

Minister of Mines and Petroleum Resources

PROVINCE OF BRITISH COLUMBIA

ANNUAL REPORT

for the Year Ended December 31

1963



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1964

BRITISH COLUMBIA
DEPARTMENT OF MINES AND PETROLEUM RESOURCES
VICTORIA, B.C.

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V.C., P.C., C.B., D.S.O., M.C.,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Mineral Industry of the Province for the year 1963
is herewith respectfully submitted.

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

Minister of Mines and Petroleum Resources Office,
March 31, 1964.

Robert Blair King, Inspector and Resident Engineer from 1948 to 1959, died in Vancouver on August 1, 1963. He was born in Rouleau, Sask., July 17, 1912. His early education was in his native Province, after which he graduated in mining engineering from Queen's University in 1935. Before joining the Department in 1948 he had a varied career in mining—as an engineer at Hollinger Consolidated Gold Mines Ltd., as an instructor at the Haileybury School of Mines, and as a mine manager at Bayonne Consolidated Mines Ltd. He left the Department in 1959 to accept the position of Safety Director with the Mining Association of British Columbia, and in these duties established close co-operation with the Department.

Mr. King was an active member of the Canadian Institute of Mining and Metallurgy and the Association of Professional Engineers of British Columbia. He is survived by his wife and two sons.

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ANNUAL REPORT OF THE MINISTER OF MINES AND PETROLEUM RESOURCES, 1963

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 at Mines and Quarries, each with its own table of contents. A table listing lode-metal properties, in geographic groupings, precedes the 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 operations 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, early in the section on Coal, and in the section on Inspection of Electrical Equipment and Installations at Mines and Quarries.

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.

The Mineral Industry of British Columbia in 1963 *

The value of mineral production in British Columbia for 1963 exceeds a quarter of a billion dollars and brings the accumulated value at the end of 1963 to more than \$5 billion. The value for the decade 1954-63 exceeds \$1.8 billion.

Metals continue to be the principal group of mineral products, contributing more than two-thirds of the 1963 total value. Within the metals group, copper has resumed a position of great importance, now ranking with lead, and exceeded only by zinc. Iron production has grown materially and now is exceeded only by zinc, lead, and copper in the metals group and by oil in the fuels group. The industrial-minerals group, largely through large production of asbestos and sulphur, contributed more than 6 per cent of the total value and structural materials about 10 per cent. Fuels contributed 16.5 per cent of the 1963 value, divided between: Oil,† 9.9 per cent; gas and by-products, 4.2 per cent; coal, 2.4 per cent.

The total value for 1963 exceeds the 1962 value by more than \$28 million, and thus is much greater than for any previous year. New records were set in quantities and values for copper, iron, asbestos, sulphur, cement, sand and gravel, and oil, in values for silver and natural gas, and in total values for all groups of products. The metals group increased \$15 million over the 1962 value, and fuels increased by \$8.5 million.

The United States dollar was at a premium in Canadian funds throughout 1963; the premium ranged over narrow limits, averaging 7.87 per cent, a little higher than in 1962, consequently the Canadian price for gold averaged higher also. The United States price for copper also ranged over very narrow limits, and because of the greater exchange premium the price in Canadian funds averaged slightly higher than in 1962. The price of silver increased substantially from January to July, 1963, and thereafter changed little. The prices for lead and zinc increased in the same period. The 1963 averages for the three metals were significantly higher than the 1962 averages. The average prices to the producers for natural gas increased from 9.4 to 10.15 cents per M s.c.f., and for oil, from \$1.79 to \$1.89 per barrel.

The increased output of copper reflects the first full year of production from the Bethlehem and Coast Copper mines. Coast Copper made a significant contribution to lode-gold production. Copper concentrates from six properties, including by-product copper concentrates from the Texada iron ore, accounted for 28 per cent of the lode gold produced. The Jedway and Brynnor iron mines had their first full year of production. The Nimpkish iron mine ceased operation at the end of 1963. Zeballos iron did not produce in 1963. Increases over 1962 output by Brynnor and Jedway and small increases by Empire Development and by the Kimberley pig-iron plant served to offset decreases by other producers and to increase the total production of iron concentrates and sinter by 266,000 tons.

Production of asbestos was greater than in 1962 by 14 per cent in quantity and 13 per cent in value. The unit prices were somewhat greater than in 1963 and the proportions of various grades differed from 1962.

Production figures for jade for the past five years have been collected, and have been inserted under industrial minerals.

* By Hartley Sargent, Chief of the Mineralogical Branch.

† Includes condensate/pentanes plus from the gas-processing plant at Taylor and condensate separated from gas in the field.

Increased sales of sulphur, recovered in processing sour natural gas at Taylor, brought the sulphur from that source to 28 per cent of the reported sales. The remainder of the 1963 sulphur production was recovered from smelter fumes at Trail, from burning iron sulphide at Kimberley, and from iron sulphide sold by the Britannia mine.

Production of almost all items in the structural-materials group was at high level, establishing a new record for the group total.

Because of a large increase in the production of crude oil and increases in coal, natural gas, and natural-gas liquid by-products, the fuels group exceeded the 1962 value and established a new record. Production of crude oil, including condensate/pentanes plus,* increased from 1,810,984 barrels in 1961 to 9,841,363 barrels in 1962 and to 13,458,739 barrels in 1963.

Exploration for molybdenum included further diamond drilling followed by underground exploration and extensive bulk sampling at the property of Endako Mines Ltd., in central British Columbia. Many claims were recorded in the surrounding area, and preliminary exploration was done on many properties. In a wider area preliminary exploration was done on numerous properties and diamond drilling was done on several. Southwest Potash Corporation did further drilling on the Glacier Gulch property, and drilling the Alice property near Alice Arm was resumed by British Columbia Molybdenum Limited. Development of the Boss Mountain property was continued in preparation for production, and modifying the Bethlehem mill to permit recovery of by-product molybdenum was begun in 1963.

A substantial increase in reserves of iron ore was achieved in the Queen Charlotte Islands, where diamond drilling on the Tasu property has indicated a large tonnage of concentrating ore, and drilling was continued on the Jib group on Burnaby Island. Texada Mines continued a development programme looking toward underground mining. Brynnor Mines began shaft sinking, and toward the end of 1963 work was resumed at the F. L. property at Zeballos, also being prepared for underground mining. At the end of the year the Coast Copper mill was being modified to permit recovery of a by-product iron concentrate, and at Kimberley expansion of the acid and fertilizer plants and of the iron smelter was well advanced. The expansion will permit substantially increased production of by-product pig iron.

Exploration for copper was carried on actively in several areas, including the southern interior, northwestern British Columbia, and Vancouver Island. In the Stikine River area more than 25,000 feet of diamond drilling was done on the Galore Creek property (Stikine Copper Limited). Further work was done on the Granduc property northwest of Stewart. At McDonald Island in Babine Lake, work continued over several years on the property of Granisle Copper Limited has substantially increased the tonnage of low-grade ore.

Exploration for silver-lead-zinc ore included deep workings at two properties in the Slocan area, diamond drilling at two properties northwest of Revelstoke, and work on several properties at Alice Arm. Work continued on the Lynx and Paramount zinc-copper-gold-silver-lead vein systems.

Drilling for petroleum and natural gas increased to a new level in 1961 and to a still higher level in 1962. Some 60 per cent of this drilling was in development wells, a significant part being in developing the Boundary Lake oil field for production. This oil found a market when completion of the pipe-line of Western Pacific Products and Crude Oil Ltd. at the end of 1961 gave access to southwestern British Columbia. Total drilling in 1963 fell below the 1961 level; however, most of the

* Obtained in processing wet natural gas.

decrease was in development drilling, which declined to about 42 per cent of the total. Exploratory outpost and wildcat drilling in 1963 were materially greater than in 1961. Producing wells, reserves of oil, gas, and natural-gas liquids, and seismic and geological exploration all increased over 1962. Land held for petroleum and natural gas at the end of 1963 was a third more than at the end of 1962.

Pressure maintenance, to replace the natural energy in an oil pool by injecting fluid (usually water or gas), has been undertaken to obtain a greater rate of production and greater total production than would be achieved by using the natural energy alone. In 1963 six water-injection proposals were approved; two followed pilot projects approved in 1962. A proposal for gas conservation and partial pressure maintenance by return of gas to the gas cap of the Mississippian oil pool in the Blueberry field was approved, and a proposal for conservation of associated gas from the Boundary Lake oil field with delivery to the gas pipe-line was approved in principle.

The number of mineral claims recorded in 1963 was some 25,160, 4,500 more than in 1962; significant increases were recorded in Kamloops, Liard, Omineca, Skeena, and Victoria Mining Divisions. Revenue from sale of free miners' certificates and from recording fees, lease rentals, etc., amounted to \$366,140.38, compared with \$316,672.60 in 1962.

Iron concentrates subject to royalty, shipped in 1963, amounted to 973,133 long tons, dry weight, and the royalty paid or payable to the Government amounted to \$243,283.25.

Revenue to the Government from petroleum and natural gas amounted to \$20,350,040, including rentals, fees, and miscellaneous, \$7,722,651; sale of Crown reserves, \$7,092,009; royalties — gas, \$1,531,977; oil, \$3,858,985; processed products, \$115,042; miscellaneous fees, \$29,376.

The average number employed through 1963 in placer, lode, coal, industrial-mineral, and structural-material mining was 10,925. Major expenditures by those branches of the industry included: Salaries and wages \$56,393,735; fuel and electricity, \$10,091,744; process supplies (inclusive of explosives, chemicals, drill-steel lubricants, etc.), \$9,249,582, and for those branches except structural materials included; Federal taxes, \$12,474,505; Provincial taxes, \$5,983,478; municipal and other taxes, \$1,379,947; levies for workmen's compensation (including silicosis) and unemployment insurance, \$2,402,047. Dividends amounted to \$30,213,090. The lode-mining industry spent \$34,008,151 in freight and treatment charges on ores and concentrates. Returns from some operators in the metal-mining and industrial-mineral sections of the industry indicate that they made capital expenditures amounting to \$10,380,785 and spent \$6,338,717 on exploration in British Columbia. Parts of these sums may duplicate some of the expenditures shown under salaries and wages, fuel and electricity, and process supplies.

Returns from 35 operators in the petroleum and natural-gas industry show the following expense items: Salaries and wages, \$1,545,559; fuel and electricity, \$455,062; process supplies, \$3,673,743.

The Canadian Petroleum Association presented the following estimates of expenditures by its industry in British Columbia: (1) Exploration—(a) geological and geophysical work, \$9,000,000, (b) exploratory drilling, \$32,600,000; (2) development drilling, \$8,200,000; (3) capital expenditures, \$5,400,000; (4) operation of wells and flow-lines, \$4,500,000; (5) operation of gas plants, \$1,800,000; (6) general—(a) taxes excluding income tax, \$500,000, (b) royalties, \$5,500,000, (c) all other expenses, \$3,000,000.

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.

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.

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

METHODS OF COMPUTING PRODUCTION

The tables of statistics recording the mineral production of the Province for each year are compiled from certified returns made by the operators, augmented by some data obtained from the Royal Canadian Mint, from the operators of custom smelters, and from the records of the Petroleum and Natural Gas Branch of the Department of Mines and Petroleum Resources. The values are in Canadian funds. Weights are avoirdupois pounds and tons (2,000 lb.) and troy ounces.

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.

PLACER GOLD

The production of placer gold is obtained from returns received annually from the operators (1958) and other sources. 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 an average fineness of 822½ was used.

LODE METALS, GROSS AND NET CONTENTS, AND CALCULATED VALUE

The gross contents are compiled from the returns made each year by the producers and for any metal are the total assay contents, obtained by multiplying the assay by the weight of ore, concentrates, or bullion.

* 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 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 20 pounds per ton of concentrates.

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 beginning with 1963 is obtained by deducting from the gross content 20 pounds of copper per ton of concentrates; formerly the deduction was 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 METAL 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 16.

INDUSTRIAL MINERALS AND STRUCTURAL MATERIALS

Prices for these materials approximate the price at the point of origin. From 1953 to 1961 asbestos was valued at the shipping point in North Vancouver. For 1962 the value has been taken as the value at that pricing point less the shipping cost from the mine to North Vancouver. The values for the preceding years have also been reduced by the amount of the shipping charges.

FUEL

Coal

All coal produced, including that used in making coke, is shown as primary mine production (1959, tables renumbered in 1960). Washery loss and changes in stocks, year by year, are shown in the table "Collieries of British Columbia, Production and Distribution by Collieries and by Districts" (p. 239).

*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 gross well output is shown in Table 12, page 205. The quantity is reported as thousands of cubic feet at standard conditions (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).

Natural-gas Liquid By-products†

The liquid by-products are the butane and propane recovered in processing natural gas at Taylor, beginning with 1958.

*Petroleum**

Production of petroleum began in 1955, and is shown in Tables I, III, and VIIA. The quantity is "net sales" (see Tables 11 and 14, pp. 204 and 209), 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).

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.

* 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.

† For natural gasoline, condensate/pentanes plus, see under "Petroleum."

**AVERAGE PRICES USED IN VALUING PROVINCIAL PRODUCTION OF GOLD,
SILVER, COPPER, LEAD, ZINC, AND COAL**

Year	Gold, ¹ 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 "	3.60 "	.....	.....
1903.....	.....	.....	50.78 "	13.24 "	3.81 "	.....	.....
1904.....	.....	.....	53.26 "	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.....	.....	.....	60.22 "	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 "	8.67 "	6.94 "	4.464
1919.....	.....	.....	105.57 "	18.70 "	5.19 "	6.24 "	.....
1920.....	.....	.....	95.80 "	17.45 "	7.16 "	6.52 "	.....
1921.....	.....	.....	59.52 "	12.50 "	4.09 "	3.95 "	.....
1922.....	.....	.....	64.14 "	13.38 "	5.16 "	4.86 "	.....
1923.....	.....	.....	61.63 "	14.42 "	6.54 "	5.62 "	.....
1924.....	.....	.....	63.442 "	13.02 "	7.287 "	5.39 "	.....
1925.....	.....	.....	69.065 "	14.042 "	7.848 Lond.	7.892 Lond.	.....
1926.....	.....	.....	62.107 "	13.795 "	6.751 "	7.409 "	.....
1927.....	.....	.....	56.37 "	12.92 "	5.256 "	6.194 "	.....
1928.....	.....	.....	58.176 "	14.570 "	4.575 "	5.493 "	.....
1929.....	.....	.....	52.993 "	18.107 "	5.050 "	5.385 "	.....
1930.....	.....	.....	38.154 "	12.982 "	3.927 "	3.599 "	.....
1931.....	.....	.....	28.700 "	8.116 "	2.710 "	2.554 "	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 "	4.002 "	.....
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 "	4.68
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.....	29.00	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	89.873 "	39.787 "	15.756 "	13.278 "	6.59
1957.....	27.59	33.53	87.057 "	26.031 "	14.051 "	11.175 "	6.76
1958.....	27.04	33.98	86.448 "	23.419 "	11.755 "	10.009 "	7.45
1959.....	27.61	33.57	87.469 "	27.708 "	11.870 "	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 "	11.605 "	7.40
1962.....	29.25	37.41	116.029 "	30.473 "	10.801 "	12.422 "	7.43
1963.....	29.31	37.75	137.965 "	30.646 "	12.012 "	13.173 "	7.33

¹ Beginning with 1962, the value of the fine-gold content has been used.

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

	Total Quantity to Date	Total Value to Date	Total Quantity, 1954-63	Total Value, 1954-63	Quantity, 1963	Value, 1963
Metals						
Antimony.....lb.	44,293,149	\$ 11,846,816	15,848,385	\$ 5,601,693	1,601,253	\$ 624,489
Bismuth.....lb.	5,796,049	10,066,173	1,906,454	4,078,434	157,099	348,760
Cadmium.....lb.	31,504,835	48,004,633	16,033,572	27,118,028	1,981,004	4,754,410
Chromite.....tons	796	32,295				
Cobalt.....lb.	1,730	420				
Copper.....lb.	3,244,759,683	574,273,830	495,265,334	153,992,663	123,401,020	37,817,476
Gold—placer.....oz.	5,228,714	96,761,413	51,569	1,453,273	4,620	135,411
Iron concentrates.....tons	16,183,864	472,144,856	1,963,586	68,160,194	155,824	5,882,356
Lead.....lb.	11,783,044	96,632,900	9,703,003	83,360,143	2,060,241	20,746,424
Magnesium.....lb.	14,233,234,001	1,097,948,182	3,150,510,101	396,431,483	314,974,310	37,834,714
Manganese.....tons	204,632	88,184				
Mercury.....lb.	1,742	32,668				
Molybdenite (MoS ₂).....lb.	4,163,662	10,409,609	75	250		
Nickel.....lb.	52,171	46,198	9,023	9,300		
Palladium.....oz.	17,887,899	13,677,603	17,606,446	13,589,879	3,699,402	3,107,498
Platinum.....oz.	749	30,462				
Selenium.....lb.	1,407	135,008	15	1,193	2	150
Silver—placer ² oz.	731	1,389				
“Iode.....oz.	20,465	17,625	6,536	6,150	651	898
Tin.....lb.	443,895,509	281,241,013	74,957,788	70,779,296	6,450,096	8,898,875
Tungsten (WO ₃).....lb.	15,396,536	11,786,369	7,053,062	5,363,216	927,062	648,943
Zinc.....lb.	16,019,324	38,663,751	8,963,397	24,689,203		
Others.....lb.	12,269,403,664	1,061,353,918	4,098,443,046	483,853,339	402,863,154	53,069,163
Totals.....		5,110,468		5,079,054		633,389
		3,830,305,783		1,343,566,995		174,502,956
Industrial Minerals						
Arsenious oxide.....lb.	22,019,420	273,201				
Asbestos ³ tons	349,148	73,495,343	346,026	72,694,102	63,215	11,681,337
Barite.....tons	202,334	2,463,608	139,084	2,161,810	8,207	69,588
Bentonite.....tons	791	16,858				
Diatomite.....tons	2,532	71,640	1,133	40,623	458	16,030
Fluorspar.....tons	35,341	784,964				
Fluxes.....tons	3,783,887	6,418,875	886,543	2,580,726	60,490	223,012
Granules.....tons	198,725	2,815,090	157,358	2,243,551	19,444	348,443
Gypsum and gypsum.....tons	2,455,526	9,782,264	1,217,441	3,557,524	160,954	482,862
Hydro-magnesite.....tons	2,253	27,536				
Iron oxide and ochre.....tons	18,108	155,050				
Jade.....lb.	207,986	72,490	207,986	72,490	16,000	15,529
Magnesium sulphate.....tons	13,894	254,352				
Mica.....lb.	12,822,050	185,818	1,539,300	25,482		
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	5,012,171	54,322,720	2,366,871	29,308,712	254,197	3,673,997
Talc.....tons	1,805	34,871				
Totals.....		151,331,075		112,685,022		16,510,898
Structural Materials						
Cement.....tons	8,343,443	122,343,376	3,996,053	66,847,065	476,071	8,546,768
Clay products.....tons		49,084,973		21,353,514		2,824,583
Lime and limestone.....tons		33,872,130	4,946,828	15,164,540	907,203	1,723,796
Rock ⁴ tons		30,830,817	15,739,691	16,561,278	1,913,906	1,259,002
Sand and gravel.....tons		119,606,462	133,237,383	77,975,203	17,387,026	9,514,095
Stone.....tons	1,074,653	8,720,671	102,232	975,546	1,827	13,946
Not assigned.....tons		5,972,171				
Totals.....		370,430,600		198,877,148		23,882,190
Fuels						
Coal ⁵ tons	137,011,697	\$76,034,904	10,014,033	70,654,166	850,446	6,237,997
Natural gas— To pipe-line.....M s.c.f.	520,416,729	44,635,019	520,416,729	44,635,019	105,525,373	10,719,298
Liquid by-products ⁶ bbl.	2,341,810	497,456	2,341,810	497,456	614,249	189,977
Petroleum crude.....bbl.	29,442,164	52,334,025	29,442,164	52,334,025	13,458,739	25,470,361
Totals.....		673,501,404		168,120,666		42,617,633
Grand totals.....		5,025,568,862		1,823,249,831		257,513,677

¹ Includes sinter used in making pig iron; 1963, 61,597 tons sinter (value, \$674,487) used in making 37,678 tons of pig iron. ² Silver content of placer gold received at Royal Canadian Mint. ³ See note under "Industrial Minerals and Structural Materials," page A14. ⁴ Rubble, riprap, and crushed stone. ⁵ Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. From 1910 and subsequent years the quantity is that sold and used. ⁶ Butane and propane produced. ⁷ Includes 12,528,681 bbl. of crude petroleum and 930,058 bbl. of condensate/pentanes plus, valued at \$24,927,586 and \$542,775 respectively. ⁸ Does not include 70,397 tons of peat moss, valued at \$4,222,783.

TABLE II.—TOTAL VALUE OF PRODUCTION, 1836-63

1836-1910.....	\$373,397,934	1952.....	\$171,365,687	1958.....	\$144,953,549
1911-20.....	332,274,218	1953.....	152,841,695	1959.....	147,643,963
1921-30.....	352,421,604	1954.....	152,894,663	1960.....	177,365,333
1931-40.....	521,652,996	1955.....	173,853,360	1961.....	179,807,321
1941-50.....	941,496,981	1956.....	188,853,652	1962.....	229,371,484
1951.....	176,867,916	1957.....	170,992,829	1963.....	257,513,677

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Description		1954		1955		1956		1957		1958	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
<i>Metals</i>			\$		\$		\$		\$		\$
Antimony	lb.	1,302,333	382,104	2,021,726	667,776	2,140,432	768,843	1,360,731	577,344	858,633	284,208
Bismuth	lb.	225,351	493,519	160,767	356,903	156,753	346,424	145,634	314,569	154,034	308,068
Cadmium	lb.	680,734	1,123,211	1,593,591	2,677,233	1,937,927	3,236,338	1,946,397	3,172,627	1,425,108	2,166,164
Copper	lb.	50,150,087	14,599,693	44,238,031	16,932,549	43,360,575	17,251,872	31,387,441	8,170,465	12,658,649	2,964,529
Gold—placer, crude	oz.	8,684	238,967	7,666	217,614	3,865	109,450	2,936	80,990	5,650	157,871
" lode, fine	oz.	258,388	8,803,279	242,477	8,370,306	191,743	6,603,628	223,403	7,495,170	194,354	6,604,149
Iridium	oz.	477	1,278	232,389	363,192	795,390	384,360	693,770	75,434	117,677	11,677
Iron concentrates ¹	tons	535,746	3,733,891	610,930	3,228,756	369,955	2,190,847	357,342	2,200,637	630,271	4,193,442
Lead	lb.	332,474,456	45,482,505	302,567,640	45,161,245	283,718,073	44,702,619	281,603,346	39,568,086	294,573,159	34,627,075
Mercury	lb.			75	250						
Molybdenite (MoS ₂)	lb.										
Nickel	tons									1,408,490	996,507
Platinum	oz.	4	408							4	260
Silver—placer ²	oz.	1,250	1,037	1,004	882	474	423	301	262	642	555
" lode	oz.	9,825,153	8,153,108	7,902,145	6,942,113	8,404,600	7,511,443	8,129,047	7,076,904	7,040,416	6,086,299
Tin	lb.	333,788	263,359	391,228	311,613	756,934	637,792	709,102	555,936	795,496	625,260
Tungsten (WO ₃)	lb.	2,172,163	5,752,172	1,914,000	5,460,967	2,264,775	6,351,376	1,921,483	5,240,479	690,976	1,884,209
Zinc	lb.	334,124,560	34,805,755	429,198,565	52,048,909	443,853,004	58,934,801	449,276,797	50,206,681	432,002,790	43,234,839
Others											
Totals			123,834,286		142,609,505		149,441,246		125,353,920		104,251,112
<i>Industrial Minerals</i>											
Asbestos ³	tons	8,599	2,329,906	17,187	3,234,751	20,356	5,398,730	31,714	7,342,966	30,078	6,398,679
Barite	tons	5,056	115,337	9,465	238,825	11,436	287,626	20,072	433,200	16,144	341,700
Diatomite	tons			14	280	40	800	120	2,400	27	540
Fluxes (quartz, limestone)	tons	39,897	40,804	111,759	208,198	176,311	392,429	137,433	442,204	90,635	311,630 ⁴
Granules (quartz, limestone, granite)	tons	4,541	65,507	6,355	73,858	13,200	173,214	17,295	221,864	22,674	284,330
Gypsum and products	tons	175,480	421,734	149,719	383,934	72,978	391,919	66,499	142,751	70,498	211,494
Jade	lb.										
Mica	lb.	284,000	5,326	505,300	2,861	198,000	4,884	180,000	1,200		
Sulphur	tons	234,252	2,525,500	227,530	2,796,783	212,885	2,523,190	228,882	2,887,465	211,300	2,410,395
Totals			5,504,114		6,939,490		9,172,792		11,474,050		9,958,768
<i>Structural Materials</i>											
Brick—common	No.	1,289,911	35,550	4,853,940	232,139	2,248,447	75,767	663,828	24,345	427,550	15,125
" face, paving, sewer	No.	5,651,260	316,676	3,901,866	248,913	6,913,682	485,176	4,660,231	345,081	4,871,562	344,133
" firebrick, blocks	No.		372,528		578,578		604,063		658,873		405,485
Clays	tons	6,609	36,425	8,033	46,757	7,985	30,263	3,849	29,495	4,105	12,579
Structural tile, hollow blocks	tons		122,903		114,460		129,257		200,216		122,877
Drain-tile, sewer-pipe, flue-linings	tons		753,297		801,019		696,385		697,611		639,173
Pottery—glazed or unglazed	tons		31,081		38,035		38,385		47,612		68,387
Other clay products	tons		32,697		55,514		69,659		38,868		32,416
Cement	tons	305,117	4,935,298	334,057	5,474,875	396,138	6,339,071	443,469	7,078,108	414,396	6,755,619
Lime and limestone	tons	317,976	1,555,002	318,152	1,711,348	396,012	1,220,792	334,303	1,494,578	269,747	997,819
Rubble, riprap, crushed rock	tons	920,707	1,253,856	890,613	962,272	2,028,143	2,210,315	2,364,301	4,272,768	1,866,950	2,098,952
Sand and gravel	tons	8,547,021	4,850,469	9,650,699	4,886,890	13,762,227	8,535,348	16,829,816	10,503,274	14,173,169	8,442,676
Stone	tons	3,055	99,392	26,079	148,454	35,266	139,150	2,403	236,110	2,141	64,335
Totals			14,395,174		15,299,254		20,573,631		25,626,939		19,999,576
<i>Fuels</i>											
Coal—sold and used	tons	1,308,284	9,154,544	1,332,874	8,986,501	1,417,209	9,346,518	1,085,657	7,340,339	796,413	5,937,860
Natural gas delivered to pipe-line	M s.c.f.	60,883	6,545	168,651	18,130	187,846	20,143	7,126,346	433,830	58,039,491	3,368,327
Natural-gas liquid by-products ⁵	bbl.									150,704	30,935
Petroleum, crude ⁶	bbl.			582	480	148,454	299,322	373,284	763,751	845,168	1,406,971 ⁷
Totals			9,161,089		9,005,111		9,665,983		8,537,920		10,744,093
Provincial totals			152,894,663		173,853,360		188,853,652		170,992,829		144,953,545

Description		1959		1960		1961		1962		1963	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Metals											
Antimony	lb.	1,657,797	\$ 540,276	1,651,786	\$ 538,482	1,331,297	\$ 469,948	1,931,397	\$ 748,223	1,601,253	\$ 624,489
Bismuth	lb.	181,843	345,502	213,009	419,628	283,363	637,567	228,601	507,494	157,099	348,760
Cadmium	lb.	1,695,821	2,170,651	1,778,866	2,525,990	907,432	1,451,891	2,086,692	3,839,513	1,981,004	4,754,410
Copper	lb.	16,233,546	4,497,991	33,064,429	9,583,724	31,692,412	8,965,149	108,979,144	33,209,215	123,401,020	37,817,476
Gold—placer, crude	oz.	7,570	208,973	3,847	107,418	3,416	99,884	3,315	96,697	4,620	135,411
Iode, fine	oz.	173,146	5,812,511	205,580	6,979,441	159,821	5,667,253	158,580	5,942,101	155,824	5,882,356
Indium	oz.	—	—	—	—	—	—	—	—	—	—
Iron concentrates ¹	tons	849,248	6,363,848	1,160,355	10,292,847	1,335,068	12,082,540	1,793,847	18,326,911	2,060,241	20,746,424
Lead	lb.	287,423,357	33,542,306	333,608,699	38,661,912	384,284,524	42,313,569	335,282,537	34,537,454	314,974,310	37,834,714
Mercury	lb.	—	—	—	—	—	—	—	—	—	—
Molybdenite (MoS ₂)	lb.	—	—	9,023	9,500	—	—	—	—	—	—
Nickel	lb.	1,061,532	743,072	3,779,878	2,645,915	4,180,677	3,194,037	3,476,467	2,902,850	3,699,402	3,107,498
Platinum	oz.	—	—	—	—	—	—	—	—	—	—
Silver—placer ²	oz.	942	824	406	360	429	402	5	375	2	150
Iode	oz.	6,197,159	5,420,593	7,446,237	6,599,823	7,373,568	6,908,738	6,189,367	7,181,400	6,450,096	8,898,875
Tin	lb.	747,443	627,852	621,718	522,243	1,119,350	727,578	650,941	442,640	927,062	648,943
Tungsten (WO ₃)	lb.	—	—	—	—	—	—	—	—	—	—
Zinc	lb.	402,342,850	44,169,198	403,399,319	50,656,726	387,951,190	45,370,891	413,430,817	51,356,376	402,863,154	53,069,163
Others	—	—	632,933	—	760,364	—	676,327	—	535,537	—	633,389
Totals	—	—	105,076,530	—	130,304,373	—	128,565,774	—	159,627,293	—	174,502,956
Industrial Minerals											
Asbestos ³	tons	33,883	7,878,947	40,748	9,482,923	45,113	8,648,503	55,133	10,297,360	63,215	11,681,337
Barite	tons	23,142	187,368	23,573	279,716	15,478	151,388	6,511	57,062	8,207	69,588
Diatomite	tons	5	100	44	430	214	8,817	211	10,228	458	16,030
Fluxes (quartz, limestone)	tons	70,570	248,913	83,370	294,559	53,335	190,500	62,743	228,477	60,490	223,012
Granules (quartz, limestone, granite)	tons	19,072	254,251	19,063	257,067	17,463	253,015	18,251	311,902	19,444	348,543
Gypsum and products	tons	112,223	282,030	107,900	337,200	153,300	459,900	147,900	443,700	160,954	482,862
Jade	lb.	15,000	5,000	50,300	10,325	69,751	20,876	56,935	20,760	16,000	15,529
Mica	lb.	—	—	122,000	3,186	250,000	8,025	—	—	—	—
Sulphur	tons	251,552	3,253,677	264,705	3,095,696	242,377	3,207,284	239,191	2,934,725	254,197	3,673,997
Totals	—	—	12,110,286	—	13,762,102	—	12,948,308	—	14,304,214	—	16,510,898
Structural Materials											
Brick—common	No.	385,810	11,954	2,262,653	187,673	244,532	14,809	1,179,165	54,849	1,086,688	63,499
face, paving, sewer	No.	5,412,822	428,100	1,775,591	145,091	3,728,779	326,346	3,313,179	309,582	2,845,704	292,535
firebrick, blocks	—	—	538,566	—	621,865	—	584,969	—	640,307	—	758,008
Clays	tons	6,250	17,001	8,003	22,671	7,908	28,396	8,105	30,027	2,573	33,151
Structural tile, hollow blocks	—	—	149,383	—	83,842	—	45,753	—	36,665	—	31,376
Drain-tile, sewer-pipe, flue-linings	—	—	680,702	—	616,858	—	686,998	—	898,908	—	846,202
Pottery—glazed or unglazed	—	—	46,902	—	48,825	—	11,890	—	23,947	—	14,562
Other clay products	—	—	80,910	—	346,883	—	667,303	—	513,153	—	785,250
Cement	tons	427,181	7,049,638	384,853	6,432,752	417,336	7,122,046	397,435	7,112,890	476,071	8,546,768
Lime and limestone	tons	519,580	1,481,292	565,945	1,602,019	758,882	1,864,315	559,028	1,513,579	907,203	1,723,796
Rubble, riprap, crushed rock	tons	1,169,854	1,128,353	1,148,305	1,075,373	1,539,640	1,016,086	1,897,272	1,284,301	1,913,906	1,259,002
Sand and gravel	tons	11,349,121	7,342,698	12,355,955	7,597,278	11,424,958	7,439,710	17,757,391	8,862,767	17,387,026	9,514,095
Stone	tons	13,710	69,710	4,328	48,859	5,400	70,300	8,023	85,290	1,827	13,946
Totals	—	—	19,025,209	—	18,829,989	—	19,878,921	—	21,366,265	—	23,882,190
Fuels											
Coal—sold and used	tons	690,011	5,472,064	788,658	5,242,223	919,142	6,802,134	825,339	6,133,986	850,446	6,237,997
Natural gas delivered to pipe-line	M s.c.f.	64,525,633	3,921,583	80,115,399	7,101,949	95,967,110	8,818,891	108,699,997	10,226,323	105,525,373	10,719,298
Natural-gas liquid by-products ⁵	bbl.	303,954	43,695	428,553	53,910	473,948	82,592	370,402	96,347	614,249	189,977
Petroleum, crude ⁶	bbl.	1,374,116	1,994,596	1,589,474	2,070,787	1,810,984	2,710,701	9,841,363	17,617,056	13,458,739	25,470,361 ⁷
Totals	—	—	11,431,938	—	14,468,869	—	18,414,318	—	34,073,712	—	42,617,633
Provincial totals	—	—	147,643,963	—	177,365,333	—	179,807,321	—	229,371,484	—	257,513,677

¹ Beginning 1961 includes sinter used in making pig iron (see note 1, page A 17).

² See note under "Industrial Minerals and Structural Materials," page A 14.

³ All petroleum sales including well-head sales, refinery sales, and condensate/pentanes plus.

⁴ Silver content of placer gold received at Royal Canadian Mint.

⁵ Includes 32 tons of fluorspar mined in 1958.

⁶ See footnote 7, page A 17.

⁷ Butane and propane.

STATISTICS

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TABLE IV.—VALUES FOR 1836-1900 ARE TOTALS FOR THE PERIOD OF PRODUCTION; VALUES FOR SUBSEQUENT PERIODS ARE AVERAGE PER YEAR OR VALUES FOR THE PARTICULAR YEAR

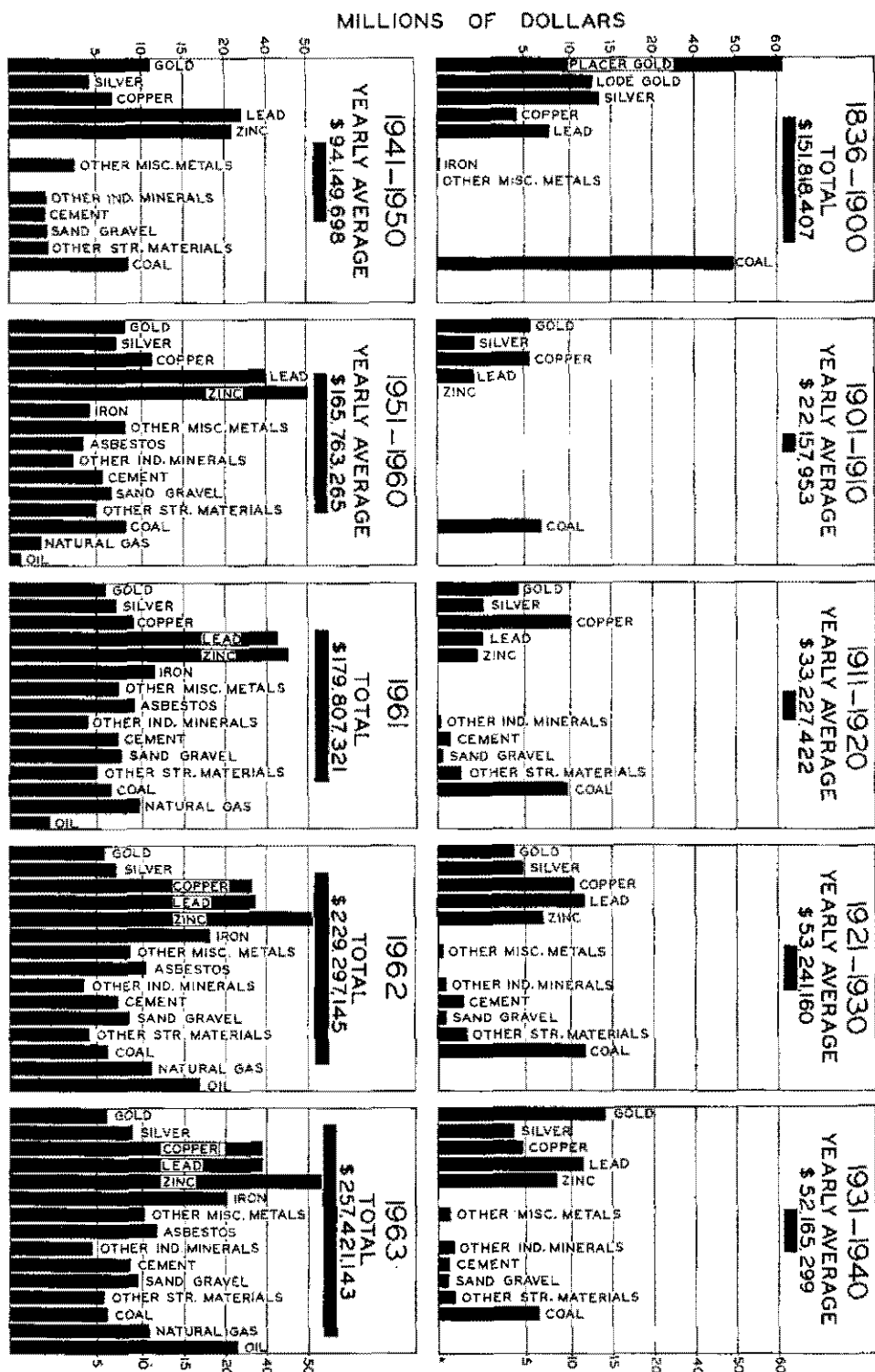


TABLE V.—QUANTITIES FOR 1836-1900 ARE TOTALS FOR THE PERIOD OF PRODUCTION; QUANTITIES FOR SUBSEQUENT PERIODS ARE AVERAGES PER YEAR OR QUANTITIES FOR THE PARTICULAR YEAR

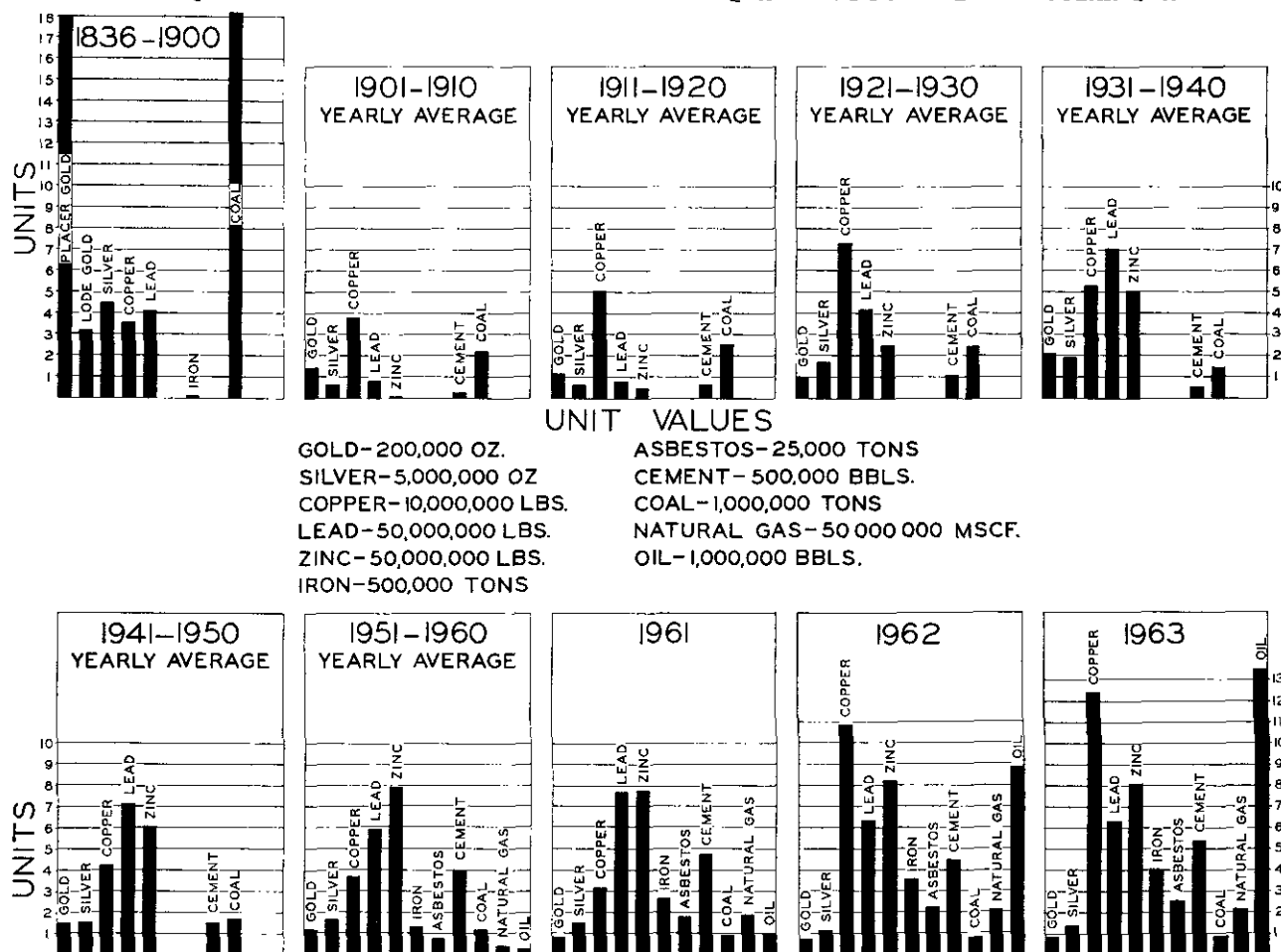


TABLE VI.—PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC, 1858–1963

Year	Placer Gold		Gold		Silver ³		Copper		Lead ⁴		Zinc ^{4 5}		Total Value
	Quantity ¹	Value	Quantity ²	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	51,582,906	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	1,968,606	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	1,876,736	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	3,498,172	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	3,592,677	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	25,767,662
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

	Oz.	\$	Oz.	\$	Oz.	\$	Lb.	\$	Lb.	\$	Lb.	\$	\$
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	359,503	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	155,824	5,882,356	6,450,747	8,899,773	123,401,020	37,817,476	314,974,310	37,834,714	402,863,154	53,069,163	143,638,893
Totals	5,228,714	96,761,413	16,183,864	472,144,856	443,915,974	281,258,638	3,244,759,683	574,273,830	14,233,234,001	1,097,948,182	12,269,403,664	1,061,353,918	3,583,740,837

¹ Ounces of crude gold.

