton	51° 123° S.E.			3									3						142
Merc	Omineca	55° 125° N.E.															3			106
Moly, Red, Canyon, Tom, Len	Omineca	55° 127° N.E.												3						73
Morrison	Omineca	55° 126° S.E.			3															104

LODE-METAL DEPOSITS REFERRED TO IN THE 1965 ANNUAL REPORT—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Antimony	Cobalt	Page
Central British Columbia—Con'd																				
Motase A	Omineca	56° 127° S.E.			3															72
Motase B	Omineca	56° 126° S.W.												3						72
Newman	Omineca	54° 126° N.E.			3															99
Northwest	Omineca	54° 128° S.E.			3															71
Nu, Elk	Omineca	54° 125° S.E.												3						136
OFF, RAID, DDT	Omineca	55° 126° S.E.			3									3						103
PENN	Omineca	54° 126° N.E.			3															103
Pinchi Lake	Omineca	54° 124° N.E.															3			112
Pondosy	Omineca	53° 126° S.W.			3															88
Rob	Omineca	54° 125° S.E.												3						136
Rob (Hazelton)	Omineca	55° 127° S.E.			3									3						73
Rod, Dot, G.S., L.H., Bob Creek	Omineca	54° 126° S.W.	3	3		3	3													80
Samson, JHG	Cariboo	54° 122° S.E.	3	3		3	3													139
Serb Creek	Omineca	54° 127° N.W.												3						76
Silver Creek, Silver Lake, Trade Dollar, Iron Vault	Omineca	54° 127° N.E.		3		3	3													74
Silver Cup	Omineca	54° 126° N.E.		3		3	3													90
Silver Queen	Omineca	54° 126° S.W.		3		3	3													81
Silver Standard	Omineca	55° 127° S.W.	2	1		1	1													241
Snell	Omineca	56° 125° N.E.															3			106
Sunshine	Omineca	54° 124° S.E.															3			113
Toulon, Copper Cliff	Omineca	54° 128° N.E.			3															70
Whit	Omineca	53° 127° N.E.			3									3						87
Wit, Wag	Omineca	55° 124° S.E.	3	3	3	3	3													108
Zen	Clinton	51° 124° S.W.			3									3						143
Coast and Islands																				
A.M. and Invermay	N. Westmin'r	49° 121° S.W.			3															206
Ajax	Skeena	55° 129° N.E.												3						63
Alice	Skeena	55° 129° S.E.												3						62
Alpha, Gamma	Nanaimo	50° 126° S.W.			3					3										230
Arcadia	Skeena	55° 129° S.E.		3																63
Aztec	Skeena	56° 129° S.E.				3	3													52
Azure	Vancouver	50° 122° S.W.			3															223
Bank of Vancouver	Vancouver	49° 123° N.E.			3															221
Basin, Silver Basin	Skeena	55° 129° N.E.		3	3															65
Bea	N. Westmin'r	49° 121° S.E.			3															217
Bell, London, Roy, Myrtle	N. Westmin'r	49° 122° N.W.			3									3						221
Big G	Nanaimo	50° 125° S.W.			3		3													233
Britannia	Vancouver	49° 123° N.E.	2	2	1	2	2		2											220, 242
Brynnor	Alberni	49° 125° S.E.								1										236, 241
Copper Road	Nanaimo	50° 125° S.E.	2	2	1															225, 242
Domineer	Nanaimo	49° 125° N.E.	2	2	1															235, 242
Dunwell	Skeena	55° 129° N.W.		3		3	3													51
East Gold	Skeena	56° 130° S.E.	3	3																49
Emperor	Skeena	56° 129° S.W.		3		3	3													52
Empress	N. Westmin'r	49° 121° S.W.			3									3						220
Empire Development (Merry Widow, Kingfisher)	Nanaimo	50° 127° S.E.								3										229
F.L., Ridge, Cordova	Nanaimo	50° 126° S.W.								1										230, 241
Goat	Skeena	56° 129° S.W.	3	3			3													55
Granduc	Skeena	56° 130° N.E.			3															44
Grey Goose, Silver Bell No. 1	Skeena	55° 129° N.E.		3		3	3													67
Gus Mac	Skeena	55° 129° S.E.												3						62
HPH, Norman	Nanaimo	50° 127° N.W.			3															227
Haywire	Skeena	55° 129° S.W.			3								3							61
Hiller	Nanaimo	50° 126° S.W.								3										232
Holberg	Nanaimo	50° 128° N.E.			3															228
Hope	Skeena	54° 128° N.W.			3	3	3													70
Iron Mike	Nanaimo	50° 125° S.W.								3										225