² Ounces of fine gold.

³ Includes silver content of placer gold received at the Royal Canadian Mint in 1947 and subsequent years.

⁴ Revisions have been 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.

⁵ 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.

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TABLE VIIA.—PRODUCTION, 1962 AND 1963, AND

Division	Period	Placer			Lode Metals	Industrial Minerals	Structural Materials
		Quantity ¹	Gold Value	Silver ² Value			
		Oz.	\$	\$	\$	\$	\$
Alberni	1962				7,348,293		104,685
	1963				7,951,884		213,735
	To date	1,617	33,253		26,997,471	9,398	1,463,865
Atlin	1962	658	19,938	111			4,537
	1963	186	5,548	37			12,739
	To date	735,153	17,370,206	1,544	38,045,476	20,325	308,995
Cariboo	1962	1,668	47,918	222	700,467	10,228	562,814
	1963	1,760	53,138	284	695,494	16,030	523,763
	To date	2,606,350	54,045,807	2,178	41,046,332	214,820	6,592,945
Clinton	1962						
	1963	21	642	3			
	To date	10,162	242,880	19	848,354	162,427	110,928
Fort Steele	1962	44	1,347	4	57,561,412	607,175	203,701
	1963				68,617,438	541,549	171,807
	To date	20,531	468,450	5	1,738,696,739	6,691,321	5,284,122
Golden	1962				3,459,565	500,762	89,178
	1963				3,382,581	552,450	9,378
	To date	469	11,268		52,170,541	5,607,080	1,690,767
Greenwood	1962				4,250,088		25,887
	1963				4,088,631		27,257
	To date	5,074	115,662	2	133,137,608	2,323,897	832,582
Kamloops	1962	15	486	1			702,513
	1963				7,704,078		532,828
	To date	27,571	604,106	3	10,857,940	6,528,308	10,115,330
Liard	1962	30	860	4		11,160,051	332,182
	1963					13,476,931	537,586
	To date	50,184	1,248,151	7	6,391	78,477,879	2,625,180
Lillooet	1962				3,760,290	20,760	165,840
	1963	25	785	4	9,808,082	15,529	209,952
	To date	91,916	1,894,304	36	133,810,753	77,619	1,830,949
Nanaimo	1962				10,971,066	32,317	1,871,992
	1963				13,388,639	44,000	1,896,475
	To date	866	19,300		89,112,825	822,100	37,218,922
Nelson	1962				15,117,191	17,512	203,273
	1963				13,164,583	81,438	237,217
	To date	3,585	88,988		250,052,137	163,076	3,373,489
New Westminster	1962				3,373,743	106,890	4,745,898
	1963				3,641,406	88,000	5,841,366
	To date	11,608	243,614		15,817,697	982,261	80,170,009
Nicola	1962				23,910,483		12,625
	1963				17,622,062		38,392
	To date	234	4,764		43,961,053	10,050	556,157
Omineca	1962	807	23,604	152	13,461		414,884
	1963	2,336	66,989	519	20,239		172,500
	To date	56,075	1,493,253	724	33,046,827	11,460	4,144,156
Osoyoos	1962	13	374	2	38,070	383,600	95,579
	1963				3,531	358,042	111,826
	To date	221	5,013	5	51,131,366	4,475,944	1,232,061
Revelstoke	1962						25,972
	1963				1,382		68,768
	To date	7,582	164,477	57	11,237,401	18,558	1,384,889
Similkameen	1962	3	75		2,026		131,550
	1963	10	301		172		131,000
	To date	12,161	288,587		120,192,570	1,229,400	2,605,377
Skeena	1962				678,096		256,384
	1963				3,112,191		193,334
	To date	4,603	105,669		214,772,679		7,495,883
Slocan	1962				5,527,010		106,928
	1963				7,331,224		38,490
	To date	366	9,397		202,207,617		1,073,450
Trail Creek	1962				46,374		92,088
	1963				75,010		66,232
	To date	851	24,260		83,730,935		1,996,203
Vancouver	1962				5,211,545	65,799	4,539,748
	1963				5,476,475	11,004	5,097,385
	To date	182	5,306		220,133,229	6,459,318	57,037,314
Vernon	1962						66,164
	1963	27	803	4			134,723
	To date	2,732	72,885	26	197,845	3,978	2,853,289
Victoria	1962				1,574,464	60	5,025,619
	1963				2,539,116	75	5,778,979
	To date	628	15,680		12,924,777	188,381	125,085,666
Not assigned ⁷	1962	77	2,095	11	15,986,445	1,399,060	1,586,244
	1963	255	7,435	47	12,242,429	1,326,850	1,536,358
	To date	1,577,993	18,186,233	13,019	209,290,182	36,853,475	13,348,572
Totals	1962	3,315	96,897	507	159,530,089	14,304,214	21,366,265
	1963	4,620	135,411	898	174,369,647	16,510,898	23,882,190
	To date	5,228,714	96,761,413	17,625	3,733,526,745	151,331,075	370,430,600

¹ Crude gold—equivalent in fine gold; 1962, 2,585 oz.; 1963, 3,588 oz. The year of first recorded production for the major placer-producing mining divisions was: Atlin, 1898; Cariboo, 1858; Lillooet, 1874; Quesnel, 1858.

² The accumulated value for placer silver is the value of the silver content of placer gold received at the Royal Canadian Mint in 1947 and subsequent years.

³ Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. For Cariboo, 1942; Fort Steele, 1898; Kamloops, 1893; Liard, 1923; Nanaimo, 1836; Nicola, 1907; Omineca, 1918; Osoyoos, 1926; Similkameen, 1909; Skeena, 1912.

TOTAL TO DATE, BY MINING DIVISIONS—SUMMARY

Coal		Petroleum ⁴		Natural Gas (Direct to Pipe-line)		Liquid By-products ⁵		Division Totals
Quantity ³	Value	Quantity	Value	Quantity	Value	Quantity	Value	
Tons	\$	Bbl.	\$	M S.C.F.	\$	Bbl.	\$	\$
								7,452,978
								5,165,619
								28,503,487
								24,588
								13,324
								55,748,546
								1,321,649
								1,289,706
								101,903,182
290	1,100							645
								1,364,608
								63,629,179
784,531	5,255,540							74,785,195
766,907	5,454,401							1,892,905,709
54,691,345	241,765,972							4,049,505
								3,944,409
								59,479,658
								4,275,975
								4,115,888
								136,409,751
								703,000
								8,537,006
15,087	59,165							28,165,452
1,389	12,501	9,841,363	17,617,056	108,699,997	10,226,323	370,402	85,347	59,445,324
1,146	10,414	13,458,739	25,470,361	105,525,373	10,719,298	614,248	189,977	50,403,567
99,383	693,771	29,442,164	52,334,025	520,416,729	44,635,019	2,341,810	497,450	180,522,879
								3,946,890
								3,534,322
								137,613,661
83,534	801,294							13,676,669
76,728	711,085							16,040,199
74,219,041	300,030,865							427,204,012
								15,337,976
								13,483,238
								253,677,690
								8,226,531
								9,570,772
								97,313,551
125	1,375							23,924,383
60	660							17,661,114
2,929,584	11,080,836							55,812,860
5,760	63,276							515,357
5,605	61,437							321,684
438,367	2,889,646							41,536,065
								517,625
								473,399
1,122	5,008							50,849,397
								25,972
								70,150
								12,805,382
								133,651
								137,478
4,617,442	19,553,725							143,869,659
								934,480
36	116							3,305,525
								222,374,247
								5,683,938
								7,369,714
								203,290,464
								188,462
								141,242
								65,751,398
								9,817,092
								10,594,864
								283,635,167
								68,164
								185,390
								3,128,023
								6,600,143
								5,915,170
								188,214,504
								18,973,555
								15,112,119
								277,091,481
825,339	6,133,986	9,841,363	17,617,056	108,699,997	10,226,323	370,402	96,347	239,371,484
850,446	6,287,997	13,458,739	25,470,361	105,525,373	10,719,298	614,248	189,977	257,513,677
137,011,697	576,034,904	29,442,164	52,334,025	520,416,729	44,635,019	2,341,810	497,456	5,025,568,862

⁴ All petroleum sales including well-head sales, refinery sales, and condensate/pentanes plus.⁵ Butane and propane.⁶ See footnote 7, page A 16.⁷ Re "not assigned," see footnotes under Tables VIIa and VIIc.

NOTE.—For individual metals, industrial minerals, and structural materials, see Tables VIIb, VIIc, VIId, and VIIe.

TABLE VII.B.—PRODUCTION, 1962 AND 1963, 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	1962	1,369	51,210	576	666			2,574	265	67	8	52,152
	1963	411	15,515	114	157			143	17			15,689
	To date	303,023	11,337,278	162,583	78,912	2,290,699	343,518	121,344	5,419	67	8	11,765,135
Atlin	1962											
	1963											
	To date	344,197	12,128,732	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	1962	18,624	696,668	3,274	3,799							700,467
	1963	18,308	691,127	3,165	4,367							695,494
	To date	1,138,110	40,927,100	133,263	90,839	2,352	920	24,560	3,724	505	19	41,022,602
Clinton	1962											
	1963											
	To date	23,390	827,328	31,564	14,214	57,548	5,905	193	7			847,454
Fort Steele	1962	392	14,664	3,790,112	4,397,630			238,618,684	24,580,111	222,131,449	27,593,168	56,585,573
	1963	358	13,515	4,018,637	5,544,313			252,795,953	30,365,850	238,141,121	31,370,330	67,294,008
	To date	6,031	179,257	215,872,177	130,846,026	28,562	6,193	12,037,631,238	896,158,897	8,775,269,170	637,921,387	1,725,111,700
Golden	1962			224,288	260,240	74,123	22,588	8,739,952	900,302	17,460,837	2,168,985	3,352,115
	1963			183,117	252,637			7,408,011	889,850	16,250,939	2,140,736	3,283,223
	To date	169	4,844	3,875,430	3,145,785	1,108,211	365,531	239,243,608	22,972,537	282,466,746	24,945,889	51,437,086
Greenwood	1962	16,812	628,886	889,745	1,032,363	7,768,401	2,367,265	888,962	91,572	959,875	119,236	4,239,322
	1963	12,570	474,517	926,088	1,277,677	6,857,135	2,101,438	793,217	95,281	957,831	126,175	4,075,088
	To date	1,205,055	26,978,367	35,729,490	23,119,996	472,931,633	79,820,521	18,207,571	1,517,276	19,534,836	1,579,903	123,016,063
Kamloops	1962											
	1963	3,191	120,460	113,186	156,157	24,236,315	7,427,461					7,704,078
	To date	51,059	1,728,788	417,443	338,148	30,654,307	8,614,502	538,097	45,030	438,023	29,826	10,756,294
Liard	1962											
	1963											
	To date	114	4,120	540	446	56	22	10,102	1,724			6,312
Lillooet	1962	99,902	3,737,034	20,043	23,256							3,760,290
	1963	87,016	3,284,854	16,836	23,228							3,308,082
	To date	3,806,657	133,157,346	917,583	602,466	400	47	62,513	2,548	15	2	133,762,403
Nanaimo	1962	2,729	102,083	21,949	25,407	2,737,051	834,062					961,552
	1963	17,539	662,097	63,454	87,544	11,672,147	3,577,046					4,326,687
	To date	109,396	2,859,639	755,022	538,276	42,608,024	9,686,572					13,084,487
Nelson	1962	983	36,771	141,444	164,117			31,339,691	3,228,302	86,505,761	10,745,746	14,174,936
	1963	1,187	44,809	112,035	154,569			19,762,519	2,373,874	72,247,522	9,517,166	12,090,418
	To date	1,333,156	41,694,637	8,527,314	5,373,075	14,915,405	1,689,196	376,729,502	44,367,518	919,668,796	113,482,369	206,606,795
New Westminster	1962	17	636	911	1,058	1,539,719	469,199					470,893
	1963					1,742,179	533,908					533,908
	To date	4,466	114,164	15,114	7,720	7,315,449	2,116,610	28,425	1,119	12,755	481	2,240,094
Nicola	1962					78,464,488	23,910,483					23,910,483
	1963					57,501,996	17,622,062					17,622,062
	To date	8,541	235,481	275,599	134,205	143,056,893	43,489,490	2,239,124	90,923	323,735	10,954	43,961,053
Omineca	1962	21	786	8,125	9,428			12,166	1,253	7,806	970	13,461
	1963	12	453	5,784	7,980			34,205	4,109	51,271	6,754	15,296
	To date	23,123	775,665	9,571,788	7,611,438	6,748,062	1,546,025	28,071,852	3,555,663	31,662,803	3,920,375	17,412,166

		Oz.	\$	Oz.	\$	Lb.	\$	Lb.	\$	Lb.	\$	Lb.	\$
Osoyoos	1962	851	31,883	4,450	5,164			6,050	623	3,622	450		38,070
	1963	69	2,605	483	666			1,245	150	836	110		3,531
	To date	1,855,607	50,308,720	597,451	306,611	2,843,616	417,190	136,418	6,571	13,878	1,254		51,130,346
Revelstoke	1962												
	1963			425	586			2,933	352	3,371	444		1,382
	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	1962	3	112	27	31	4,948	1,508						1,651
	1963			4	6			133	16				22
	To date	184,016	6,327,372	4,219,468	2,582,303	601,192,869	111,136,369	382,677	13,376	72,275	3,964		120,063,384
Skeena	1962	3,292	123,144	51,229	59,441			27,839	2,868	36,922	4,586		190,089
	1963	634	23,934	9,222	12,723			5,870	705	7,886	1,039		38,401
	To date	2,411,800	60,886,453	68,738,191	44,008,072	689,106,270	98,026,097	59,948,914	5,429,782	17,073,030	2,522,114		210,873,328
Slocan	1962	40	1,496	455,538	528,557			21,157,419	2,179,426	21,180,081	2,630,990		5,340,469
	1963	44	1,661	442,620	610,661			24,765,984	2,974,890	26,718,582	3,519,770		7,106,982
	To date	15,878	459,001	72,770,200	47,234,401			937,646,217	77,681,484	740,959,688	73,371,723		198,748,470
Trail Creek	1962	780	29,177	524	608			52,362	15,656				46,374
	1963	1,276	48,169	1,159	1,599			76,650	23,490				75,010
	To date	2,984,168	63,325,193	3,672,651	2,101,920	122,546,213	18,240,252	145,250	12,109	129,814	15,687		83,695,161
Vancouver	1962	11,152	417,163	54,854	63,647	12,683,238	3,864,963	82,927	8,542	6,582,011	817,617		5,171,932
	1963	9,778	369,119	57,903	71,608	12,851,885	3,938,619	193,135	23,199	7,613,418	1,002,916		5,405,461
	To date	476,736	15,336,886	4,992,944	3,142,625	986,002,005	169,350,374	18,429,883	1,861,661	227,577,559	29,362,298		219,053,844
Vernon	1962												
	1963					654	100	24,913	2,933	10,816	1,146		188,345
	To date	5,224	176,082	12,823	8,084								1,574,464
Victoria	1962	1,218	45,562	13,497	15,661	4,965,843	1,513,241						2,539,116
	1963	1,822	68,781	19,065	26,303	7,975,045	2,444,032						12,889,340
	To date	40,703	927,073	908,781	548,218	48,969,438	11,110,278	210,097	19,848	3,568,709	283,923		11,642,303
Not assigned ¹	1962	665	24,876	508,781	590,324	685,611	208,926	34,403,437	3,543,898	58,559,841	7,274,279		7,364,646
	1963	1,609	60,740	482,799	666,094	487,568	149,420	9,204,543	1,105,650	40,861,929	5,382,742		150,754,366
	To date	13,946	378,070	4,214,747	3,652,319	47,376,378	10,995,050	453,589,584	36,903,760	1,132,428,722	99,725,167		
Totals	1962	158,850	5,942,101	6,189,367	7,181,400	108,979,144	33,209,215	335,282,537	34,537,454	413,430,817	51,356,376		132,226,546
	1963	155,824	5,882,356	6,450,096	8,898,875	123,401,020	37,817,476	314,974,310	37,834,714	402,863,154	53,089,163		143,502,594
	To date	16,183,864	472,144,856	443,895,509	281,241,013	3,244,759,683	574,273,830	14,233,234,001	1,097,945,182	12,269,493,664	1,061,353,918		3,486,961,799

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.

STATISTICS

TABLE VIIc.—PRODUCTION, 1962 AND 1963, 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	1962									702,020	7,296,141				
	1963									750,901	7,986,485				
	To date									1,452,921	15,282,626				
Atlin	1962														
	1963														
	To date					319,212	561,782								
Cariboo	1962														
	1963														
	To date														
Clinton	1962														
	1963														
	To date														
Fort Steele	1962							126	900						
	1963									49,4161	533,199				
	To date									61,5971	674,487				
Golden	1962					1,837	3,823								
	1963					53,397	107,450								
	To date	40,082	14,906			41,399	99,358			162,184	1,706,603				
Greenwood	1962					410,251	718,549								
	1963					5,351	10,766								
	To date					5,843	13,543								
Kamloops	1962					50,735	99,150	670	31,805						
	1963														
	To date														
Liard	1962									21,167	95,551			10,987	5,790
	1963														
	To date														
Lillooet	1962														
	1963														
	To date	13,466	4,321											1,783	3,555
Nanaimo	1962									888,898	10,009,514				
	1963									908,735	3,061,952				
	To date									9,752,499	74,028,338				
Nelson	1962					512,095	942,255								
	1963					447,569	1,074,165								
	To date					5,405,842	9,526,653								
New Westminster	1962														
	1963														
	To date														
Omineca	1962														
	1963					393	843								
	To date	104,489	15,217			262,507	519,061							4,150,892	10,400,259
Osoyoos	1962														
	1963														
	To date											162			
Revelstoke	1962														
	1963														
	To date	9,394	3,455			103,612	176,102								

		Lb.	\$	Lb.	\$	Lb.	\$	Tons	\$	Tons	\$	Tons	\$	Lb.	\$
Similkameen	1962														
	1963														
	To date														
Skeena	1962									53,515	488,057				
	1963									339,008	3,073,790				
	To date					141,890	316,764			393,723	3,567,847				
Slocan	1962					101,381	186,541								
	1963					93,434	224,242								
	To date	31,865	8,133			1,893,872	3,442,854					541	8,160		
Trail Creek	1962														
	1963														
	To date					115	210			550	1,925				
Vancouver	1962					21,529	39,613								
	1963					29,589	71,014								
	To date					524,483	1,079,385								
Vernon	1962														
	1963														
	To date														
Victoria	1962														
	1963														
	To date					7,000	10,929					1,167	24,508		
Not assigned ³ & ⁵	1962	1,931,397	748,223	228,601	507,494	1,387,439	2,552,888								
	1963	1,601,253	624,489	157,099	348,760	1,362,977	3,271,145								
	To date	44,093,373	11,800,784	5,796,049	10,066,173	22,383,499	31,558,391								
Totals —	1962	1,931,397	748,223	228,601	507,494	2,086,692	3,839,513			1,793,847	18,328,911				
	1963	1,601,253	624,489	157,099	348,760	1,981,004	4,754,410			2,080,241	20,748,424				
	To date	44,293,149	11,846,816	5,796,049	10,066,173	31,504,855	48,004,633	796	32,295	11,783,044	96,632,900	1,724	32,668	4,163,662	10,409,609

¹ Sinter required to produce 31,441 tons and 37,678 tons of pig iron in 1962 and 1963 respectively.

² Estimated manganese content of about 40 tons of ore shipped for testing by Olalla Mines Ltd. in 1956.

³ 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.

⁴ 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.

⁵ Bismuth and indium recovered at the Trail smelter are not assigned to mining divisions and may include some metal from sources outside British Columbia.

Principal productive periods: Antimony, 1939-63; bismuth, 1929-63; cadmium, 1928-63; chromite, 1918 and 1929; indium, 1942-63; iron concentrates, 1951-63; manganese, 1918-20; mercury, 1940-44; molybdenite, 1914-18; nickel, 1958-63; palladium, 1928; platinum, 1887-1951; tin, 1941-63; tungsten, 1937-58.

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TABLE VHC.—PRODUCTION, 1962 AND 1963, AND TOTAL TO DATE, BY MINING DIVISIONS—MISCELLANEOUS METALS—Continued

Division	Period	Molybdenite (MoS ₂)		Nickel		Palladium		Platinum		Tin		Tungsten (WO ₃)		Other Value	Division Totals
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value		
		Lb.	\$	Lb.	\$	Oz.	\$	Oz.	\$	Lb.	\$	Lb.	\$	\$	\$
Alberni	1962														7,286,141
	1963														7,938,195
	To date														15,224,336
Atlin	1962														
	1963														
	To date											292	360		562,122
Cariboo	1962														
	1963							59	2,299			27,698	21,431		23,730
	To date														900
Clinton	1962														
	1963														
	To date														
Fort Steele	1962									650,941	442,640				975,839
	1963									927,062	648,943				1,329,430
	To date									15,396,536	11,786,369			88,1846	13,584,979
Golden	1962														107,450
	1963														99,358
	To date														733,455
Greenwood	1962														10,766
	1963														13,543
	To date														121,545
Kamloops	1962														
	1963														
	To date														101,646
Liard	1962														
	1963														
	To date									2	79				79
Lillooet	1962														
	1963														
	To date	2,448	2,440							3	113	32,353	37,921		48,350
Nanaimo	1962														10,009,514
	1963														9,081,952
	To date														78,028,888
Nelson	1962														942,255
	1963														1,074,165
	To date	25,958	18,378									13,739,939	33,906,311		43,445,342
New Westminster	1962			3,476,167	2,902,850										2,902,850
	1963			3,699,402	3,107,498										3,107,498
	To date			17,887,899	13,677,603										13,677,603
Omineca	1962														
	1963														
	To date	1,600	1,840							3	154	2,210,892	4,697,710	4207	15,684,601
Osoyoos	1962														
	1963														
	To date	1,020	1,020												1,020
Revelstoke	1962														
	1963														
	To date											7,784	5,687		185,244

		Lb.	\$	Lb.	\$	Oz.	\$	Oz.	\$	Lb.	\$	Lb.	\$	\$	\$
Similkameen	1962							5	375						375
	1963							2	150						150
	To date							1,287	129,186						129,186
Skeena	1962														488,057
	1963														8,073,790
	To date	13,022	13,020									366	331	1,389 ⁸	8,899,351
Slocan	1962														186,541
	1963														224,242
	To date														8,459,147
Trail Creek	1962														
	1963														
	To date					749	30,462	53	3,177						35,774
Vancouver	1962														39,613
	1963														71,014
	To date														1,079,385
Vernon	1962														
	1963														
	To date	9,023	9,500												9,500
Victoria	1962														
	1963														
	To date														35,437
Not assigned	1962													535,537	4,344,142
	1963													633,389	4,877,783
	To date													5,110,468	58,535,816
Totals	1962			3,476,467	2,902,850			5	375	650,941	442,640			535,537	27,303,543
	1963			3,699,402	3,107,488			2	150	927,062	648,943			633,389	30,864,063
	To date	52,171	46,198	17,887,899	13,077,603	749	30,462	1,407	135,008	15,896,536	11,786,369	16,019,324	38,662,751	5,200,461	246,564,946

⁶ Magnesium, 204,632 lb., 1941 and 1942.

⁷ Cobalt, 1,730 lb., 1928.

⁸ Selenium, 731 lb., 1931.

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TABLE VIII.D.—PRODUCTION, 1962 AND 1963, AND TOTAL

Division	Period	Asbestos		Barite		Diatomite		Fluxes (Quartz and Limestone)		Granules, (Quartz, Limestone, and Granite)	
		Quantity	Value ¹	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		Tons	\$	Tons	\$	Tons	\$	Tons	\$	Tons	\$
Alberni	1962										
	1963										
	To date										
Atlin	1962										
	1963										
	To date										
Cariboo	1962					211	10,228				
	1963					458	16,030				
	To date					2,502	71,340			48	168
Clinton	1962										
	1963										
	To date										
Fort Steele	1962										
	1963										
	To date										
Golden	1962			8 ¹	80						
	1963			6,511	57,062						
	To date			8,207	69,588						
Greenwood	1962			202,328	2,463,528						
	1963										
	To date							1,790,502	1,540,319		
Kamloops	1962										
	1963										
	To date										
Liard	1962	55,133	10,297,360								
	1963	63,215	11,681,337								
	To date	349,148	73,495,343								
Lillooet	1962										
	1963										
	To date										
Nanaimo	1962							17,386	32,317		
	1963							20,000	44,000		
	To date							724,819	822,100		
Nelson	1962									839	17,512
	1963									3,752	81,438
	To date									4,593	99,001
New Westminster	1962							7,601	8,174	8,812	106,890
	1963									8,000	89,000
	To date									75,487	982,261
Nicola	1962										
	1963										
	To date										
Omineca	1962										
	1963										
	To date										
Osoyoos	1962							45,350	196,100	10,800	187,500
	1963							40,483	178,937	9,692	179,105
	To date							659,863	2,998,485	79,300	1,157,974
Similkameen	1962										
	1963										
	To date										
Skeena	1962										
	1963										
	To date										
Vancouver	1962							601,019	1,050,722		
	1963										
	To date									29,692	418,606
Vernon	1962										
	1963										
	To date										
Victoria	1962							7	60		
	1963							7	75		
	To date							83	1,075	9,605	157,080
Not assigned	1962										
	1963										
	To date										
Totals	1962	55,133	10,297,360	6,511	57,062	211	10,228	62,743	228,477	18,251	311,902
	1963	63,215	11,681,337	8,207	69,588	458	16,030	60,480	223,012	19,444	348,543
	To date	349,148	73,495,343	202,334	2,463,608	2,502	71,340	3,783,887	6,418,875	198,725	2,815,980

¹ Value f.o.b. mine, not including containers; see also note under "Industrial Minerals and Structural Materials," page A 14.

² Arsenious oxide: Omineca, 1928, 16,997 lb., \$340; Osoyoos, 1917-30 and 1942, 22,002,423 lb., \$272,861.

³ Bentonite: 1926-44, 791 tons.

⁴ Fluorspar: Greenwood, 1918-29 and 1942, 35,309 tons, \$783,578; Osoyoos, 1958, 32 tons, \$1,386.

⁵ Hydromagnesite: Atlin, 1915-16, 1,450 tons, \$20,325; Clinton, 1921, 803 tons, \$7,211.

⁶ Iron oxide and ochre: 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.

⁷ Magnesium sulphate: Clinton, 1918-20, 1,923 tons, \$39,085; Kamloops, 1918-42, 8,742 tons, \$193,967; Osoyoos, 1915-19, 3,229 tons, \$21,300.

TO DATE, BY MINING DIVISIONS—INDUSTRIAL MINERALS

Gypsum and Gypsite		Jade		Mica		Sulphur		Other Value	Division Totals	Period
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value			
Tons	\$	Lb.	\$	Lb.	\$	Tons	\$	\$	\$	
								9,898 ⁸	9,398	1962
										1963
										To date
								20,325 ⁵	20,325	1962
									10,228	1963
				10,013,800	143,012			3001 ⁹	16,030	To date
									214,820	1962
										1963
873	6,236							156,191 ^{5 7 11}	162,427	To date
						36,206	607,175		607,175	1962
						44,840	541,549		541,549	1963
112,878	298,824					369,751	6,375,523	16,894 ¹⁰	6,691,321	To date
147,900	443,700								500,762	1962
160,954	482,862								552,450	1963
1,092,200	3,142,276							1,276 ^{6 12}	5,607,080	To date
										1962
								783,578 ⁴	2,323,897	1963
										To date
1,246,918	6,323,178			424,700	2,075			203,055 ^{7 11}	6,528,308	1962
						57,787	862,691		11,160,051	To date
						75,795	1,794,584		13,475,931	1963
						267,013	4,982,536		78,477,879	To date
		56,935	20,760						20,760	1962
		16,000	15,529					5,120 ¹²	15,529	1963
		207,986	72,490						77,610	To date
									32,317	1962
									44,000	1963
									822,100	To date
									17,512	1962
								55,901 ⁶	81,438	1963
									163,076	To date
									106,890	1962
									88,000	1963
									982,261	To date
										1962
2,407	10,050								10,050	1963
										To date
								11,460 ^{2 9}	11,460	1962
									383,600	To date
				1,588,800	25,938			295,547 ^{2 4 7}	358,042	1963
									4,475,944	To date
										1962
250	1,700							16,858 ³	18,558	1963
										To date
						41,624	178,678		1,229,400	1962
						5,282	65,799		65,799	To date
						777	11,004		11,004	1963
				634,250	10,815	633,466	5,932,508	97,389 ⁶	6,459,318	To date
										1962
				160,500	8,978				3,978	1963
									60	To date
									75	1962
								30,226 ^{6 12}	188,381	1963
						139,906	1,399,060		1,399,060	To date
						132,685	1,326,850		1,326,850	1962
						3,700,317	36,853,473		36,853,473	1963
147,900	443,700	56,935	20,760			239,191	2,934,725		14,304,214	To date
160,954	482,862	16,000	15,529			254,197	3,673,997		16,510,888	1962
2,455,526	9,782,264	207,986	72,490	12,822,050	185,818	5,012,171	54,322,720	1,703,527	151,331,075	1963
										To date

⁸ Natro-alunite: 1912-27, 522 tons.

⁹ Perlite: 1953, 1,112 tons, \$11,120.

¹⁰ Phosphate rock: 1927-33, 3,842 tons.

¹¹ Sodium carbonate: Clinton, 1921-49, 9,524 tons, \$109,895; Kamloops, 1931-35, 968 tons, \$9,088.

¹² Talc: Golden, 1927, 5 tons, \$356; Lillooet, 1916-36, 296 tons, \$5,129; Victoria, 1919-35, 1,504 tons, \$29,386.

¹³ Volcanic ash: Cariboo, 30 tons.

First production: Arsenious oxide, 1917; asbestos, 1952; barite, 1940; bentonite, 1926; diatomite, 1928; fluorspar, 1918; flux, 1911; granules, 1930; gypsum and gypsite, 1911; hydromagnesite, 1904; iron oxide and ochre, 1918; magnesium sulphate, 1915; mica, 1932; natro-alunite, 1912; perlite, 1953; phosphate rock, 1927; sodium carbonate, 1921; sulphur, 1916; talc, 1916.

		\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
Osoyoos	1962				3,400	92,179									95,579
	1963		1,000		650	110,176									111,826
	To date		33,070	14,850	149,607	1,034,534									1,232,061
Revelstoke	1962				42	25,930									25,972
	1963				5,564	63,204									68,768
	To date		1,000	5,575	331,126	1,047,188									1,384,889
Similkameen	1962				18,625	112,925									131,550
	1963				1,000	130,000									131,000
	To date	10,500	11,571	24,000	530,844	2,015,107			1,363				11,992		2,605,377
Skeena	1962		53,550		92,846	109,088									256,384
	1963		55,259		20,069	118,066									193,334
	To date	1,494,444	144,000	1,343,019	4,501,171	1,722			4,925				8,324		7,495,883
Slocan	1962				1,722	105,206									106,928
	1963				3,359	35,101									38,490
	To date		1,000	115,143	106,689	850,618									1,073,450
Trail Creek	1962				2,000	4,143									92,088
	1963				2,850	1,200									66,232
	To date		28,000	81,484	217,585	1,668,834									1,996,203
Vancouver	1962	3,220,693		74,405	288	1,244,362									4,539,748
	1963	4,028,311			4	1,069,070									5,097,385
	To date	17,856,391	40,885	4,010,781	7,498,921	26,541,744	142,208	241,216	580,778	12,724			23,362	88,304	57,037,314
Vernon	1962				2,912	63,252									66,164
	1963				2,937	131,786									134,721
	To date		46,499	81,052	200,018	2,364,466	181,467	6,202	1,011	5	18,224	4,325		20	2,853,289
Victoria	1962	3,892,197	16,122	45	535	823,241		6,500	24,000			42,000	2,000	218,979	5,025,619
	1963	4,518,457	18,175			933,937								308,408	5,778,979
	To date	104,476,485	826,362	45	456,413	14,500,869	1,814,647	29,552	119,930	1,050	705,821	1,072,346	136,504	945,642	125,085,666
Not assigned	1962					1,556,244								30,000	1,586,244
	1963				74,017	1,462,341									1,536,358
	To date		315,498	505,018	356,472	3,018,585							3,180,828	5,972,171	13,348,572
Totals	1962	7,112,890	1,513,579	85,290	1,284,301	8,862,767	54,849	309,582	640,307	30,027	36,665	898,908	23,947	513,153	21,366,265
	1963	8,546,768	1,723,796	13,946	1,259,002	9,514,095	63,499	292,535	758,008	33,151	31,376	846,202	14,562	785,250	23,882,190
	To date	122,343,376	33,872,130	8,720,671	30,830,817	119,606,462	5,143,681	5,730,981	13,543,781	992,184	3,602,816	13,614,684	525,765	5,931,081	370,430,600

1 Includes \$3,150,828 of unclassified clay products, 1886-1910.

2 Includes a value of \$5,972,171 that cannot be allotted to a particular class of structural material.

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TABLE VIIIA.—QUANTITY¹ 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	1913	2,713,535	\$9,197,460
1860	15,956	56,988	1914	2,237,042	7,745,847
1861	15,427	55,096	1915	2,076,601	7,114,178
1862	20,292	72,472	1916	2,583,469	8,900,675
1863	23,906	85,380	1917	2,436,101	8,484,343
1864	32,068	115,528	1918	2,575,275	12,833,994
1865	36,757	131,276	1919	2,433,540	11,975,671
1866	28,129	100,460	1920	2,852,535	13,450,169
1867	34,988	124,956	1921	2,670,314	12,836,013
1868	49,286	176,020	1922	2,726,793	12,880,060
1869	40,098	143,208	1923	2,636,740	12,678,548
1870	33,424	119,372	1924	2,027,843	9,911,935
1871	55,458 ²	164,612	1925	2,541,212	12,168,905
1872	55,458 ²	164,612	1926	2,406,094	11,650,180
1873	55,459 ²	164,612	1927	2,553,416	12,269,135
1874	91,334	244,641	1928	2,680,608	12,633,510
1875	123,362	330,435	1929	2,375,060	11,256,260
1876	155,895	417,576	1930	1,994,493	9,435,650
1877	172,540	462,156	1931	1,765,471	7,684,155
1878	191,348	522,538	1932	1,614,629	6,523,644
1879	270,257	723,903	1933	1,377,177	5,375,171
1880	299,708	802,785	1934	1,430,042	5,725,133
1881	255,760	685,171	1935	1,278,380	5,048,864
1882	315,997	846,417	1936	1,352,301	5,722,502
1883	238,895	639,897	1937	1,446,243	6,139,920
1884	441,358	1,182,210	1938	1,388,507	5,565,069
1885	409,468	1,096,788	1939	1,561,084	6,280,956
1886	365,832	979,908	1940	1,662,027	7,088,265
1887	462,964	1,240,080	1941	1,844,745	7,660,000
1888	548,017	1,467,903	1942	1,996,000	8,237,172
1889	649,411	1,739,490	1943	1,854,749	7,742,030
1890	759,518	2,034,420	1944	1,931,950	8,217,966
1891	1,152,590	3,087,291	1945	1,523,021	6,454,360
1892	925,495	2,479,005	1946	1,439,092	6,732,470
1893	1,095,690	2,934,882	1947	1,696,350	8,680,440
1894	1,134,509	3,038,859	1948	1,604,480	9,765,395
1895	1,052,412	2,824,687	1949	1,621,268	10,549,924
1896	1,002,268	2,693,961	1950	1,574,006	10,119,303
1897	999,372	2,734,522	1951	1,573,572	10,169,617
1898	1,263,272	3,582,595	1952	1,402,313	9,729,739
1899	1,435,314	4,126,803	1953	1,384,138	9,528,279
1900	1,781,000	4,744,530	1954	1,308,284	9,154,544
1901	1,894,544	5,016,398	1955	1,332,874	8,986,501
1902	1,838,621	4,832,257	1956	1,417,209	9,346,518
1903	1,624,742	4,332,297	1957	1,085,657	7,340,339
1904	1,887,981	4,953,024	1958	796,413	5,937,860
1905	2,044,931	5,511,861	1959	690,011	5,472,064
1906	2,126,965	5,548,044	1960	788,658	5,242,223
1907	2,485,961	7,637,713	1961	919,142	6,802,134
1908	2,362,514	7,356,866	1962	825,339	6,133,986
1909	2,688,672	8,574,884	1963	850,446	6,237,997
1910	3,314,749	11,108,335			
1911	2,541,698	8,071,747			
1912	3,211,907	10,786,812			
			Totals	137,011,697	\$576,034,904

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.—QUANTITY¹ AND VALUE OF COAL SOLD AND USED²

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
Total to date	40,012,312	2,194,988	12,484,045	54,691,345	241,765,072
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	36,983	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
Total to date	99,097	286	—	99,383	698,771
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
Total to date	69,368,383	4,291,673	558,985	74,219,041	300,030,865
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	5,605	—	—	5,605	61,437
Total to date	434,272	4,095	—	438,367	2,839,646
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	6,135,986
1963	641,678	17,089	191,879	850,446	6,237,997
Total to date	116,938,734	7,029,933	13,043,030	137,011,697	576,034,904

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 1963

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	1,338,563	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
Totals	16,655,920	72,010,008	6,223,241	35,571,124	3,094,763	34,815,503	1,829,283	11,777,717	11,146,384	82,164,344	83,269,939	4,308,783	553,717	170,296,783

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, 1897-1963

Dividends Paid during 1962 and 1963

	1962	1963
Bralorne Pioneer Mines Ltd.....	\$642,540	\$645,740
Cassiar Asbestos Corporation Ltd.....	2,376,000	2,376,000
Craigmont Mines Ltd.....	893,972	4,084,480
Consolidated Mining and Smelting Co. of Canada, Ltd.....	18,018,452	21,294,551
Crow's Nest Pass Coal Co. Ltd.....	582,781	582,878
Giant Mascot Mines Ltd.....	174,387	244,141
Highland-Bell Ltd.....	161,200	-----
Nimpkish Iron Mines Ltd.....	860,750	756,000
Reeves MacDonald Mines Ltd.....	467,600	-----
Sheep Creek Mines Ltd.....	206,250	225,000
Others.....	10,365	4,300
Totals.....	\$24,394,297	\$30,213,090

Dividends Paid Yearly, 1917 to 1963, Inclusive

Year	Amount Paid	Year	Amount Paid
1917.....	\$3,269,494	1941.....	\$16,598,110
1918.....	2,704,469	1942.....	13,627,104
1919.....	2,494,283	1943.....	11,860,159
1920.....	1,870,296	1944.....	11,367,732
1921.....	736,629	1945.....	10,487,395
1922.....	3,174,756	1946.....	15,566,047
1923.....	2,983,570	1947.....	27,940,213
1924.....	2,977,276	1948.....	37,672,319
1925.....	5,853,419	1949.....	33,651,096
1926.....	8,011,137	1950.....	34,399,330
1927.....	8,816,681	1951.....	40,921,238
1928.....	9,572,536	1952.....	32,603,956
1929.....	11,263,118	1953.....	22,323,089
1930.....	10,543,500	1954.....	25,368,262
1931.....	4,650,857	1955.....	35,071,583
1932.....	2,786,958	1956.....	36,262,682
1933.....	2,471,735	1957.....	24,247,420
1934.....	4,745,905	1958.....	14,996,123
1935.....	7,386,070	1959.....	16,444,281
1936.....	10,513,705	1960.....	20,595,943
1937.....	15,085,293	1961.....	20,720,239
1938.....	12,068,875	1962.....	24,394,297
1939.....	11,865,698	1963.....	30,213,090
1940.....	14,595,530	Total.....	\$697,773,489

TABLE X.—DIVIDENDS PAID BY MINING COMPANIES, 1897-1963—*Continued**Lode-gold Mines¹*

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	3,173,165
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-Denoro	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			\$81,275,035

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 in 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 Since March, 1956, company name is Sheep Creek Mines Ltd.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, 1897-1963—*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	553,974,373 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	862,500
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			\$586,964,570

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, 1897–1963—*Continued**Copper Mines*

Company or Mine	Locality	Class	Amount Paid
Britannia M. & S. Co. ¹	Britannia Beach	Copper	\$18,803,772
Canada Copper Corporation	Greenwood	Copper	615,399
Cornell	Texada Island	Copper	8,500
Craigmont Mines Ltd.	Merritt	Copper	4,978,452
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			\$54,949,099

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.

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

Company or Mine	Locality	Class	Amount Paid
Wellington Collieries Ltd.	Nanaimo	Coal	\$16,000,000
Bulkley Valley Collieries Ltd.	Telkwa	Coal	24,000
Crow's Nest Pass Coal Co. Ltd.	Fernie	Coal	19,119,599
Canadian Collieries Resources Ltd.	Nanaimo	Coal	828,271
Unsworth & Dunn	Nanaimo	Coal	7,065
Total, coal mines			\$35,978,935

Aggregate of All Classes

Lode-gold mining	\$81,275,035
Silver-lead-zinc mining and smelting	586,964,570
Copper-mining	54,949,099
Coal-mining	35,978,935
Miscellaneous, structural, and placer gold	21,232,066
Total	\$780,399,705

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
Lode-mining ²	\$45,570,133	\$6,417,397	\$6,920,411
Placer-mining.....	202,2253	1,487	257
Fuel—coal, coke, and gas plant.....	2,761,244	300,592	510,592
„ petroleum and natural gas.....	1,545,559	455,062	3,673,743
Industrial minerals.....	2,928,636	1,003,638	492,120
Structural-materials industry.....	4,931,497	2,368,580	1,326,202
Totals, 1963.....	\$57,939,294	\$10,546,806	\$12,923,325
Totals, 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	21,490,912
1959.....	49,961,996	7,677,821	17,371,658
1958.....	48,933,560	8,080,989	15,053,026
1957.....	56,409,056	8,937,567	24,257,177
1956.....	57,266,026	9,702,777	22,036,839
1955.....	51,890,246	9,144,034	21,131,572
1954.....	48,702,746	7,128,069	19,654,724
1953.....	55,543,490	8,688,099	20,979,411
1952.....	62,256,031	8,557,845	27,024,500
1951.....	52,607,171	7,283,051	24,724,101
1950.....	42,738,085	6,775,998	17,500,663
1949.....	41,023,786	7,206,637	17,884,408
1948.....	38,813,606	6,139,470	11,532,121
1947.....	32,160,338	5,319,470	13,008,948
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.....	20,051,467	7,432,585	6,572,317
1942.....	26,913,160	7,066,109	6,863,898
1941.....	26,050,491	3,776,747	7,260,441
1940.....	23,391,330	3,474,721	6,962,162
1939.....	22,357,035	3,268,000	6,714,347
1938.....	22,765,711	3,396,108	6,544,500
1937.....	21,349,690	3,066,811	6,845,830
1936.....	17,887,618	2,724,144	4,434,501
1935.....	16,753,387	2,619,639	4,552,730
Grand totals, 1935-63.....	\$1,130,813,064	\$192,753,969	\$395,463,444

¹ In some cases 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 Prior to 1962 this included data related only to the principal lode metals as then detailed in Table I. Other lode metals then classed as miscellaneous metals in Table I were included under the heading "Miscellaneous Metals and Industrial Minerals."

³ Includes amounts of \$29,400 and \$171,500 estimated for Germansen Mines Ltd. and Wingdam and Lightning Creek Mining Co. Ltd. respectively.

NOTE.—"Process Supplies" include explosives, chemicals, drill-steel, lubricants, etc.

TABLE XII.—AVERAGE NUMBER EMPLOYED IN THE MINING INDUSTRY,¹ 1901-63

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	.....	.....	3,187	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	1,289	3,993	.....	.....	2,862	907	3,769	.....	.....	.....	7,712
1908.....		2,567	1,127	3,694	.....	.....	4,432	1,041	5,073	.....	.....	.....	9,767
1909.....		2,184	1,070	3,254	.....	.....	4,713	1,705	6,418	.....	.....	.....	9,672
1910.....		2,472	1,237	3,709	.....	.....	5,003	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	1,866	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	1,760	5,247	.....	.....	.....	9,087
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	875	2,230	.....	.....	4,722	2,163	6,885	.....	.....	.....	9,215
1922.....		1,510	1,239	2,749	.....	.....	4,712	1,932	6,644	.....	.....	.....	9,398
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.....		2,099	2,606	4,705	808	2,461	3,757	1,565	5,322	493	324	124	14,172
1927.....		415	2,671	3,086	854	2,842	3,646	1,579	5,225	647	138	122	14,830
1928.....		355	2,707	3,062	911	2,748	3,814	1,520	5,334	412	368	120	15,424
1929.....		341	2,926	3,267	966	2,948	3,675	1,353	5,028	492	544	268	15,565
1930.....		425	2,316	2,741	832	3,197	3,389	1,256	4,645	843	344	170	14,032
1931.....		688	1,463	2,151	581	3,157	2,967	1,125	4,082	460	526	380	12,171
1932.....		874	1,355	2,229	542	2,036	2,628	980	3,608	536	329	344	10,524
1933.....		1,134	1,786	2,920	531	2,436	2,241	853	3,094	376	269	408	11,369
1934.....		1,122	2,796	3,918	631	2,890	2,050	843	2,893	377	187	360	12,085
1935.....		1,201	2,740	3,941	907	2,771	2,145	826	2,971	538	270	754	13,737
1936.....		1,124	2,959	4,083	720	2,678	2,015	799	2,814	931	288	825	14,179
1937.....		1,371	3,603	4,974	1,168	3,027	2,286	867	3,153	724	327	938	16,129
1938.....		1,303	3,840	5,143	919	3,158	2,088	874	2,962	900	295	369	16,021
1939.....		1,252	3,905	5,157	996	3,187	2,167	809	2,976	652	311	561	15,890
1940.....		1,004	3,923	4,927	1,048	2,944	2,175	699	2,874	827	334	647	15,705
1941.....		939	3,901	4,840	1,025	3,072	2,229	404	2,723	766	413	422	15,084
1942.....		489	2,920	3,409	960	3,555	1,892	468	2,860	842	378	262	13,270
1943.....		212	2,394	2,606	891	2,835	2,240	611	2,851	673	326	567	12,448
1944.....		253	1,896	2,149	849	2,981	2,150	689	2,839	690	351	628	12,314
1945.....		209	1,933	2,142	822	2,834	1,927	503	2,430	921	335	586	11,820
1946.....		347	1,918	2,265	672	2,813	1,773	532	2,305	827	555	679	11,938
1947.....		360	3,024	3,384	960	3,461	1,694	731	2,425	977	585	869	14,899
1948.....		348	3,143	3,491	1,126	3,884	1,594	872	2,466	1,591	656	754	16,397
1949.....		303	3,034	3,337	1,203	3,763	1,761	545	2,306	2,120	542	626	16,621
1950.....		327	3,309	3,636	1,259	3,759	1,745	516	2,261	1,916	616	660	16,612
1951.....		205	3,785	3,990	1,307	4,044	1,462	463	1,925	1,783	628	491	17,863
1952.....		230	4,171	4,401	1,516	4,120	1,280	401	1,681	1,530	557	529	18,257
1953.....		132	3,145	3,277	1,371	3,901	1,154	896	1,560	1,909	559	634	15,790
1954.....		199	2,644	2,843	1,129	3,119	1,076	358	1,434	1,861	638	584	14,128
1955.....		103	2,564	2,667	1,091	3,304	1,100	378	1,478	1,646	641	722	14,102
1956.....		105	2,637	2,742	1,043	3,339	968	398	1,366	1,598	770	854	14,539
1957.....		67	2,308	2,375	838	3,328	1,020	360	1,380	1,705	625	474	13,257
1958.....		75	1,919	2,094	625	3,081	826	260	1,086	1,483	677	446	11,201
1959.....		99	1,937	2,036	618	3,008	765	291	1,056	1,357	484	459	10,770
1960.....		86	1,782	1,868	648	3,034	894	288	1,182	1,704	557	639	11,541
1961.....		74	1,785	1,859	626	3,118	705	237	942	1,828	508	671	11,034
1962.....		85	1,684	1,769	950	3,356	548	228	776	1,523	481	517	11,560
1963.....		343	1,752	2,095	850	3,239	501	247	748	881	461	528	10,925

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 1901-63

Year	Tonnage ²	Number of Shipping Mines	Number of Mines Shipping over 100 Tons	Gross Value as Reported by Shipper ³	Freight and Treatment ³	Net Value to Shipper ⁴	Gross Value of Lode Metals Produced ¹
1901.....	926,162	119	78	.....	.....	.....	\$13,287,947
1902.....	1,009,016	124	75	.....	.....	.....	11,136,162
1903.....	1,288,466	125	74	.....	.....	.....	11,579,882
1904.....	1,461,609	142	76	.....	.....	.....	12,309,085
1905.....	1,706,679	146	70	.....	.....	.....	15,180,164
1906.....	1,063,872	154	77	.....	.....	.....	17,484,102
1907.....	1,805,614	147	72	.....	.....	.....	16,222,097
1908.....	2,083,606	108	59	.....	.....	.....	14,477,411
1909.....	2,057,713	89	52	.....	.....	.....	14,191,141
1910.....	2,216,428	83	50	.....	.....	.....	13,228,731
1911.....	1,770,755	80	45	.....	.....	.....	11,454,063
1912.....	2,688,532	86	51	.....	.....	.....	17,662,766
1913.....	2,663,809	110	58	.....	.....	.....	17,190,838
1914.....	2,175,971	98	56	.....	.....	.....	15,225,061
1915.....	2,720,669	132	59	.....	.....	.....	19,992,149
1916.....	3,229,942	169	81	.....	.....	.....	31,483,014
1917.....	2,797,368	193	87	.....	.....	.....	26,788,474
1918.....	2,912,516	175	80	.....	.....	.....	27,595,278
1919.....	2,146,920	144	74	.....	.....	.....	19,756,648
1920.....	2,215,445	121	60	.....	.....	.....	19,451,725
1921.....	1,586,428	80	35	.....	.....	.....	12,925,448
1922.....	1,592,163	98	33	.....	.....	.....	19,228,257
1923.....	2,447,672	77	23	.....	.....	.....	25,348,399
1924.....	3,413,912	86	37	.....	.....	.....	35,538,247
1925.....	3,849,269	102	40	.....	.....	.....	40,200,135
1926.....	4,775,327	138	55	.....	.....	\$38,558,613	51,508,031
1927.....	5,416,411	132	52	.....	.....	27,750,364	44,977,082
1928.....	6,241,672	110	49	.....	.....	29,070,075	48,281,825
1929.....	6,977,903	106	48	.....	.....	34,713,887	51,720,436
1930.....	6,804,276	68	32	.....	.....	21,977,688	41,292,980
1931.....	5,549,622	44	22	.....	.....	10,513,931	22,900,229
1932.....	4,354,904	75	29	.....	.....	7,075,393	19,705,043
1933.....	4,063,775	109	47	.....	.....	13,976,858	25,057,907
1934.....	5,141,744	145	69	.....	.....	20,243,278	34,071,955
1935.....	4,927,204	177	72	.....	.....	25,407,014	40,662,633
1936.....	4,381,173	168	70	.....	.....	30,051,207	43,813,898
1937.....	6,145,244	185	113	\$48,617,920	\$4,663,843	43,954,077	62,950,536
1938.....	7,377,117	211	92	40,222,237	4,943,754	35,278,483	53,878,093
1939.....	7,212,171	217	99	45,183,788	4,416,919	40,716,869	53,554,092
1940.....	7,949,736	216	92	50,004,909	6,334,611	43,670,298	61,735,604
1941.....	8,007,937	200	96	52,354,870	5,673,048	46,681,822	62,607,882
1942.....	6,894,844	126	76	50,494,041	5,294,637	45,199,404	59,694,192
1943.....	5,786,864	48	32	37,234,070	3,940,367	33,293,703	52,651,868
1944.....	4,879,851	51	31	29,327,114	2,877,706	26,449,408	39,369,738
1945.....	4,377,722	36	27	34,154,917	2,771,202	31,383,625	48,724,001
1946.....	3,705,594	50	32	48,920,971	2,904,130	46,016,841	56,653,485
1947.....	5,011,271	75	33	81,033,093	4,722,010	76,311,087	93,124,847
1948.....	5,762,321	97	51	118,713,859	18,585,183	100,128,727	121,696,891
1949.....	6,125,460	118	54	99,426,678	19,613,185	79,814,604	107,775,413
1950.....	6,802,482	112	58	108,864,792	22,113,431	86,751,361	113,464,619
1951.....	6,072,400	119	64	142,590,427	25,096,743	117,493,684	147,646,989
1952.....	9,174,617	95	58	140,070,389	30,444,575	109,601,451	144,151,515
1953.....	9,660,281	80	43	94,555,069	27,815,152	66,739,892	123,619,837
1954.....	8,513,865	93	40	106,223,833	20,135,673	77,088,160	120,829,789
1955.....	9,126,902	53	34	119,039,285	30,606,044	88,433,241	138,145,095
1956.....	8,827,037	70	40	125,043,590	31,933,681	93,110,262	143,546,586
1957.....	7,282,436	59	40	95,644,930	30,273,000	65,370,185	119,409,764
1958.....	6,402,198	57	28	83,023,111	28,068,396	54,955,069	100,591,049
1959.....	6,990,985	60	44	92,287,277	27,079,911	65,208,728	100,549,519
1960.....	8,242,703	67	31	114,852,061	29,505,158	85,346,903	125,674,531
1961.....	8,392,161	59	39	112,488,918	30,304,050	82,184,868	123,913,897
1962.....	11,212,106	64	45	137,759,188	34,274,698	103,484,490	153,378,622
1963.....	11,898,408	65	36	139,881,792	34,008,151	105,873,641	167,356,506

¹ Gross value calculated by valuing gold, silver, copper, lead, zinc, mercury (1938-44, 1955), and nickel (1936-37, 1958-63) at yearly average prices, and iron (1901-03, 1907, 1918-23, 1928, 1948-63) and tungsten (1939-45, 1947-58) 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."

TABLE XIV.—LÖDE-METAL PRODUCTION IN 1963

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
NORTHERN BRITISH COLUMBIA			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
<i>Atlin Mining Division</i>										
<i>Nil</i>										
<i>Liard Mining Division</i>										
<i>Nil</i>										
CENTRAL BRITISH COLUMBIA										
<i>Cariboo Mining Division</i>										
Aurum	Wells	The Cariboo Gold Quartz Mining Co. Ltd., Vancouver	34,702	Bullion	18,308	3,165				
<i>Clinton Mining Division</i>										
<i>Nil</i>										
<i>Omineca Mining Division</i>										
Cronin	Smithers	New Cronin Babine Mines Ltd., Vancouver	362	Lead concentrates, 27 tons; zinc concentrates, 36 tons	7	3,498		30,946	41,468	562
Silver Standard	Hazelton	P. Kindrat, Smithers, lessee	27	Crude ore	5	2,405		3,957	15,500	
COAST AND ISLANDS										
<i>Alberni Mining Division</i>										
Brynnor	Kennedy Lake	Brynnor Mines Ltd., Vancouver	968,106	Iron concentrates, 750,901 tons						
Musketeer	Tofino	Kootenay Base Metals Ltd., Vancouver, lessee	2	Gold concentrates	80	38	12	286		
Fandora	Tofino	W. E. McArthur, Greenwood	49	Siliceous ore	331	79				

<i>Nanaimo Mining Division</i>			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Merry Widow and Kingfisher	Benson Lake	Empire Development Co. Ltd., Vancouver	159,871	Iron concentrates, 96,610 tons						
Nimkish	Beaver Cove	Nimkish Iron Mines Ltd., Vancouver	561,675	Iron concentrates, 307,679 tons						
Old Sport	Benson Lake	Coast Copper Co. Ltd., Port McNeill	327,433	Copper concentrates, 16,154 tons	16,289	27,607	9,669,840			
Texada	Texada Island	Texada Mines Ltd., Vancouver	954,591	Iron concentrates, 504,446 tons; copper concentrates, 5,820 tons	1,250	37,142	2,441,787			
<i>New Westminster Mining Division</i>										
Pride of Emory	Choate	Giant Mascot Mines Ltd., Vancouver	313,836	Nickel-copper concentrates, 20,107 tons; nickel content, 4,203,866 lb.			2,049,622			
<i>Skeena Mining Division</i>										
Harriet Harbour	Jedway	Jedway Iron Ore Ltd., Vancouver	724,273	Iron concentrates, 339,008 tons						
Silbak Premier	Premier	Silbak Premier Mines Ltd., Vancouver	96	Crude ore	634	9,410		5,990	8,762	
<i>Vancouver Mining Division</i>										
Britannia	Britannia Beach	The Anaconda Co. (Canada) Ltd., Britannia Beach	493,700	Copper concentrates and precipitates, 21,538 tons; zinc concentrates, 7,045 tons; tailings, 36,633 tons	9,778	52,650	13,266,984	386,271	8,459,353	42,270
Cambrian Chieftain	Pender Harbour	J. A. McKeivie, Vancouver	495	Crude ore		312	13,861			
<i>Victoria Mining Division</i>										
Alpha, Beta, etc.	Lake Cowichan	Albeta Mines Ltd., Lake Cowichan	590	Crude ore	6	330	51,567			
Sumloch	River Jordan	Cowichan Copper Co. Ltd., Vancouver	267,675	Copper concentrates, 16,031 tons	1,816	19,124	8,255,898			
<i>SOUTH CENTRAL BRITISH COLUMBIA</i>										
<i>Greenwood Mining Division</i>										
Highland-Bell	Beaverdell	Mastodon-Highland Bell Mines Ltd., Vancouver	21,689	Lead concentrates, 1,766 tons; zinc concentrates, 734 tons; jig concentrates, 351 tons	571	877,861		806,019	1,063,211	8,061
King Midas	Greenwood	King Midas Mines Ltd., Vancouver	5	Crude ore		36		177	31	
Phoenix	Greenwood	Phoenix Copper Co. Ltd., Grand Forks	645,083	Copper concentrates, 14,532 tons	11,991	65,746	7,147,775			

TABLE XIV.—LODE-METAL PRODUCTION IN 1963—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
<i>Greenwood Mining Division—Continued</i>			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Skomac	Rock Creek	c/o Gowan and Butts, Vancouver	42	Crude ore	8	1,345		3,209	1,013	
<i>Kamloops Mining Division</i>										
Bethlehem	Ashcroft	Bethlehem Copper Corporation Ltd., Vancouver	1,265,988	Copper concentrates, 29,631 tons	3,191	115,496	24,828,935			
<i>Lillooet Mining Division</i>										
Bralorne	Bridge River	Bralorne Pioneer Mines Ltd., Vancouver	152,601	Bullion; gold concentrates, 9 tons	87,016	16,836				
<i>Nicola Mining Division</i>										
Craigmont	Merritt	Craigmont Mines Ltd., Vancouver	1,787,717	Copper concentrates, 108,325 tons			59,668,496			
<i>Osoyoos Mining Division</i>										
Conway	Oliver	Conway Mines, c/o G. R. McKay, Oliver	72	Crude ore	10	72		287	143	
Nickel Plate	Hedley	Hedley Mining Syndicate, c/o L. J. Penney, Vernon		Clean up	7	3		1	8	
Smuggler	Oliver	K. G. Ewers, Okanagan Falls	25	Siliceous ore	33	38		166	305	
Susie	Oliver	K. G. Ewers, Okanagan Falls	236		19	380		816	472	
<i>Similkameen Mining Division</i>										
Mazie	Princeton	Mazie Mines Ltd., Princeton	3	Crude ore		4		136		
<i>Vernon Mining Division</i>										
Nil										
<i>SOUTHEASTERN BRITISH COLUMBIA</i>										
<i>Fort Steele Mining Division</i>										
Estella	Wasa	Copper Soo Mining Co. Ltd., Osoyoos	2,674	Crude ore		16,549		632,929	1,232,578	

			Tons		Oz.	Oz.	Lb.	Lb.	Lb.	Lb.
Humbolt	Crawford Bay	D. J. Fulton and R. A. Sutton, Cranbrook	3	Crude ore		90		2,125	668	
Sullivan	Kimberley	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	1,742,008	Lead concentrates, 167,992 tons; zinc concentrates, 261,228 tons; tin concentrates, 610 tons; iron sinter, 61,597 tons	358	4,084,011	731,400	257,320,000	263,368,000	
<i>Golden Mining Division</i>										
Mineral King	Toby Creek	Sheep Creek Mines Ltd., Nelson	203,942	Lead concentrates, 5,583 tons; zinc concentrates, 15,895 tons		186,468	140,429	7,559,017	18,056,543	59,141
St. Anthony Group	Doctor Creek	Ronald Archer, Kimberley	6	Crude ore		386	56	180	56	
<i>Nelson Mining Division</i>										
Bonanza	Nelway	A. R. Thompson and A. A. Christensen, Metaline, Wash.	15	Crude ore	4	92		261		
Gold Belt	Salmo	A. Endersby, Fruitvale	242	Crude ore	54	47		484	747	
Golden Age	Ymir	Foremost Construction Ltd., North Burnaby	62	Crude ore	4	25		123	123	
H.B.	Salmo	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	473,909	Lead concentrates, 4,215 tons; zinc concentrates, 39,968 tons		68,556		6,600,400	41,306,080	349,922
Jersey	Salmo	Canadian Exploration Ltd., Vancouver	368,673	Lead concentrates, 6,315 tons; zinc concentrates, 23,865 tons		28,752		10,122,433	28,348,153	233,547
Kootenay Belle	Salmo	K-Belle Enterprise Co., Linden, Alta., and M. Arishenkoff, Trail	6,206	Crude ore	751	629		12,166	11,173	
Lucky Strike	Nelson	L. C. de Kock, Nelson	4	Crude ore	6	42		102	44	
New Arlington	Erie	G. D. Fox, Trail	1,357	Siliceous ore	348	1,004		17,171	17,553	
Reeves MacDonald	Remac	Reeves MacDonald Mines Ltd., Vancouver	145,966	Lead concentrates, 2,330 tons; zinc concentrates, 8,868 tons		15,016		3,963,691	10,569,776	55,830
Trans Mountain	Blewett	Trans Mountain Mines Ltd., c/o Kennedy, Andrews & Taylor, Kamloops		Zinc concentrates, 25 tons	8	121		2,262	20,007	80
Venango	Nelson	D. H. Norcross, Nelson	63	Siliceous ore	12	25		126	126	
<i>Revelstoke Mining Division</i>										
Mohawk	Beaton	Mohawk Silver Mines Ltd., Beaton	9	Crude ore		434		2,993	3,746	
<i>Slocan Mining Division</i>										
Anna	Slocan	H. Marasek, Slocan	51	Siliceous ore		125		125	113	
Antoine	Kaslo	L. N. Garland, Kaslo	77	Crude ore		13,315		72,410	26,513	

TABLE XIV.—LODE-METAL PRODUCTION IN 1963—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.
<i>Slocan Mining Division—Continued</i>										
Arlington	Slocan	Arlington Silver Mines Ltd., Vancouver	326	Crude ore	.....	1,589	.....	5,141	4,107	.....
Black Diamond	Ainsworth	T. Lane, Ainsworth	10	Crude ore	.....	346	.....	4,372	1,845	.....
Bluebell	Riondel	The Consolidated Mining & Smelting Co. of Canada, Ltd., Trail	256,484	Lead concentrates, 16,819 tons; zinc concentrates, 27,993 tons	.....	350,370	408,800	24,869,808	29,301,241	131,135
Freddy	Silverton	V. C. Hanson and H. Lyon, Silverton	19	Crude ore	3	2,057	.....	225	262	.....
Idaho	Three Forks	M. Tarnowski and J. Nesbitt, Silverton	15	Crude ore	.....	1,913	.....	20,764	845	.....
Krao	Ainsworth	T. Lane, Ainsworth	11	Crude ore	.....	235	.....	5,969	556	.....
Meteor	Slocan	Cultus Explorations Ltd., Edmonton, Alta.	265	Crude ore	4	2,569	.....	.....	.....	.....
Ottawa	Slocan	Ottawa Silver Mines Ltd., Spokane, Wash.	384	Crude ore	3	43,569	.....	2,238	1,279	.....
Shady M.C.	Sandon	N. Sibilleau, Rossland	17	Crude ore	.....	1,283	.....	22,698	1,025	.....
Silver Bell	Retallack	J. Nesbitt and C. Towgood, Silverton	3	Crude ore	.....	223	.....	2,893	193	.....
Silversmith	New Denver	E. and A. Perepolkin, Hills; L. D. Irwin, New Denver	709	Lead concentrates, 52 tons; zinc concentrates, 90 tons; crude ore, 23 tons	6	10,180	.....	85,115	112,899	756
Utica	Kaslo	Peerless Exploration Ltd., Toronto, Ont.	.....	Lead concentrates, 1 ton; zinc concentrates, 4 tons	.....	300	.....	965	3,923	24
Victor	Sandon	L. Fried and E. Derosa, New Denver; J. Stewart and E. Anderson, New Denver	1,091	Lead concentrates, 107 tons; zinc concentrates, 197 tons; crude ore, 24 tons	28	23,579	.....	178,687	233,621	1,561
<i>Trail Creek Mining Division</i>										
I.X.L.	Rosslund	J. A. Ruelle and W. and J. Hermans, Rosslund	19	Gold concentrates	178	32	.....	77	39	.....
Sunset	Paterson	K. H. Woell, Rosslund	5	Crude ore	.....	17	.....	992	820	.....
Velvet	Rosslund	Mid-West Copper & Uranium Mines Ltd., Vancouver	5,100	Concentrates, 202 tons	185	894	80,690	.....	.....	.....
W.D.	Trail	W.D. Mining Co. Ltd., Trail	2,741	Crude ore	913	240	.....	5,482	7,417	.....

TABLE XV.—LODE-METAL OPERATIONS' EMPLOYMENT DURING 1963¹

Name of Mine or Operator	Days Operating		Tons		Average Number Employed	
	Mine	Mill	Mined	Milled	Mine	Mill
<i>Shipping Mines</i>						
Bethlehem Copper Corp. Ltd. (including Floods Mining and Aggregate Co.)	255	365	1,265,988	1,265,988	83	53
Bluebell (Cons. M. & S. Co. of Canada, Ltd.)	255	351	256,484	256,484	219	14
Bralorne Pioneer Mines Ltd.	249	328	152,601	152,601	324	41
Britannia (The Anaconda Co. (Canada) Ltd.)	272	246	493,700	493,700	376	33
Brynnor Mines Ltd.	365	365	1,114,526	968,106	127	23
Canadian Exploration Ltd. (Jersey) ²	365	365	382,855	368,673	164	10
Cariboo Gold Quartz Mining Co. Ltd.	280	365	34,702	34,702	103	8
Coast Copper Co. Ltd.	365	365	327,433	327,433	194	8
Craigmont Mines Ltd. (including Pooley Bros.)	357	365	1,787,717	1,787,717	323	189
Cowichan Copper Co. Ltd. (Suncoch mine)	340	263	267,675	267,675	117	25
Empire Development Co. Ltd.	163	125	50,244	159,871	15	1
Estella (Copper Soo Mining Co. Ltd.)	150	—	2,673	2,673	11	—
Giant Mascot Mines Ltd. (Pride of Emory mine)	365	365	313,836	313,836	130	21
H.B. (Cons. M. & S. Co. of Canada, Ltd.)	363	252	473,909	473,909	96	21
Jedway Iron Ore Ltd.	365	365	700,553	724,273	116	26
Mastodon-Highland Bell Mines Ltd.	243	302	21,689	21,689	34	6
Mineral King (Sheep Creek Mines Ltd.)	307	359	203,942	203,942	84	11
Nimpkish Iron Mines Ltd.	285	262	561,675	561,675	39	26
Phoenix Copper Co. Ltd.	279	365	645,083	645,083	76	28
Reeves MacDonald Mines Ltd.	88	123	145,966	145,966	33	7
Silbak Premier Mines Ltd. ³	—	—	—	—	10	—
Sullivan (Cons. M. & S. Co. of Canada, Ltd.)	254	263	1,742,008	1,742,008	805	263
Texada Mines Ltd.	328	332	926,889	954,591	229	35
Velvet (Mid-West Copper & Uranium Mines Ltd.)	200	80	5,100	5,100	13	1
Other mines	—	—	—	—	4	—
<i>Development and Exploration⁴</i>						
Dolly Varden Mines Ltd.	—	—	—	—	39	—
Falconbridge Nickel Mines Ltd. (including Tasu)	—	—	—	—	47	—
Granduc Mines Ltd.	—	—	—	—	30	—
Johnsby Mines Ltd.	—	—	—	—	14	—
Kennco Explorations (Western) Ltd.	—	—	—	—	43	—
Mastodon-Highland Bell Mines Ltd. (non-producing establishment)	—	—	—	—	20	—
New Indian Mines Ltd.	—	—	—	—	10	—
Newmont Mining Corp. of Canada Ltd.	—	—	—	—	13	—
Noranda Exploration Co. Ltd. (excluding Boss Mountain)	—	—	—	—	43	—
Noranda Exploration Co. Ltd. (Boss Mountain)	—	—	—	—	16	—
Rio Tinto Canadian Exploration Ltd.	—	—	—	—	15	—
South Seas Mining Ltd.	—	—	—	—	12	—
The Mining Corp. of Canada Ltd.	—	—	—	—	10	—
Utah Construction and Mining Co.	—	—	—	—	10	—
Western Mines Ltd.	—	—	—	—	42	—
Other companies	—	—	—	—	86	—

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 Includes personnel on exploration of other properties.

³ Ore was produced in 1962 but shipments were made in 1963.

⁴ 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 101, 739 West Hastings 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 53.

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 101, 739 West Hastings Street. The maps conform in geographical detail, size, and number to the reference and mineral reference maps issued by the Legal Surveys Branch of the Department of Lands, Forests, and Water Resources, and the approximate position of mineral claims held by record and of placer-mining leases are plotted from details supplied by the locators. Provision has been made to supply the general public, on request to the office of the Chief Gold Commissioner, with copies of the maps. The charge for these maps is \$1.25 for each sheet.

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	G. C. Kimberley
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
Frail Creek	Rossland	W. L. Draper	W. L. Draper
Vancouver	Vancouver	J. Egde	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, 1963

Mining Division	Free Miners' Certificates		Lode-mining						Placer-mining					Revenue		
	Individual	Company	Mineral Claims Recorded	Certificates of Work	Cash in Lieu	Certificates of Improvements	Bills of Sale, etc.	Mineral Leases	Placer Claims Recorded	Placer Leases Granted	Certificates of Work	Cash in Lieu	Bills of Sale, etc.	Free Miners' Certificates	Mining Receipts	Total
Alberni	85	3	612	995	\$6,160.00	4	76	1	1	—	4	—	1	\$650.00	\$12,614.25	\$13,264.25
Atlin	150	3	434	221	1,600.00	—	14	—	2	23	120	\$3,350.00	36	1,000.00	12,043.25	13,043.25
Cariboo	855	17	614	1,248	2,000.00	—	52	—	1	119	378	1,500.00	70	5,539.00	38,035.25	43,574.25
Clinton	54	—	284	237	800.00	—	20	3	—	3	21	—	4	270.00	3,438.50	3,708.50
Fort Steele	210	2	301	568	1,100.00	—	31	5	—	26	53	—	20	1,200.00	4,812.50	6,012.50
Golden	139	3	188	171	672.00	—	13	2	—	2	7	—	—	895.00	2,101.00	2,996.00
Greenwood	124	6	420	422	1,224.00	—	43	20	—	4	5	250.00	—	1,170.00	7,293.25	8,463.25
Kamloops	323	3	3,582	3,331	6,400.00	—	186	3	—	7	11	—	6	1,881.00	28,278.75	30,159.75
Liard	248	1	1,176	1,448	4,900.00	—	60	—	3	43	25	1,750.00	25	1,340.00	15,525.00	16,865.00
Lillooet	159	3	510	433	700.00	—	40	2	—	25	27	250.00	17	1,046.00	6,211.10	7,257.10
Nanaimo	135	2	951	1,290	5,840.00	—	175	5	1	2	1	—	1	825.00	13,192.00	14,017.00
Nelson	241	8	362	301	600.00	—	32	6	—	5	9	—	5	2,260.00	4,277.25	6,537.25
New Westminster	396	12	815	959	4,000.00	—	295	1	—	4	13	1,000.00	3	2,986.00	11,275.75	14,261.75
Nicola	90	—	2,281	2,723	700.00	—	378	—	—	—	—	—	—	492.00	18,328.00	18,820.00
Omineca	391	3	6,047	4,006	11,144.00	—	304	13	2	33	112	1,000.00	76	2,210.00	50,200.78	52,410.78
Osoyoos	154	2	399	221	700.00	—	38	11	—	—	—	—	—	920.00	3,494.00	4,414.00
Revelstoke	75	3	349	220	2,600.00	—	30	6	—	16	8	—	6	626.00	6,598.00	7,224.00
Similkameen	144	4	802	947	500.00	—	85	7	1	27	21	250.00	35	1,020.00	8,838.75	9,858.75
Skeena	126	3	1,606	3,633	6,300.00	—	135	24	—	2	3	—	—	880.00	23,826.50	24,706.50
Slocan	159	7	853	312	1,240.00	—	47	38	—	—	—	—	—	1,450.00	7,807.50	9,257.50
Trail Creek	95	2	225	111	—	—	19	2	—	—	1	750.00	—	625.00	2,259.25	2,884.25
Vancouver	2,037	252	562	470	1,300.00	—	35	1	—	1	1	—	—	33,140.00	7,587.75	40,727.75
Vernon	107	73	247	117	200.00	—	60	—	1	8	18	—	7	900.00	2,333.50	3,233.50
Victoria	378	41	1,540	264	1,400.00	—	26	—	—	4	26	—	2	5,640.00	6,803.50	12,443.50
Totals for Province, 1963	6,875	453	25,160	24,648	\$62,080.00	4	2,194	150	12	353	860	\$10,100.00	314	\$68,965.00	\$297,175.38	\$366,140.38
Totals for Province, 1962	6,968	352	20,602	22,957	\$49,800.00	30	1,730	149	20	233	951	\$7,200.00	308	\$65,419.00	\$251,253.60	\$316,672.60

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, 1963

Licences—		
Fees	\$725.00	
Rental	3,817.95	
		\$4,542.95
Leases—		
Fees	\$100.00	
Rental	94.50	
Cash in lieu	Nil	
		194.50
		\$4,737.45

At the end of 1963, 36,919,417 acres, or approximately 57,686 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
349 permits	24,902,690
3 natural-gas licences	74,987
29 drilling reservations	641,919
3,392 leases (all types)	11,299,821
	36,919,417

Petroleum and Natural-gas Revenue, 1963

Rentals and fees—	
Permits	\$1,638,748
Drilling reservations	121,632
Natural-gas licences	4,738
Petroleum, natural-gas, and petroleum and natural-gas leases	5,957,533
Total rentals and fees	\$7,722,651

Petroleum and Natural-gas Revenue, 1963—Continued

Sales of Crown reserves—	
Permits	\$79,519
Drilling reservations	1,585,935
Leases	5,426,555
Total Crown reserve sales	\$7,092,009
Royalties—	
Gas	\$1,531,977
Oil	3,858,985
Processed products	115,042
Total royalties	5,506,004
Miscellaneous fees	29,376
Total petroleum and natural-gas revenues	\$20,350,040

ANALYTICAL AND ASSAY BRANCH

By S. W. Metcalfe, Chief Analyst and Assayer

ROCK SAMPLES

During 1963 the chemical laboratory in Victoria issued reports on 2,212 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 radio-metric 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)	1,869	1,864	4,935
Prospectors (grantees)	150	149	398
Departmental engineers	193	88	696
Totals	2,212	2,101	6,029

Samples submitted to the laboratory for identification are examined by the Mineralogical Branch of the Department. During the year 82 such samples were examined.

PETROLEUM AND NATURAL-GAS SAMPLES

Reports were issued on 36 samples. Of this number, 17 were samples of formation waters from wells being drilled for gas and oil in the Province; 3 were samples of wet mud on which water analyses could not be performed; 12 were samples of oil; 2 were suspected oil seeps; and 1 was a sample of Tretolyte. In addition,

* 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.

the sediment in a water sample was identified. Fifteen spectrographic analyses were reported on samples in this category.

COAL SAMPLES

Reports were issued on 46 samples of coals, one of which was submitted by a citizen of the Province, the rest having been submitted by the Purchasing Commission.

MISCELLANEOUS SAMPLES

Reports were issued on 210 samples of a miscellaneous nature. One hundred and five assays and 49 spectrographic analyses were reported in this category.

For the Purchasing Commission, 3 samples of anti-freeze were examined, and 29 spectrographic analyses were performed on 10 steel reinforcing rods.

For the Department of Agriculture, the calcium and sulphate contents of 3 samples of water were determined; 1 soil sample was spectrographed; 2 samples consisting of poplar and willow bark were spectrographed; calcium oxide was determined in a marl sample and potassium in a sample of sylvite; 29 samples of clay were examined by the X-ray powder diffraction technique; and 5 samples of animal forage were analysed for copper, manganese, phosphorus, molybdenum, and sulphur.

For the Department of Highways, Materials Testing Branch, 6 clay samples were spectrographed, and one of them was examined by X-ray; the sediment in a water sample was spectrographed; 2 water samples were analysed, pH measurements were made on 6 water samples, and 2 other waters were given a partial examination; the deposits on 2 concrete samples were examined by spectrograph, and one of them in addition by X-ray; a deposit in hot-water pipes was determined; 1 soil was analysed; and the sulphur content of a coal sample was determined.

For the Department of Mines and Petroleum Resources, 1 sample of an organic material was spectrographed; 4 samples of rock were analysed for sulphur; 3 samples of rock were spectrographed, and one of them was analysed for its major constituents; the composition of an old metallic tray was determined.

For the Provincial Museum, 1 sample composed of concretions was spectrographed.

For the Senior Animal Pathologist at the University of British Columbia, 2 water samples were analysed.

For Smoke Inspection, City Hall, Victoria, B.C., determination was made of the residue collected in 29 bottles of water placed in various open locations in the city.

For the citizens of the Province, 1 water sample was analysed; the sediment in 2 water samples was determined, as was the residue on a sample of wood which had been in contact with the water.

X-RAY POWDER DIFFRACTION ANALYSES

One hundred and thirty-two analyses of this type were performed for identification purposes.

EXAMINATION FOR ASSAYERS

One Provincial Government examination for certificates of efficiency was held in Trail, when two candidates were granted licences to practise assaying in the Province, and three were granted supplemental examinations. In addition, one citizen of the Province was granted a licence to practise assaying without having had to write an 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
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
S. Elias, Inspector, Silicosis Control.....	Vancouver

The Inspectors are stationed at the places listed and inspect coal mines, metaliferous 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

P. E. Olson was appointed Inspector and Resident Engineer for the Nelson district on the resignation of J. D. McDonald. Harry Bapty was appointed Inspector and Resident Engineer for the Prince Rupert district. W. C. Robinson was transferred from Prince Rupert to Kamloops to a new office serving northern and central British Columbia. A. R. C. James, Inspector and Resident Engineer at Vancouver, took over part of the Vancouver Island and Lower Mainland district from J. E. Merrett. D. R. Morgan, Inspector and Resident Engineer for the East Kootenay and Fernie district, was transferred from Fernie to a new office at Cranbrook. W. H. Childress was transferred to a new mine-rescue station at Nanaimo to replace W. High, who had served on a part-time basis. G. J. Lee was appointed instructor for the Nelson station.

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. 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, 1963, the professional staff included the following engineers classified as geologists: H. Sargent, Chief of the Mineralogical Branch; M. S. Hedley, Senior Geologist; S. S. Holland, J. W. McCammon, N. D. McKechnie, G. E. P. Eastwood, J. T. Fyles, A. Sutherland Brown, J. M. Carr, W. G. Jeffery, A. F. Shepherd, J. E. Hughes, and E. W. Grove.

W. C. Jones left the employ of the Department in August, 1963. E. W. Grove, formerly with the Quebec Department of Mines, joined the staff in November. R. V. Kirkham was employed for the 1963 season and was assigned to a mapping project on Hudson Bay Mountain. In the autumn he left to begin postgraduate studies in geology at the University of Wisconsin.

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.

FIELD WORK, 1963 SEASON

A. Sutherland Brown spent the early part of the field season on the Queen Charlotte Islands examining mineral deposits on Moresby and Burnaby Islands, and logging core from Graham Island. Some 3½ weeks were devoted to visiting magnetite deposits on Vancouver and Texada Islands.

J. M. Carr made reconnaissance studies of porphyries, breccias, and copper mineralization in southwestern British Columbia, including the following localities:

Copper Mountain, Penticton, Kamloops, Highland Valley, Chattaway Creek, Guichon Creek, Merritt, Whipsaw Creek, Spatsum, Lytton, Clayoquot Sound, and Mount Washington.

G. E. P. Eastwood completed geological mapping in the Brynnor mine area at Kennedy Lake. He also examined copper-molybdenum showings along Deer Bay and Tofino Creek.

J. T. Fyles continued detailed structural studies of the northern Kootenay Lake area. The work included examination of mineral deposits and completion of mapping in the Duncan Lake area. He also made reconnaissance studies in the northern Selkirk Mountains and at Jordan River.

S. S. Holland studied molybdenite occurrences related to the Topley intrusives in central British Columbia. He also examined mineral deposits at Copper Island on Babine Lake, Banks Island, and in the Stewart area.

W. G. Jeffery began geological mapping in the area adjacent to the southern part of Buttle Lake.

R. V. Kirkham began a geological study of Hudson Bay Mountain, including the silver-lead-zinc deposits and the molybdenite deposit currently being explored at Glacier Gulch.

J. W. McCammon studied and mapped various industrial-mineral deposits, including limestone southeast of Cowichan Lake and in the Tulameen River area; magnesite in the Marysville and Brisco areas; new work at the Birch Island fluorite deposit; and various clay, gypsum, and dolomite deposits.

N. D. McKechnie examined and mapped numerous prospects in southwestern British Columbia, from Vancouver Island to Greenwood.

W. C. Jones examined and reported upon proposed dam-sites in the upper Fraser River and on the Clearwater River, and also dykes on the lower Fraser River.

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, made pursuant to the *Petroleum and Natural Gas Act*. The regulation 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.

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 provisions of the regulations, including adequate plugging of abandoned wells, surface restoration of well-sites, production of oil and gas wells at rates not in excess of established maximum limits, measurement of production, disposal of produced water, general conservation, and protection of installations against fire.

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 and 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 on the Alaska Highway about 5 miles northwest of Fort St. John.

Detailed reservoir and geological studies are conducted on the basis of technical information submitted to the Branch by operating companies, as well as information acquired through field work done 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 the Branch
R. R. McLeod	Senior Reservoir Engineer, and member of the Board of Arbitration
K. C. Gilbert	Reservoir Engineer
G. V. Rehwald	Reservoir Engineer
P. K. Huus	Reservoir Assistant
W. L. Ingram	Senior Development Engineer
M. B. Hamersley	Development Assistant
J. F. Tomczak	Statistician
S. S. Cosburn	Senior Petroleum Geologist
D. L. Griffin	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
H. B. Fulton	Field Geologist
D. L. Johnson	Field Engineer
M. A. Churchill	Field Technician
D. A. Selby	Field Technician
G. T. Mohler	Field Technician

The field office staff includes also three core and sample laboratory assistants, one clerk-stenographer, and one clerk-typist. Additional office staff was hired on a casual basis during periods of peak work loads, and one university student was employed during the summer months.

STAFF CHANGES

In 1963 the following changes to permanent staff occurred:—

H. A. Sharp, field technician, met accidental death in the performance of his duties on March 6th.

G. T. Mohler, field technician, joined the field staff by transfer from the Department of Commercial Transport on August 19th.

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, responsible to the Minister of Mines and Petroleum Resources, held one hearing in 1963, at which nine applications for right of entry were heard. Of the eight cases pending at the end of 1962, seven were settled by Board awards, and one was settled by agreement between parties. Four applications were made in 1963, of which two were settled by Board awards and two, made late in the year, were held over until 1964.

CONSERVATION COMMITTEE

Chairman: P. J. Mulcahy, Deputy Minister, Department of Mines and Petroleum Resources, was appointed as Chairman on July 5, 1963, replacing A. N. Lucie-Smith, who resigned on October 15, 1962. Members: N. D. McKechnie, mineral engineer, 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.

On December 28, 1962, Amerada Petroleum Corporation made application, under section 4 of the Regulations Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas, to the Minister to order the Conservation Committee to hold a hearing with respect to the appeal of the applicant from the decision of the Chief of the Petroleum and Natural Gas Branch refusing to designate the well Amerada Boundary 8-5-85-14 as a wildcat entitled to a full unpenalized production allowable.

The well, initially classified as an exploratory outpost, was drilled on oil-well spacing to the Boundary Lake Zone during the months of September and October, 1961. As the Boundary Lake Zone was found to be unproductive, the well was completed subsequently as a gas well in the Cadomin Formation. The well classification was not changed because the well was located less than 4½ miles from the nearest well capable of producing from the Cadomin Formation, and because there was insufficient geological and geophysical evidence to substantiate the possibility of its being completed in an entirely separate pool. A temporary exemption from a reduced production allowable was opposed by the owner of the contiguous natural-gas spacing area, namely, Pacific Petroleums Ltd.

The hearing, which was attended by representatives of Amerada Petroleum Corporation, Pacific Petroleums Ltd., and the Petroleum and Natural Gas Branch, was held in two parts on August 12th and September 10th respectively.

On October 9th the Minister, acting on the recommendation of the Conservation Committee, dismissed the appeal.

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, beryllometers, 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 the latest Departmental information circulars 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 prospectors 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. Any discoveries made, staked, and recorded are exclusively the grantee's own property. 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 a grub-stake. 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

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

Seventy-five applications were received in 1963, and 50 grub-stakes were authorized. One grantee was unable to go out, and he returned his initial payment. Grantees who were unable to complete the terms and conditions of the grant received only partial payment. Twenty-one prospectors were given grants for the first time, and five proved unsatisfactory. A few grantees used aircraft for transportation to their prospecting areas. One grantee received injuries in the field but was able to complete the season. One grantee was taken seriously ill and was unable to continue prospecting.

D. H. Rae again gave able service in interviewing applicants and managed to contact 28 grantees in the field. 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 work was done west of the Esquimalt and Nanaimo Railway near the headwaters of Granite Creek. In the Corrigan Creek watershed old open cuts were opened up, exposing disseminated chalcopyrite and pyrite in minute fractures in the granite. Volcanic flows intruded by granite showed minor mineralization along the contacts.