LODE-METAL DEPOSITS REFERRED TO IN THE 1965 ANNUAL REPORT—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Antimony	Cobalt	Page
***Coast and Islands—* Continued**																				
Iron River	Nanaimo	49° 125° N.E.			3					3										233
Jackie, MoS_2	Skeena	56° 129° S.W.	3	3										3						54
Jessie, Adonis	Skeena	52° 131° S.W.								1										69, 242
Jib	Skeena	52° 131° S.E.								3										69
Kay	Skeena	56° 130° N.E.	3	3		3	3													44
Kennedy Silver	Skeena	55° 129° N.W.		1		1	1													242
Kinskuch	Skeena	55° 129° N.E.			3															65
Koros	Alberni	48° 124° N.W.			3	3	3													238
Linda	Vancouver	50° 124° S.E.	3	3	3	3	3													224
Little Billie	Nanaimo	49° 124° N.W.			3									3						224
London	Vancouver	50° 122° S.W.			3															223
Lucky Four	N. Westmin'r	49° 121° S.W.			3															219
Lucky Strike, Cascade Falls, Copper Creek	Skeena	55° 129° N.W.			3	3	3													65
Lynx, Price	Alberni	49° 125° N.W.	3	3	3	3	3													234
McVicar	Vancouver	49° 123° N.E.			3	3	3													222
Mal	Victoria	48° 124° N.W.			3															239
Mammoth	N. Westmin'r	49° 121° S.E.											3							213
Meares, Lone Cone, Flon, etc.	Alberni	49° 125° S.W.			3								3							235
Meg	N. Westmin'r	49° 121° N.W.												3						219
Mobile	Skeena	56° 129° S.W.		3		3	3													51
Molly Mack	Skeena	55° 129° S.W.												3						61
Monarch	Skeena	55° 129° N.E.		3	3	3	3													66
Murphy	N. Westmin'r	49° 121° S.E.		3	3															218
Oktwanch	Alberni	49° 126° N.E.			3					3										233
Old Sport	Nanaimo	50° 127° S.E.	2	2	1					1										230, 242
Porter Idaho	Skeena	55° 129° N.W.		3		3	3													50
Pride of Emory	N. Westmin'r	49° 121° S.W.			1								1							213, 242
R.A.F.	Skeena	56° 129° S.W.	3	3		3	3											3		51
Redwing	Skeena	55° 129° S.W.			3															59
Roundy Creek	Skeena	55° 129° S.E.												3						62
Russ	Skeena	52° 126° N.W.												3						89
Sevrens, Copper Ridge	Alberni	49° 125° N.W.	3	3	3	3	3													234
Shag Rock	Skeena	54° 132° S.W.									3									68
Silbak Premier	Skeena	56° 130° S.E.	1	1		2	2													49, 242
Silver Bar	Skeena	55° 129° N.E.		3		3	3													67
Silver Crown	Skeena	56° 129° S.W.				3	3													50
Skarn	Nanaimo	49° 124° S.E.			3															239
Sunloch and Gabbro	Victoria	48° 124° S.E.			3															239
Sun-West	Alberni	49° 125° S.W.			3									3						236
Tasu	Skeena	52° 132° N.E.			3					3										68
Texada	Nanaimo	49° 124° N.W.	2	2	1					1										224, 242
Thistle	Nanaimo	49° 124° S.W.			3															238
Tidewater	Skeena	55° 129° S.W.												3						63
Treasure Island	Skeena	52° 127° S.W.			3		3													90
Woss	Nanaimo	50° 126° S.W.			3															233
Yreka	Nanaimo	50° 127° S.W.			3															228
Zel	Vancouver	49° 123° N.E.			3									3						222
South Central British Columbia																				
Ace	Lillooet	50° 122° N.W.	3															3		143
Ajax	Greenwood	49° 118° S.E.			3	3	3													173
Annis, Dawn, Lakeview	Kamloops	50° 119° N.E.			3	3														205
B.C.	Greenwood	49° 118° S.W.	3	3	3															170
BO, LF	Nicola	50° 120° S.W.			3									3						151
Barriere	Kamloops	51° 119° S.W.			3	3	3													159
Bethlehem	Kamloops	50° 120° S.W.	2	2	1									2						146, 243
Betty Lou	Nicola	50° 120° S.W.			3															154
Boundary Creek Group	Greenwood	49° 118° S.W.			3															168
Bounty	Greenwood	49° 119° S.E.		3		3														167
Bralorne	Lillooet	50° 122° N.W.	1	2																143, 243