Atlin Mining Division.—Considerable work was done in an area 4 miles south of the Yukon boundary 15 miles west of the Haines road. Numerous rusty honey-combed quartz veins from 4 to 6 feet wide were investigated, but were not sampled. A contact zone between granite and serpentine was reported, and minor copper mineralization in limestone. Two fairly large mineralized outcrops, one containing asbestos and one copper, were located and uncovered.

Cariboo Mining Division.—North of Wasko Creek in the Quesnel Lake area small mineral zones containing stringers of barite and odd patches of fluorite were prospected. Some work was done on the west side of the north arm of Quesnel Lake.

West of Williams Lake work was done in several localities. On the Klinaklini River a wide quartz vein carrying good values in gold received some attention. On the east side of Bluff Lake a shear zone in granite showed some galena, some molybdenite in quartz, and tetrahedrite in a narrow offshoot vein. High-grade gold-bearing quartz float was picked up on the east side of Perkins Peak, but its source was not located.

Northeast of Quesnel, on the Barkerville road, some work was done on a mineralized zone which showed fairly good values in copper.

Two miles southeast of Giscome a new discovery of lead-zinc was reported, but no details are now available.

Fort Steele Mining Division.—In the upper reaches of the Priest River some scattered tetrahedrite was found in dolomite, and several narrow quartz veins containing galena were prospected and sampled. Values were reported to be low. Some work was also done in the Char and Monk Creek areas where low-grade quartz veins were sampled.

Greenwood Mining Division.—Some work was done southwest of Baldy Mountain, near McGlashin Lake, but nothing of interest was reported.

In the Beaverdell area, from one-half mile west of Carmi to King Solomon Mountain, a considerable area was prospected and some ground was staked. Several interesting mineral occurrences were reported, including a large mineralized fault zone, heavy sulphides in quartzite of the Wallace Series, fair to good disseminations of molybdenite on the face of a cliff, and numerous pyritized quartz veins; results of sampling are not available. Mineralization was investigated on Cranberry Ridge, on Wallace Mountain, and in the Dry Creek area. Molybdenite float was picked up on China Ridge and some miles south of Beaverdell.

Prospecting was also done in the Greenwood area and up Granby River.

Kamloops Mining Division.—Some work was done in the areas adjacent to Hobson Lake, Pyramid Mountain, Clearwater Lake, and Azure Lake. Some claims were staked on molybdenite showings near Taweel Lake. Several areas lying east of the North Thompson River were investigated, but nothing of interest was reported.

On the west side of Adams Lake, from 10 miles south of Skwaam Bay to 20 miles north, considerable work was done on the higher ground, largely in areas of schist. Several large bodies of pyrrhotite were prospected and sampled, but the assay values obtained were low. Work was done on other schist areas on both sides of the lake.

Liard Mining Division.—Some work was done west of the Cassiar road at Mile 43 (from the Alaska road) where some barren quartz veins were seen. Some work was also done north and west of McDame Creek. Near the headwaters of the Blue River a large amount of chromite float was found.

Some inconclusive work was done along the Cassiar-Stewart road near Kinaskan Lake and eastward to the Klappan River.

Southeasterly from Dease Lake, in the Kutcho Creek sector, a large area was prospected, and a number of claims were staked on a narrow but high-grade vein containing considerable amounts of chalcocite. South of Kutcho Creek a wide

serpentine belt was found to contain minor amounts of short-fibre asbestos stringers. Float showing good asbestos fibre was found near Rainbow Lake.

Lillooet Mining Division.—During the 1963 season a great deal of work was done astride the lower reaches of the Bridge River, primarily to find deposits of nephrite jade. Outcrops of nephrite jade of various types were found at Ama Creek, Blue Creek, lower Jim Creek, Liza Creek, Hog Creek, and near Moha.

In lower Shulaps Creek a deposit of talc was located. There is much magnesium carbonate in the upper reaches of Dickey Creek, and copper was discovered on Mount McLean. Near Birken a mineral deposit containing appreciable amounts of copper and zinc sulphides was staked, and a large area underlain by granite was prospected.

Some work was done in the Luluwissin Creek valley, where minor amounts of copper mineralization were noted. Narrow asbestos fibre was observed in serpentine on Blue Creek, and in an area between Brett and Jim Creeks float containing chalcopyrite was found and quartz float carrying low values in gold.

Close to McGillivray Falls at approximately 1,500 feet above Anderson Lake, some claims were staked and considerable work was done on a 10-foot-wide shear zone in argillite showing appreciable amounts of chalcopyrite and bornite. Further prospecting is being done to prove continuity of the shear. Near Birkenhead Lake a narrow vein showed high values in silver, and some mineralization was observed along a granite-andesite contact in the same area. At Birkenhead Lake heavy pyritization occurred at a granite contact, and several narrow high-grade silver-lead veins were sampled close to the contact. Some claims were staked at the headwaters of Haylmore Creek, and more prospecting was done near Melvin Creek.

Some field work was done near Duffy Lake and at the headwaters of Cayoosh Creek.

Nanaimo Mining Division.—Prospecting was done in numerous localities at the north end of Vancouver Island. Very little geological information was sent in, and only at Quatse Lake were important mineral indications reported. In this area a deposit of magnetite was discovered, prospected, and staked, and since then a deal is reported to be pending on the claims.

Nelson Mining Division.—Seven miles east of Boundary Lake an attempt was made to locate the source of copper-bearing float and other oxidized vein material. North of Boundary Lake traces of chalcopyrite and galena were found in dolomite. At Arrow Creek a wide zone of magnetite was investigated, and at Summit Creek a narrow copper-bearing quartz vein in schist.

New Westminster Mining Division.—Some prospecting was done on a wide serpentine zone and along a serpentine contact 6 miles east of Jessica in the Coquihalla River area.

Some claims were staked, and prospecting was done on a 5-foot-wide quartz vein carrying values in gold in mountainous country north of Haney. Some work was also done between Pitt and Alouette Lakes on a well-mineralized quartz vein containing gold values.

Nicola Mining Division.—Some claims were staked on Quilchena Creek near Nicola Lake. Some prospecting was done near Mount Hamilton and in the vicinity of Minnie and Paradise Lakes; nothing of interest was reported.

Omineca Mining Division.—On the upper Ingenika River, at Flameau Creek, and near Fleet Peak considerable arsenopyrite was observed disseminated in the rock; on Fredrickson Creek barren quartz veins outcropped.

West of Germansen Lake at Twenty Mile Creek a wide low-grade copper-bearing zone was investigated.

Some prospecting was done on the south side of Decker Lake on narrow mineralized zones showing considerable chalcopyrite.

Inconclusive work was done in a number of areas, including Omineca River, Misinchinka River, Gable Mountain, James Creek, Tenakihi Range, Vega Creek, Germansen Lake, Osilinka River, Thane Creek, and Vital Range. Some claims were staked near Kwanika Creek.

Prospecting was done at a number of places west of Prince George. Some claims were staked north of Fort Fraser.

Work started in the McDonell Lake-Serb River area in 1962 was continued in 1963. In the Serb River valley a few narrow galena-bearing quartz stringers were seen, and minor amounts of native copper in the exposed rocks. At the headwaters of the Serb River some narrow veins containing some malachite and narrow stringers of chalcopyrite were prospected. In the Coal Creek area, hematite was found associated with the sedimentary rocks in several places.

An area on the east flank of Kisgegas Peak was thoroughly prospected. Narrow discontinuous stringers of galena were investigated. Several barren quartz veins were found at Goathead Creek. Prospecting was also done on the westerly arm of Morice Lake.

Mineralized volcanics and limestone were investigated in the Bulkley Range, at Philips Lake, where mineralized limestone and slate were reported, and in the Kleanza Creek watershed along a granite-limestone contact.

Good results were obtained from a prospecting trip at the headwaters of Frisco and Legate Creeks; up the latter creek a high-grade copper deposit was thoroughly prospected and sampled. The zone is very strong and appears to be much more extensive than when first uncovered. High values in copper were obtained from the samples. Claims were staked and an option has been exercised on the property by a mining company.

Osoyoos Mining Division.—The 1962 prospecting was continued in the valley of Trepanier Creek west of Peachland. On the north fork of McDonald Creek a large outcrop of pyrrhotite was staked. Some work was done in the valleys of Lacoma, Verner, and Clover Creeks, but nothing of interest was reported. More prospecting was done on the slopes of Dividend Mountain.

Similkameen Mining Division.—A great deal of prospecting was done in the Princeton-Coalmont-Tulameen area, but without producing information of particular value. Localities included Corral Creek (tributary of Whipsaw Creek), Granite, Manion, Newton, Britton, Jim Kelly, Railroad, and Sutter Creeks, Lodestone Mountain, and Mount Thynne. On the railway north and east of Princeton prospecting was done at Jura, Thirsk, and at Osprey and Tepee Lakes. A little work was done at Copper Creek and near Aspen Grove. Float and minor evidences of mineralization were found in a few places. Some claims were staked on an occurrence of magnetite on Olivine Mountain.

Skeena Mining Division.—Some work was done on a magnetite deposit on the north end of Pitt Island, in the Knight Inlet area, at Dutchman Head, and up the Franklin River where some copper-bearing float was found. At Mussel River a fault zone in granodiorite was prospected. Some time was spent prospecting a molybdenite showing at Cascade Point.

The Kahylskt Creek (Burnt Bridge River) valley received considerable attention, but samples taken from the several zones mineralized with pyrite, arsenopyrite, and chalcopyrite were too low to be of interest.

Slocan Mining Division.—In the Lardeau district considerable prospecting was done in areas close to Tenderfoot, Mobbs, and Lake Creeks. Some lead-zinc showings were seen in northwesterly trending shear zones and minor amounts of lead and zinc along a contact between limestone and slate.

Some work was done on Seven Mile Creek near Kaslo, where some manganese minerals and sphalerite were reported in quartzite.

Vancouver Mining Division.—Some prospecting was done from a boat in the area of Toba Inlet. A number of creek and river valleys were investigated as far back as accessible, and other areas were entered and prospected by way of the fairly numerous logging-roads. The following stream valleys were examined: Brem River, Little Toba River, Racoon Creek, Klite River, Jimmie Creek, and Hillis Creek.

Vernon Mining Division.—A little work was done in the Lumby area, on Harris Creek and south of Mabel Lake.

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 trunk 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 fiscal year ended March 31, 1964, were as follows:—

Mining roads and trails—	Miles	Cost
Construction and reconstruction	111.7	\$108,405.21
Maintenance	178.6	32,305.50
Bridges—Construction and reconstruction.....		24,072.59
Total		\$164,783.30

In addition to the above, work was continued on the Stewart-Cassiar road. This road is being constructed under the Roads to Resources Agreement between Canada and British Columbia. The construction is supervised by the Department of Highways on behalf of the Department of Mines and Petroleum Resources. At the north end of the road the 40.12-mile section from Eddontenagon Lake to Bura River was 95 per cent completed when work was suspended in November for the winter. 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 over 80 per cent completed. No new contracts were let in 1963.

MUSEUMS

The Department has a large exhibit of mineral and rock specimens in the Douglas Building, Victoria; collections are also displayed in the joint office in Vancouver and in the offices of the Inspectors of Mines in Nelson 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 elsewhere in the Province. They are also available for reference use in the Department's library (Mineralogical Branch) at Victoria, in the joint office 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 in Vancouver. Copies of these maps may be obtained on request. 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.

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

Provincial Department's Inspectors and Resident Engineers for the Vancouver Island and Lower Mainland districts, the Silicosis Control Instructors, the Gold Commissioner and Mining Recorder for Vancouver Island Division, and the officers

of the Federal Geological Survey occupy offices on the ground floor of the same building. Official information relating to mining, from the Provincial and Federal offices, is available to the public at 739 West Hastings Street, Vancouver 1, B.C.

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

Topographic Mapping and Air Photography

The Provincial surveys and mapping programme is under the direction of the Surveyor-General, who administers the Legal Surveys, Topographic, Geographic, and Air Divisions of the Surveys and Mapping Branch, Department of Lands, Forests, and Water Resources.

In 1963 the Legal Surveys Division recorded the survey of 893 lots, of which 12 were made under the *Mineral Act* and the remainder under the *Land Act*. Rural home-site subdivisions involving 66 lots were completed at Lantzville, Sproat Lake, Brackendale, Gambier Island, Spences Bridge, Apex Mountain, and Fort St. John. Waterfront subdivisions at Gun Lake, Charlotte Lake, Norman Lake, Kimberley, Moyie Lake, Riondel, and Lac le Jeune produced another 139 lots. A total of 55.9 miles of highway was surveyed in the Houston-Telkwa, Blaeberry, Golden-Yoho, Radium Junction, Yahk, and Fort Steele-Wasa areas.

Field crews of the Topographic Division established horizontal survey control for 8 map-sheets west of Quesnel and 18 sheets northwest of Babine Lake. Additional monuments were established in the Lower Fraser Valley as a basis for survey by the co-ordinate system, and a map revision programme was begun on southern Vancouver Island.

During 1963, 23 standard topographic manuscripts were draughted at a scale of 2 inches to 1 mile.

Work by the Air Division included 20-chain (4 inches to 1 mile) aerial photography at Blueberry, Parsnip, Burns Lake, Ootsa, Okanagan, and Cranbrook Sustained-yield Units. Large blocks of photography were also done on southern Vancouver Island, between Quesnel and Prince George, and in the Lower Fraser Valley. Mining companies purchased 6,434 reprints of aerial photographs in 1963 and borrowed an additional 4,067, while totals requested by the petroleum and natural-gas industry were 1,385 and 56 respectively. The Provincial Department of Mines and Petroleum Resources requisitioned 1,845 photographs on purchase and loan.

Some 2,800 square miles of final interim maps at 1-inch-to-20-chains scale were draughted and made available for general distribution. Since the 20-chain programme began in 1957, interim maps covering 10,150 square miles have been completed by the Air Division.

Seven new national topographic map-sheets were issued by the Geographic Division. They show hydrographic features in blue, contours in brown, and roads, place-names, administrative boundaries, and lands alienated or applied for under the *Land Act* in other distinctive colours. Four sheets—namely, 92J (Pemberton), 93D (Bella Coola), 103B-C (Moresby Island), and 103F-G-J-K (Graham Island)—were lithographed at 1:250,000 scale, while three others—82 G/SE (Flathead), 82 G/SW (Elko), and 82 K/SE (Lardeau)—were reproduced at a scale of 1 inch to 2 miles.

One regional map-sheet (South Western British Columbia) was revised and reprinted in three editions during 1963, including a landforms edition in the new sand tone. Also, 160 petroleum and natural-gas well-site survey plans were checked.

Federal agencies printed 71 full-colour and 15 provisional (black and blue) national topographic maps at 1:50,000 scale covering widely scattered parts of the Province.

On January 1, 1963, the price of Provincial maps was raised commensurate with the rates charged by Federal mapping agencies.

Further details of surveying and mapping in British Columbia are contained in the 1963 Annual Report of the Lands Service. Map and air-photo indexes, together with additional information, are available from the Director, Surveys and Mapping Branch, Department of Lands, Forests, and Water Resources, 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 Division 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 739 West Hastings Street, Vancouver 1.

FIELD WORK BY GEOLOGICAL SURVEY OF CANADA IN BRITISH COLUMBIA, 1963

H. W. Little began field work in the Greenwood (82 E/2) map-area.

G. B. Leech and R. V. Best began field work in the Windermere (82 J, W. ½) map-area.

J. O. Wheeler continued mapping in the Big Bend (82 M, E. ½) map-area.

R. B. Campbell completed field work in Adams Lake (82 M, W. ½) and began work in Canoe River (83 D, W. ½) map-areas.

J. E. Muller began field work in the Alberni (92 F, E. ½) map-area.

H. W. Tipper continued mapping in the Taseko Lakes (92 O) map-area and began work in the Bonaparte River (92 P, W. ½) map-area.

J. G. Souther, A. J. Baer, and W. W. Hutchison began coastline mapping with a view to completing reconnaissance mapping of the Coast Mountains by about 1970.

G. C. Taylor and R. T. Bell commenced Operation Liard, a study of outstanding parts of the northern Rocky Mountains, southern Liard Plateau, and Interior Plains.

J. A. Jeletzky studied Cretaceous stratigraphy and palæontology in the Taseko Lakes map-area and on Vancouver Island.

D. J. McLaren studied Devonian biostratigraphy in the Halfway River (94 B) and Fernie (82 G, E. ½) map-areas.

E. T. Tozer studied Triassic biostratigraphy in the Halfway River (94 B) and Taseko Lakes (92 O) map-areas.

E. C. Halstead continued his study of the surficial geology of southeastern Vancouver Island and the Gulf Islands.

R. J. Fulton began mapping the surficial geology in the Vernon (82 L, W. ½) map-area.

S. F. Leaming commenced the study of gravel deposits in south central British Columbia.

J. E. Reesor, J. W. Moore, and G. Mursky continued the study of gneisses and granites in southern British Columbia, particularly the study of a gneiss dome west of Arrow Lakes.

P. B. Read completed the study of the eastern contact of the Kuskanax batholith in the Poplar Creek (82 K/6) map-area.

P. Sawatzky and party conducted an experimental aeromagnetic survey in the region of Buttle Lake (92 F/12, 13) map-area.

PUBLICATIONS OF THE GEOLOGICAL SURVEY

A total of 62 publications of the Geological Survey of Canada relating to British Columbia was received by the British Columbia Department of Mines and Petroleum Resources in 1963.

MINES BRANCH

The Mines Branch has branches dealing with mineral dressing and process metallurgy, physical metallurgy, radioactivity, and fuels and explosives. A total of 17 publications of the Mines Branch pertaining to British Columbia was received in 1963 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

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GENERAL REVIEW

The average Canadian prices paid in 1963 for silver and lead were well up, in comparison with 1962, the price for zinc showed a moderate increase, and the prices for gold and copper were practically unchanged. The United States price for silver was \$1.216 per ounce at the start of 1963 and \$1.293 at the end; the average Canadian price was a record \$1.37965. Lead increased 1.7 cents per pound in average Canadian price, and zinc increased three-quarters of a cent per pound. The fractional increase in the rate of exchange more than offset a very small drop in the United States price for copper.

It has been the long-standing custom in the Annual Report to group the principal metals—gold, silver, copper, lead, and zinc—and to refer to all others as miscellaneous. However, concentrated iron ore has exceeded for the fifth successive year the values of production of both gold and silver, and is currently in fourth place. In 1963 the value of iron concentrates and iron sinter was \$20,746,424, the highest yet. The gold, silver, copper, lead, zinc, and concentrated iron ore produced at British Columbia lode mines had a value of \$164,249,008. Other metals, including nickel, tin, and minor metals recovered as smelter by-products, had a value of \$10,117,639. The total quantity of ore mined at all lode mines amounted to 11,898,408 tons and came from 65 mines, of which 36 produced 100 tons or more. The average number employed in the lode-mining industry in 1963, including mines, mills, and smelters, was approximately 8,200.

In 1963, 25 mills were operated, 19 of them throughout the year. Of the others, three were on a part-time basis, two were closed, and one operated for the first time. In addition, two small mills were built but did not operate. Two mills treated gold ore and one small one was built, nine treated silver-lead-zinc ore and one small one was built, seven treated ores of copper, six of iron, and one of nickel. The Bethlehem mill came into production early in the year, and the rated capacity of 3,500 tons per day was exceeded by the year's end. The iron-ore mill at the Nimpkish mine closed because of exhaustion of reserves. Modification was made of the Coast Copper mill to produce a magnetic iron by-product, and modification was made of the Bethlehem mill to produce a molybdenite by-product.

The Trail smelter recorded custom receipts of 13,095 tons of ore, 2,348 tons of lead concentrates, and 30,018 tons of zinc concentrates. The ore was from 34 properties, 10 of which shipped a total of 9,150 tons of siliceous ore. The lead concentrates were from five properties, one of which shipped 90 per cent of the total. The zinc concentrates came from six properties, two of which contributed 92 per cent of the total. Lead concentrates exported to American smelters totalled 14,228 tons, and zinc concentrates, 26,740 tons. Of the copper concentrates, 167,466 tons went to Japanese smelters and 44,767 tons went to the Tacoma smelter. Copper matte from the Trail smelter, amounting to 435 tons, went to the Tacoma smelter. Nickel-copper bulk concentrates amounting to 20,107 tons were shipped to Japan. All iron-ore concentrate was shipped under contract to Japan, a total of 1,998,644 tons.

Gold production was relatively unchanged. A drop in output from Bralorne was more than made up by the Coast Copper mine, which in 1963 ranked third as a producer of gold. Discovery of a gold-bearing zone on Banks Island led to the location by several companies of several hundred mineral claims. This was the first staking rush for gold ore in many years.

There was no marked change in the situation of silver, lead, and zinc. Exploration activity on old properties was slight, except near Sardon and Silverton. Two deposits diamond drilled west and north of Revelstoke are of potential interest even though neither has yet been proved economic. These are extensive bedded deposits containing chiefly zinc. One of the few new mills to be erected was at the Ottawa silver mine near Slocan City. A new source of zinc is seen in the Western Mines ore zone at Buttle Lake.

Copper production continued to increase, and established a new record of 123,401,020 pounds worth \$37,817,476, a yearly value almost equal to that of lead. The Bethlehem mill started officially on February 1st at a rate of about 2,500 tons per day and treated almost 4,000 tons per day by the end of 1963. Production at Phoenix again showed an increase over the previous year. The extent of the Craigmont operation may be judged from the fact that about 1,000,000 tons of ore and waste rock was removed from the open pit per month.

The two brightest copper hopes continued to be the Granduc property, with early preparations for production almost assured, and the Galore Creek property, with more diamond drilling to be done. The growing sureness of production from the general Stikine-Unuk area greatly stimulated prospecting, and many claim groups were recorded in the region. Problems of access and the pattern and rate of growth are of great importance to the future of this rugged section of British Columbia. Several copper deposits were investigated on Vancouver Island. A shaft was sunk on the Lynx copper-zinc zone of Western Mines at Buttle Lake.

The production of iron ore showed little change from 1962. The Nimpkish operation closed late in 1963 with exhaustion of ore reserves, having produced 2,400,000 tons of ore in four years. Exploration work was done on a number of properties in the coastal area, the most significant fact to emerge being that the Tasu magnetite deposit is the largest yet known. The Tasu deposit contains considerable copper in addition to iron. Copper production from an iron mine is not new, but Coast Copper started remodelling its copper mill to make a magnetic iron concentrate.

The F.L. property closed in February, 1963, after a brief and unsuccessful period of open-pit mining. However, work recommenced in November with preparation for underground mining. The first underground mining of iron ore was done at the Kingfisher orebody at Benson Lake. The change-over from open pit to underground was well under way at Texada, and at the end of 1963 Brynnor had started to sink a shaft to develop the deeper part of its ore zone.

Molybdenite dominated the exploration scene, but in spite of several extremely interesting developments it will be the Bethlehem mine that will contribute as a by-product the first substantial production of molybdenite in the history of the Province. Careful checking of all data, plus new sampling, led to installation of a molybdenite circuit in the Bethlehem mill at the end of 1963. Decision to go into production at the rate of 1,000 tons per day was reached at Boss Mountain in November. This is the culmination of exploration at a property at which diamond drilling was first done more than 20 years ago.

The greatest interest in molybdenite was shown in the Endako area—the general region west of Prince George where Topley intrusions may occur—with a general focus south of Endako station. About 6,000 mineral claims were located in 1963, presumably to cover ground that might have a chance to contain molybdenite. Interest centred on the Endako property, at and near the old Stella molybdenite-bearing quartz vein, where extensive diamond drilling established the existence of a large tonnage of low-grade molybdenite ore, and a decision to put the property into production at the rate of 10,000 tons per day was reached early in

1964. Diamond drilling was continued at Glacier Gulch and was resumed on Lime Creek near Alice Arm. Many other new properties were under investigation for molybdenite, most, but not all, in the central and northwestern parts of the Province.

The year 1963 was a boom year in prospecting and exploration, and 25,461 mineral claims were recorded, almost as many as the peak year of 1956, in which interest centred on the Kamloops-Ashcroft-Merritt region. The interest in 1963 was more widespread, with molybdenite and copper the chief prizes, extending through almost the entire length of the western and central sections of the Province. The search is for deposits that on the whole are low in grade, and prospecting in areas with a thick cover of drift and little exposed rock is not easy. In the northern and western mountains the ruggedness of the terrain poses many problems, one of which is expense. All exploration techniques are used, embracing geology, geochemistry, and geophysics, in order to find targets for the diamond drill. Several large companies maintain staffs and laboratories of a size that, until recently, were more commonly associated with governmental organizations. The helicopter is of prime importance in this work, whether for freighting in supplies, positioning the geologist, or for moving drilling equipment from one set-up to the next.

NOTES ON METAL MINES

TAKU RIVER

Copper

Thorn (Julian Mining Co. Ltd.)* (58° 132° N.W.) Company office, 1030 West Georgia Street, Vancouver 5. B. G. Gore, president; R. Macrae, engineer in charge. The Thorn group of 22 recorded claims is on a tributary of Sutlahine River about 13 miles southeast of King Salmon Lake. Some hand-trenching commenced in May was completed in November by a crew of 14 men. A magnetometer survey was conducted over 11,000 feet of line and 300 soil samples were taken. Transportation was by charter aircraft. The property was not visited.

CASSIAR

Gold

Copco, Liz, Cote (Hanna Gold Mines Ltd.)† (59° 129° S.W.) Head office, 401, 470 Granville Street, Vancouver 2; mine office, Cassiar. J. A. Hanna, president; W. C. Hood, Jr., managing director. The property, which was originally known as the Cornucopia group, is on the east slope of Quartzrock Creek valley, 2 to 3 miles north of McDame Lake. The showings have been described in previous Annual Reports. Underground exploration work, which started in 1961, was continued in 1963. Work in 1963 commenced on May 4th and was suspended on October 31st. Development of the 3600 level continued and comprised 1,387 feet of drifting and crosscutting. Other work included surface stripping and 1,500 feet of diamond drilling from underground. An average crew of 16 men was employed under the supervision of Donald Martin. The property is serviced by the Cassiar-Stewart road.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1947, pp. 70-72.]

Silver-Lead

McDame Belle, Bar (Ventures Mining Ltd.)* (59° 129° S.E.) Company office, 850 West Hastings Street, Vancouver 1. H. A. Briden, managing director; A. P. Fawley, consulting geologist. This property is located on McDame Creek, 23 miles east of Cassiar and 2 miles west of Centreville. A total of 54 claims is held, of which 5 are under option from John Bartle, of Lower Post, and 49 by record. Work commenced in late May and terminated in early October. A programme of geological study, trenching, and cutting of grid lines was done for a geophysical survey. An average crew of two men was employed under the direction of R. G. Hawley. The property is serviced by an all-weather gravel road which connects Cassiar to the Alaska Highway. The property was not visited.

DEASE LAKE

Copper

Joy* (58° 129° S.E.) Kennco Explorations, (Western) Limited; company office, 1111, 1030 West Georgia Street, Vancouver 5. C. J. Sullivan, president. The company holds the

* By H. Bapty.

† By W. C. Robinson.

Joy group of 32 claims lying east of Dease Lake and from 5 to 7 miles southeast of Eaglehead Lake. Scattered showings of copper mineralization associated with a geochemical anomaly were investigated by geochemical sampling and some trenching. This work was done by an average crew of four men under the direction of C. S. Ney between July 15th and August 20th. Transportation was by helicopter. The property was not visited.

KING MOUNTAIN

Copper

TNA (Julian Mining Co. Ltd.)* (58° 128° S.W.) Company office, 1030 West Georgia Street, Vancouver 5. B. G. Gore, president; R. Macrae, engineer in charge. The TNA group of 40 recorded mineral claims is on Kehlechoa River near the head of the Stikine River. Work commenced in May and was completed by November by a crew of 14 men. A magnetometer survey was conducted over 20,000 feet of line, 500 soil samples were taken, and 80 feet of light diamond drilling was done. Transportation was by charter aircraft. The property was not visited.

SHESLAY RIVER

Copper-Molybdenum

FAE* (58° 131° S.W.) Kennco Explorations, (Western) Limited, holds the FAE group of 24 recorded claims about 35 miles northwest of Telegraph Creek and 5 miles south of the junction of Samotua and Sheslay Rivers. It is reported that molybdenite and a small amount of copper mineralization are found in fractures in a stock of quartz monzonite. Work commenced in late June and was terminated in early August. An average crew of four men was employed under the direction of C. S. Ney. Work included soil-sampling, trenching, and some diamond drilling. A packsack drill cored 250 feet of rock. About 1 mile of trail was constructed. Transportation was by helicopter. The property was not visited.

STIKINE

Molybdenum

Sam* (57° 132° N.E.) Southwest Potash Corporation; company office, 718 Granville Street, Vancouver 2. This company holds the Sam group of 59 recorded mineral claims and fractions near the headwaters of the Barrington River, 35 miles west of Telegraph Creek. Molybdenite occurs in quartz veinlets cutting argillite and volcanic rocks. Work done in 1963 consisted of a helicopter-borne magnetometer survey under the direction of W. W. Shaw. Sixty line-miles were surveyed. The work was carried out between July 29th and August 2nd, and involved a crew of three men. Transportation was by Hiller 12E helicopter. The property was not visited.

Copper

Poke* (57° 132° N.E.) Kennco Explorations, (Western) Limited; company office, 1111, 1030 West Georgia Street, Vancouver 5. C. J. Sullivan, president. The company holds the Poke group of 24 recorded mineral claims south of Limpoke Creek, a tributary to Barrington River approximately 25 miles west of Telegraph Creek. Copper showings in fractured zones in syenite and syenitized volcanics are exposed along the bank of the creek. The overburden-covered slopes adjacent to the creek were

* By H. Bapty.

investigated by geochemical soil-sampling and by an induced polarization survey. One diamond-drill hole was attempted, but it did not reach bedrock. Work in 1963, which was carried out by an average crew of eight men, was under the direction of C. S. Ney. Work commenced in June and was suspended in mid-August. Transportation was by helicopter. The property was not visited.

Molybdenum

Ann (Julian Mining Co. Ltd.)*

(57° 131° S.W.) Company office, 1030 West Georgia Street, Vancouver 5. B. G. Gore, president; R. Macrae, engineer in charge. This group of 92 recorded mineral claims is on Split Creek. Work commenced in May and was completed by November by a crew of 14 men. A magnetometer survey was conducted over 56,000 feet of line, 1,160 soil samples were taken, and 100 feet of light diamond drilling was done. Transportation was by charter aircraft. The property was not visited.

Copper

Goat*

(57° 131° S.E.) Kennco Explorations, (Western) Limited, holds the Goat group of 40 recorded mineral claims on Sphaler Creek 16 miles east of the junction of the Porcupine and Stikine Rivers. It is reported that several copper showings occur in a northerly trending belt associated with small intrusives. Work done during July and August consisted of prospecting, mapping, sampling, and trenching. Five men were employed under the direction of G. H. Rayner. Transportation was by helicopter. The property was not visited.

Molybdenum

Decker Creek*

(57° 131° S.W.) Southwest Potash Corporation; company office, 718 Granville Street, Vancouver 2. F. Coolbaugh, president, New York. The company holds the Decker Creek group at the headwaters of Decker Creek, 48 miles southwest of Telegraph Creek. The mineralization is reported to consist of molybdenite-bearing quartz veins cutting quartz monzonite. Work done between August 19th and August 31st consisted of four diamond-drill holes totalling 196 feet of EX core. This work was done by a three-man crew under the direction of G. W. Mannard. The property was serviced by helicopter. The camp was not visited.

Copper

Galore Creek (Stikine Copper Limited)*

(57° 131° S.E.) Company office, 1111, 1030 West Georgia Street, Vancouver 5. C. H. Burgess, president. This company holds 176 claims by record and 16 claims by option, all in the headwaters of Galore Creek, about 20 miles southeast of the junction of the Stikine and Scud Rivers. Chalcopyrite and bornite occur in several deposits within an area of 8 square miles. The largest deposit developed to date, the Central zone, has been traced by diamond drilling for a length of 1 mile. Work commenced on May 16th and stopped October 15th. An average crew of 70 men was employed under the direction of D. A. Barr. Work consisted of 34,894 feet of diamond drilling, geological mapping, and induced polarization and magnetometer surveys. Two core-storage sheds were constructed. Two helicopters were employed at the property. Supplies and

* By H. Bapty.

equipment were barged up the Stikine River to Anuk River at the start of the season and regular service trips were made by fixed-wing aircraft from Prince Rupert. The property was not visited.

[Reference: *Minister of Mines, B.C., Ann. Rept., 1961, p. 7.*]

ISKUT RIVER

Molybdenum

Mary*

(57° 130° S.E.) Southwest Potash Corporation; company office, 718 Granville Street, Vancouver 2. F. Coolbaugh, president, New York. The company holds the Mary group of 43 recorded claims on Ball Creek, a tributary of the Iskut River. The claims are 5 miles west of a newly completed part of the Cassiar-Stewart road, at a point 20 miles south of Kinaskan Lake. Small quantities of molybdenite occur with pyrite in quartz veinlets and on fracture surfaces in altered andesite and feldspar porphyry. Four men were employed on the property in the 1963 field season. Six diamond-drill holes totalling 199 feet were put down by packsack drill. The area was geologically mapped, and a geochemical soil survey was done under the direction of G. W. Mannard. All transportation was by helicopter. The property was not visited.

UNUK RIVER

Copper and Copper-Iron

Granduc (Granduc Mines Limited)*

(56° 130° S.E.) Company office, 604, 744 West Hastings Street, Vancouver 1. J. Drybrough, president; C. J. McLellan, mine superintendent. The Granduc mine, at the head of the Leduc River, 25 miles north-northwest of Stewart, comprises 64 Crown-granted and 180 recorded mineral claims.

Shan.—This group of 20 recorded claims is located 3.8 miles southeast of the confluence of Snippaker Creek with the Iskut River. A shallow skarn zone overlying syenite porphyry contains an erratic distribution of magnetite, chalcoppyrite, pyrite, and sphalerite. A four-man crew carried out geophysical surveys on 67,000 feet of line between June 19th and July 2nd. Geological mapping of control lines and surrounding area was carried out by a two-man crew between September 10th and September 26th under the direction of G. Gutrath, engineer in charge.

Mag.—Fourteen recorded claims in the upper Forrest Kerr Creek area along a limestone-diorite contact cover a skarn zone mineralized with massive magnetite with minor pyrite and traces of chalcoppyrite. A four-man crew carried out geological and geophysical surveys on 50,000 feet of control line between June 6th and 13th under the charge of G. Gutrath, engineer in charge.

Ken.—Five recorded claims are located west of the headwaters of Forrest Kerr Creek. Small outcrops of skarn occur on feldspar porphyry contacts. A heavy concentration of magnetite containing chalcoppyrite was discovered. A six-man crew carried out geological and geophysical surveys on 67,000 feet of control lines between July 27th and 31st. This work was under the care of G. Gutrath, engineer in charge.

Jon.—Twelve recorded claims lying at the head of the east fork of the Inhini River cover a quartz vein from 4 to 8 feet wide erratically mineralized with tetrahedrite. The vein is along a contact of folded volcanics and limestone and in an indeterminate shatter zone sparse tetrahedrite was found in reticulated quartz

* By H. Bapty.

stringers in the limestone footwall. A two-man crew did geological mapping between August 29th and September 1st under the direction of G. Gutrath, engineer in charge.

Don.—Forty recorded claims at the headwaters of Forrest Kerr Creek are located along a contact zone between feldspar porphyry and limestone. Sparse pyrite, tetrahedrite, and chalcopyrite mineralization occur in porphyry and in the limestone. A four-man crew carried out geological and geophysical surveys on 77,050 feet of control line between June 15th and 30th under G. Gutrath, engineer in charge.

In.—Four recorded claims on the upper Inhini River were trenched by a two-man crew between August 26th and 30th, directed by G. Gutrath, engineer in charge. This work was done on a narrow quartz vein mineralized with galena, sphalerite, and chalcopyrite. The property was not visited.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1962, p. 8.]

Gold-Silver-Lead-Zinc

(56° 130° N.E.) Company office, 425 Howe Street, Vancouver 1. **Kay (Western Resources Limited)*** T. J. McQuillan, president. This company holds the Kay group of 40 mineral claims located 3 miles east of Tom MacKay Lake on the headwaters of the Unuk River. Work commenced August 5th and was suspended on October 15th. Three hundred and sixty-five feet of adit driving and crosscutting was done. Other work consisted of building a 4-mile tractor-road from the lake to the property. An average crew of seven men was employed under the supervision of T. F. Tomlinson. Transportation to the property was by aircraft. The property was not visited.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1953, pp. 87–89.]

PORTLAND CANAL

SALMON RIVER (56° 130° S.E.)

Gold-Silver-Lead-Zinc

Company office, 844 West Hastings Street, Vancouver 1. **Silbak Premier Mines Limited*** A. E. Bryant, president; H. Hill & L. Stark & Associates Ltd., consulting engineers. The property has been described in previous Annual Reports. Work in 1963, which was carried out by a crew of 11 men under the supervision of D. McLeod, commenced in April and was suspended on November 9th. During the summer two mucking-machine draw points involving 97 feet of drifting and crosscutting were driven into the glory-hole. Construction was commenced on a loading-trestle and ore-bin. A crusher-site was excavated. The camp now consists of two 8-man bunk trailers, one 18-man kitchen-diner trailer, a mine dry, repair-shop, oil-shed, and the warehouse-office. The camp was not visited.

Silver-Lead-Zinc

(56° 130° S.E.) Company office, 789 West Pender Street, Vancouver 1. **New Indian Mines Ltd.*** T. E. Blossom, president; F. J. Hemsworth, field engineer. This company holds 82 Mammoth-Indian mineral claims, of which 54 are Crown-granted, 7 are recorded, and 21 are held by lease. The claims are on the Salmon River, 15 miles from Stewart, and adjoin the Silbak Premier on the west and north. The showings consist of silicified fracture zones in altered volcanics, mineralized with sphalerite,

* By H. Bapty.

galena, and chalcopyrite and containing variable values in gold and silver. Work, between May and September, was done by a crew of 11 men, and included trenching, soil-sampling, and geological mapping. Four diamond-drill holes recovered 2,000 feet of core on the Payroll showing. The Payroll zone is located on the west side of the Big Missouri Ridge at the 2,200-foot elevation. Lead, copper, zinc, and silver mineralization occur intermittently along a strike length of 800 feet. The mineralized zone is contained in a northerly trending in echelon fracture system which is in part filled by quartz breccia containing argillite and greenstone fragments. Transportation of men and equipment was by helicopter from Stewart. The property was not visited.

SUMMIT LAKE (56° 130° S.E.)

Gold-Silver

East Gold and East Gold Extension* Utica Mines Ltd.; company office, 1030 West Georgia Street, Vancouver 5. A. Robertson, president. This group of 14 claims was under option to Utica Mines Ltd. The claims are 24 miles north of Stewart and 11 miles north of the Big Missouri mine. An adit 494 feet long was driven under the ore zone, and 746 feet of EX diamond drilling completed. A 2,000-foot landing-strip suitable for an Otter-type aircraft was cleared on the Tide Lake flats. An average crew of seven men was employed under the direction of R. C. Coutts. Access to the property was by helicopter. The option was relinquished on June 26th. The property was not visited.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1927, p. 106; 1946, pp. 68-72.]

BEAR RIVER (55° 129° N.W.)

Silver-Lead-Zinc

Prosperity, Porter Idaho (Cassiar Consolidated Mines Limited)* Company office, 1519 Marine Building, 355 Burrard Street, Vancouver 1. W. R. Wheeler, president; A. C. Skerl, consulting geologist. This property consists of 91 Crown-granted claims, 46 claims south of Stewart, and 45 claims on Glacier Creek northwest of Stewart. Work on the property commenced on July 27th and continued until December 2nd. Drifts and caved areas in the Prosperity tunnel were rehabilitated and retimbered. The crew consisted of four men under the direction of H. Fahle. Access to the property was by helicopter. The property was not visited.

[Reference: *Geol. Surv., Canada*, Mem. 175, 1935, p. 135.]

Bayview and United Empire* Bayshore Silver Mines Ltd. is a private company. Capital: 100,000 shares, \$1 par value. Company office, 556 Howe Street, Vancouver 1. F. J. Hemsworth, president; C. C. Buckland, geological engineer in charge at the property. Twenty Crown-granted claims are held by mineral lease, covering claims formerly held by Bayview Mining Company and United Empire Mines. The property is situated on the eastern slopes of Mount Dolly, on the Bear River Ridge, 3 miles north of Stewart. Work, which was started in June and terminated in August, consisted of cutting 3½ miles of trail and geological mapping. The property is served by the Bear River road and trail. The property was not visited.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1933, p. 53.]

* By H. Bapty.

ALICE ARM

Silver-Lead

Ace and Galena (Silver Butte Mines Ltd.)* (55° 129° N.W.) Company office, 581 Hornby Street, Vancouver 1. B. Brynelsen, president. The company holds the Ace and Galena claims located on the east side of the Kitsault River, 23 miles north from the village of Alice Arm. Work in 1963 commenced in August and continued until October. Work consisted of clearing old trails, clearing a heliport, erecting two "paneloc" buildings, and diamond drilling. Five holes were drilled, totalling 772 feet. An average crew of six men was employed under the supervision of S. J. O. McClay. The camp was serviced by a jeep-road within 2 miles of the camp and by helicopter.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1951, pp. 91-93.]

Silver

Victory (Sirmac Mines Limited)* (55° 129° N.W.) Registered offi, Suite 1326, 67 Yonge Street, Toronto. D. H. Baird, president. This property of 1 leased claim and 11 recorded claims is on the east side of the Kitsault River and 22 miles north of Alice Arm. Work on the property commenced in June and continued until October 26th. An average crew of four men was employed under the direction of G. B. Tribble. Twelve diamond-drill holes were drilled, with a combined footage of 2,021 feet. The property is served by a jeep-road from Alice Arm to within 2 miles of the camp and then by trail. Transportation of freight is by helicopter.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1951, pp. 93-94.]

Molybdenum

Alice (British Columbia Molybdenum Limited)* (55° 129° N.W.) Company office, 1030 West Georgia Street, Vancouver 5. C. H. Burgess, president. The property is on Patsy Creek, the east fork of Lime Creek, and is 5 miles south of Alice Arm. It consists of 72 full and fractional claims held by record. An elliptical stock, about half a mile in diameter, intrudes greywacke of the Hazelton Group. The molybdenite mineralization is in a quartz vein stockwork in the northern half of the stock. Work during 1963 started on July 15th and terminated on November 22nd. Twenty-seven diamond-drill holes totalling 21,378 feet were drilled from the surface with NW wire-line. An average crew of 22 men was employed under the direction of B. A. Bradshaw. The camp was supplied mainly by helicopter. The camp was not visited.