LODE-METAL DEPOSITS REFERRED TO IN THE 1965 ANNUAL REPORT—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Antimony	Cobalt	Page
***South Central British Columbia—* Continued**																				
Brenda	Osoyoos	49° 120° N.E.			3									3						164
Cal	Kamloops	50° 120° S.W.			3															153
Cap	Lillooet	50° 122° N.W.			3															144
Chataway	Nicola	50° 120° S.W.			3															149
Cinderella	Nicola	50° 120° S.W.			3															154
Copper Canyon	Nicola	50° 121° S.E.			3															155
Craigmont	Nicola	50° 120° S.W.			1															153, 243
Cris	Kamloops	50° 121° S.E.			3									3						151
Dansey	Kamloops	50° 120° N.W.			3									3						146
David, PR	Similkameen	49° 121° N.E.			3															161
Dot, Silverquick	Lillooet	51° 122° S.W.															1			144, 243
Eden, Ezra, Job	Kamloops	50° 120° N.W.			3															147
Elk and Dakota	Vernon	50° 118° N.W.			3		3													165
Fiddler	Kamloops	50° 120° S.W.			3															149
Gem	Greenwood	49° 118° S.W.			3															168
Helen, S.B.	Kamloops	50° 119° N.W.		3		3	3													160
Highland-Bell	Greenwood	49° 119° S.E.	2	1		2	2		2											166, 243
Highland Silver	Greenwood	49° 119° S.E.		3		3	3													167
Hope	Nicola	49° 121° N.E.		3		3	3													160
Horn Silver	Osoyoos	49° 119° S.W.	3	3																162
Ilk, Elk, Ni	Similkameen	49° 120° S.W.			3															161
Imperial Metals and Power Ltd.	Similkameen	49° 120° S.E.								3										161
Independence	Nicola	49° 120° N.W.			3									3						160
Index	Lillooet	50° 122° N.E.												3						145
Iva Lenore	Greenwood	49° 118° S.W.			3															168
JAC, RAF, TAM, MER	Kamloops	50° 121° S.E.			3									3						148
Jericho	Kamloops	50° 120° S.W.			3									3						147
Jim	Kamloops	50° 119° S.W.												3						164
July Creek	Greenwood	49° 118° S.W.			3															172
Kan, Tin	Nicola	49° 120° N.W.			3															154
Krain	Kamloops	50° 121° N.E.			3									3						145
Last Chance	Nicola	50° 120° S.W.			3			3												155
Lee, Sunshine, Lo	Nicola	50° 120° S.W.			3		3													150
Lode	Similkameen	49° 120° N.W.			3															161
Lornex	Kamloops	50° 121° S.E.			3									3						148
Lou, Halo	Nicola	49° 120° N.W.			3															156
Lux, Forge	Kamloops	50° 120° N.W.			3									3						146
MLM	Kamloops	50° 120° S.W.			3															149
MO	Greenwood	49° 119° S.E.												3						167
MO	Kamloops	50° 120° N.E.			3															159
Mab	Nicola	50° 121° S.W.			3															155
Maple Leaf	Greenwood	49° 118° N.E.	3	3	3															172
Mo	Kamloops	51° 120° N.E.												3						160
North Brenda	Osoyoos	49° 120° N.E.			3									3						163
Oro Denoro	Greenwood	49° 118° S.W.			3															171
PP	Greenwood	49° 118° S.W.			3															168
Par	Nicola	49° 120° N.W.			3															157
Pay	Nicola	49° 120° N.W.			3															156
Phoenix Copper	Greenwood	49° 118° S.W.	2	2	1															170, 243
Planet	Nicola	50° 120° S.E.	3	3		3														157
Primer	Similkameen	49° 120° N.E.			3															157
Pyramid	Nicola	49° 120° N.W.			3															156
Quilchena	Nicola	50° 120° S.W.			3															155
Rain	Kamloops	50° 120° S.W.			3															153
Red Star	Similkameen	49° 120° S.E.		2	1		1													243
Regal	Similkameen	49° 120° S.E.			3															161
Rocco Plata	Greenwood	49° 119° S.E.		3		3	3													167
SO, RO	Kamloops	51° 120° N.E.			3									3						159
Sal, R, EE, etc.	Lillooet	50° 123° N.E.												3						223
Selish	Nicola	49° 120° N.W.			3															154
Sheba, Highmont, Minex, B.X.	Kamloops	50° 120° S.W.			3									3						148