Silver-Lead-Zinc

Dolly Varden Mines Ltd.* (55° 129° N.W.) Company office, 837 West Hastings Street, Vancouver 1. F. C. Buckland, president; T. E. Swanson, of J. A. C. Ross & Associates, manager. The company holds 21 Crown-granted claims, 7 recorded claims, and 21 optioned claims. Nineteen surface diamond-drill holes were collared and 3,026 feet drilled. On the North Star claim 62 feet of raising was done, and on the Wolf claim three adits were driven a total of 627 feet with 164 feet of cross-cutting. All the work was under the direction of J. C. S. Moore. Other work consisted of extending the road from the Dolly Varden camp to a new bridge across the Kitsault River and the widening of the mining-trail 2.5 miles to the

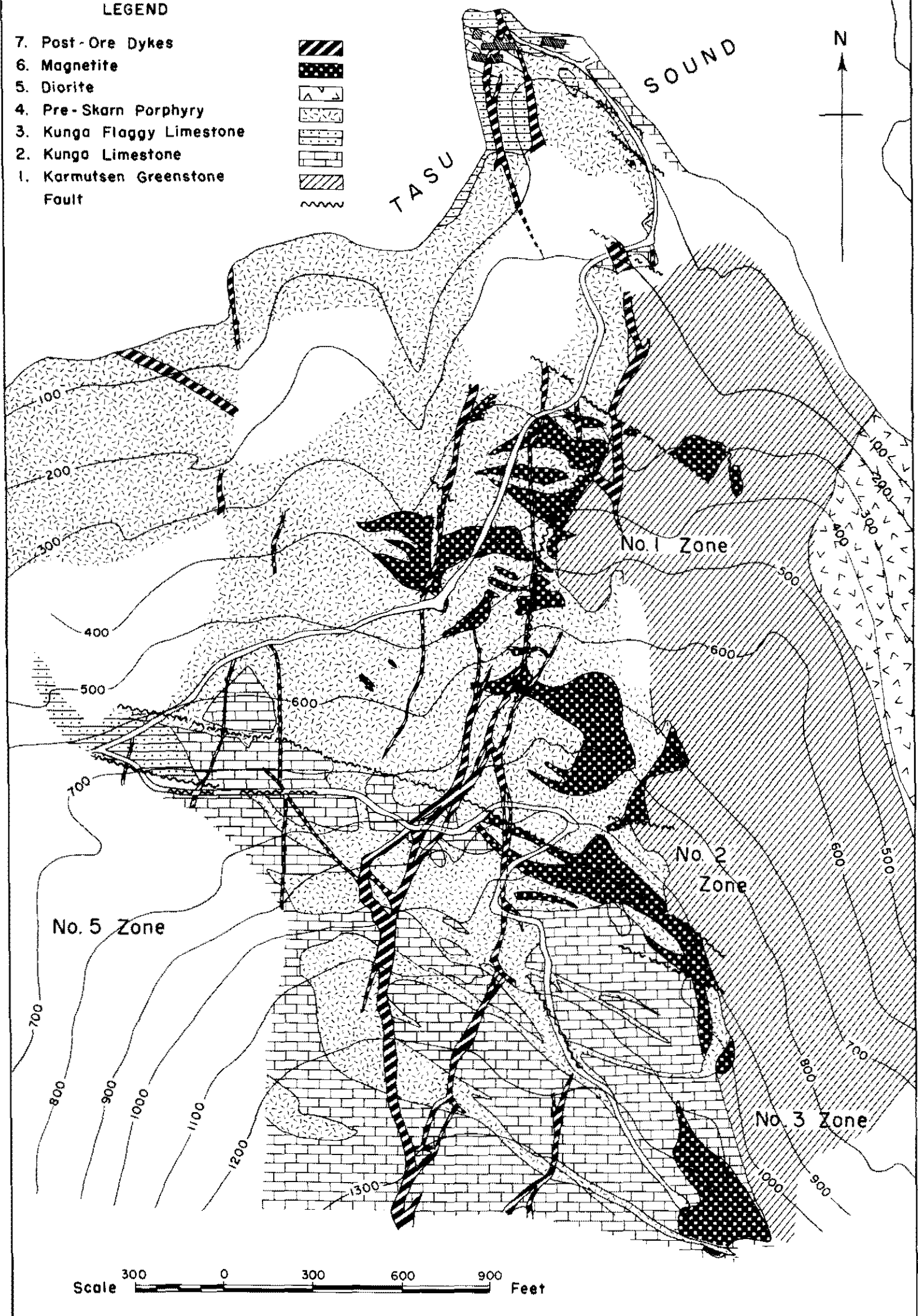
* By H. Bapty.

Figure 1

GEOLOGY of TASU IRON-COPPER PROPERTY of WESFROB MINES LIMITED

LEGEND

7. Post-Ore Dykes
6. Magnetite
5. Diorite
4. Pre-Skarn Porphyry
3. Kunga Flaggy Limestone
2. Kunga Limestone
1. Karmutsen Greenstone
- Fault



Wolf property. On the Wolf, access roads were built to the portals of the 1500, 1450, and 1350 levels from the 1200 main adit level. The number of men employed for this work averaged 40. Transportation to the camp is by a good truck-road from Alice Arm.

[Reference: *Minister of Mines, B.C., Ann. Rept., 1962, pp. 9-10.*]

OBSERVATORY INLET

Copper

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

(55° 129° S.W.) Company office, Tadanac. J. B. Murphy, geologist in charge. The property is on the west side of Observatory Inlet and comprises 73 Crown-granted claims and 7 recorded claims. In the period from late July to late September, one diamond-drill hole was cored a length of 2,898 feet from the surface of the Kenneth mineral claim. The drilling and minor road maintenance was done by an average crew of eight men. The property was serviced by barge and helicopter. The camp was not visited.

Red Wing (Magnum Consolidated Mining Co. Ltd.)*

(55° 129° S.W.) Company office, 700 Burrard Building, Vancouver 1. J. D. Little, president; E. T. Lonergan, engineer in charge of property. This company is working three Crown-granted claims, at the head of Glacier (Tauw) Creek, approximately 4 miles south of the old village of Anyox. Work in 1963, which was carried out by an average crew of 10 men, commenced in September and was suspended on October 3rd. Two miles of trail was built to the claims from Granby Bay. A heliport and compressor-site was blasted out of the steep mountain-side. A helicopter was used to transport men and equipment from the beach to the mine-site. Equipment and supplies were shipped from Prince Rupert by barge. The property was not visited.

[Reference: *Minister of Mines, B.C., Ann. Rept., 1932, p. A 53.*]

QUEEN CHARLOTTE ISLANDS

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. P. N. Pitcher, president. Vancouver office, 504, 1112 West Pender Street, Vancouver 1. G. K. Polk, resident geologist. The property is in Tasu Sound near the entrance of Fairfax Inlet, and it consists of 21 Crown-granted claims and 50 recorded claims. It is the largest metasomatic iron-copper deposit explored so far in coastal British Columbia. Reserves are of the order of 40 million tons of magnetite ore (about 37 per cent iron), of which between a quarter and a third is also copper ore.

The geology of the western part of Tasu Sound was described and illustrated in the Annual Report for 1961 (pp. 11-13). The geology in the vicinity of the Tasu orebodies is shown on Figure 1. The stratified succession consists of three units. The upper part of the Karmutsen Formation, which is here composed of massive, slightly amygdaloidal chloritized sodic basalts, is the oldest unit present. Overlying it successively are massive grey limestone and flaggy black limestone, which form respectively the lower and middle members of the Kunga Formation. The lower

* By H. Bapty.

† By A. Sutherland Brown and H. Bapty.

member is about 500 to possibly 600 feet thick at Tasu and is Middle Karnian (Early Upper Triassic) in age. Only a small part of the middle member shows on the figure. This member is commonly 600 to 1,000 feet thick and is of Late Karnian and Norian age (Late Upper Triassic). The stratified succession is cut by a series of intrusive rocks, of which the San Cristoval batholith of foliated hornblende diorite and quartz diorite is the largest body. The batholith is exposed to the east of the showings and is believed to be penetrated below the limestone in the deepest drill-holes in the southwestern part of Figure 1. Of greater importance within the ore zones is a laccolith-like body of feldspar-hornblende porphyry, which splits Kunga limestone from Karmutsen greenstone. The relative age of porphyry and diorite is not certainly known, but the porphyry may have been emplaced first. All the foregoing rocks may contain skarn and magnetite, with the possible exception of the diorite. Younger than the mineralization are two groups of dykes, of which the oldest are andesites and porphyritic andesites not very different from the pre-skarn porphyries but which clearly cut ore and skarn and are unreplaced themselves. Still younger is a group of undeformed dykes and minor sills of basalt, diabase, fine gabbro, and porphyritic gabbro, which are probably Early Tertiary and are related to Masset volcanism.

The pre-ore porphyry is highly variable, partly because of differences in original texture but mainly because of great variation in metasomatism and alteration. The original rock was composed of about 45 per cent plagioclase phenocrysts ($An_{30\pm}$) with prominent oscillatory zoning, 5 to 10 per cent hornblende phenocrysts, and rare quartz and pigeonite phenocrysts in a finely lathy quartzofeldspathic matrix. Much of the variation in appearance of unaltered specimens results from differing colour contrast between phenocrysts and matrix, both of which vary from dark green to white, but in even the least altered specimens the feldspars are almost completely sericitized and the rock contains variable amounts of carbonate, chlorite, epidote, tremolite, and pyrite. Quite commonly the porphyry is converted to skarn, with progressive development of epidote, actinolite, and finally garnet.

The post-ore dyke rocks are also variable, but they fall into two chief suites, the earlier of which contains rocks dominantly of greenish cast, including sugary to stony green andesite, porphyritic andesite, and glomeroporphyritic andesite. Plagioclase phenocrysts form a variable proportion of the rock (3 to 20 per cent of $An_{30\pm}$ composition). There are no other phenocryst minerals. The matrix is a lathy mixture of plagioclase, quartz, pyroxene, and alteration minerals: Plagioclase ($An_{28\pm}$), 45 per cent; quartz, 8–10 per cent; pyroxene, 2–8 per cent; iron ores, 2–3 per cent, with carbonate, sericite, chlorite, and some epidote in all specimens examined. Some porphyritic dykes resemble the main porphyry but are not similarly altered. The later suite of dykes includes diabase, gabbro, and basalt and slightly porphyritic varieties. These rocks cut all others and are completely undeformed, cross most faults without offset, and are essentially unaltered. Their crystallinity depends mainly on the size of the dyke. Multiple dykes formed of representatives of the two suites are not rare. The quantity of dykes throughout the ore zone is large, in places approaching 30 per cent of the volume. The figure shows only some of the largest dykes and does not distinguish the two suites. The dominant strike of the first suite is northwesterly with steep, southwesterly dips; of the later, basalt suite, the strike is more northerly with dips steeply to east or west.

Structurally the Tasu ore zone is at the northern termination of the San Cristoval batholith, within a folded panel that plunges northwestward at about 20 degrees. The property is on the east limb of a moderate-sized syncline with bedding striking northward and dipping 25 to 65 degrees westward. The shape of the porphyry

mass resembles that of a Christmas-tree laccolith with a base along the greenstone-limestone contact, which folding and erosion have left in partial plan. If symmetrical, at least half of the body is covered by Tasu Sound. However, the roof or hangingwall cuts up section to the middle member of the Kunga Formation and is found along Horn Island, 700 feet west of the map, so that the massive limestone member is entirely missing in the area of the northern orebodies (No. 1 zone). The apparent bodily removal of the limestone indicates a mode of intrusion less concordant than that of a laccolith.

Faults are numerous and important, although none is large. At least two ages of faults are known. The older have pre- and probable post-ore movements, whereas the younger are entirely post-ore. Most faults of both kinds strike in the northwest quadrant. The two most important faults are nearly normal to one another; one strikes about north 70 degrees west and dips 60 degrees south and the other strikes about north 20 degrees east and dips 60 degrees west. Both are mainly normal faults with maximum vertical displacement of about 200 feet. Both seem to exercise considerable control over the position and development of the thickest ore sections. Post-ore faults which offset the gabbro diabase suite of dykes are relatively unimportant on the property.

Skarn occurs over a much wider zone than does significant magnetite, a zone that may be taken to include in some degree most of the pre-ore rocks of Figure 1. The skarn is somewhat selective, affecting massive limestone less than greenstone or flaggy limestone, and these less than porphyry. This is well illustrated in the vicinity of No. 3 ore zone, where porphyry dykes or sills cutting limestone may be quite highly skarnified, but the limestone is only bleached and recrystallized or is apparently unaffected. The flaggy limestone near the hairpin turn on the road is converted to a banded garnet-tremolite rock that on weathering resembles a garnet sandstone. With porphyry and greenstone, the less intense and earliest stage of metasomatism is thorough chloritization, followed by growth of epidote and actinolite-tremolite, and less commonly anthophyllite; the latter minerals are particularly common to the Karmutsen alterations. Garnet replaces the earlier minerals, and magnetite is apparently still younger but more local.

The orebodies are lenticular and digitating, but they are crudely planar and occur in a general layer parallel to the contact between the Karmutsen Formation and either porphyry or limestone. Some ore occurs below the Karmutsen-porphyry contact, but it is thought to be of relatively minor amount. The main layer containing ore is 200 feet or more thick, becoming thicker with a higher percentage of ore of higher grade on approach to the pre-ore faults. The individual orebodies are separated by skarn bands or rarely by less altered porphyry or limestone and are cut by a large number of post-ore dykes. The orebodies are divided for convenience into five zones as shown. The orebodies of Zone 3 replace limestone with little associated skarn, are copper rich, and are concentrated at the contact with the Karmutsen Formation. The orebodies of Zone 1 replace porphyry, are copper poor, and form a flat ramifying network. The orebodies of Zone 2 have something of the characteristics of each zone. Zone 4, as far as is known, is a small zone south of Zone 3. Zone 5 in the west, currently being explored, has characteristics like Zone 3.

Exploration continued throughout the year by surface diamond drilling and detailed geological mapping. One hundred and nine AX surface diamond-drill holes cored a total of 33,727 feet. Total footage drilled to date is 109,255 feet. An access road commenced in 1962 was completed in February, 1963. The work was done by an average crew of 32 men under the supervision of G. Davis. The camp

is serviced by a weekly aircraft flight from Sandspit and periodically by an oil tanker and barge.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1913, pp. 96-97; 1956, pp. 125-127; 1961, pp. 11-13; 1962, p. 11; *Western Miner*, Oct., 1959, pp. 38-44.]

Iron

Harriet Harbour (Jedway Iron Ore Limited)*

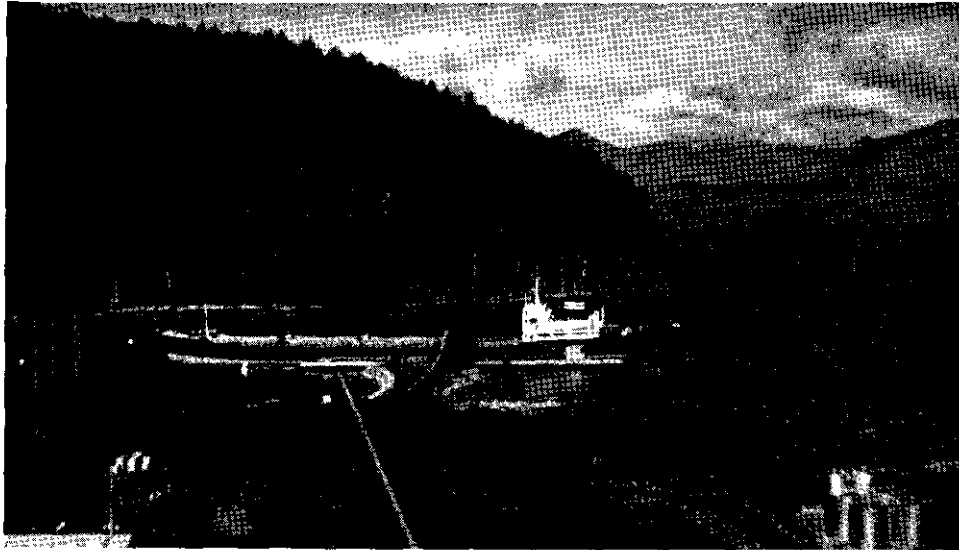
(52° 131° S.E.) Head office, 1111 West Georgia Street, Vancouver 5; mine office, Jedway. L. T. Postle, president; A. J. McDougall, manager; G. M. Cornish, mine superintendent; F. Irwin, mill superintendent. Harriet Harbour is on Skincuttle Inlet, on the southeastern coast of Moresby Island, and is 70 miles south of Sandspit. The company is a subsidiary of The Granby Mining Company Limited and was formed in April, 1961, to take over and mine the Harriet Harbour property of Silver Standard Mines Limited. Jedway Iron Ore Limited has a contract with Sumitomo Shoji Kaisha Ltd., of Tokyo, to supply 2,000,000 long tons of iron-ore concentrates over five years. The first shipment was on October 27, 1962. In 1963, 724,273 tons of ore averaging 35.5 per cent iron was trucked from the open pit, 2,623,080 tons of waste was removed, and 339,008 tons of concentrate shipped. During the year a new 9- by 9-foot adit was driven at 475 feet above sea-level for a distance of 1,526 feet. From this adit 14,902 feet of diamond drilling developed proven reserves of 2,750,000 tons of 35 per cent iron ore between the level and the bottom of the pit, most of which will be mineable by open pit. Ore below the adit was not further investigated.

The geology of Harriet Harbour was described in the Annual Reports for 1959 and 1961 as it was known from surface mapping and diamond-drill holes. Minor modification of these reports is needed as a result of the complete exposure resulting from mining. The main modification is that moderate-sized faults are far more important than was realized in the early stages of exploration. At Jedway the ore occurs in two zones which, with the enclosing Karmutsen Formation greenstones, strike about east-west and dip about 35 degrees northward. The upper and main ore zone is about 100 feet below the base of the Upper Triassic Kunga Formation limestone. The zone is about 100 to 140 feet thick, including ore, skarn, and chloritized greenstone. The lower, footwall ore zone is about 100 feet below the main zone, is about 20 feet thick, and is largely ore. The pit area is cut by four faults which trend north to northwestward (north 30 degrees west to north 15 degrees east) and dip 45 to 65 degrees eastward. In plan they form a reversed letter "N." Separations are of the order of 200 feet. The ore is associated with the faults—not only does some ore occur parallel to the fault planes, but better ore sections plunge north 25 degrees east at about 30 degrees along the intersections of beds and faults.

New installations at Jedway include a 60-man bunk-house, a dry, and a core-shack. An Atlas Copco D-T-4 air compressor was installed in a new building to supply air for adit-driving. Two oil hydraulic-powered fast-acting chute gates were installed in order to provide more positive fine-ore control from the mill fine-ore bins to the feeders. A new manager's house was built to accommodate the mine manager and his family. Other new work consisted of two water-storage areas. The "Fish Creek" dam was completed. The "Mill Pond," a reclaiming-pond for mill effluent, is still under construction. The working force was 142 men working for Jedway Iron Ore Limited, 20 men for the trucking contractor, and 13 men for the catering company.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1959, pp. 11-14; 1960, pp. 11-12; 1961, pp. 13-15; 1962, pp. 11-13.]

* By H. Bapty and A. Sutherland Brown.



M.V. "Harriet Maru" loading concentrates at Jedway.



Tasu camp at junction of Tasu Sound and Fairfax Inlet (*see Fig. 1*).

BURNABY ISLAND

Nickel**Johnson Nickel
(Silver Standard
Mines Limited)***

(52° 131° S.E.) Company office, 808, 602 West Hastings Street, Vancouver 2. R. W. Wilson, president; W. St. C. Dunn, engineer in charge. The property was explored jointly with Jedway Iron Ore Limited. The Johnson Nickel claims lie on the northwest corner of Burnaby Island and includes 138 claims held by record and 2 claims held under option. The option was dropped in October.

The area is geologically complex because it is within a belt of braided faults which form the Louscombe Inlet-Rennell Sound fault zone. Argillites of the Kunga Formation have been intruded by small heterogeneous diorite stocks and later gabbro dykes and plugs and cut by the north-northwesterly faults. The initial showing is in the bottom of the westernmost north-flowing creek about 600 feet from the shore. An outcrop about 18 feet in diameter consists of gabbro mineralized with pyrrhotite, chalcopyrite, and bravoite with minor nickeliferous minerals. The showing contained about 1 per cent nickel and 1 per cent copper. The area is heavily drift covered, and the mineralization is very local, although another mineralized gabbro body was found several hundred feet south.

Work commenced January 3rd and finished June 5th and consisted of 30 packsack diamond-drill holes with a total length of 1,857 feet, geological mapping, and magnetometer, E.M., and soil surveys. Five trenches were dug for a total of 100 feet by an average crew of three men. Transportation was by small boat from Jedway.

Iron**Mac (Merrican
International
Mines Limited)†**

(52° 131° S.E.) Company office, 202, 114 West 15th Street, North Vancouver. W. R. Bandeen, president; A. J. McClellan, manager. A group of 87 claims is held by record on Burnaby Island. Work commenced on June 27th and continued until the year-end. A crew of six men under the direction of W. E. Selnes, engineer in charge, drilled nine diamond-drill holes totalling 685 feet. Trenching was done on three zones, and four pits were dug. A 2-mile tractor-road with bridges and culverts was constructed. The property is reached by boat from Jedway or direct by plane from Sandspit. The property was not visited.

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 mineral claims held by record, extends from Poole Peninsula of Burnaby Island to Skincuttle Island of the Copper Islands. A magnetic anomaly at Bluejay Cove at the southeast tip of Burnaby Island was discovered in 1961 by an aeromagnetic survey in which a fixed-wing aircraft flew northwesterly lines at quarter-mile intervals with a mean terrain clearance of 500 feet. Subsequent surface investigation confirmed the presence of magnetic anomalies and defined three of 5,000 to 10,000 gammas relief, at and just offshore in an area of Kunga Formation limestone in which no significant mineralization was

* By H. Bapty and A. Sutherland Brown.

† By H. Bapty.

‡ By A. Sutherland Brown.

exposed. The anomalies were investigated by 12,208 feet of diamond drilling from six positions along the shore over a length of 760 feet. Drilling started in January and continued with an interruption until September. This preliminary programme developed reserves of the order of $2\frac{1}{2}$ million tons of ore grading 50 per cent iron and an additional $1\frac{1}{2}$ million tons of probable ore. The drilling did not explore an anomaly, centred 900 feet offshore, which is the largest areally.

The geology of the shoreline is shown on Figure 2. At the property the lower part of the normal stratigraphic sequence of the Queen Charlotte Islands consists of Karmutsen Formation greenstones overlain successively by about 600 feet of the massive limestone member of the Upper Triassic Kunga Formation and about 200 feet of the black flaggy limestone member of the same formation. The remainder of the black flaggy limestone member and the overlying flaggy argillite member are exposed nearby. The limestone is apparently cut by sill-like bodies and some dykes of greenstone which are difficult to distinguish from the Karmutsen Formation. The Burnaby Island batholith, a post-Lower Cretaceous intrusion of monzonite and quartz monzonite, outcrops on the shore about 1,200 feet northwest of the ore zone and is penetrated at 875 feet in Hole S-7 drilled at 45 degrees. Dykes probably from this body are intersected in Hole S-12. Feldspar porphyry dykes found in other holes may also be related. Some minor post-ore basalt dykes also occur on the surface and in the drill-holes. Southwestern Burnaby Island and the Copper and Bolkus Islands are in a monoclinal panel of gentle north-to-northwest dips, and the whole area is block faulted. The area of the anomalies is no exception; dips are mostly 10 to 20 degrees, except adjacent to some faults. Three prominent trends of steep block faults are north 50 to 60 degrees west, north 60 to 70 degrees east, and north 10 to 20 degrees east.

The drilling has revealed two ore zones, but the lower one is penetrated by only one hole. The shape and structure of the upper ore zone is uncertain, because of the enforced geometry of the drilling. The structure of the enclosing rocks indicated by the contact of the two limestone members is essentially flat. The over-all ore zone can be readily traced from section to section and is a crudely tabular body parallel or subparallel to bedding, and dipping gently northeastward. The zone starts about 180 feet below the bottom of the black flaggy limestone member and includes ore, skarn, chloritized greenstone, and some limestone. The ore zone is between 100 and 160 feet thick and may be composed almost entirely of magnetite ore in the best sections. In shape the ore zone is irregularly thickened in the centre. This shape can readily be explained by a fault striking north 50 degrees west and dipping steeply southwest with the northeast block dropped 120 to 140 feet compared to the southeast block. The trace of this hypothetical fault at sea-level is shown on the plan. The ore appears to replace a greenstone sill within the limestone. Unmineralized sections of the zone are chiefly skarn and skarny or chloritized greenstone; remnants of greenstone also occur in small amount within the ore. The somewhat irregular shape of the greenstone body and irregularly included masses of limestone suggest that it is a sill rather than a flow. Similar sills in the limestone can be demonstrated on the Copper Islands.

Below the upper ore zone is an additional 300 to 440 feet of massive limestone (depending on whether or not a fault exists). The lower ore zone was found by deepening Hole S-6 at the completion of the programme. This zone is at the contact with the Karmutsen greenstones and has a true thickness of about 60 feet and a grade of about 45 per cent iron. A nominal allowance of 62,500 tons is made for it in the probable reserves.

The ore in both zones varies from dense magnetite, in which little impurity other than flecks of calcite and occasional chlorite and quartz are present, to magnetite containing minor sporadically distributed pyrite, chalcopyrite, and hematite (maghemite?).

A crew averaging six men was employed from January 7th to September 16th in diamond drilling, sampling, and core-logging. A landing-barge was used to transport the drilling equipment from Queen Charlotte City to the property. Subsequent supplies were taken via Jedway and the Jedway fish-boat. Personnel were transported by aircraft based at Sandspit.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1962, pp. 13-14.]

POOLEY ISLAND

Copper

(52° 128° N.E.) Company office, 1557 West Broadway, Vancouver 9. W. Howden, president; J. P. Elwell, engineer in charge. The H and C property consists of 1 Crown-granted mineral claim and 37 claims held by record. The claims are on Pooley Island, adjacent to Griffin Passage and 35 miles northwest of Ocean Falls. Work done from May until December consisted of 200 feet of trenching, 600 feet of diamond drilling, and half a mile of road and trail construction. The work was done by five men. Access to the property was by boat and aircraft. The property was not visited.

BANKS ISLAND

Gold

(53° 130° S.E.) Falconbridge Nickel Mines Limited, 1112 West Pender Street, Vancouver 1, holds about 250 claims on Banks Island, mostly in a belt about 20 miles long extending southeastward from a point 3 miles north of Banks Lake. The main belt of claims coincides with a prominent northwesterly trending lineament that runs the full length of the island.

The first claims were located in July, 1960, on Hepler Lake, midway between Banks Lake and Waller Lake, and cover an exposure of auriferous, siliceous, and pyritized skarn. It is a new discovery of important gold-bearing mineralization in the coastal area that has resulted from systematic prospecting of major lineaments.

Banks Island is largely underlain by granitic rocks of the Coast Intrusions, of which light-coloured granodiorite, quartz monzonite, and quartz diorite are common, but darker dioritic to gabbroic phases are also present. These rocks intrude older sedimentary formations, of which only remnants remain. The remnants lie in northwesterly trending belts, of which the largest and most prominent is one extending discontinuously from Calamity Bay to Kingkown Inlet. One remnant forms a fringe on the west side of the island northwestward from Waller Bay, another outcrops extensively at and west of Deadman Inlet, and several remnants occur on the east coast of the island.

The belt northwest of Calamity Bay lies at the west end of Keecha and Kooryet Lakes and passes through Waller, Hepler, and Banks Lakes. It is narrow, seldom more than 1,000 feet wide, and comprises isoclinally folded limestone, silty limestone, and agillaceous rocks which are metamorphosed to marble, skarn, and slate. The rocks strike north 20 to 40 degrees west and dip to the northeast, and lie in an isoclinal syncline whose axis is rumpled, alternatively plunging northwest and south-

* By H. Bapty.

† By Stuart S. Holland.

east. The opposed plunges essentially cancel each other, and the over-all effect is that of a synclinal structure whose axis is horizontal. A pronounced lineament expressed topographically by the alignment of streams, lakes, ridges, and bluffs, and expressed especially by the height and the depth of colour of the tree growth, coincides with the belt of sediments. This lineament runs the full length of the island and is the topographic expression of major faulting that was localized along the belt of sediments.

Figure 3, drawn directly from aerial photographs, gives an indication of the structural complexity of the major lineament in the vicinity of Hepler Lake. The main lineament extends northwestward from Waller Lake through Hepler Lake to Banks Lake. It is interpreted to be a complex shear zone as much as 2,000 feet wide, made up of strands crossing from one side to the other. Horizontal movements along the zone have developed tensional fractures between bounding shear planes. The northwesterly trending shear is joined by branches having a westerly strike. Two of these on the west side offset a belt of sediments which extends north-northwestward from Waller Bay and which joins the main zone at Banks Lake. The granitic rocks on either side of the lineament are strongly jointed along northerly, easterly, and northeasterly directions.

At Hepler Lake two fault strands enclose a lens of marble, skarn, and metamorphosed sediments about 1,000 feet wide and 2 miles long. The gold-bearing mineralization is in these rocks.

A dominantly garnet skarn outcrops east of the south end of Hepler Lake and has been traced in outcrop and by diamond drilling to the southeast and northwest from there. The outcrop at the lake is pyritized and gold-bearing. This mineralization was explored by diamond drilling during the summer of 1963. The drilling consisted of 5 EX drill-holes totalling 1,250 feet and 18 AXWL holes totalling 5,800 feet, starting at a point about 1,000 feet southeast of the lake and of the camp. The drilling has shown that the skarn is brecciated, silicified, and mineralized with pyrite, pyrrhotite, chalcopyrite, arsenopyrite, and minor galena and sphalerite. Gold values are associated with arsenopyrite, and widths up to 50 feet in some places are mineralized. The deepest drill-hole penetrated gold-bearing silicified and pyritized skarn at a depth of 350 feet. The mineralization is localized by tension fractures which would open preferentially in skarn rather than in marble. Potential areas of mineralization within the shear may be indicated by the presence of quartz-filled tension fractures in adjoining granitic rocks.

Additional drilling consisted of two EX holes totalling 125 feet at Kingkown Lake and three EX holes totalling 214 feet at Waller Lake.

The company established a temporary camp at the south end of Hepler Lake. It was serviced by fixed-wing aircraft from Prince Rupert. From it prospecting crews operated by helicopter. It served as a camp for diamond drilling the nearby mineralization. J. J. McDougall was in charge of the work and Jack Genest was foreman.

ZYMOETZ RIVER

Copper

Northwest, Bet*

(54° 128° S.E.) Bralorne Pioneer Mines Limited, 355 Burrard Street, Vancouver 1. F. Joubin, president; D. H. James, geologist. Forty-eight claims are held by option and eight claims by record. The property lies 25 miles east of Terrace in a right-angle bend of the Zymoetz River. Work commenced June 22nd and was suspended September 2nd. An average crew of four men was employed under the direction

* By H. Bapty.

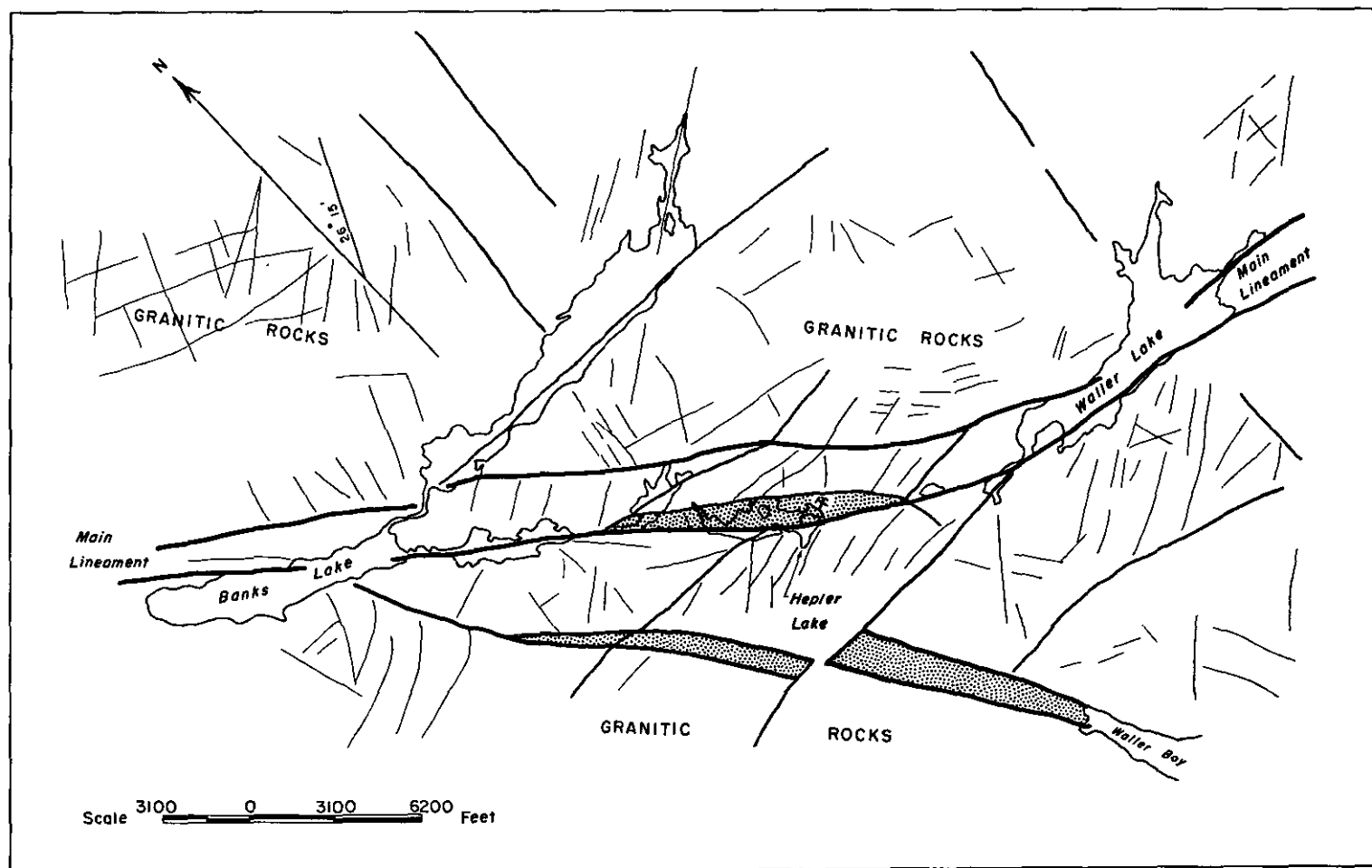


Figure 3. Lineaments on part of Banks Island. Sedimentary belts stippled.

of T. Bell. Ten trenches were excavated in overburden on the original showing. Prospecting a mile to the north turned up a new showing on the Keeler property, on which 11 trenches were excavated. Access to the property is by private logging-road to a new bridge across the Zymoetz River, thence by an old ill-defined trapper's trail to a tent camp.

Keeler* (54° 128° S.E.) The two Keeler claims are 1 mile north 25 degrees west of the Northwest group at an elevation of 5,000 feet. Mineralization is at the top of a line of high and very steep bluffs which are covered with thick brush. The mineralization occurs in a feldspar porphyry flow within andesite flows. The porphyry flow consists of a light-grey matrix which contains phenocrysts (up to 1½ inches in diameter) of pink orthoclase feldspar. The chief copper mineral is chalcocite, but bornite, native copper, azurite, and malachite are also present. The mineralization occurs in veinlets in fractures in the rock and also disseminated throughout the groundmass. Copper occurs over a distance of 600 feet but is not continuous. The property was not visited.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1914, pp. 118-119.]

BABINE RANGE

Molybdenum

Molly, Moly, Red Canyon, Tom, Len (The Buttle Lake Mining Company Limited)† (55° 127° N.E.) Company office, 355 Burrard Street, Vancouver 1. H. H. Huestis, president. The company holds the Molly, Moly, Red Canyon, Tom, and Len groups on the north side of Tomlinson Mountain at the north end of the Babine Range about 25 miles north of Hazelton. The claims lie between the heads of Shegistic and Tomlinson Creeks and essentially along the crest and on the northeast-ern slope of a high northwesterly trending ridge.

A tent camp was established in a saddle on the ridge at an elevation of about 6,000 feet, there being just sufficient flat space for half a dozen tent frames and a helicopter pad. The camp was serviced by helicopter.

The claims are underlain by a stock of moderately coarse-grained pink porphyritic granite, containing feldspar phenocrysts as much as 2 inches long and three-quarters of an inch wide and commonly quartz grains half an inch across. This rock at its western contact is finer grained and foliated and is in contact with slate and with hornfelsed members of the Hazelton Group. The contact strikes north 25 to 30 degrees east and dips 45 to 60 degrees northwest.

Across a width of 300 feet along its western margin, the intrusive is cut by narrow dykes of rhyolite porphyry and granophyre. The whole zone is fractured and veined by narrow quartz veinlets of two or more ages. The predominant strike of the veinlets is north 30 degrees east; 10 per cent, and in places considerably more, of the rock is quartz. The quartz veinlets are accompanied by pyrite and a small amount of chalcopyrite as well as some molybdenite. There is a considerable amount of oxidation and surface leaching, and fracture surfaces show films of green copper stain (malachite) or yellow molybdenum stain (molybdic ochre).

The mineralized contact zone near camp was exposed by three trenches put down through talus to bedrock. The trenches were about 300 feet long and were explored on the southwest side of the ridge through a vertical range of about 300 feet.

* By H. Bapty.

† By Stuart S. Holland.

It is estimated that the molybdenite content of the southwestern part of the contact zone is low, probably less than 0.15 per cent.

The contact zone extends northeastward along the ridge and is very largely covered by talus until, at a distance of about 3,000 feet from the tent camp, it outcrops on steep bluffs facing northeast and dropping off toward the Babine River. These northeastern exposures of the contact zone are better mineralized than that part near camp, and during late August were investigated by engineers of Southwest Potash Corporation. They were not examined by the writer.

The company reports that the results of 78 samples ranged from 0.14 to 0.67 per cent molybdenite. The higher assay values are presumably from the northeastern contact zone.

Tom Lisle was in charge of the work.

SMITHERS

Silver-Lead-Zinc

**Duthie, Mamie
(Sil-Van Consolidated Mining & Milling Company Ltd.)***

(54° 127° N.E.) Company office, Bank of Nova Scotia Building, 602 West Hastings Street, Vancouver 1. R. W. Wilson, president and managing director. The Sil-Van mine is on the southwest slope of Hudson Bay Mountain 16 miles by gravel road from Smithers.

Five major subparallel, complex breccia-vein systems are known to occur over an east-west distance of 1 mile on the southwest slopes of Hudson Bay Mountain. Most of the fracture systems strike about north 60 degrees east and are vertical or dip steeply to the northwest. Negligible offsets of contacts have been found along these zones. The main vein system, the Henderson, is irregularly mineralized along a strike length in excess of 1 mile. The width of mineralization is highly variable, ranging from zero to more than 10 feet. The reported ore minerals include galena, sphalerite, pyrite, arsenopyrite, pyrrhotite, chalcopyrite, tetrahedrite, pyrargyrite, and gold.

The country rock consists of spherulitic flow-banded rhyolite and massive lapilli tuff cut by numerous greenstone, diabasic, and a few fine-grained diorite dykes. The flow-banded rhyolite outcrops in the southern part of the area on the lower slopes of the mountain. It is overlain to the north, east, and west by the massive lapilli tuff. The contact dips about 20 degrees north at about the 4,000-foot level on the Henderson vein. In the vicinity of the veins the country rock is usually bleached and altered.

Work in 1963 consisted of a "Turam" geophysical survey carried out by Hunting Survey Corporation in an attempt to find extensions of the Henderson, Mamie, and Coronado veins. During July and August an average crew of about seven men was employed. A 5,000-foot base-line trending north 65 degrees east was established in the vicinity of the Mamie vein and about 12 miles of line was cut. Four diamond-drill holes totalling 250 feet were put down.

W. St. C. Dunn was in charge of the work.

Copper

**Canadian Citizen,
American Citizen,
May, J.W.B.***

(54° 127° N.E.) The two Crown-granted mineral claims Canadian Citizen (Lot 7171) and American Citizen (Lot 7238) and the May and J. W. B. groups held by W. Yorke Hardy and associates, of Smithers, were under option to Noranda Exploration Company, Limited.

* By R. V. Kirkham.

The claims are about 1½ miles south of Smithers and surround two sets of showings, one on the north side of Dahl Creek at an elevation of 2,100 feet and about three-quarters of a mile west of the Sil-Van road, and the other at an elevation of 2,000 feet and 1,500 feet west of the north end of Seymour Lake. The showings were originally located in 1925 and 1926, and at that time were called the Smithers Copper and Canadian Citizen respectively.

Both showings are similar and consist of small veinlets of bornite and chalcopryrite in fracture zones in massive dark-purple and grey volcanic rocks of the Hazelton Group. The dominant fracturing strikes west and dips 70 degrees south.

In the early part of the summer the Noranda company made a geophysical and geochemical survey of the area. The option was relinquished in August, 1963.

Silver-Lead-Zinc

Silver Creek, Silver Lake, Trade Dollar Groups*

(54° 127° N.E.) The property consists of a number of Crown-granted claims and fractions owned by Sil-Van Consolidated Mining & Milling Company Ltd. They are at elevations between 5,000 and 7,000 feet on the northwest slopes of Hudson Bay Mountain near the divide between Silvern and Toboggan Creeks. They are reached by 6 miles of logging-road to the north side of Glacier Gulch, thence by 4 miles of steep tractor-road up the north side of Toboggan Creek.

In 1963 the steep trail up Toboggan Creek was converted into a road on which it was possible by late August to drive a four-wheel-drive vehicle to an elevation of 5,500 feet, about half a mile from Silvern Lake.

Molybdenum

Glacier Gulch (Southwest Potash Corporation)*

(54° 127° N.E.) Executive office, 1270 Avenue of the Americas, New York 20. F. Coolbaugh, president. British Columbia office, 718 Granville Street, Vancouver 2. The company holds a large number of mineral claims centred on Glacier Gulch on the east side of Hudson Bay Mountain. The main molybdenite mineralization occurs in a stockwork of narrow quartz veinlets in altered volcanic rocks near the toe of the glacier and under the glacier. Some highly altered rocks intersected at depth in drill-holes are believed to be derived from a thick sill of granodiorite. The volcanic rocks in the cirque area dip between 40 and 60 degrees to the north.

A drill camp at about 5,700 feet elevation below the ice-fall on the glacier was reoccupied. Three AX drill rigs occupied sites at about 5,700 feet elevation on bedrock on the north and south sides of the glacier. Six holes totalling 14,500 feet were put down.

The camp was completely serviced by helicopter, a large Sikorsky being used to move the drills and heavy equipment and a Hiller 12E for fuel and camp supplies.

A crew of 19 men was employed from July to October. R. E. Anderson was engineer in charge of the work.

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 & L. Starck & Associates Ltd., consulting mining engineers. The property is on the east slope of Cronin Mountain, about 30 miles by road from Smithers. During the summer and fall

* By R. V. Kirkham.

† By H. Bapty.

12 diamond-drill holes were aimed to intersect the downward extension of the vein. Twenty-two inches of vein were found in four drill-holes after drilling 1,007 feet. The vein averages 51 ounces of silver per ton, 14 per cent lead, and 15 per cent zinc. A winze was sunk 68 feet below No. 5 level in the hangingwall of the vein; a drift was driven on ore for 55 feet from the bottom of the winze. The development muck was milled.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1962, p. 16.]