LODE-METAL DEPOSITS REFERRED TO IN THE 1965 ANNUAL REPORT—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Antimony	Cobalt	Page
***South Central British Columbia*—Continued**																				
Skomac	Greenwood	49° 118° S.W.		3		3	3													167
Smuggler	Osoyoos	49° 119° S.W.	3																	165
Spotted Horse	Greenwood	49° 118° S.W.		2		1	1													167, 243
Tetra, Jean	Kamloops	50° 121° S.W.			3															145
Vanco	Kamloops	50° 120° N.E. and N.W.			3															158
Voight Camp	Similkameen	49° 120° S.E.			3															162
W.D.R., Huestis, Outrider, Toketic, Bethsaida, Buttle Lake	Kamloops	50° 120° N.W. and S.W. 50° 121° S.E.			3									3						147
Wade	Nicola	50° 120° S.W.			3															154
White Knight	Osoyoos	49° 119° S.W.		3																165
Yubet	Nicola	50° 120° S.W.			3															151
Southeastern British Columbia																				
Alpha	Golden	50° 117° N.E.		3	3	3	3													203
Altoona	Slocan	49° 117° N.E.		1		1	1		2											192, 244
Amazon	Slocan	49° 116° N.W.		2		1	1													187, 245
Antoine	Slocan	50° 117° S.E.	2	1		2	2		2											190, 244
Arlington	Slocan	49° 117° N.E.		3																196
Beatrice	Revelstoke	50° 117° N.W.		1		1	1													196, 245
Big Ledge	Revelstoke	50° 118° N.E.					3													196
Black Fox (*see* Blue Star)	Slocan	49° 116° N.W.																		
Bluebell	Slocan	49° 116° N.W.		2	2	1	1		2											184, 244
Blue Star	Slocan	49° 116° N.W.	2	2		1	1		2											245
Boy Scout	Fort Steele	49° 116° N.E.		3		3	3													201
Charleston	Slocan	50° 117° S.E.		1		1	1		2											189, 245
Cody Reco Mill	Slocan	49° 117° N.E.		1		1	1		2											191, 245
Consolidated St. Elmo	Trail Creek	49° 117° S.W.	3											3						178
Cork Province	Slocan	49° 117° N.E.		1		1	1		2											187, 245
Coxey, Mountain View, Nevada	Trail Creek	49° 117° S.W.												3						176
Deadman	Slocan	49° 117° N.E.	2	1		1	1		2											191, 245
Doherty	Slocan	50° 117° S.E.		3		3	3													189
Empire, Strathcona	Fort Steele	49° 115° S.E.			3															199
Enterprise	Slocan	49° 117° N.E.		1		1	1													194, 245
Exchange	Slocan	49° 117° N.E.		3		3	3													196
Fern	Nelson	49° 117° S.E.	3																	180
Galena Farm	Slocan	49° 117° N.E.		2		1	1													194, 245
Giant, Gold King, Little Darling, Evening	Trail Creek	49° 117° S.W.	3											3						178
Gold Belt	Nelson	49° 117° S.E.	1	2		2	2													181, 244
Golden Queen, St. Elmo, Gertrude, Surprise	Trail Creek	49° 117° S.W.												3						177
Greenhorn	Slocan	49° 117° N.E.	2	1		1	1													192, 245
Grey	Trail Creek	49° 117° S.W.												3						174
H.B.	Nelson	49° 117° S.E.		2		1	1		1											181, 244
Hecla, Mammoth	Slocan	49° 117° N.E.		1		1	1		2											193, 245
Hewitt	Slocan	49° 117° N.E.		1		1	1													193, 245
I.X.L.	Trail Creek	49° 117° S.W.	1	2		2	2													174, 245
J & L	Revelstoke	51° 118° S.E.	3	3		3	3													204
Jack Pot, Oxide, Last Chance	Nelson	49° 117° S.E.					3													180
Jersey	Nelson	49° 117° S.E.		2		1	1		2											182, 244
Jersey	Golden	50° 116° N.E.		3	3	3	3													203
Jewel	Slocan	49° 116° N.W.		3		3	3													187
Joan	Revelstoke	51° 118° S.E.												3						205
Jumbo	Slocan	49° 117° N.E.	3	3																194

Lode-metal Deposits Referred to in the 1965 Annual Report—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Antimony	Cobalt	Page
Southeastern British Columbia— Continued																				
King Fissure, S.B., C.R., Deby	Revelstoke	51° 118° S.E.				3	3													204
Kootenay Belle	Nelson	49° 117° S.E.	1	1		2	2													181, 244
Liz B	Nelson	49° 116° S.W.		3		3	3													198
London, Panama	Slocan	50° 117° S.E.		3		3	3													189
M.J.P.	Fort Steele	49° 115° N.W.				3	3													199
Mayflower	Trail Creek	49° 117° S.W.	3	3																178
Midnight	Trail Creek	49° 117° S.W.	3																	174
Midway	Fort Steele	49° 115° S.W.	3	3																198
Mineral King	Golden	50° 116° S.E.		2	2	1	1		2											202, 244
Molly Gibson	Slocan	49° 117° N.E.		3	3	3	3													188
Myrtle	Slocan	49° 117° N.E.		3																195
New Arlington	Nelson	49° 117° S.E.	1	2		2	1													181, 244
New Springfield	*Slocan*	*49° 117° N.E.*		*1*		*1*	*1*													*192, 245*
O.K.	Golden	50° 116° S.E.			3															202
Ottawa	Slocan	49° 117° N.E.		1		2	2													195, 245
Reco	Slocan	49° 117° N.E.		3		3	3													192
Reeves MacDonald	Nelson	49° 117° S.E.		2		1	1		2											183, 244
Rockland	Slocan	49° 117° N.E.	3		3															193
Ronoke	Nelson	49° 117° S.E.	3	3																180
Ruth	Golden	50° 116° N.W.	2	1		1	1													203, 244
St. Anthony	Golden	50° 116° S.E.		3		3	3													201
St. Eugene, St. Eugene Extension, Aurora	Fort Steele	49° 115° N.W.	3	3																199
Scranton	Slocan	49° 117° N.E.	3	3		3	3													187
Shady	Slocan	49° 117° N.E.		1		1	2													191, 245
Silver Dollar	Nelson	49° 117° S.E.	1	1		1	2													181, 244
Silver King	Nelson	49° 117° S.E.	3	3	3															179
Silversmith (Rabbitt Paw)	Slocan	49° 117° N.E.		1		1	1		2											191, 245
Sir Charles	Slocan	50° 117° S.E.		3		3	3													189
Slocan Sovereign	Slocan	49° 117° N.E.		1		1	2													192, 245
Star	*Nelson*	*49° 116° S.E.*		*2*		*1*	*2*													*198, 244*
Sullivan	Fort Steele	49° 115° N.W.	2	2	2	1	1		2	2		2								200, 243
Tam O'Shanter	Slocan	49° 116° N.W.		3		3	3													186
Teddy Glacier	Revelstoke	50° 117° N.W.		3		3	3													197
Triumph	Slocan	49° 116° N.W.		2		1	1													186, 245
United Copper	Slocan	49° 116° N.W.	3	3	3															197
Utica	Slocan	49° 117° N.E.		3		3	3													189
Velvet	Trail Creek	49° 117° S.W.	3		3															174
Victor	Slocan	49° 117° N.E.	2	1		1	1		2											192, 245
Vin	Slocan	50° 116° S.W.				3	3													197
W.D.	Trail Creek	49° 117° S.W.	1	2		2	2													178, 245
Washington	Slocan	50° 117° S.E.		1		2	1		2											190, 245
Western Exploration	Fort Steele	49° 115° N.W.				3	3													201
White Hope	Slocan	49° 117° N.E.		3		3	3													195
Yankee Dundee	Nelson	49° 117° S.E.	3	3		3	3													180
Abacon	Unknown		1	2	2															245

INDEX

A

B

C

D

E

F

G

H

I

J

K

L

Mc and Mac

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

Printed by A. Sutton, Printer to the Queen's Most Excellent Majesty in right of the Province of British Columbia.
1966

2,980-466-3548