BABINE LAKE

Copper

McDonald Island (Granisle Copper Limited)*

(54° 126° N.E.) Head office, 1111 West Georgia Street, Vancouver 5. L. T. Postle, president. This company is a wholly owned subsidiary of The Granby Mining Company Limited. The property, formerly known as the Richmond, is on McDonald Island at the entrance of Hagan Arm near the north end of Babine Lake. It is 10 miles by boat north of Topley Landing.

The original claims were located more than 50 years ago. In 1929 they were under option to The Consolidated Mining and Smelting Company of Canada, Limited, at which time some diamond drilling was done, and it was announced by the company that approximately 8,000,000 tons grading 0.01 ounce gold, 0.15 ounce silver, and 0.80 per cent copper had been indicated. The property lay idle for many years, but since 1955 has been under active exploration by the Granby company. During the past few years a considerable amount of systematic diamond drilling of vertical and inclined holes has been done, and the company has stated that 22,000,000 tons grading 0.55 per cent copper has been delimited to a depth of 500 feet. A vertical drill-hole disclosed that mineralization extends to a depth of 1,000 feet. Currently a feasibility study has been made, complete metallurgical testing of the ore has been undertaken, and detailed engineering information has been accumulated.

Andesitic volcanic rocks of the Hazelton Group striking north 70 degrees east outcrop on the shores and inland at McDonald Island. In the central part of the island, about half a mile from the south end, these rocks are intruded by a small stock of porphyritic nepheline syenite. It outcrops mainly on a low hill rising to 250 feet above lake-level and standing above the general level of its surroundings. The volcanics at the margin of the stock are metamorphosed to a granular dioritic texture that is accompanied by the development of biotite and hornblende. Some layers in the volcanics are feldspathized, carbonatized, and pyritized by the intrusion, and weather to a light-brown colour. The stock is elongated in a northeasterly direction and cuts obliquely across the trend of the volcanics.

The mineralized area is about 500 feet wide and lies within the syenite porphyry and in the adjoining volcanics along the eastern side. It is exposed on the knoll and has been completely outlined by diamond drilling. The mineralization consists of chalcopyrite, pyrite, bornite, some magnetite, and a small amount of molybdenite associated with narrow quartz veinlets which occupy unsystematic fractures. Some mineralization, unaccompanied by quartz, occupies joint surfaces. At surface there is some leaching of pyrite and copper sulphides and deposition of malachite along fracture planes. Geochemical soil-sampling on the island indicates that copper mineralization is localized only in the vicinity of the stock.

* By Stuart S. Holland.

During the summer a detailed geological survey of the island was made by two geologists under the direction of K. C. Fahrni. A crew of four men did the necessary surveying to lay out a grid preparatory to a magnetometer survey. Work was completed by November 23rd.

MORICE LAKE

Molybdenum

Lucky Ship (Southwest Potash Corporation)*

(54° 127° S.E.) Executive office, 1270 Avenue of the Americas, New York 20. F. Coolbaugh, president; J. W. Hoadley, geologist in charge, 718 Granville Street, Vancouver 2. The company holds the Lucky Ship property, consisting of 109 recorded claims and fractions. Forty-two of these claims are held under option from Plateau Metals Ltd. The property is on the east side of Morice Lake, 50 air miles west of Houston. The claims cover a stockwork of molybdenite-bearing quartz veins in quartz porphyry. Geological mapping, trenching, sampling, geochemical and magnetometer surveys, and 103 feet of EX diamond drilling were carried out by a crew of 12 men from September 15th to October 21st under the direction of G. W. Mannard and T. J. R. Godfrey. Transportation was via helicopter from Smithers. The property was not visited.

TAHTSA LAKE

Copper-Molybdenum

Berg*

(53° 127° N.E.) Kennco Explorations, (Western) Limited, 1030 West Georgia Street, Vancouver 5. The company holds the Berg group of 33 mineral claims between Nanika and Tahtsa Lakes. The mineralization consists of pyrite, chalcopyrite, malachite, azurite, and molybdenite in fractures and disseminations associated with a feldspar porphyry stock. Work commenced July 16th and terminated September 1st with an average crew of six men under the direction of P. T. Black. Water was used to ground-sluice trenches. Seventy-three chip samples for a total length of 650 feet were taken, and 1 square mile of plane-table geologic mapping was done. The property was not visited.

Copper-Molybdenum

Len*

(53° 127° N.E.) Kennco Explorations, (Western) Limited, 1030 West Georgia Street, Vancouver 5. The company holds the Len group of 44 claims on Huckleberry Mountain east of Tahtsa Lake. The mineralization consists of chalcopyrite in fractures in a small granite stock, and pyrite, chalcopyrite, and molybdenite in adjacent altered and fractured volcanics. Work started May 23rd and terminated October 2nd with an average crew of eight men under the direction of P. T. Black. A bulldozer excavated a total of 8,240 cubic yards in seven trenches. A total of 953 feet of diamond drilling was done from five drill-sites. Sampling was done on 550 feet of drill core and 250 feet of chip-sampling. The property was not visited.

WHITESAIL LAKE

Molybdenum

Cob*

(53° 127° S.E.) Kennco Explorations, (Western) Limited, 1030 West Georgia Street, Vancouver 5. The Cob group of 10 claims lying southeast of the west end of Whitesail Lake

* By H. Bapty.

was held by option from C. V. and W. H. Harrison. The mineralization consists of disseminated pyrite and molybdenite in volcanic rocks in the vicinity of a granitic intrusion. Work commenced on August 5th, and terminated September 3rd, under the direction of P. T. Black. Forty-six stream silt geochemical samples were collected, 126 feet of core was taken with a packsack diamond drill, and 14 man-days of prospecting were done. The property was not visited.

EUTSUK LAKE

Molybdenum

CAFB*

(53° 127° S.E.) Phelps Dodge Corporation of Canada Limited, 404, 1112 West Pender Street, Vancouver 1, holds the CAFB claims, extending northward from Haven (Bone) Lake to the top of Red Bird Mountain. Haven Lake is 8 miles west of Pondosy Bay on Eutsuk Lake. The claims cover a stock of quartz feldspar porphyry containing molybdenite mineralization. A good trail leads from Haven Lake to a tent camp which was established near timberline at an elevation of about 4,500 feet. The camp was supplied by service flights of fixed-wing aircraft from Tchesinkut Lake.

A teardrop-shaped stock of white quartz feldspar porphyry on the south slope of Red Bird Mountain between 3,900 and 6,000 feet elevation intrudes a succession of tuffs and volcanic rocks of the Hazelton Group. The porphyry stock has dimensions of 4,000 feet in an easterly direction by 5,000 feet in a northerly direction. A central core of the stock is silicified, and the constituent feldspars are partly to thoroughly altered. On the western side of the stock and in a roof pendant within it, the Hazelton rocks have been hornfelsed and in places silicified and mineralized with pyrite and molybdenite.

On the western side of the stock, along the contact which locally strikes north, the porphyry and the adjoining hornfelsed volcanics are fractured and silicified by quartz veinlets striking east and north. The quartz is accompanied by pyrite and molybdenite, but the molybdenite content is low. At the eastern contact at about 5,000 feet elevation, quartz-filled fractures of at least two ages form a stockwork in which the dominant direction strikes north 60 degrees east. Some pyrite and molybdenite are present in surface exposures and especially in the vicinity of No. 4 drill-hole.

In March and April eight diamond-drill holes totalling about 5,000 feet were put down. They were essentially laid out to test the periphery of the porphyry stock and the enclosing hornfels. After a summer spent surveying and geological mapping, a small bulldozer was brought onto the property in order to trench in selected areas where slopes were not too steep and the overburden and talus not too deep. Trenching was started in early September, and in addition to 15,500 feet of access roads to the camp and to drill set-ups, 3,680 lineal feet of trenching was accomplished. Four additional diamond-drill holes were put down in October, making a total footage in 1963 of 6,514 feet in 12 drill-holes.

Bruce Woodsworth was in charge of the work.

TIT (Julian Mining Co. Ltd.)†

(53° 126° S.W.) Company office, 1030 West Georgia Street, Vancouver 5. B. G. Gore, president; R. Macrae, engineer in charge. This group of 32 recorded claims is on Rivers Peak, 2 miles north of Tesla Lake. Work commenced in May and was completed by November by a crew of 14 men. A magnetometer survey was conducted over 17,000 feet of line, 400 soil samples were taken, and 30

* By Stuart S. Holland.

† By H. Bapty.

feet of light diamond drilling and 500 feet of hand-trenching were done. Transportation was by charter aircraft and leased vehicles. The property was not visited.

ENDAKO*

Success in exploration by Endako Mines Ltd. in 1963 at the Stella molybdenite deposit focused attention on the molybdenite possibilities of a considerable area in the vicinity of Endako. Previously known occurrences and new discoveries indicate that numerous molybdenite occurrences lie within granites of the Topley Intrusions.

The Topley Intrusions are a group of related granites, granodiorites, diorites, and syenites of Lower Jurassic age which extend discontinuously for at least 100 miles from Babine Lake in a southeasterly direction past the west end of Fraser Lake to the West Road (Blackwater) River. The main body of granite lies between Shovel Creek, northwest of Endako, and the Nechako River. It has a length of about 36 miles and a maximum width of about 20 miles.

The granitic area in the vicinity of Endako consists very largely of pink and grey granite. Porphyritic granite with pink feldspars an inch or more long is common northwest of the Stellako River. Medium-grained pink granite is at the Endako mine, on Nithi Mountain, and elsewhere. This granite contains only a small amount of biotite and normally no hornblende. A pale-pink to white leucogranite is exposed near the summit and on the east side of Nithi Mountain.

Although it has been stated that some gradation has been observed between granite and granodiorite,† the relations between the several varieties of pink granite are not known with assurance, and no contact relationships have been observed.

The granites are intruded by a variety of dykes: white to pink quartz feldspar porphyry which is seen on surface and in drill core at the Endako mine, pale porphyritic trachyte, dense olive-coloured uranium-bearing rhyolite porphyry on Nithi Mountain, and fine-grained dark-grey andesite. The dykes of quartz-feldspar porphyry at the Endako mine are mineralized with molybdenite; no others are known to be.

Stratigraphic evidence and potassium-argon determinations date the Topley Intrusions as Lower Jurassic. It is significant, nevertheless, that one diorite body, intrusive into the Topley Intrusions, was found to be Paleocene.‡ This introduces the possibility that within the Topley Intrusions there may be others of considerably younger age. Such occurrences might be of considerable importance in localizing mineralization.

In the following property descriptions the numbers refer to the locations in Figure 4.

Molybdenum

Tor (1) (Triform Explorations (B.C.) Ltd.)§

(54° 125° S.W.) Company office, 629 Hornby Street, Vancouver 1. J. San Severino, president; J. Sullivan, engineer in charge. The property consists of 54 claims held by record, 10 miles northeast of Decker Lake Post Office and 1 to 2 miles south of Ling Lake. Work commenced July 15th and was completed by November 2nd. Two men took soil samples over the surface of 29 mineral claims, dug trenches in weak anomalous zones on the Tor Nos. 49 and 51 claims, and cut out 3½ miles of trail. The property was not visited.

* By Stuart S. Holland, except as noted

† *Geol. Surv., Canada, Mem. 252, p. 92.*

‡ *Geol. Surv., Canada, Paper 62-17, p. 135.*

§ By H. Bapty.

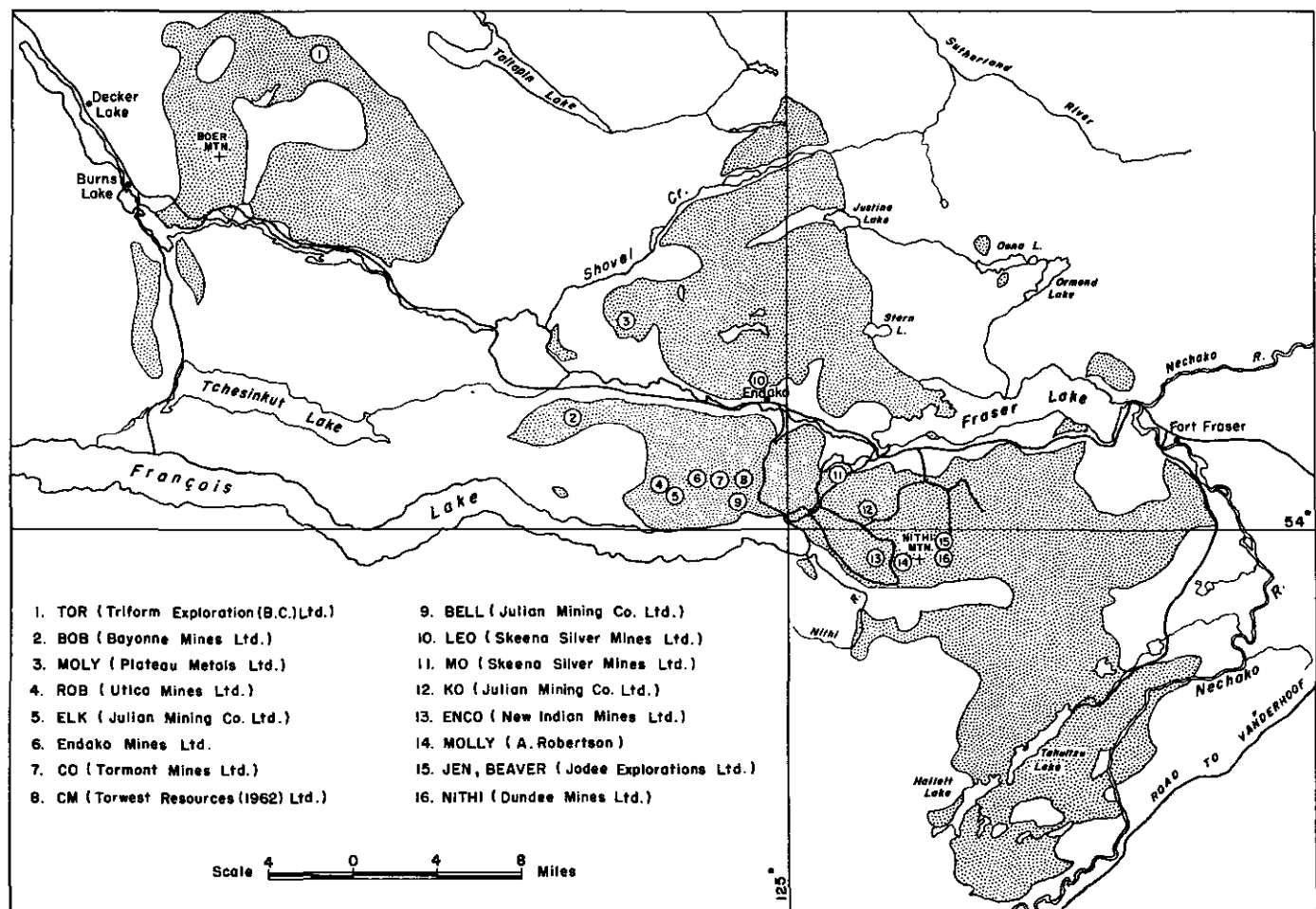


Figure 4. Locations of properties in the Endako area. Topley intrusions stippled.

Bob (2) (Bayonne Mine Ltd.)*

(54° 125° S.E.) Company office, 404, 409 Granville Street, Vancouver 2. C. F. Mackenzie, president; W. G. Hainsworth, consulting geologist. The Bob group of 40 recorded claims lies south of the Endako River 7 miles west of Endako. Work commenced in July and was completed by September with a crew of three men. An electromagnetic survey was conducted over the claims. The property was not visited.

Moly (3) (Plateau Metals Limited)*

(54° 125° S.E.) Company office, 420 West Pender Street, Vancouver 3. C. Riley, president; K. Lovang, engineer in charge. During the early summer, soil-sampling and surface prospecting was done on the Moly group of 25 recorded claims, situated 10 miles west of Endako and 4 miles north of Savory station. Two base-lines of 9,000 feet each were cut, and from these cross-lines were run at 500-foot intervals. Soil samples were taken 300 feet apart. Work was done by a two-man crew commencing in April and was completed by the end of May. Subsequently the claims were allowed to lapse. The property was not visited.

Rob (4) (Utica Mines Ltd.)*

(54° 125° S.E.) Company office, 1218 Burrard Building, Vancouver 5. A. Robertson, president. The Rob group of 28 recorded mineral claims adjoins Endako Mines Ltd. property on the west and is about 6 miles southwest of the village of Endako. Geological and geochemical surveys were carried out by Endako Mines Ltd. under an agreement with Utica Mines Ltd. The crew consisted of seven men under the supervision of C. E. Dunn and C. W. Ball. The property is reached by 1 mile of private road from Endako Mines Ltd. The property was not visited.

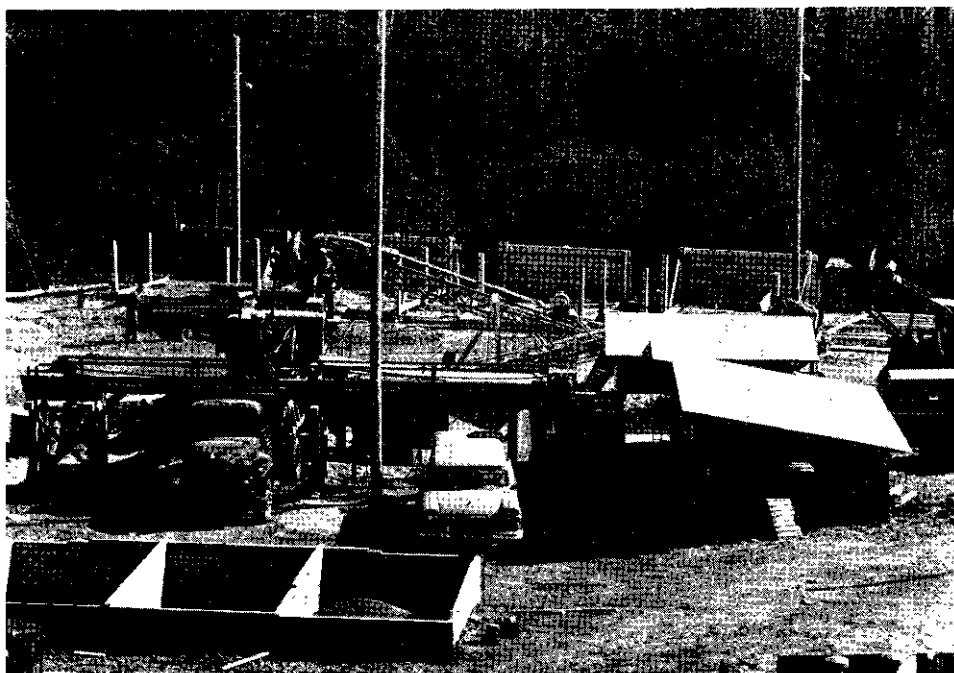
Elk (5) (Julian Mining Co. Ltd.)*

(54° 125° S.E.) Company office, 1030 West Georgia Street, Vancouver 5. B. G. Gore, president; R. Macrae, engineer in charge. This group of 92 recorded claims is west of Endako Mines Ltd. property. Work, which began in May and finished in November, consisted of some diamond drilling, a magnetometer survey run on 56,000 feet of cut lines, and the taking of 1,150 soil samples by a crew of 14 men. The property was not visited.

Endako Mines Ltd. (6)

(54° 125° S.E.) Company office, 1218 Burrard Building, 1030 West Georgia Street, Vancouver 5. Andrew Robertson, president; Canadian Exploration Limited continued to finance exploration, their engineer in charge at the property being C. E. Dunn. Diamond drilling began again in February, 1963, and continued until December. Wire-line equipment was used, and the core recovery, which in 1962 had been poor, was increased to about 90 per cent. A total of 119 vertical holes were put down, mostly to a depth of 500 feet, mostly at intervals of 200 feet on lines 400 feet apart. Total distance drilled was 48,257 feet. All drill core was weighed (to determine percentage of recovery), and the specific gravity of the rock was measured at 5-foot intervals. The core was then split, half being shipped to Vancouver for assay and the balance retained in the core-shed at the mine. In addition, a mechanical splitter was used to take about one-eighth of the drill return water. The sludge from this was collected and weighed for each 10-foot run, and

* By H. Bapty.



Endako Mines Ltd. sampling plant. Sample-bins in foreground and other bins under construction in background.



Endako Mines Ltd. sampling shaft.

a sample was sent in for assay. By August the drilling had outlined a mineralized zone 5,000 feet long, from 600 to 1,200 feet wide, and as much as 500 feet deep. Three holes extended to depths of 1,000 to 1,077 feet showed mineralization persisting to depths ranging between 600 and 800 feet. The general trend of the mineralized zone is south 64 degrees east.

During all of the drilling there was a discrepancy between the assay of drill core and the assay of the corresponding sludge sample, the sludge being higher but not uniformly so. It was decided, therefore, to let a contract for underground work which would supply mineralized material for bulk sampling and metallurgical testing. Work was started in early August on a crosscut adit near the western end of the mineralized zone. The crosscut, about 730 feet long, was driven along the line of drill-holes just west of the Foote inclined shaft. From it vertical raises about 80 feet high were driven on five drill-holes. Three thousand feet east a shaft was sunk 140 feet on drill-hole No. 92, and from the bottom crosscuts were driven 200 feet north and south. From them vertical raises 130 feet high were driven on four diamond-drill holes. Assays of material from the raises provided an accurate check of the earlier drill-holes' results and enabled the derivation of a factor that could be applied to all the drilling.

Each round from underground, whether crosscut, shaft, or raise, was treated as a bulk sample, and was hauled to a sampling plant and dumped into a separate bin. From the bin it was put through successive crushers and splitters to reduce its size and bulk, was dried and sacked to provide a sample for assay and material for metallurgical testing at Salmo. The results of the bulk sampling upgraded the values obtained by assay of drill core by a significant amount. The underground sampling was concluded in October.

Additional work on the property consisted of a great many thousand feet of line cutting and bulldozing of roadways for use in the intensive geochemical soil-sampling of the property and adjoining ground. Soil samples were taken at 100-foot intervals on lines 1,000 feet apart.

A new road was built from a point on the highway 5 miles west of Endako to the mine camp, a distance of 5.6 miles.

[References: *B.C. Dept. of Mines*, Bull. No. 9, 1940, pp. 11-16; *Minister of Mines*, B.C., Ann. Rept., 1962, pp. 17-19.]

**CO (7) (Tormont
Mines Limited)***

(54° 125° S.E.) Company office, 405, 25 Adelaide Street West, Toronto 1, and 1218 Burrard Building, Vancouver 5. A. Robertson, president. Twenty recorded claims lie 4 miles southwest of Endako, adjoining Endako Mines Ltd. property on the east. During May and June two NX diamond-drill holes totalling 602 feet were completed and soil-sampling, stripping, and road-building were done by an average crew of eight men under the supervision of C. E. Dunn, engineer for Canadian Exploration Limited. The property is 6 miles by road from Endako or 1½ miles east of the Endako mine camp. The property was not visited.

**C.M. and R.W. (8)
(Torwest Resources
(1962) Ltd.)**

(54° 125° S.E.) Company office, 404, 409 West Hastings Street, Vancouver 1. W. E. Garnett, president; R. E. Falkins, secretary-treasurer. The company held 50 claims, comprising the C.M. and R.W. groups adjoining Endako Mines Ltd. holdings on the east and west respectively. The eastern-

* By H. Bapty.

most claims are accessible by about 1 mile of road leading west from the Francois Lake road running south from Endako.

Early in the year Scope Mining and Exploration consultants conducted an electromagnetic survey of the C.M. group. Three westerly trending conductors were discovered, which later provided targets for diamond drilling after some geochemical soil-sampling had been completed.

Very few outcrops are present on the C.M. group, and as a consequence the geophysical work was taken as the sole basis for laying out the diamond drilling.

Drilling began in June and was completed by August. Seven holes, of which the deepest was 449 feet, were put down, and the total footage drilled was 2,719 feet.

The rocks encountered in the drilling are the same pink granite that lies to the west at the Endako mine. On the average it is not so intensely altered nor are any pale quartz feldspar porphyry dykes seen in drill core. Dykes of amygdular basalt are present, and pink to grey biotitic feldspar porphyry is not uncommon. Some molybdenite mineralization was encountered, and in hole No. C.M. 3 the company announced that the core between 210 and 330 feet assayed 0.24 per cent molybdenite. On the average the amount and degree of alteration is small and the amount of molybdenite mineralization disappointingly low.

Maurice Mathieu was the engineer in charge at the property, working under W. G. Hainsworth, company geologist.

Bell (9) (Julian Mining Co. Ltd.)* (54° 125° S.E.) Company office, 1030 West Georgia Street, Vancouver 5. B. G. Gore, president; R. Macrae, engineer in charge. The Bell group of 19 recorded claims lies southeast of Endako Mines Ltd. property. Work commenced in May and ceased in November, and was done by a crew of 14 men. Some hand-trenches were dug, a magnetometer survey was conducted on 11,000 feet of line, and 190 soil samples were taken. The property was not visited.

Leo (10) and Mo (11) (Skeena Silver Mines Limited)* (54° 125° S.E. and 54° 124° S.W.) Company office, 301, 744 West Hastings Street, Vancouver 1. A. F. Lungley, president; C. Rutherford, engineer in charge. The Leo group consists of 20 recorded claims northwest of Endako, and the Mo group of 20 recorded claims is 5 miles southeast of Endako and on the east side of the Stellako River. Work commenced May 1st and was completed by June 15th by an average crew of three men. Six hundred lineal feet of bulldozer trenching was done on the Leo and 800 feet of similar trenching was done on the Mo group. These claims were not visited.

Nithi Mountain.—Nithi Mountain, which is about 10 miles distant in a direction slightly south of east from the Endako mine, was the locus of exploration activity by several companies during the year. The mountain lies within the area of the Topley Intrusions, but the pink granite is unlike that west of the Stellako River, and the summit and nearby terrain is underlain by a white to pale leucogranite or alaskite.

The various claims are reached from highway No. 16 by a road that turns south a few miles east of the west end of Fraser Lake. It branches with one branch following old logging-roads and eventually leading up the west side of Nithi Mountain and another branch leading up to the east side of the mountain. It is possible with four-wheel-drive vehicles to continue down the southwest slope of the mountain and to reach the Nithi River road about 4 miles east of the east end of Francois Lake.

* By H. Bapty.

(54° 124° S.W.) Company office, 1030 West Georgia Street, Vancouver 5. B. G. Gore, president; R. Macrae, engineer in charge. The KO group of 179 recorded claims lies east of the Stellako River and on the northwest slope of Nithi Mountain. It is accessible from the Stellako River road and the old "Burma" road to Nithi Mountain. Work commenced in May and was completed by November by a crew of 14 men. A magnetometer survey was conducted over 104,000 feet of line, 2,300 soil samples were taken, and 360 feet of light diamond drilling was done. The property was not visited.

(53° 124° N.W.) Company office, 714, 789 West Pender Street, Vancouver 1. T. E. Blossom, president. The company holds the Enco group of 29 claims and 8 fractions on the west slope of Nithi Mountain. The easternmost claims are reached by the west branch of the Nithi Mountain road. From it a steep cut (used by four-wheel-drive vehicles) was bulldozed downhill to one that joins the old road to the "uranium showing." It also continues southeastward around Nithi Mountain about 500 feet below the Molly-Linda roadway. The New Indian road system eventually connects with the Nithi River road about 4 miles east of Francois Lake.

Bedrock is poorly exposed, and bulldozed trenches were used to prospect the claims. Ray Richards was in charge of the work.

The main mineralized showings are exposed by trenches on the Enco No. 1 Fraction, Enco No. 2 Fraction, and Enco No. 3 Fraction. These are rather small wedge-shaped fractions projecting into the acute angles between the Molly No. 2 and No. 4, the Molly No. 6 and No. 8, and the Molly No. 12 and No. 14 mineral claims. When the bulldozer trenching was completed, shallow cuts were blasted along altered zones and mineralized fractures were revealed in the exposed bedrock.

There were exposed several mineralized fractures on the Enco No. 1 Fraction, one of which produced an inch or more of high-grade molybdenite mineralization. The bulk of the work was done on the Enco No. 3 Fraction and Enco No. 11 claim. There, pink granite was exposed at shallow depth and rock cuts were made on narrow quartz-molybdenite veinlets in fractures striking north 20 to 40 degrees east. Some finely disseminated pyrite is present in the granite, but the degree of alteration (kaolinization and feldspathization) is slight.

No work was done on the more westerly of the Enco claims, which lie lower down the mountain slope where the depth of overburden might be expected to be significantly greater.

(53° 124° N.W.) The Molly, Pogo, and Sandy groups are held by Andrew Robertson, of Vancouver. They lie on the western and southwestern slopes of Nithi Mountain near 4,000 feet elevation and are reached by the westerly branch of the Nithi Mountain road.

The claims are very largely underlain by a light-coloured, medium-grained, foliated granite having biotite as the sole dark mineral. The granite is cut by olive-coloured rhyolite porphyry and darker-green basaltic dykes, but in general dyke rocks are not common.

Mineralized showings are made accessible by and lie close to a road which is on the west side of Nithi Mountain, and which runs southerly through the Molly group and then swings almost due east across the Linda claims. The Molly 1 and

* By H. Bapty.

2 claims cover uranium showings described in the Minister of Mines Annual Reports for 1955, page 28, and 1956, page 28. The secondary uranium minerals are in a northerly striking westerly dipping rhyolite porphyry dyke traced on surface for more than 800 feet. Molybdenite mineralization a few inches wide occurs in the granite along the east side of the dyke in a fracture striking north 65 degrees east. On the Molly 8 mineral claim, fractures striking north 65 degrees east contain narrow quartz veinlets and fine-grained molybdenite. Farther along the road to the east two bulldozed trenches trending northwest expose an area of altered granite cut by a dark-grey fine-grained andesitic dyke. Both trenches expose small areas of disseminated molybdenite as well as quartz-filled vertical fractures striking north 60 degrees east.

Work in the early part of the season was under the supervision of R. G. Coutts and later under Sol Waisberg.

(53° 124° N.W.) Company office, 404, 510 West Hastings Street, Vancouver 2. In 1963 the company did some exploration work on the Jen and Beaver groups of claims, adjoining the Nithi group, on the east side of Nithi Mountain.

Jen, Beaver (15) (Jodee Explorations Limited)

The claims extend from near the summit of Nithi Mountain down the southern slope. They are accessible from the easterly Nithi Mountain road by a roadway bulldozed west and northwest from the Dundee Mines Ltd. drill camp.

The Beaver group and Jen Nos. 1 and 2 claims near the summit of Nithi Mountain are underlain by pale-pink, fine sugary textured leucogranite or alaskite in which the feldspar has been altered to pale-green sericite. These rocks are broken by fractures striking north 65 degrees east and dipping 80 degrees north. Quartz veinlets up to half an inch wide and mineralized with specular hematite, magnetite, and rare molybdenite occupy some of the fractures. Five bulldozed and blasted trenches on these claims expose veinlets of this sort.

Six thousand feet to the south on the Jen No. 10 claim a trench in pink granite, similar to the Endako type, exposes a small showing of disseminated molybdenite associated with a northeasterly striking fracture occupied by a narrow pink aplite stringer.

(53° 124° N.W.) Company office, 19, 425 Howe Street, Vancouver 1. Ralph Sostad, president. In 1963 the company held a very large number of Nithi claims and fractions on the east side of Nithi Mountain. These claims are accessible from the more easterly of the Nithi Mountain roads, built by the company from the closest of a number of logging-roads on the north side of the mountain.

Nithi (16) (Dundee Mines Limited)

Bedrock is fairly well exposed on the highest of the Nithi claims and down on the south slope; elsewhere on the claims it is at comparatively shallow depth and the ground is amenable to bulldozer trenching.

The claims are underlain by pink sericitized granite which, at higher elevations on the Nithi No. 28 claim and to the west on the Jodee ground, is intruded(?) by a somewhat finer-grained leucogranite or alaskite. In several places grey rhyolite porphyry dykes a few feet or a few tens of feet wide intrude the granite.

Early in the season, prospecting revealed some molybdenite-bearing float on the Nithi Nos. 27 and 28 claims and others to the south. This was followed by geochemical soil-sampling over a comparatively small area. Concurrently 10,000 feet or more of bulldozer roadways and trenches were made for access and to expose bedrock. As on the western side of Nithi Mountain, the granite is fractured along a north 60 to 70 degrees east direction with the surfaces dipping 65 degrees northwest.

Fractures of this orientation are not uncommonly occupied by frozen, narrow quartz veinlets in which specular hematite is present but in which molybdenite was rarely seen.

In July diamond drilling was begun, the first hole being put down on a small showing where sparse molybdenite was disseminated through altered pink granite near a northeasterly striking fracture. A total of 2,976 feet in nine diamond-drill holes was completed. In general the core shows very little alteration and contains very little molybdenite.

Ray Richards was in charge of the work. Exploration ceased with the completion of the last hole in August.

STUART LAKE

Antimony-Gold

Snowbird (Bralorne Pioneer Mines Limited)*

(54° 124° N.W.) Company office, 320, 355 Burrard Street, Vancouver 1. F. R. Joubin, president; D. H. James, chief geologist. The Snowbird antimony property consists of 6 claims held under option and 16 recorded claims, which lie on the southwest side of Stuart Lake. Work commenced in May and was completed by August, and was done with an average crew of seven men under the direction of S. B. Fulton. A grid was cut consisting of 72,000 feet of lines at 400-foot intervals from a central base-line, and magnetometer readings were taken every 100 feet. The camp was serviced by boat and aeroplane from Fort St. James. The camp was not visited.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1929, p. C 186.]

AIKEN LAKE

Copper-Gold

Croydon*

(55° 125° S.W.) Croydon Mines Ltd.; company office, 108, 718 Granville Street, Vancouver 2. H. Hill & L. Starck & Associates Ltd., consulting engineers. This is a group of 62 recorded mineral claims under option to Rio Tinto Canadian Exploration Limited. The claims are about 8 miles west of Aiken Lake, some 50 miles north of the end of the existing highway. During 1963 some 23 miles of lines were cut, and magnetometer readings were taken every 100 feet over an area of 3,000 by 3,500 feet. This was followed by induced polarization and geochemical surveys. The work was done by a crew of 12 men under the supervision of E. Bronlund. The camp was serviced by helicopter and pack-horse from Aiken Lake.

The camp 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. Royden Morris, president; Marcel Guiget, general manager; Charles McNeil, mine superintendent; J. J. Stone, mill superintendent. Capital: increased during 1963 from 2,000,000 shares, \$1 par value, to 4,000,000 shares. This company operates the Aurum mine on the east side of Island Mountain. The mine is adjacent to the community of Wells and is 51 miles by road from Quesnel.

The mine has been in production since 1934 and has been operated by the present company since 1954. It is developed from a main haulage adit at the 4,000-

* By H. Bapty.

† By W. C. Robinson.

foot level, from which a three-compartment internal shaft 1,450 feet deep is sunk. Eleven levels have been developed from the Aurum shaft.

The following is a summary of development work done during 1963:—

	Ft.
Drifting and crosscutting.....	5,223
Raising	595
Box-holes and sub-drifts.....	404
Diamond drilling.....	25,052
Test-holes (jackleg and ribbon steel).....	13,327

A total of 34,702 tons of ore was milled, yielding 18,308 ounces of gold and 3,165 ounces of silver. An average crew of 119 men was employed.

LAC LA HACHE

TAKOMKANE MOUNTAIN (52° 120° S.W.)

Molybdenum

**Boss Mountain
(Noranda Exploration
Company,
Limited)***

British Columbia office, 202, 2256 West 12th Avenue, Vancouver 9; mine office, Box 247, 100 Mile House. B. O. Brynelsen, manager, Vancouver; S. G. Bruce, superintendent, Boss Mountain. The property comprises 11 Crown-granted and 135 recorded claims. The showings are at an elevation of 5,500 feet on the east side of Takomkane (Big Timothy) Mountain about 50 air miles due east of Williams Lake. The property is reached by 57 miles of road from 100 Mile House. From Eagle Creek on the north shore of Canim Lake the forest access road is followed for 22 miles to Hendryx Lake, where a permanent camp is planned, thence 6 miles to the adit site and present temporary camp.

The country rock is quartz diorite, intruded near the ore zone by a granite stock. There are felsite (quartz porphyry) and lamprophyre dykes. The ore under development is in brecciated quartz diorite. Molybdenite-bearing quartz veins which were investigated in the past are not currently receiving attention. Regional fracturing includes a dominant steep northeast set of fractures and a subsidiary northwest set. The long axis of the granite stock, which is nearly 1 mile long, trends northeast. The ore breccia and the quartz-molybdenite veins are aligned northwest. The full extent of brecciation within the quartz diorite has not been determined, largely due to the lack of exposures. The most widespread type is a rock breccia that contains no quartz. It is finely comminuted quartz diorite that is little altered.

The ore occurs in two bodies aligned about north 35 degrees west and 240 feet apart at surface. The south orebody measures about 220 feet by as much as 120 feet wide and consists of quartz breccia; that is, rock fragments cemented by quartz. The north orebody is about 500 feet long by a maximum of 140 feet wide. It consists of quartz breccia, except for the north end, which is fractured quartz diorite containing seams of molybdenite. The quartz breccia bodies are pipes, with the greatest abundance of quartz in the central parts. Alteration is marked by kaolin, sericite, and chlorite, but is not as a rule intense. There has been considerable rotation and translation within the quartz breccia pipes, as is shown by the distribution of numerous fragments of dyke rock, both felsite and lamprophyre. The southern pipe contains fragments of rock breccia and the northern one does not. The quartz-free breccia ore at the north end of the north body shows little or no rotation of the fragments.

* By M. S. Hedley.



Boss Mountain temporary camp.



Boss Mountain mine plant at adit portal. View from camp.

The breccia of the two pipes appears plainly to be explosion breccia. The more widespread quartz-free comminuted rock has no obvious pattern of occurrence, although its full extent is not known. The quartz breccia pipes are aligned northwestward, along one of the regional directions of fracturing. The plunge is steep to the northwest. The foregoing are generalizations; the distribution of molybdenite within the orebodies cannot be simply stated, and is not precisely known until underground development has progressed further.

A 10-foot lamprophyre dyke encountered underground, near the north orebody, is sheeted with quartz and molybdenite. Development was insufficient in mid-August to indicate the extent of this mineralization, but some sections were of high grade. It is understood that this occurrence is an extremely important addition to the ore reserves.

The adit driven west to the ore zone, begun in 1962, was completed, a total distance of about 6,000 feet. The southwestern end of the granite stock was crossed in this drive. The inner part of the adit passed to the northeast of the orebodies, and crosscuts were driven from it to the ore. A vertical raise was driven from the adit, elevation 5,045 feet, to surface at an elevation of 5,488 feet. No deep drilling to test the extension of ore below the adit had been done at the time of examination in mid-August.

In 1963 underground work comprised 1,980 feet of crosscutting, 1,915 feet of drifting, and 678 feet of raising. Diamond drilling from underground amounted to 23,893 feet, and from surface, 1,595 feet.

Investigations were made of a mill-site close to the adit portal. Preparations were made for a camp-site at Hendryx Lake. Geochemical investigations were carried out on surface.

During 1963 an average crew of 30 men was employed.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1956, pp. 34-35; 1957, pp. 18-22; 1961, pp. 21-22; 1962, pp. 20-21; Stevenson, J. S., *B.C. Dept. of Mines*, Bull. 9, 1940.]

LILLOOET

BRIDGE RIVER (50° 122° N.W.)

Gold

Bralorne Pioneer Mines Limited*

Company office, 355 Burrard Street, Vancouver 1; mine office, Bralorne. G. H. Davenport, president; C. M. Campbell, Jr., resident manager; J. P. Weeks, mine superintendent; E. H. Hall, mill superintendent; A. J. Learmonth, plant superintendent. This 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 was described in some detail in the 1958 Annual Report.

The workings are approached by a main haulage adit on the 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 No. 26 level; the Queen shaft, 2,300 feet deep from No. 26 to No. 41 level. The major portion of present production is 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,

* By W. C. Robinson.

and hauled by trolley locomotive to the mill. The ore is treated in a 600-ton cyanide mill. In 1963, 152,601 tons of ore was milled, yielding 87,016 ounces of gold.

A summary of development work done in 1963 is given below:—

	Ft.
Drifting.....	5,824
Crosscutting.....	2,137
Raising.....	1,673
Diamond drilling.....	15,969

A major problem is created at this operation by high rock temperatures in the deeper workings of the mine. Rock temperatures reach 108 degrees, and an ample air flow is required to maintain reasonable working conditions. Insulated ventilation pipe was used, successfully, during the year to deliver relatively cool air to development headings where an acute heat problem existed.

The number of employees was 341, of whom 234 were underground.

TYAUGHTON CREEK (51° 122° S.W.)

Mercury

Dot (Silverquick Development Co. (B.C.) Ltd.)*

Company office, 325, 1155 West Georgia Street, Vancouver 5; mine address, Gold Bridge. Robert E. Woods, president. The company holds a group of claims between Tyaughton Creek and Taylor Creek. The showings on this property contain cinnabar mineralization. Work in 1963 was carried out by a crew of five men under the direction of Bruce Buck. The work included camp construction and mining and stockpiling of material containing cinnabar. It has been reported that one load of this material was trucked approximately 23 miles to a proposed mill-site on Tyaughton Lake before work was suspended for the winter. It has been indicated that plans are to install a Gould rotary furnace capable of treating 10 to 15 tons per day. Initial plant construction began during November. Access to Tyaughton Lake is by 3 miles of road from the Bridge River road.

ANDERSON LAKE

Gold-Silver

Barkley Valley Mines Ltd.*

(50° 122° S.E.) Office, 736 Granville Street, Vancouver 2. Thomas Barkley, president; Harvey Cohen, consulting engineer. This company holds the Gladys No. 1, Gladys No. 2, and Nita groups of located claims, totalling 14 claims, on Haymore, Lawlawton, and Crystal Creeks, about 15 miles by road southeast of D'Arcy station on the Pacific Great Eastern Railway. Work on the property commenced on June 3rd and was suspended on September 29th. Approximately 1½ miles of trail was constructed. Four holes, averaging about 50 feet long, were diamond drilled and an adit was driven 50 feet. A crew of three men was employed.

[Reference: *Minister of Mines, B.C., Ann. Rept., 1962, p. 28.*]

LYTTON

Copper

Rocky, Tom, Nav (Lytton Minerals Limited)†

(50° 121° S.E.) Company office, 624 Howe Street, Vancouver 1. E. Koblanski, president; D. W. Asbury, geologist in charge. This newly formed company is controlled jointly by Macacona Minerals Ltd. and The Patiño Mining Corporation Ltd. It holds 113 claims and fractional claims by record,

* By W. C. Robinson.

† By J. M. Carr.

mainly in the Rocky, Tom, and Nav groups, on the south slopes of the Scarp Range, near Pitquah on the north side of the Thompson River. The property extends westward from Shushten Creek to within about 1 mile of Botanie Creek and covers dry, rugged terrain ranging from river-level at about 500 feet to elevations of as much as 4,600 feet.

Showings in the eastern part of the property are known as the Pop zone and are best reached from a point on the Trans-Canada Highway about 8 miles east of Lytton, by means of a foot-bridge across the Thompson River to Mile 89 on the Canadian National Railway and thence westward along the railway right-of-way for a distance of 1 mile to the start of newly constructed roads at the mouth of Shushten Creek. A jeep-road about $2\frac{1}{4}$ miles in length leads to the eastern showings, which are west of Shushten Creek at an elevation of about 2,600 feet. Other showings on the property lie as much as 1 mile to the northwest of the Pop zone and include showings on the Tom group discovered earlier by Tom Curnow, of Spences Bridge. They are best reached by ascending a creek west of the railway tunnel at Mile 93 and are reported to lie at scattered locations which range in elevation from 2,500 to 3,500 feet. They were not visited by the writer.

Work in 1963 was directed by The Patiño Mining Corporation Ltd. and employed a maximum crew of 10 men from June onward. It included $4\frac{1}{2}$ miles of road construction, prospecting, geological mapping of the whole property, and detailed mapping of the Pop zone, which was sampled by means of eight trenches at intervals along a length of 1,800 feet. Lesser amounts of trenching and sampling were done on other showings. Diamond drilling of the Pop zone began in December and by year-end totalled 679 feet.

The property is mostly underlain by a thick series of banded plutonic rocks which are mainly light-coloured anorthosites and dark-coloured gabbroic rocks (eucrites). These rocks dip northeastward at moderate angles and may be part of a large layered intrusion whose full extent is unknown. The banded rocks are cut by numerous dykes of andesite, some of which post-date the sulphide mineralization, as well as by a few sheets of intrusion breccia and, near Shushten Creek, by a body of quartz diorite. Near the northern limit of the property they are overlain by Lower Cretaceous volcanic rocks of the Spences Bridge Group.

Showings in the Pop zone are on a steep south-facing slope and occur in dark, fractured gabbroic rocks which underlie anorthosites. The western limit of the exposures is beneath a prominent bluff, beyond which a rockslide extends for as much as 1,700 feet along the westerly strike of the rocks. Eastward there are showings intermittently for nearly 2,000 feet along the strike, and chalcopyrite is disseminated in some of them across widths of as much as 100 feet.

MARTEL

Copper

Dora Kay (North-west Ventures Ltd.)*

(50° 121° S.E.) Company office, 718, 355 Burrard Street, Vancouver 1. T. J. McQuillan, manager. This property consists of 64 claims, including the Dora Kay showings on the east side of the Thompson River about 7 miles northeast of Spences Bridge. Access is by a narrow road which leaves No. 8 highway just northeast of the Nicola River bridge and follows the east bank of the Thompson River. A branch road leads up Pimainus Creek valley for 2 miles and then climbs rapidly to the main camp, which is on the brow of the hill overlooking the Thompson and Spences Bridge. In 1963, 385 feet of drifting and cross-

* By David Smith.

cutting was done under contract in a mineralized zone. A crew of six men was employed under the direction of K. G. Sanders.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1961, p. 29.]

Copper-Iron

(50° 121° N.E.) Company office, 549 Howe Street, Vancouver 1. **Spatsum (Alscope Consolidated Ltd.)*** N. Martini, president; V. M. Prescott, secretary-treasurer; Chapman, Wood and Griswold Ltd., consulting engineers. This company holds a large number of claims on either side of the Thompson River near Spatsum, including newly located groups on the west side.

Work in 1963 included completion of a vertical diamond-drill hole on the east side of the river to a depth of 564 feet. The hole ended in diorite containing occasional minor concentrations of magnetite and some gougy faults.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1962, p. 45.]

HIGHLAND VALLEY

Copper

(50° 120° N.W.) Company office, 390 West Hastings Street, Vancouver 3. **Trojan (South Seas Mining Limited)*** R. E. Signorello, president; A. R. Allen, consulting geologist. By an agreement made early in 1963 with Trojan Consolidated Mines Ltd., this company controls 57 claims, 24 of which are Crown granted, to the north and east of the south peak of Forge Mountain, about 30 miles by road from Ashcroft. The Trojan mine, where most work on the property has been done, is about 3 miles to the north of the Bethlehem open pit and consists of a shaft completed in 1957 and workings on a level at 150 feet depth. The shaft is in the west wall of a mineralized breccia pipe that is as much as 1,500 feet long from north to south and in places nearly 900 feet wide. Work to 1962 explored chiefly a well-mineralized zone in breccia near the shaft, the rest of the breccia pipe being tested by widely spaced, inclined surface diamond-drill holes.

Work by the company in 1963 included 960 feet of crosscutting and 380 feet of drifting and was done by a crew of 23 supervised by Arpad Fustos. A caved east crosscut was cleaned out and extended to the east wall of the breccia pipe, and north and south drifts were made in breccia near the east wall. Muck and face samples taken for assay throughout the new workings confirmed the existence of wide sections of material containing sub-commercial amounts of copper.

[References: *Minister of Mines, B.C.*, Ann. Repts. 1956, pp. 43-44; 1957, pp. 24-26; 1958, p. 21; 1959, p. 29; 1961, p. 30; 1962, p. 47.]

(50° 120° N.W.) Company office, 1818, 355 Burrard Street, Vancouver 1. **Dave (Huestis Mining Corporation Ltd.)*** H. H. Huestis, president; P. M. Reynolds, secretary-treasurer. This company, in which The Consolidated Mining and Smelting Company of Canada, Limited, has an interest, holds about 60 claims in the Dave group north of the Bethlehem property. In 1963 work included geochemical and magnetometer surveying, an induced polarization survey by Hunting Survey Corporation, and 1,876 feet of diamond drilling in six holes, of which two did not reach bedrock. Frank Cooke was in charge of the work and B. Chaplin was geologist on the property. Hole No. 3 was drilled westward under a trench near the road

* By J. M. Carr.



Bethlehem Copper Corporation Ltd. Blast at East Jersey open pit.



East Jersey open pit. Note steepness of blasted face.

south of Bose Lake and intersected a chloritic fault exposed with northerly strike in the trench. Holes No. 1 and No. 2 were drilled toward one another under a creek about 1,000 feet farther east, and they also intersected a fault. Small amounts of bornite and chalcopryite were exposed in the trench and were intersected in all three holes. Hole No. 6 was drilled eastward near the northwest side of Bose Lake, and its core was not seen by the writer.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1962, p. 47.]

(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; C. J. Coveney, production 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 106 recorded claims and fractions, immediately east of Quiltanton (Divide) Lake.

Following the tune-up period of the mill, which commenced in December, 1962, the property was officially declared open on February 1, 1963. The plant, with a rated capacity of 3,500 tons per day, commenced treating about 2,500 tons of ore per day. Subsequently the tonnage was increased, and at the end of 1963 an average of between 3,900 and 4,000 tons per day was being treated. Additions to the plant in 1963 included a tertiary 4-foot cone crusher, which handles a scalped feed from the secondary crusher discharge to the fine-ore bin and returns the crushed product to the fine-ore bin. An additional circuit was being added to the mill, and when completed a molybdenum concentrate will be recovered. Concentrates are handled by truck and unloaded at the Vancouver Wharves in North Vancouver. Concentrate produced in 1963 totalled 29,631 tons.

Mining of the East Jersey open pit was under contract. In 1963 production from the East Jersey zone pit was 3,446,880 tons of waste, 882,950 tons of marginal ore, 80,410 tons of molybdenum-bearing ore, and 1,265,988 tons of ore. The Jersey zone was cleared on surface, boundaries were established, and roads were built to the new waste-dump area.

Additional equipment placed in service in the pit in 1963 included a 4½-yard shovel, four 27-ton Euclid trucks, and a rotary drill using 9-inch bits. There has been no work underground.

In 1963 the number of persons employed was 131—71 employed by the company and 60 employed by the contractors. No housing is provided at the property, employees commuting to Ashcroft.

Other work done on the property in 1963 consisted of further exploration on known ore zones. Two holes were diamond drilled on the Spud Lake zone, totalling 800 feet. An additional 1,180 feet of diamond drilling was done on the East Jersey zone.

(50° 121° S.E.) Company office, 1121, 355 Burrard Street, Vancouver 1. H. H. Huestis, president. This company holds a large number of recorded claims in the Tom group at Calling Lake and also holds by option the adjoining property of Bethsaida Copper Mines Limited together with the Empire claim and the Kathleen Crown-granted claim. The Tom group adjoins the western boundary of the Noranda property and is partly a

* By David Smith.

† By J. M. Carr.

relocation of the Nancy and Terry groups, on which trenching was done in 1956 by Laco Mines Limited.

Work on the Tom group was done by a small crew under T. E. Lisle and included geological mapping and magnetometer surveying. Geological mapping of the Bethsaida property was done by J. Sullivan.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1956, p. 45.]

Noranda Exploration Company, Limited* (50° 121° S.E.) Company office, 202, 2256 West 12th Avenue, Vancouver 9. In 1963 this company acquired 342 claims, partly by option from E. H. Lorntzen, south of Highland Valley between the O.K. mine and Pimainus Lake on the west and the Gnawed Mountain area on the east.

The property includes former parts of the Bethsaida, Cadamet, and Jericho properties. It is covered widely by superficial deposits and is underlain chiefly by Bethsaida granodiorite of the Guichon batholith.

Work was done by a crew of six men directed by B. Botel and D. Pegg under the supervision of A. Burton. It included rebuilding a road between Calling and Pimainus Lakes and making a new road parallel to this one and farther to the east. It also included geological, geochemical, and geophysical surveying, making pits and trenches, and diamond drilling a single hole 500 feet in length.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1958, p. 24; 1959, p. 30.]

Sheba, Highmont, Minex, B.X. (The Anaconda Company (Canada) Ltd.)* (50° 120° S.W.) Company office, Britannia Beach. Glenn C. Waterman, assistant vice-president and chief geologist. Late in the summer this company optioned about 157 claims on the south side of Highland Valley in a single block extending southward from the Bethlehem property as far as Roscoe Lake and including, from north to south, the Sheba property, which is controlled by Peel Resources Limited

(company office, 408, 580 Granville Street, Vancouver 2), the Highmont property, owned by Torwest Resources (1962) Ltd. (company office, 404, 409 West Hastings Street, Vancouver 3), and two properties owned by Minex Development Ltd. (company office, 310, 850 West Hastings Street, Vancouver 1) and B.X. Mining Company Limited (company office, 1500, 355 Burrard Street, Vancouver 1), respectively. Work by the Anaconda Company included both reconnaissance and detailed geological mapping and some induced polarization surveying. Minex Development Ltd., on its own, diamond drilled four holes totalling about 1,500 feet, partly on the A.M. No. 10 and No. 12 claims and partly on the A.M. fractional claim, where stripping was done in 1962. Core from the two holes on the fractional claim showed copper mineralization in silicified quartz diorite and granodiorite porphyry.

[References: *Minister of Mines, B.C.*, Ann. Repts. 1957, p. 27; 1962, pp. 49-50.]

Jericho Mines Ltd.† (50° 120° S.W.) Company office, 1531 Davie Street, Vancouver 5. Hamlin B. Hatch, secretary-treasurer. This company holds 157 claims south of Witches Brook, about 7 miles east of Quiltanton (Divide) Lake. The Jericho camp lies on the Witches Brook road about 8 miles west of Guichon Creek. In 1963 magnetometer and geochemical surveys were carried out over 40 claims. Trenching and stripping were

* By J. M. Carr.

† By David Smith.

done with a bulldozer, and some diamond drilling was done. An adit, to be driven by contractors a distance of 500 feet, had been collared and was 50 feet long at the end of 1963. A crew of 12 men was employed under the direction of Mr. Hatch.

GUICHON CREEK

Copper

**P.G. (Noranda
Exploration Com-
pany, Limited)***

(50° 120° N.W.) Company office, 202, 2256 West 12th Avenue, Vancouver 9. This company holds 99 recorded claims in the P.G. group along and mainly west of Guichon Creek to the north of Witches Brook. The property is partly a relocation of the Fran and Giselle claims held by Deer Horne Mines Limited in 1956 and on which Rio Canadian Exploration Ltd. (now Rio Tinto Canadian Exploration Limited) then did geological and geochemical work. Much of the property is drift covered and is at least partly underlain by older and younger quartz diorites of the Guichon batholith.

In 1963 work was carried out intermittently during the summer by a small crew under A. Burton and consisted of geological, geochemical, and geophysical surveys.

WDR*

(50° 120° N.W.) This group of 68 recorded claims is held by W. D. Rorison and associates and extends north-northwestward mainly between Forge and Guichon Creeks. Access to the northern part of the property is from the Rorison ranch on the Savona-Mamit Lake road about 5½ miles north of the Highland Valley turn-off. The property is largely drift covered and is at least partly underlain by the older quartz diorite of the Guichon batholith. Work in 1963 included road-building and bulldozer trenching at a number of localities scattered at intervals throughout a distance of nearly 4 miles in a north-northwesterly direction. Chalcopyrite is reported to have been uncovered in some of the new trenches in the northern part of the property.

BROOM CREEK

Copper

**Chataway (Chata-
way Exploration
Co. Ltd.)***

(50° 120° S.W.) Company office, 1926 Ogden Avenue, Vancouver 9. S. W. Wright, president. This company holds 211 recorded claims in a large block extending from Roscoe and Antler Lakes southward nearly to Broom Creek. The property is accessible by 5 miles of jeep-road leading from the Aberdeen mine on Broom Creek to a recently constructed camp at Dot Lake and thence by branch roads to other parts of the property. Since 1956 the company and its predecessor, Chataway Mining Syndicate, have explored the property by prospecting, soil-testing, bulldozer trenching, and limited diamond drilling. In 1963 work included geological mapping of most of the property by K. C. McTaggart, trenching, and 3,047 feet of diamond drilling, as well as soil-testing, surveying, and magnetic surveying on 40 claims in the southeastern part of the property. As many as seven men were employed under the direction of S. W. Wright.

The property is largely drift covered and is underlain by rocks of the Guichon batholith, which are mainly Bethsaida-type granodiorite in the southwestern part and varieties of the older and younger quartz diorites elsewhere on the property. Quartz porphyry float is abundant between Dot and Chataway Lakes, and a differ-

* By J. M. Carr.

ent variety of quartz porphyry is exposed as dykes in the northwestern part of the property.

The main showings in the southern part of the property are east of Chataway Creek on the SHO No. 11 claim, which is about 1,000 feet north of the road to Twin Lakes. On this claim widely spaced lenses and seams of oxidized copper mineralization are exposed by stripping and occur in older quartz diorite which is partly altered to a brownish colour. Nearby the rock is cut by younger quartz diorite dykes and northerly faults, which are not conspicuously mineralized. Six holes totalling 1,835 feet were drilled near this showing.

Most of the showings in the northern part of the property are between Roscoe and Chataway Lakes and occur variously in older quartz diorite that is cut by younger quartz diorite or porphyry dykes, and in younger quartz diorite cut by porphyry dykes. The mineralized rocks are fractured and faulted, argillized, silicified, and rusty. The exposed mineralization is low grade and consists chiefly of fracture fillings and disseminations of specular hematite, chalcopyrite, and bornite, which are partly oxidized to copper carbonates and chalcocite. Extensive trenching has been done on and near the Jay No. 1 claim, which is about 1 mile west of the south end of Chataway Lake. Two inclined holes, each 75 feet long, were drilled prior to 1963 and failed to reach the altered zone exposed on the claim. In 1963 a further 854 feet of drilling was done in two or more holes at this showing and is reported partly to have intersected mineralization. One hundred and fifty-eight feet of drilling was done farther north on the Bob No. 8 claim, where there are mineralized exposures of quartz porphyry that is similar in type to porphyry found at the Bethlehem mine and at other major prospects in Highland Valley. On the WIZ No. 3 claim south of Dot Lake, a single hole 200 feet in length was drilled.

[Reference: *Minister of Mines.*, Ann. Rept., 1962, p. 50.]

Copper

Rich (R. & P. Metals Corpora- tion Limited)*

(50° 120° S.W.) Western office, 1218 Burrard Building, Vancouver 5. A Robertson, president. This group of 12 recorded claims lies on Broom Creek to the north of the Aberdeen mine. In 1963 five AX diamond-drill holes were drilled, totalling 1,471 feet. A crew of four men was employed under the supervision of B. A. Nekrasov.

MERRITT

Copper

Laron (Tormont Mines Limited)*

(50° 120° S.W.) Western office, 1218, 1030 West Georgia Street, Vancouver 5. A Robertson, president. This company holds 30 claims in the Laron group adjoining the northeast border of the Craigmont property. Access is by the Aberdeen road and through the Craigmont property. In 1963 three holes were diamond drilled, totalling 3,744 feet. A crew of five men was employed under the direction of B. A. Nekrasov.

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. G. Duthie, mine manager. This company holds 107 mineral claims and fractions, of which

* By David Smith.



Craigmont open pit, August, 1963. The final benches are 66 feet high.



Craigmont Mines Limited. Rotary drilling for geological information on Promontory Hills.

22 claims and fractions are held in 10 separate leases. The Craigmont orebodies are on the Merrell Nos. 7 and 8 claims and 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 was continuous throughout 1963. Production was mainly from the open pit. Underground development was speeded up, and a small tonnage of ore from underground was milled. Most of the concentrate was shipped to Japan, and the remainder was shipped to the American Smelting and Refining Co. smelter at Tacoma, Wash. The iron content of the ore was impounded with the tailings. In 1963 material moved in the open pit by contractors measured 896,100 cubic yards, including glacial till and waste rock. An additional 12,580,900 tons of material, including glacial till, waste rock, and stockpiled ore, was moved by the company which also mined 1,652,600 tons of open-pit ore. Underground work was continued on three levels and is summarized as follows:—

Development—		Ft.
Lateral development		7,142
Raising		4,575
Shaft sinking		738
Ore production—		Tons
Cut-and-fill stopes		12,700
Blast-hole stope		54,600
Development		39,000

Diamond drilling was continued underground and on the surface.

The internal service shaft connecting the 2400 level and the 3000 level was completed and equipped with friction-type hoisting. Installation of the primary crusher, of 550 tons per hour capacity, serving the underground and situated at the portal of the 2400 level, has been completed. The conveyor carrying the crushed ore from the crusher to the coarse-ore stacker was completed. Additions to the open pit included six new 27-ton trucks and a 4-yard electric shovel.

In 1963 the number of persons employed was 533. No housing is provided on the property, and the crews commute from Merritt, a distance of approximately 8 miles.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1959, pp. 31–34; 1960, pp. 35–40; 1961, pp. 31–37; 1962, pp. 52–53.]

Copper

Tom (Peel Resources Limited)*

(50° 120° S.W.) Company office, 230 West Broadway, Vancouver 10. N. H. McDiarmid, president. This company holds the Tom group of about 11 claims, which are high on the southern slope of Promontory Hills adjoining the road to the lookout. No work is reported for 1963, but in 1962 an induced polarization survey was done on contract and at least one diamond-drill hole was completed. This hole was drilled to 711 feet at minus 45 degrees northward and intersected greywacke, tuff, and rarely limestone belonging to the Nicola Group. The beds are partly strongly faulted, and the core commonly contains disseminations and fracture fillings of pyrite.

* By J. M. Carr.

**Har, Mid, etc.
(Mid-West Copper
& Uranium
Mines Ltd.)***

(50° 120° S.W.) Company office, 535 Howe Street, Vancouver 1. G. S. Shaw, president. This company holds 38 claims in four groups south of the Craigmont mine. These are the Har, Mid, AR, and ARH groups. In 1963 work done consisted of magnetic and geochemical surveys and two diamond-drill holes totalling 592 feet. A crew of six men was employed under the direction of B. R. Richards.

**Wade, Sarg, Major
(General Resources
Ltd.)†**

(50° 120° S.W.) Company office, 213, 678 Howe Street, Vancouver 1. E. M. Olts, president; R. B. Stokes, senior engineer. This company holds 96 claims in the Wade, Sarg, and Major groups on the southwestern slopes of Promontory Hills immediately north of Highway No. 8. In 1963 a vertical diamond-drill hole begun in 1962 on an induced polarization anomaly on the Wade No. 7 claim was lengthened to 1,003 feet. The hole was in overburden to bedrock at 177 feet and thence in a light-coloured Kingsvale andesite dyke to 230 feet. From 230 to 428 feet it was partly in limestone containing disseminated pyrite and minor amounts of chalcopyrite and partly in similar unmineralized andesite rock. From 428 feet to its end the hole was mostly in Nicola volcanic and tuffaceous strata containing scarce pyrite, pyrrhotite, and chalcopyrite. Between 816 and 894 feet it was in slightly mineralized limestone.

**Justice (The Con-
solidated Mining
and Smelting Com-
pany of Canada,
Limited)†**

(50° 120° S.W.) This group of about 55 claims is mainly north and west of Jesse Creek, about 4 miles north of Merritt, and is owned by Vanmetals Exploration Limited (company office, 213, 678 Howe Street, Vancouver 1). In 1963 the property was optioned by The Consolidated Mining and Smelting Company of Canada, Limited, which diamond drilled four holes totalling about 2,000 feet. The property is largely underlain by quartz monzonite similar to younger phases of the nearby Guichon batholith. The drilled area contains a large induced polarization anomaly and is underlain partly by dacite porphyry, intrusive breccia, and diorite bodies which intrude the quartz monzonite. Holes Nos. 1 and 2 were drilled one-quarter of a mile apart and intersected rock containing disseminated pyrite partly with small amounts of chalcopyrite. Holes Nos. 3 and 4, drilled about one-half mile south of the northernmost hole (No. 2), intersected sheared, faulted, and somewhat pyritized volcanic rocks on the south side of the quartz monzonite body. G. M. Gibson was geologist in charge of the work.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1962, pp. 55-56.]

**Rye, Jesse, Jack
(Earlcrest Resources
Ltd.)†**

(50° 120° S.W.) Company office, 213, 678 Howe Street, Vancouver 1. E. M. Olts, president. This company holds about 20 claims in the Rye, Jesse, and Jack groups adjoining the northern boundary of the Justice group about 5 miles north of Merritt. Access is through the Justice group by a road 5 miles long from the Mamit Lake road. Work was done by a crew of four under R. B. Stokes and included magnetometer surveying and bulldozer trenching on the Rye group near the Indian reserve boundary. In the trenches, quartz monzonite of the same type as on the Justice group is fractured and locally mineralized

* By David Smith.

† By J. M. Carr.

with chalcopyrite, malachite, specular hematite, and pyrite near a steep fault that strikes west-northwestward.

**Magna Copper,
Ranch***

(50° 120° S.W.) Twelve claims in the Magna Copper group and seven claims in the adjoining Ranch group are owned by H. P. Thornton and associates and J. A. Hext, of Route 2, Oliver, respectively. They adjoin the Jesse group on the east side of Jesse Creek. Seven diamond-drill holes, ranging in length from 38 to 86 feet, were drilled on the Magna Copper group, and one hole 74 feet long was drilled farther east, on the Ranch group. It is reported that copper mineralization was intersected in six of the holes drilled on the Magna Copper claims. An examination of specimens of core from the hole drilled on the Ranch group showed small amounts of partly oxidized copper mineralization in one of the specimens. The hole was drilled in Nicola tuffs showing a moderate degree of alteration accompanied generally by small amounts of pyrite.

Copper-Iron

Judy*

(50° 120° S.W.) This group of about 40 claims, owned by M. D. Merrell and associates, of Merritt, is on the southwest slopes of Iron Mountain. Stripping additional to that reported in 1961 has been done in a zone of specular hematite and chalcopyrite mineralization in Nicola tuffs, which are shattered and mineralized adjacent to inferred northeast-trending faults. In new trenches near an old inclined shaft on the lower southwestern slopes of the mountain, hematite and chalcopyrite are developed where shears cut massive limestone and adjacent tuff beds.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1961, pp. 43-45.]

CANFORD

Copper

**Copper Canyon
(Hurley River
Mines Ltd.)†**

(50° 121° S.E.) Company office, P.O. Box 335, Bralorne. P. Polischuk, president; W. A. McLelland, vice-president and secretary. The property consists of 54 recorded mineral claims and fractions in the Copper Canyon, Eagle, and P.J.H. groups situated on the east slope of Mimenuh Mountain, which is 10 miles west-northwest of the village of Canford on the Nicola River. It is reached by jeep-road from Canford.

The claims are underlain by Lower Cretaceous Kingsvale volcanic rocks. On Copper Canyon No. 2 mineral claim, at about 5,000 feet elevation, the volcanics are intruded by a stock of porphyritic diorite which limited prospecting indicates to be about 700 feet long by 300 feet wide with the longer dimension lying nearly north-south. The rock type is described in Geological Survey of Canada Memoir 262, page 85.

Mineralization consists of chalcopyrite and bornite with minor pyrite in fine fractures in the porphyritic diorite. The mineralization appears to be confined to the diorite.

In 1963 work done consisted of magnetic surveys, geochemical surveys, trenching, and road-building. A total of 4,479 feet of diamond drilling was carried out in 1963. An average crew of five men was employed under the direction of B. R. Richards and W. A. McClelland.

* By J. M. Carr.

† By N. D. McKechnie.

NICOLA

Copper**Copperado
(Tolima Mining
and Development
Co. Ltd.)***

(50° 120° S.W.) Head office, 1040 West Georgia Street, Vancouver 5. Mine office, Box 849, Merritt. W. B. Montgomery, general manager. The property consists of 60 claims held by record and the Turlite Crown-granted claim. The property is 4½ miles by road north of Nicola at an elevation of between 3,500 and 4,500 feet. Work done in 1963 consisted of a geochemical survey and geological mapping.

Gold-Silver**Quilchena (Guichon
Mines Limited)***

(50° 120° S.W.) The property is controlled by Quilchena Mining and Development Co. Ltd., 201, 901 Jervis Street, Vancouver 5. It comprises 7 Crown-granted mineral claims held by lease agreement with Quichon Mines Limited, a mineral lease covering 12 former Crown-granted claims, and 55 claims held by record, all on the west side of Quilchena Creek and south of Nicola Lake. A road leads about 1 mile from the Nicola-Kamloops highway to the workings. Work done in 1963 consisted of geological mapping and sampling. A crew of two men was employed under the direction of P. Schutz.

ASPEN GROVE

Copper**Georgit**

(50° 120° S.W.) This group of four mineral claims is held by record in the name of F. A. McGowan, Merritt, and is half a mile southwest of Garcia Lake, 8 miles southeast of Merritt. The only mineral showing consists of a shear in fine-grained Nicola volcanic rocks. The shear is 4 feet wide, strikes north 85 degrees east, and dips 55 degrees southward, and is exposed in an old shaft about 8 feet deep. The footwall of the shear is a reddish fine-grained rock which may be tuffaceous; limy tuff is exposed in outcrops south of the shaft. The hangingwall is a highly siliceous rock now composed of white and grey quartz. The grey quartz shows, in places, faint outlines, which suggest that the rock may be a silicified fragmental.

Mineralization consists of barren quartz in the shear and scattered malachite and azurite in the hangingwall. A few specks of yellow metallic mineral, too small to identify, were seen in the hangingwall. No sulphides were seen in the footwall rocks.

Neither the shear nor the wallrocks appear to cross a shallow north-south depression which lies immediately west of the shaft. To the east there are no outcrops.

**Porcupine (Amalgamated Resources
Ltd.)†**

(50° 120° S.W.) Company office, Box 466, Lillooet. The Porcupine group comprises 36 recorded mineral claims situated on the east side of the Princeton-Merritt highway one-half mile north of Corbett Lake. The property is underlain by Upper Triassic Nicola flows and pyroclastics, and to the northeast by Miocene Coldwater sediments. The mineralization is in Nicola rocks and is exposed in and near an old inclined shaft on the Porcupine No. 1 mineral claim about 4,500 feet east of the highway. The bottom of the shaft is filled with rubble, but the depth is believed to be about 50 feet.

* By David Smith.

† By N. D. McKeechie.

The shaft is sunk on a band of dark-grey amygdaloidal basalt, extensively altered to chlorite and carbonate. The basalt strikes north 50 degrees east and dips 45 degrees southeastward. It is overlain by red tuffs.

Mineralization appears to be confined to the basalt and consists of disseminated chalcocite, chalcopyrite, bornite, and native copper, and the secondary copper minerals malachite, azurite, and cuprite. The basalt also contains finely disseminated specular hematite which in hand specimen may be mistaken for chalcocite and vice-versa. The basalt shows some fracturing, but no direct relationship was recognized between this fracturing and the mineralization.

A grab sample made up of five basalt specimens taken at random in and near the shaft assayed 1.73 per cent copper. No chalcopyrite, bornite, or native copper was recognized in these specimens.

Work done in 1963 comprised 410 feet of diamond drilling in six holes in the vicinity of the shaft, and a spontaneous polarization survey of the shaft area. Two men were employed under the direction of Sherwin F. Kelley.

Robin (Utica Mines Ltd.)* (49° 120° N.W.) Head office, 1218, 1030 West Georgia Street, Vancouver 5. G. L. Mill, president; Boris A. Nekrasov, consulting geologist. The group consists of 50 claims held by record and is situated at the confluence of Pothole and Quilchena Creeks. The northwestern half of the group is underlain by Miocene valley basalts, the remainder of basaltic lavas of the Upper Triassic Nicola Group.

Trenches in an area south of Quilchena Creek expose a dark amygdaloidal basalt with epidote amygdules separated from tuffs by an unmineralized fault. The fault strikes north 20 degrees west and is nearly vertical. Another unmineralized fault 10 feet wide is exposed cutting the basalt, striking north 60 degrees east and dipping 88 degrees southeast.

Two mineralized faults, strike north 80 degrees east, dip 75 degrees south and strike north, dip 85 degrees west, each about 2 feet wide, are exposed in the basalt. They show malachite, specular hematite, and very minor chalcopyrite.

Work in 1963 consisted of stripping and trenching and a geological survey. A crew of three men was employed under the direction of B. A. Nekrasov.

Pay (Payco Mines Ltd.)* (49° 120° N.W.) Head office, 2117 West Fourth Avenue, Vancouver 9. William Swanson, president; Sherwin F. Kelley, project manager. This company holds by record the Pay group of 40 claims surrounding Alleyne Lake, 3 miles southeast of Aspen Grove. The property is reached by a narrow road which turns north from the Kentucky Lake road about 2½ miles east of the Princeton-Merritt highway.

The property is underlain by Upper Triassic Nicola volcanic rocks. At the time of the writer's visit in July, rock trenching and diamond drilling were in progress near the northwest corner of the group, northwest of the north end of Alleyne Lake. Here the rocks are andesite and trachyte flows and flow breccias. The rocks are well altered to carbonate and chlorite and are more or less abtized and epidotized; epidote-garnet skarn occurs in minor quantities.

Intraformational contacts could rarely be recognized with certainty. A strike of north 45 degrees west and a dip of 40 degrees southwest was obtained on an andesite-trachyte contact near the site of diamond-drill holes Nos. 1 and 2. A less evident contact between andesite and andesite breccia about 1,000 feet to the north-

* By N. D. McKechnie.
5

east had a strike of north 60 degrees east and a dip of 80 degrees northwestward. A fault marked by closely spaced shear planes but little crushing, striking north 70 degrees east and dipping 85 degrees northwestward, lies just north of the site of Nos. 1 and 2 diamond-drill holes.

The mineralization is chalcocite, bornite, pyrite, and chalcopyrite disseminated in finely brecciated andesite. Although No. 2 diamond-drill hole cut very sparse pyrite and chalcopyrite down the dip of the fault, the writer could see no surface evidence that this fault had had any appreciable influence on the distribution of sulphides. It was not possible to determine whether or not the sulphides were restricted to a single volcanic horizon.

(49° 120° N.W.) These adjoining groups of recorded claims comprise the June 1 to 18 and Saw 1 to 12 mineral claims and are held in the name of John Tancowny, 4430 Albert Street, North Burnaby. They are on the east side of the Princeton-Merritt highway and west of Kentucky Lake. The road to Kentucky and Alleyne Lakes passes eastward through the Saw group and just to the north of the June group.

The claims are underlain by volcanic breccias, andesite, and amygdaloidal basalt of the Nicola Group. The beds strike north 45 degrees west and dip 35 degrees southwest. No intrusive rocks were recognized. The rocks are not well fractured.

Mineralization exposed in three places consists of chalcocite, sparsely disseminated and in scattered fine fractures in the fragmental rocks, and malachite.

On the June 8 mineral claim a 2-foot-thick bed of grey andesite flow breccia containing angular and rounded light-grey, green, and red fragments is overlain by a reddish andesite and underlain by a red andesite flow breccia. The grey flow breccia is stained with malachite and contains sparsely disseminated chalcocite. A specimen assayed 0.44 per cent copper.

At the initial posts of the June 4 and 6 mineral claims a similar grey andesite flow breccia is overlain by reddish andesite and underlain by amygdaloidal basalt. This breccia is about 30 feet thick. It contains finely disseminated chalcocite; a grab sample comprising two specimens assayed 0.34 per cent copper.

The third showing is about one-half mile westward on the Saw group. The host rock is a grey flow breccia, of finer grain than in the other showings, underlain by amygdaloidal red andesite and overlain by reddish andesite. Chalcocite occurs in the flow breccia as sparse, short, thin stringers and disseminated grains. The rocks strike northwestward and dip southwestward, but the dip was not determined. About 50 feet to the northwest a green andesite flow showed a few small grains of chalcopyrite.

MOUNT THYNNE

Copper-Iron

(49° 120° N.W.) About 19 claims and fractions in the adjoining Dawn and B and R groups are owned by R. E. Dale and Barbara Dale and are situated mostly between 5,500 and 6,000 feet elevation west of the summit of Mount Thynne. Access to the east limit of the group is by a newly constructed road servicing the forest lookout and microwave station, which leaves the public road about 1 mile east of Brookmere. The property is underlain by fairly steeply dipping strata of the Nicola Group which strike northward and include limestones. Magnetite, pyrite, and some chalco-

* By N. D. McKechnie.

† By J. M. Carr.

pyrite are developed in places of strong epidote alteration, principally in tuffaceous and volcanic strata which are sheared and faulted. Recent work by the owners includes road construction, bulldozer trenching, and hand-pitting at various widely scattered localities.

MISSEZULA LAKE

Copper

Shamrock (Shannon Group) (Missezula Lake Mines Ltd.)* (49° 120° N.W.) This group of 15 claims, on the west side of Summers Creek about a mile south of Missezula Lake, is held by record in the name of Missezula Lake Mines Ltd. The country rocks are Nicola volcanics. The rocks at the mineral showing are reddish flow breccias with a texture which superficially resembles that of an intrusive rock. The flows strike nearly north and dip from 40 to 60 degrees westward.

The flows are cut by narrow shears striking north 20 to 25 degrees east and dipping 70 degrees northwestward. At one point the northeast shear passes into subsidiary shears, one striking north 2 degrees east and dipping 65 degrees west, and another striking north 35 degrees west and dipping 55 degrees southwest. In the vicinity of the shearing the flows, which elsewhere are massive, show a banding subparallel to the north-striking plane. The northeast-striking shears and the subsidiary ones are mineralized.

The flows and mineralized shears are cut by faults striking north 75 degrees east and dipping 80 to 90 degrees northward, and striking north 30 degrees west and dipping 80 degrees northeastward. The horizontal displacement of the flows across the north 75 degrees east faults appears to be about 15 feet to the right; that of the mineralized shears is about 5 feet to the left. These displacements suggest a movement on the planes of the faults of about 80 feet, with the northwest side moving left and down on a plunge of 60 degrees.

The mineralization is chiefly malachite and azurite. Minor chalcocite was seen in the flow rocks and in the shear together with a few grains of chalcopyrite. Primary sulphide is more evident in the flow rocks than in the shears.

The mineral showings are exposed by trenches for a strike length of about 350 feet. Two diamond-drill holes were completed at the end of July to depths of about 150 feet each, and a third was in progress of drilling. Some mineralization was cut, which appeared to be on the extensions of the flows exposed in the trenches. Neither of the completed holes was deep enough to have reached the shear. The shear, however, was not with certainty identifiable in the trench at a strike distance of less than 50 feet from its best exposure, and so it may not persist.

The work was being done by Consolidated Woodgreen Mines Limited under agreement with Missezula Lake Mines Ltd.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1929, p. 278; *Geol. Surv., Canada*, Mem. 243, 1947, p. 92.]

Primer*

(49° 120° N.E.) This group of 92 recorded claims is owned by Primer Group Minerals Ltd., 501, 1111 West Georgia Street, Vancouver 5. A. Murray Inch, president. It is situated southeast 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 property includes ground described as the King George group in Geological Survey of Canada Memoir 243, page 92.

* By N. D. McKechnie.

In 1962 a geophysical survey and some surface stripping were done by McIntyre Porcupine Mines, Limited. The stripping was in two areas south of Dillard Creek at elevations between 4,100 and 4,900 feet. The western area is on the Primer 8, 55, and 56 mineral claims, near their common boundaries; the eastern area is about 4,500 feet to the southeast on the Primer 21 claim, at the end of the jeep-road.

The western area, exposed by five trenches, is about 700 feet in a southwesterly direction by about 600 feet in a southeasterly direction. The underlying rocks are carbonatized and albitized andesitic lavas. A prominent fault, about 80 feet wide, striking north 5 degrees east and dipping 80 degrees westward passes across the northwest side of the area. It is well exposed only in the most southwesterly trench. Three small faults also are exposed; one near the northeast end strikes north 35 degrees east and dips 75 degrees southeastward; of the other two, in a middle trench, one strikes north 30 degrees west and dips 80 degrees northeastward, and one strikes north 65 degrees east and dips 60 degrees southeastward.

The lavas are sparsely and locally mineralized with pyrite and chalcopyrite; malachite and azurite are noticeable in parts of the trenches where fracturing is prominent. No continuous structures associated with sulphides were recognized. The large fault and the three smaller ones described above appear to be essentially post-mineral.

The eastern area is about 500 feet southwest by about 200 feet southeast and rock is exposed in five trenches. The rock is monzonite porphyry, little altered compared to the andesites and considered to be an intrusive. The monzonite is cut by a fault 15 feet wide striking north 25 degrees west and dipping 80 degrees southwestward and by minor faults striking north 60 degrees west, dipping 60 degrees northeastward and striking north 70 degrees west, dipping 80 degrees northeastward.

Chalcopyrite occurs sparsely in a small pit 75 feet northeast of the jeep-road, and malachite was seen on closely spaced joint planes in the second-last trench southwest. There seems to be no evidence that the sulphides are associated with the faults.

Magnetometer, electromagnetic, and geochemical surveys were carried out. Some stripping was done on zones of mineralization. A crew of four men was employed under the direction of A. E. Angus.

KAMLOOPS

Copper

Galaxy Minerals Ltd.*

(50° 120° N.E.) Company office, 1403, 1030 West Georgia Street, Vancouver 5. W. F. Evans, president; W. I. Nelson, consulting engineer. This company holds 6 Crown-granted and 46 recorded claims east of the road to Le Jeune Lake, about 5 miles southwest of Kamloops. Work in 1963 consisted of an induced potential survey on the Prince of India, Evening Star, and Golden Star mineral claims. Eight surface holes were diamond drilled, totalling 2,963 feet. A crew of five men was employed.

Makao Development Company Limited*

(50° 120° N.E.) Company office, 915, 736 Granville Street, Vancouver 2. L. G. Wood, president; W. I. Nelson, general manager. This company holds 5 Crown-granted and 67 recorded claims in the vicinity of Coal Hill, about 3 miles southwest of Kamloops. Work in 1963 consisted of

* By David Smith.

an induced potential survey and of stripping and diamond drilling under the direction of A. Poole, engineer in charge. A crew of five men was employed.

Laura, Earl (Copper Lake Explorations Ltd.)*—(50° 120° N.E.) Company office, 1288—20th Avenue, Prince George. This company holds 19 recorded claims about 6 miles south of Kamloops and lying to the northeast of Edith Lake. Access is by secondary road to Long Lake. Two men were employed doing assessment work.

NORTH THOMPSON

BARRIERE

Copper-Lead-Zinc

(51° 119° S.W.) Company office, 640 West Hastings Street, Vancouver 1. R. Martin, president. This company holds 36 claims on the west and north shores of North Barriere Lake. Work done in 1963 consisted of diamond drilling eight holes, totalling about 1,700 feet, and stripping. Two men were employed. Access to the property is by road from Barriere. The property was not visited.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1962, p. 60.]

TULAMEEN

Iron

(49° 120° N.W.) Company office, 230 West Broadway, Vancouver 10. N. H. McDiarmid, president. The property includes 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. Magnetite has been known to occur in the area for many years. The area has been explored, some of it in detail, by magnetic surveys. Work done in 1962 consisted of a bulk-sampling programme on a section of the Lodestone Mountain deposit. Eleven diamond-drill holes, the deepest 330 feet, were drilled. In 1963 an economic survey and tabulation of results was carried out under the direction of G. E. Leonard.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1959, pp. 39–53.]

SIMILKAMEEN RIVER

Copper

(49° 120° S.W.) Company office, 411, 850 West Hastings Street, Vancouver 1. D. V. Hawkes, managing director; D. D. Campbell, consulting geologist. This newly incorporated company holds about 30 claims in the Ilk, Elk, and Ni groups transferred from Friday Creek Development Co. Ltd.

The property lies between the Hope–Princeton highway and the Similkameen River, about 17 miles by road south of Princeton. The main showings are astride Friday Creek at a distance from the river of about 1,500 feet and are reached from the north by 2 miles of dirt road which leaves the highway at a point almost opposite the Kennedy Lake turn-off. In previous years an area on the south bank was stripped, measuring about 250 feet across with about 150 feet of relief. In 1963 the present company drove an adit due south under the stripped area for 100 feet, did 195 feet of underground diamond drilling in four holes and about 300 feet of surface drilling

* By David Smith.

† By W. C. Robinson.

‡ By J. M. Carr.

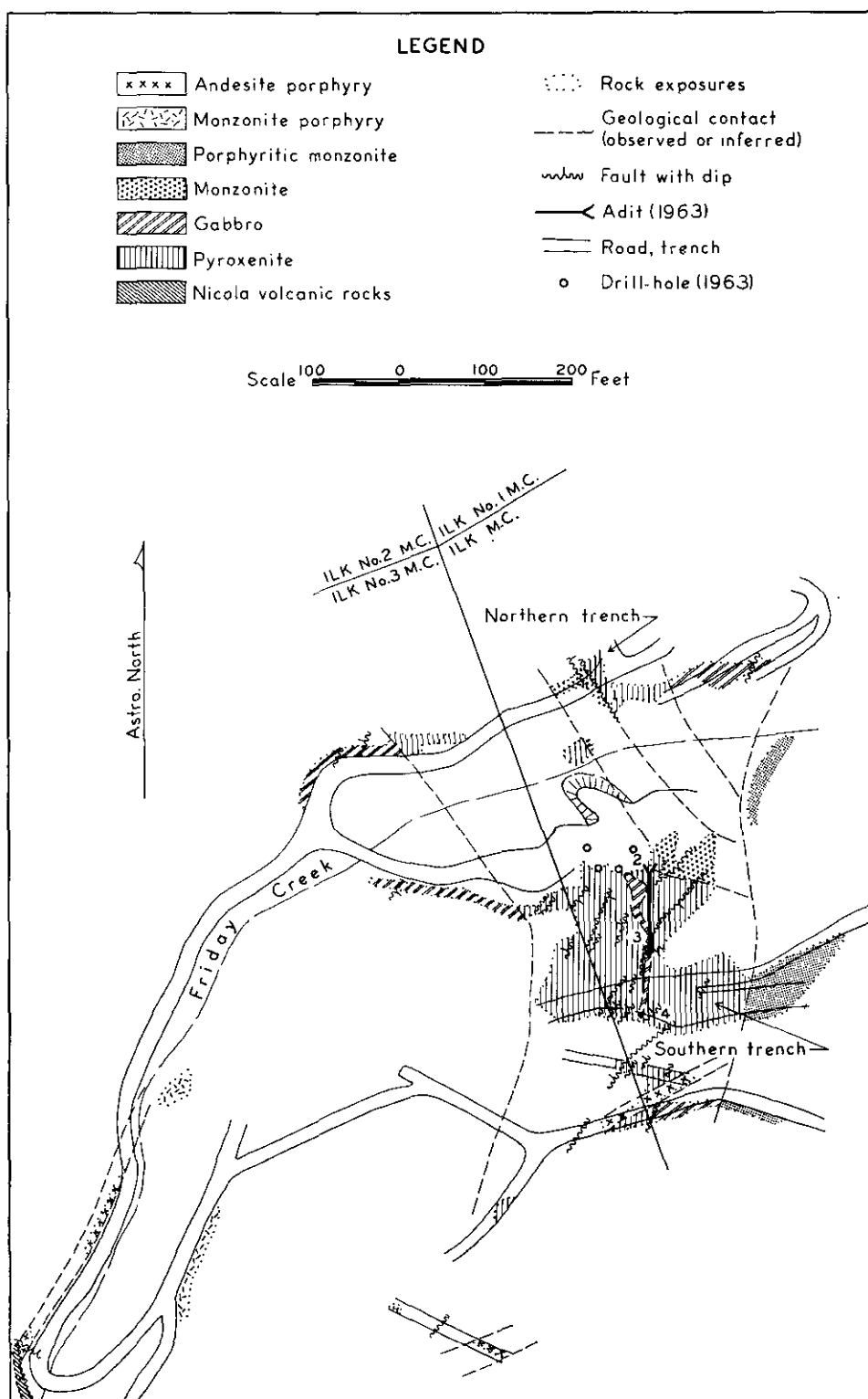


Figure 5. Geology of Friday Creek showings. Princeton Exploration Ltd.

in four holes, all near the adit, and stripped on both sides of the creek. The showings have partly been described in the Annual Reports for 1960 and 1962 and are in the Copper Mountain stock near its western margin. Figure 5 illustrates the geology and is based on a pace and compass survey of the showings. Pyroxenite, gabbro, monzonite, and porphyritic monzonite are all parts of the stock and were probably emplaced successively in that order. A separate, probably later intrusion of monzonite porphyry occurs between the stock and sheared Nicola volcanic rocks farther southwest. Small dykes of red feldspar pegmatite cut the stock and possibly the monzonite porphyry also, and are older than dykes of andesite or diorite porphyry which cut the same rocks. The pegmatite dykes occur either singly or, more often, in groups and networks, and they are especially numerous in pyroxenite and gabbro. Their widths range from a fraction of an inch to as much as several feet, and their attitudes are both flat and steep. Many of the steep pegmatites strike northeastward and cannot be traced for more than a few feet. Faults near the showings are mostly in pyroxenite or gabbro and are either flat or steep. Only the steep faults are shown in Figure 5; they strike predominantly northeastward and dip either way. Flat faults are rather irregular in attitude; some of them end at steep faults, whilst others continue across the latter and seem to offset them. Some faults lie along pegmatite dykes, and others cut and displace the pegmatites. Near faults the rocks are brecciated and altered and contain plentiful biotite and epidote. Pyroxenite altered in this way contains much disseminated pink feldspar. Many faults carry a thin seam of brown gouge that formed after brecciation of the wallrock.

Mineralization is localized chiefly near faults. It consists principally of bornite and chalcopyrite as fracture fillings and local disseminations in brecciated, altered rocks and as bunches and stringers in calcite or quartz veins in faults. Pyrite is disseminated, partly adjacent to copper mineralization. Most mineralized exposures are moderately or slightly oxidized and contain malachite or azurite. Where strongly oxidized, they contain limonite without copper minerals.

The best mineralization seen is all in pyroxenite and occurs at the following four places, which are numbered on Figure 5 and lie approximately on a north-south line passing through the adit. (1) North of the creek in new stripping near an old caved glory-hole, mineralization extends eastward for about 15 feet from a faulted monzonite contact and lies about 50 feet to the west of another mineralized exposure, which is about 9 feet across. (2) South of the creek in the adit, a steep irregular lens of mineralization extends north-northeastward from a steep northeasterly fault near the portal, and may join below rail-height a flat mineralized body that is exposed just north of the adit, where it lies close to a flat fault and is several feet thick in drill-holes. (3) In the west wall of the adit, between 70 and 90 feet from the portal, mineralization is part of a shoot that lies in the north wall of a steep northeasterly fault and is intersected for about 14 feet by a flat hole diamond drilled westward. From 85 to 90 feet a sample collected across the fault and its north wall assayed: Gold, trace; silver, 1.2 ounces per ton; copper, 4.21 per cent. This shoot apparently extends to surface, where the exposed rock is mineralized. An inclined hole was drilled from near the adit portal but was stopped short of the distance required to intersect the shoot in depth. (4) Farther south a small, partly oxidized body of mineralization was exposed temporarily in the south wall of the southern trench and apparently occurs in the western hangingwall of a northeasterly fault at its intersection with a flat fault.

[References: *Minister of Mines, B.C., Ann. Repts.*, 1960, p. 56; 1961, p. 56; 1962, pp. 61-62.]

Copper-Iron**Lela (Copper Basin Mines Ltd.)***

(49° 120° S.W.) Company office, Room 2, 615 West Pender Street, Vancouver 2. J. W. Gallagher, president; E. N. Rhodes Elliott, secretary. This company holds about 30 recorded claims in the Kay, Jap, and May groups on Kennedy Mountain, west of the Hope-Princeton highway, about 10 miles by road south of Princeton. The company also holds the adjoining Lela and Key West Crown-granted claims on option from The Granby Mining Company Limited. In 1960 work was done about one claim length west of the adjoining Copper King claim and included trenching and diamond drilling one hole in the vicinity of a showing reported to contain magnetite and copper mineralization. In 1962 work was done on the Lela claim and consisted of stripping the surface and diamond drilling two holes totalling about 300 feet in length.

The showing on the southern part of the Lela claim is in altered volcanic rocks of the Nicola Group, which are extensively intruded by syenodiorite porphyry and latite porphyry. The mineralized zone apparently trends northward and is enclosed on either side by faults, of which a western fault separates the mineralized rocks from westward-dipping schistose volcanic rocks and argillite, and one or more eastern faults are poorly exposed and trend either northward or northeastward. The rocks of the zone are strongly fractured and contain magnetite and partly oxidized chalcopyrite mineralization as veinlets and disseminations over a length of as much as 700 feet and a possible width of 200 feet. It is reported that the results of drilling indicate that the zone dips westward.

Copper**Ray (Copper Mountain Consolidated Limited)***

(49° 120° S.W.) Company office, 1500, 355 Burrard Street, Vancouver 1. R. Collishaw, president. This company holds by record 14 claims and fractions in the Ray group on the west bank of the Similkameen River about 10 miles by road south of Princeton. It also holds a number of claims in a separate block about 2 miles farther south known as the Deep Gulch property, on which no work was done in 1962 or 1963. The main showings on the Ray group are on the Ray No. 3 claim and Ray No. 4 fractional claim, which are partly a restaking of the cancelled Homestake No. 2 Crown-granted claim. The showings are north of the Red Buck mine and slightly more than 1 mile distant from the Copper Mountain mine, and they occupy a steep, southeast-facing rock bluff which overlooks the river at elevations ranging approximately from 2,750 to 2,950 feet. Work on the Ray group in 1962 and 1963 was done by an average crew of five men supervised by R. Collishaw. It included bulldozer trenching above the bluff, construction of a road to the foot of the bluff at an elevation of about 250 feet above the river and of several ladders down the face, sampling the exposures, and diamond drilling six flat or gently inclined holes from set-ups at the foot of the bluff.

The bluff is composed of strongly altered, dark massive volcanic rocks and dark-grey to pink intrusive dykes. The volcanic rocks probably are andesites or basalts of the Nicola Group in which most of the primary structure is obscured. Some of the rocks are breccias, as shown by their high content of semi-rounded igneous fragments. The rocks are traversed by persistent widely spaced joints, which may indicate the stratification and which dip to the north or northwest at about 35 degrees. Under the microscope the rocks have an irregular hornfelsic texture and their composition is clearly modified by alteration.

* By J. M. Carr.

Most of the dykes strike slightly to the west of north, dip fairly steeply westward, and are of syenodiorite porphyry. Each may be as much as 30 feet wide, and in some cases they occur close together. One distinctive pink dyke of latite porphyry about 10 feet wide strikes approximately north and dips west at about 60 degrees. Although less altered than the volcanic rocks, the dykes commonly possess altered margins. Together with the adjacent rocks, they are traversed by joints which range in trend from north-northeast to northwest and which dip mostly westward at fairly steep angles.

Rock alteration gives many rocks the appearance of a breccia. Veins, patches, and larger masses of altered rock are composed of a variety of minerals, including augite, biotite, pink orthoclase feldspar, white albite feldspar, grey scapolite, chlorite, epidote, calcite, and small amounts of quartz. Magnetite is unevenly disseminated and, since it occurs locally in fractures, is partly an alteration product.

Sulphide mineralization took place apparently after most of this alteration, and was followed by the deposition in places of the red zeolite, heulandite. Chalcopyrite and pyrite occur either together or separately as disseminations and fine seams in the altered rocks. Locally malachite and limonite have been produced by a limited degree of oxidation. Some of the best mineralization seen is close to the latite porphyry dyke, in drill core on the east side of the dyke and in outcrop on the west side. Apparently the mineralization, if in shoots, may trend approximately parallel to the dykes. Other mineralized outcrops contain small pods of disseminated material which are localized in more extensive zones of orthoclase alteration, whose trend is irregular. Well-defined faults were seen only in drill core as occasional sheared, sericitic sections. In outcrop near the bottom of No. 5 ladder, a gash vein of calcite and chloritic material with small amounts of sulphide has a north-northeasterly strike and a steep easterly dip.

PRINCETON

Copper

G.E., Regal (Climax Copper Mines Limited)*

(49° 120° S.E.) This group of 41 recorded claims is controlled by Climax Copper Mines Limited, a subsidiary of Silver Standard Mines Limited, 808, 602 West Hastings Street, Vancouver 2; mine office, Princeton. A. C. Ritchie, managing director; D. D. Campbell, consulting geologist.

It is situated on the east side of Allison Creek valley 2½ miles northeast of Princeton. The property includes the former Regal group, which is briefly described in the Annual Reports for 1918, pages 214, and 1929, page 278.

The working area with which this report is concerned comprises, from the Regal showing, about three claim lengths east-northeast by four claim lengths south-southeast.

The working area is underlain by volcanic rocks of the Nicola Group. North of the Regal showing the rocks are coal-bearing sediments of the Princeton Group. The exact position of the Nicola-Princeton contact is not known, but it is north of the Regal showings, and the gully crossing the G.E. 2 and G.E. 4 mineral claims is believed to be underlain by Princeton sediments.

The Nicola rocks are tuffs, breccias, and andesitic lavas, all altered to chlorite and carbonate and to a lesser degree to epidote and zoisite. It was found that almost all rock specimens would react to hydrochloric acid. Two small exposures of limestone occur toward the southeast side of the G.E. 3 claim, and a volcanic breccia exposed in a rock bluff near the northeast corner of the G.E. 16 claim con-

* By N. D. McKechnie.

tains a high proportion of limy fragments. In a closely trenched area on the G.E. 47 claim a crystalline rock is exposed which is reddish in colour and coarser grained than the lavas. It has the appearance of an intrusion, but thin-section examination shows it to be essentially of the same composition and degree of alteration as the andesitic lavas. No definitely intrusive relations were observed, and this rock is presumed to be a phase of the Nicola lavas. No rocks within the working area were recognized as intrusive.

Strikes and dips on bedding are not readily apparent; limited information indicates a general strike of south-southeast to southeast and dips of 40 to 55 degrees northeastward. On the eastward side of the area, strikes nearly east-west and dips steeply north were observed.

The area is crossed by two and possibly four faults. The best exposed extends south 20 degrees east from the Regal showing and is traced in trenches and a road cut across the G.E. 3, G.E. 6, and into G.E. 16 claims for a strike length of 3,200 feet. It is about 100 feet wide and the dip is near vertical. The second fault is exposed in trenches on the G.E. 7 and G.E. 8 claims. It strikes south 5 degrees west, dips nearly vertical, is about 50 feet wide, and has an apparent length of 2,200 feet. Swampy ground on the east side of the G.E. 5 claim is about on strike and may indicate the presence of this fault some 2,500 feet south of the last exposure. The existence of faults between these two is shown by sheared ground in, respectively, a trench on the side of the gully on the G.E. 2 claim and in a short adit by a jeep-road near the southward boundary of the same claim. The short exposures at these workings do not permit reliable dip and strike readings, so it is not known whether or not they may be on the same fault. Sheared rock also is exposed in trenches on the G.E. 7 and G.E. 9 claims near their joint boundary.

Mineralization consists of very sparsely disseminated chalcopyrite, pyrite, and bornite, chiefly in the original Regal showings on the G.E. 4 claim and in the reddish andesite in the trenched area of the G.E. 47 claim. Specular hematite is fairly common, mostly as disseminated grains, and some of the andesite is slightly magnetic due to magnetite. Some very fine-grained metallic mineral was identified as chalcocite. Native copper was seen in a piece of drill core in hole No. 4. Malachite and azurite occur occasionally in the faults. The most prominent occurrence is in the Regal showing. The writer found no primary copper sulphides, which appeared to follow structures in the faults or which were associated with them.

In an effort to obtain some data on a possible source of the secondary copper minerals in the faults, 11 specimens were taken along exposures on the jeep-road crossing the G.E. 8 claim. The rocks are cut by the south 5 degree west fault described above; the rocks on the eastern side are altered andesite; those on the western side are tuffs. The specimens were tested by semi-quantitative spectographic analysis. Of the 11, five showed the presence of copper in fractions of one-tenth of 1 per cent. One tuff specimen was included in the five. Chalcopyrite was identified in one thin-section in finely brecciated andesite; in the others the copper appeared to occur solely as chalcocite.

Copper-bearing volcanic beds, then, may be in part the source of secondary copper minerals in the faults. The secondary minerals are noticeably more evident in the Regal showing than elsewhere, and this may be indicative of a stronger primary mineralization nearby.

The group southward has been quite well prospected; that to the north, perhaps under the Princeton sediments, may be worth more attention.

In 1963 exploration work consisted of a geophysical survey, geological mapping, and an induced potential survey, and a total of 3,535 feet of diamond drilling.

Numerous trenches were dug in conjunction with the geological mapping. A crew of five men was employed under the direction of A. C. Ritchie.

CAWSTON

Molybdenum-Copper**King Edward
(Friday Mines
Limited)***

(49° 119° S.W.) Company office, 230 West Broadway, Vancouver 10. N. H. McDiarmid, president; G. E. Leonard, geologist. This property consists of 14 recorded mineral claims, four of which were held by option from B. Williams, of Keremeos. The claims lie 7 miles south of Keremeos and about 3 miles west of the Similkameen River, and are located on Susap Creek. Access was by pack-trail. Four short X-ray diamond-drill holes were drilled. Bulk sampling was done on the upper adit. Geophysical and geological surveys were carried out. A crew of four was employed.

Gold-Silver**Horn Silver
(Santos Silver
Mines Limited)***

(49° 119° S.W.) Mine office, Box 217, Keremeos. C. J. Cryderman, resident engineer. The property includes the Horn Silver and Silver Bell Crown-granted claims, and seven recorded claims—the Silver Bell 1 to 5 and Silver Bell 7 and 8. The property is on the east slope of Richter Mountain, 16 miles south of Keremeos and 4 miles north of the International Boundary. Access is by road from Keremeos to a point near the foot of Richter Mountain; the adit portals at the 2,622-foot elevation are reached by a steep jeep-road approximately 1 mile long. A total of 300 feet of surface diamond drilling was completed in 1963. A programme of resampling was carried out. A crew of three men was employed.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1928, p. 258; 1958, p. 32; 1960, pp. 58–60.]

OLIVER

Gold-Silica**Conway Mines***

(49° 119° S.W.) Mine office, Box 221, Oliver. Partnership, R. Conrad and G. McKay. The property consists of the three Conway claims on the north shore of Sawmill Lake, approximately 5 miles northwest of Oliver. Some stripping was carried out on a mineralized quartz vein, and one car of siliceous ore was shipped to the Trail smelter. A crew of two men was employed.

Smuggler*

(49° 119° S.W.) Mine office, Box 106, Okanagan Falls. Owner, K. G. Ewers. This old property, of seven recorded claims and the leased Powis Crown-granted claim, lies just west of the golf course, about 4 miles southwest of Oliver. A small amount of stripping was done and some bulk material stockpiled with the intention of shipping a silica product to Trail. Two men were employed.

OSOYOOS

Copper**Gem, Dividend-
Lakeview†**

(49° 119° S.E.) The Gem group, consisting of 14 recorded mineral claims, 3 mineral leases, and the Gem Crown-granted claim, is owned by Kenneth Butler, R.R. 1, Osoyoos. It is situated about one-half mile west of Osoyoos Lake at

* By David Smith.

† By N. D. McKechnie.

the International Boundary. It surrounds on three sides the old Dividend-Lakeview property, which to 1949 had produced 122,636 tons of gold-copper ore.

The geology of the region is shown on the following Geological Survey of Canada maps: Map 341A, Keremeos, 1940; Map 538A, Kettle River West Half, 1940; Map 15-1961, Kettle River West Half, 1961. The geology of the Dividend-Lakeview claims is described and illustrated in Geological Survey of Canada Memoir 179, 1935, pages 20 to 26.

The claims to the east, northeast, and southeast of the Dividend-Lakeview group are underlain by sedimentary and volcanic rocks of the Kobau Group, of probable Cache Creek age. To the south and southwest of the Dividend-Lakeview, the Kobau rocks are intruded by a dioritic rock to which no name has been given; it is described in Memoir 179 as "altered diorite." North of the Dividend-Lakeview the Kobau is intruded by diorite of the Osoyoos batholith, and this in turn is intruded by a younger granite not described in Memoir 179.

In the localities examined by the writer, the Kobau rocks are either skarns composed of a mosaic of quartz and garnet, with subordinate calcite, epidote, and hematite, or are volcanic flow rocks. The flow rocks are highly altered andesites and basalts now composed of a matrix of sericitized and carbonatized feldspar laths which may appear only as vague outlines, and of ferromagnesian minerals now wholly changed to chlorite, calcite, and iron oxide. Epidote and zoisite are present to prominent. Calcite stringers cut all other minerals.

The "altered diorite" in hand specimen is greenish-grey in colour and has a somewhat mottled appearance. It is not everywhere easily distinguished from altered Kobau volcanic rocks. In thin-section the rock is seen to be finely brecciated, the plagioclase highly altered to saussurite, the pyroxene wholly altered to chlorite, carbonate, and iron oxide. The relict texture is that of a coarse-grained holocrystalline rock and is different from that of the Kobau volcanic rocks.

The Osoyoos diorite here is grey to greenish in colour, medium grained, and with, locally, a porphyritic appearance due to prominent grains of secondary calcite. The feldspars are saussuritized, and the ferromagnesian minerals are wholly altered to chlorite and carbonate. These minerals are more or less brecciated, and are veined and partially replaced by fresh orthoclase and quartz.

Mineralization consists of quartz, pyrite, chalcopyrite, arsenopyrite, and magnetite in the Kobau volcanic rocks and the "altered diorite." Molybdenite occurs in the granite that is intrusive into the Osoyoos diorite.

On the Manx Crown-granted claim a pit exposes a shear 2 feet wide striking north 70 degrees west and dipping 75 degrees southwestward; the hangingwall is quartz-garnet skarn and the footwall is altered andesite. The shear is mineralized with pyrite and chalcopyrite. About 50 feet to the southwest a parallel shear is exposed, the footwall of which is altered andesite and the hangingwall is the "altered diorite." This shear is mineralized with massive pyrite and arsenopyrite veined by magnetite. To the southeast a shallow depression striking north crosses the strike of these shears, and although outcrops are numerous and some magnetite occurs on the east side of the depression, no certain indication of the presence of the shears was found beyond it. East to southeast of the two pits a distance of about 1,000 feet and still on the Manx claim, a pit in altered andesite exposes a shear 10 feet wide striking south 85 degrees west and dipping 55 degrees north. The shear contains magnetite stringers.

On the Chukar No. 5 claim, a pit in altered basalt exposes a mineralized fault 5 feet wide; strike north 15 degrees east and dip 50 degrees eastward. The rock in the fault is very chloritic but is not notably schistose. Mineralization consists

of quartz and chalcopyrite; most of the chalcopyrite occurs in the quartz. The fault is in line with a topographic depression which is traceable for about 1,000 feet.

A small shear lies near and to the west of the fault; it is about 10 inches wide, strikes north 20 degrees east, and dips 45 degrees eastward; it may be part of the same zone.

South of these showing, and still on the Chukar No. 5 claim, a copper-stained quartz vein strikes south 85 degrees west and dips 60 degrees north. It ends here against an unmineralized fault striking north 75 degrees west and dipping 45 degrees northward. The vein is exposed on the west side of a deep gully trending north 20 degrees east.

On the Chukar No. 4 claim, a 3-foot-wide zone of quartz stringers striking north 30 degrees west and dipping 50 degrees northeastward is in altered andesite exposed in an old crosscut. The quartz carried chalcopyrite and pyrite.

On the Gem Crown-granted claim, disseminated molybdenite occurs in a granite dyke striking south 85 degrees west and dipping irregularly near vertical. The wallrocks are Osoyoos diorite. The dyke is from 3 to 10 feet wide and is exposed for a length of about 40 feet. The dyke pinches out eastward, and a second dyke is exposed for a few feet of length in echelon to the left. A third dyke is exposed in the south wall of the first, striking north and dipping 50 degrees west.

In 1963 an option was taken by Sheep Creek Mines Limited, 490 Baker Street, Nelson, on the Gem group and also on the Dividend-Lakeview group, owned by D. P. Simpson, of Osoyoos. Exploration was conducted on the combined property under the direction of D. M. Edwards. Magnetometer and self-potential surveys were carried out, and 15 holes totalling 2,404 feet were drilled.

WESTBRIDGE

Gold

Amcana Gold Mines Limited*

(49° 118° N.W.) Company office, 4181 Miller Street, Vancouver 12. H. A. Thielman, managing director. This company holds 20 claims and fractions, including the Barnato Crown-granted claim, on Horseshoe Mountain. The property is reached by 20 miles of good logging-road up the Kettle River from Westbridge and then by 5 miles of mine road to the Amcana camp. Work done in 1963 consisted of stripping by bulldozer and diamond drilling totalling 660 feet. A crew of three men was employed under the direction of H. A. Thielman.

[Reference: *Minister of Mines*, B.C., Ann. Rept., 1938, pp. D 17-D 22.]

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 4 recorded claims. Production for 1963 was obtained from the 2850, 2900, and 3000 levels, the main haulage being the 2900 adit. Development work underground has been continued on all levels. In 1963 the normal production of 75 tons per day was raised to 95 tons per day, of which 87 tons was put through the flotation cells and the remaining 8 tons was sorted and discarded as waste. This has been accomplished by the introduction of

* By David Smith.

a washing and picking belt in the crusher-room. Some further exploration and diamond drilling was carried out on the Sally and underground on the Bell.

The following is a summary of operations for 1963: Drifting and crosscutting, 1,586 feet; raising, 397 feet; diamond drilling, 8,623 feet; a total of 2,851 tons of lead and zinc concentrate was shipped to Trail. An average crew of 40 men was employed, of whom 22 worked underground.

PHOENIX

Copper-Gold-Silver

Phoenix Copper Company Limited*

(49° 118° S.W.) Company office, 1111 West Georgia Street, Vancouver 5; mine office, Phoenix. L. T. Postle, president; P. R. Matthew, manager; J. S. Kermeen, mine superintendent; G. Hingley, mill superintendent. The property consists of 111 claims, of which 55 are Crown granted, 43 are recorded, and 13 are held under four leases. Twenty-six Crown-granted claims were purchased during the year. These include the Rawhide, Brooklyn, and Stenwinder, former producing mines adjoining Phoenix.

All mining is by open-pit method, with production coming from three pits—Old Ironsides, 478,875 tons; Snowshoe, 75,196 tons; and Idaho, 108,724 tons. The total ore mined, 662,795 tons, required the removal of 2,167,073 tons of waste rock.

Three shovels were used in 1963, with dipper capacities of 1½ cubic yards, 2½ cubic yards, and 4½ cubic yards. Two 20-ton Euclid trucks and two 35-ton Haulpak trucks were used for hauling ore and waste. Drilling was done mainly with an Ingersoll-Rand Drillmaster, which proved quite successful in drilling holes in caved ground and back filled stopes. Gardner-Denver air-tracs were also used for drilling. Contractor's trucks were used only as required. Blasting is done with AN/FO, which is mixed on the property.

A power-line was extended 2,000 feet from the old Brooklyn workings to a small lake north of Phoenix. The diesel pump formerly used at this lake was replaced with an electric pump. A three-bay repair-shop was constructed in 1963 to service trucks, shovels, and bulldozers.

The mill treated 645,083 tons of ore during 1963, all concentrates produced being shipped to Japan. A propane-fired drier was used to reduce the moisture content of the concentrates to below 7 per cent. A 15-by-90-foot addition to the flotation section of the mill was constructed. Six No. 30 Denver cells were added to the flotation section. Three 12-inch hydro-cyclones were added to the grinding circuit to increase classification.

A total crew of 105 men was employed, as follows: Surface, 15; open pit, 40; mill, 33; and staff, 17.

ROSSLAND

Copper-Gold

Velvet (Mid-West Copper & Uranium Mines Ltd.)*

(49° 117° S.W.) Company office, 201, 535 Howe Street, Vancouver 1; mine office, Rossland. R. W. Liversidge, president; A. G. Ditto, mine manager. The property is on the western slope of Sophie Mountain, 11 miles from Rossland on the Rossland-Cascade highway.

On No. 8 level 350 feet of drifting was done, and a raise 200 feet long was driven to the 706 orebody. The No. 7 level was extended a total of 150 feet, and subdrifting under the 706 orebody amounted to 220 feet during 1963.

* By P. E. Olson.

All production came from the 706 orebody and amounted to approximately 7,000 tons. Stopping is done by the open-stope method, and broken ore is scraped to chutes and loading points by air-operated slushers. The dip of the orebody ranges between 10 and 45 degrees.

Diamond drilling amounting to 1,210 feet was done from No. 4 level to test extensions of the 706 orebody.

The company concentrator treated 5,100 tons of ore during 1963 and the concentrates were shipped to Tacoma, Wash. Employment averaged 11 men, most of whom lived in Rossland.

TRAIL

Gold

W.D.* (49° 117° S.W.) The W.D. Mining Company Limited, owned by F. Donnelly and Associates, of Trail, operated the W.D. mine until June, 1963, after which the mine remained closed. The property is on the west side of the Columbia River, 5 miles south of the old Trail bridge along the Casino road.

Development consisted of 105 feet of crosscutting and 75 feet of raising. Stopping was done on the No. 1 vein between No. 1 and No. 3 levels. One stope which was abandoned by Casino Gold Mines Limited in 1962 was extended about 40 feet.

A total of 2,741 tons of ore was shipped to the Trail smelter, grading approximately 0.33 ounce gold per ton. Work was done on a part-time basis by three partners in the company.

NELSON

Gold-Silver

Venango (Venango Gold Mines Limited)* (49° 117° S.E.) D. H. Norcross, of Nelson, has the Venango under lease. This property is located beside the Kenville mine on Eagle Creek. The portal on the No. 2 vein was re-opened and the main drift was extended 38 feet. A raise was driven 48 feet from the drift face. A total of 63 tons of gold ore was recovered from this work and shipped to the Trail smelter. All work was done by Mr. Norcross.

YMIR

Gold-Silver-Lead-Zinc

Yankee Dundee (Cayzor Athabaska Mines Limited)* (49° 117° S.E.) Company office, 3669 West 35th Avenue, Vancouver 13. J. D. Lippmann, president. Capital: 3,500,000 shares, no par value. D. C. Smith, exploration engineer. Cayzor Athabaska Mines Limited has the property under option from Yankee Dundee Mines Limited.

All work done in 1963 was on the Yankee Girl vein in the Wildhorse adit, which is at an elevation of 2,800 feet. Drifting on the vein amounted to 415 feet, 315 feet of which was eastward and 100 feet westward. Diamond drilling amounted to 725 feet of EX core from two holes drilled southeastward from the southern section of the Wildhorse adit.

Work started on July 3rd and was completed on November 30th. During that time an average crew of eight men was employed.

* By P. E. Olson.

SALMO

ERIE CREEK (49° 117° S.E.)

Gold**New Arlington***

This property is leased by G. D. Fox, 3307 Dahlia Crescent, Trail, from J. Russell, Borrega Springs, Calif. The property is on Rest Creek, 7 miles by road from Salmo. The lessee and his two partners, Don and Ron Tjader, drove about 90 feet of new crosscut in the vicinity of the old "40-foot" level, from which about 90 tons of shipping ore was sorted. A total of 1,357 tons of ore, most of which was sorted from old dumps, was shipped to the Trail smelter. The gold content was 348 ounces.

SHEEP CREEK (49° 117° S.E.)

Silica**Kootenay Belle***

K. Belle Enterprise Company Limited, Linden, Alta., leased the dumps of the old Kootenay Belle mine from M. M. Arishenkoff, of Shoreacres, from January to September. This company hauled 4,923 tons of dump material to the Trail smelter for flux; the gold content is paid for in addition to the silica. After September, Brian's Transfer, of Trail, hauled 1,283 tons of dump material to the Trail smelter.

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. D. S. Campbell, property superintendent; R. R. McMichael, mine superintendent; P. Conder, mill superintendent. The H.B. mine is on the west side of Aspen Creek, with the main camp on the north side of Sheep Creek, 7 miles by road from Salmo. The ore occurs as galena-sphalerite replacement of dolomite. The main production comes from the No. 1 orebody, in which the ore is mined by long-holing from sublevels located on the ore-boundary and is scraped to ore-passes from draw points in scam drifts. The total long-hole footage for the year was 74,876 feet, and this accounted for 79 per cent of the tonnage mined. The remainder is mined in flat-lying orebodies named the X-1, X-2, and No. 4 orebodies. Mining in these areas is done by slashing and benching with jacklegs, using a system of panels and pillars to maintain roof support. Development: Drifting and crosscutting, 1,804 feet; sublevels, 2,345 feet; raising, 2,542 feet; total, 6,691 feet. Underground diamond drilling was 12,536 feet, and surface diamond drilling was 5,065 feet.

AN/FO explosive was used in all types of stoping, including long-hole, and amounted to 74 per cent of explosives used.

The concentrator treated 473,099 tons of ore in 1963, an average of 39,426 tons per month. The average number of men employed was 116, 50 of whom were employed underground.

There was one lost-time accident over six days in 1963, the first in almost six years. The mine-rescue team competed in the West Kootenay competition.

* By P. E. Olson.

IRON MOUNTAIN (49° 117° S.E.)

Lead-Zinc**Jersey (Canadian Exploration Limited)***

Head office, 700 Burrard Building, Vancouver; mine office, Salmo. R. G. Weber, mine manager; J. W. Robinson, mine superintendent; R. W. Gould, mill superintendent. This company is a wholly owned subsidiary of Placer Development Limited. The property is reached by two roads which leave the Nelson-Nelway highway 4 and 4½ miles respectively south of Salmo, the north road being the main access road. The lead-zinc concentrator is beside the Nelson-Nelway highway and is served by a conveyor system from the underground crusher at the mine. The mine, offices, and camp are located on the summit between Sheep Creek and Lost Creek.

All production came from the Jersey mine. The majority of production came from relatively thin, flat, although sometimes locally steeply dipping beds, and is being mined by conventional open stoping with jacklegs and slushers above the trackless mine, and is hauled from chutes or loading points to the coarse-ore bins on the surface. The trackless production was 348,378 tons; the remainder was 1,969 tons from the track mine, 9,051 tons from the open pit, and 12,973 tons from pillar recovery. Mining from the track mine was completed, and all rail, pipe, and other services were removed in 1963.

The pillar recovery programme is continuing on a retreating basis. Pillar drilling has been standardized with the use of timber stagings, the construction of which has been facilitated by the use of prefabricated steel corner connectors. Stagings 40 feet in height with five 16- by 16-foot decks have been erected and dismantled with a minimum of effort.

Total development was 7,680 feet, consisting of 206 feet of 16- by 16-foot drifting, 6,776 feet of 5- by 7-foot subdrifting, and 698 feet of 6- by 6-foot raising.

AN/FO explosive was in continuous use during the year and constituted 70 per cent of the total explosives used.

The surface exploration programme started in 1962 on the Truman and TK groups was completed in 1963.

The concentrator treated 368,673 tons of ore during 1963. Concentrates were shipped to the Bunker Hill smelter at Kellogg, Idaho, and to the Trail smelter.

A mine-rescue team, captained by J. F. Ablett, competed in the West Kootenay Mine Rescue Competition at Nelson. The average number of men employed, including staff, was 167, of whom 68 worked underground.

NELWAY

Lead-Zinc**Reeves MacDonald Mines Limited***

(49° 117° S.E.) Company office, 410 Metropolitan Building, 837 West Hastings Street, Vancouver 1; mine office, Remac. L. M. Kinney, Metalline Falls, Wash., general manager; F. R. Thompson, manager; W. Pollock, mine superintendent; J. M. McDermid, mill superintendent. Capital: 3,000,000 shares, \$1 par value. The Reeves MacDonald mine is on the Pend d'Oreille River, on the Nelway-Waneta road 4 miles west of Nelway. Lead-zinc replacement orebodies in limestone have been developed from the 1900 main haulage level.

The operation worked at full capacity until May 5, 1963, when strike action closed the plant. The dispute was settled on December 20, 1963, and limited crews started work on December 23rd to rehabilitate the mine. Production was not

* By P. E. Olson.

resumed in 1963. Prior to the strike the operation employed a total of 113 men, 49 of whom were engaged underground.

Mining is done with long-hole machines, drilling down-holes from horizontal slots. These slots are usually slashed to the ore outline and are at 50-foot intervals. On deeper levels, instead of slashing horizontal slots, hanging and footwall subdrifts have been driven and the long-hole drilling is done from the sublevels. In all cases a vertical slot is taken out along the main longitudinal pillar and the down-holes are blasted toward the vertical slot. Drilling is done with 2½-inch (39,076 feet) and 3-inch (13,123 feet) tungsten carbide bits.

Total development was 2,360 feet, consisting of 791 feet of primary drifting, 570 feet of sublevels, 695 feet of ore-pass raising, and 304 feet of slot-raising. In addition to drilling blast-holes, long-hole machines were used to drill 1,477 feet of test-holes.

A total of 145,966 tons of ore was milled prior to the strike. Zinc concentrates were shipped to the Trail smelter, and lead concentrates were shipped to the smelter at Kellogg, Idaho.

SUMMIT CREEK

Gold

Bayonne (Bayonne Mine Ltd.)*

(49° 116° S.W.) Company office, 404, 409 Granville Street, Vancouver 2. W. E. Garnett, president; W. G. Hainsworth, consulting geologist in charge of operations. Except for intermittent work by lessees, the property has not been worked since 1946. A new road, 5.6 miles long, was built from the north side of the Salmo-Creston highway, starting 4.7 miles east of the summit. Mine buildings, damaged beyond repair by snow loads, were demolished, and the 24-man bunk-house was renovated. New ore-bins were constructed, and concrete footings were poured to accommodate a new mill building. The No. 8 main vein level portal was retimbered, and the track gauge was widened from 18 inches to 24 inches. During road construction 19 men were employed, but the number was reduced to four by the end of 1963.

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; N. Anderson, mine superintendent; T. F. Walton, mill superintendent. This property is at Riondel, on a small peninsula 1½ miles long, on the east shore of Kootenay Lake, 6 miles by road north from the Southern Trans-Provincial highway at Kootenay Bay ferry-landing. The mine is serviced by No. 1 shaft, inclined at 35 degrees. The levels are at intervals of 150 vertical feet. All levels service the Kootenay Chief zone on the south, with No. 2 level and No. 5 level extending north to the Bluebell and Comfort zones.

Mining methods are open stoping and cut-and-fill stoping with deslimed tailings. Backfilling totalled 87,783 cubic yards, including 83,675 cubic yards of tailings and 4,108 cubic yards of waste rock. Some fill was placed in open stopes to aid in pillar recovery.

When it was found from diamond drilling that excessive thermal water would be encountered, the No. 9A level was abandoned and the No. 2 winze was sealed off

* By P. E. Olson.

with a concrete bulkhead. All equipment and material were salvaged from the area before it was allowed to flood.

Development work done in the three mining zones totalled 11,443 feet. Drifting and crosscutting amounted to 6,273 feet and raising amounted to 5,170 feet.

Ventilation of the Kootenay Chief area of the mine was maintained at 200,000 cubic feet of air per minute, and the Comfort and Bluebell zones were provided with 70,000 cubic feet per minute. Auxiliary fans of the aerofoil type are used to supply ventilation within the mine as required. Regular tests are made to determine the level of carbon dioxide gas in the mine air. Stand-by power consisting of three diesel units, two 375-kva. and one high-speed 187.5-kva., are installed at the mine. In the event of power outages these units will supply power to the main fans, some auxiliary fans, No. 6 level hoist, and essential pumping.

On No. 5 level the north drift was extended into the limestone to explore well to the north of any present workings. Ore which was previously drilled from the surface will be explored from this drift. Diamond drilling totalled 13,607 feet. Drilling was for exploration purposes and for safety holes ahead of drifting.

Production for 1963 was 256,484 tons. This ore came from cut-and-fill stopes (45 per cent), open stopes (30.8 per cent), pillars (10.2 per cent), and development (14.0 per cent).

Mine-rescue and first-aid classes were held. Two teams competed in the West Kootenay Mine Rescue Competition at Nelson. The team captained by P. Rowan won this competition and later won the competition for the Provincial championship at Victoria.

AINSWORTH (49° 116° N.W.)

Silver-Lead-Zinc

Crown and Anchor*

These claims are owned by D. H. Norcross, of Nelson, who has worked the property since early 1962. The claims straddle the ridge between Cedar Creek and the south fork of Woodbury Creek. The workings are accessible by 4 miles of old logging-road which leaves the Ainsworth-Kaslo road 2 miles north of Ainsworth. In 1962 a shipment of 13 tons of ore to the Trail smelter contained 1,253 ounces of silver, 2,445 pounds of lead, and 1,025 pounds of zinc. This ore came from a discovery on the Crown, which has since been exposed by open cuts. In 1963 an old portal was cleaned out and 12 feet of raise driven in the mineralized zone.

KASLO (49° 117° N.E.)

Silver-Lead-Zinc

Utica (Peerless Canadian Explorations Limited)*

Company office, 906, 357 Bay Street, Toronto; mine office, Kaslo. L. Dillman, president; W. W. Tyler, mine manager. This company has an option on 17 claims of the Utica Mine group. The mine is located at the head of Twelve Mile Creek, about 15 miles west of Kaslo. Twenty-three men were employed at the mine from April to October. Along the West vein on No. 4 level 600 feet was reconditioned, and 150 feet of raises were driven to test the vein in this area. On No. 5 level 65 feet of crosscut was driven. To test the East vein on this horizon, 750 feet of EX diamond drilling was done from No. 5 level. Five surface diamond-drill holes amounting to 700 feet were put down on the Sol and Andrew J veins.

* By P. E. Olson.

RETALLACK-THREE FORKS

*Silver-Lead-Zinc***Wellington
(Blue Star Mines
Limited)***

(50° 117° S.E.) Company office, 400, 837 West Hastings Street, Vancouver 2; mine office, Retallack. E. L. Borup, president; C. E. Lind, manager. The property is north of Retallack, at an elevation of 4,300 feet, and is reached by 2.3 miles of road which leaves the Kaslo-New Denver highway at Retallack. The Matheson adit was extended 869 feet in 1963 to a total length to date of 2,174 feet. On the Wellington vein 298 feet of drifting was done. On the Whitewater vein 400 feet of drift was reopened and 98 feet of raise was subsequently driven. Three hundred and fifty feet of open cut was put in on the Whitewater vein to trace the vein extensions.

Early in 1963 a heavy flow of water encountered in the Matheson adit flowed for six months before returning to normal. The company employed an average of four men in 1963.

**Antoine (Antoine
Silver Mines)†**

(50° 117° S.E.) Company office, Box 509, Kaslo. This is a private company of L. N. Garland and Associates. L. N. Garland is mine manager. The property consists of the Antoine group of five Crown-granted and three recorded mineral claims. The Soho group of eight Crown-granted mineral claims, which adjoins the Antoine, is held under option. The property is in an alpine basin on the western shoulder of Reco Mountain and is reached by about 9 miles of road from the old Rambler siding on the New Denver-Kaslo road, about 8 miles from New Denver. In 1962 a road was built to the property from the Rambler mine road; this was improved in 1963 and the Rambler mine road was widened in several places.

Work was continuous throughout 1963, employing four or five men. Supplies for the start of 1964 were hauled to the mine during the latter part of 1963 in order to avoid snow-ploughing. A total of 77 tons of sorted ore was shipped to the Trail smelter. Gross metal content: Silver, 13,315 ounces; lead, 72,410 pounds; zinc, 26,513 pounds. A total of 220 feet of drifting and crosscutting and 40 feet of raising was done in 1963. A dry-room and an ore-sorting building were constructed.

It was reported that L. N. Garland purchased control of the company late in 1963.

The Antoine is one of the oldest claims in the district. Shipments of hand-sorted ore from 1895 to 1927 totalled 1,541 tons, with an average content of 156 ounces of silver per ton and 36.3 per cent lead. The workings consist of an inclined shaft connecting at 150 feet vertical depth with an adit level known as No. 5. There is a short winze level 35 feet below No. 5, and a 240-foot sublevel above, known as No. 4 level. The rocks are slaty sediments, porphyry dykes, and one lamprophyre dyke. Figure 6 shows the ore zone on No. 5 level. Production has come from a northeast-striking vein dipping 65 degrees to the southeast, mineralized for a length of 230 feet on No. 5 level. Most of the ore has been mined in the footwall of a 2- to 5-foot lamprophyre dyke that follows the vein for a distance of about 165 feet. At the innermost end of the level the vein rolls flatly to the east into the bedding. At the southwest end of the ore zone the vein continues in part as a steeply dipping fracture, but a good deal of the vein structure flattens and passes to the west into the bedding.

A steep northeast fracture, locally mineralized, lies about 40 to 50 feet in the hangingwall of the vein. It has been followed for a total distance of 200 feet. It is

* By P. E. Olson.

† By M. S. Hedley and P. E. Olson.

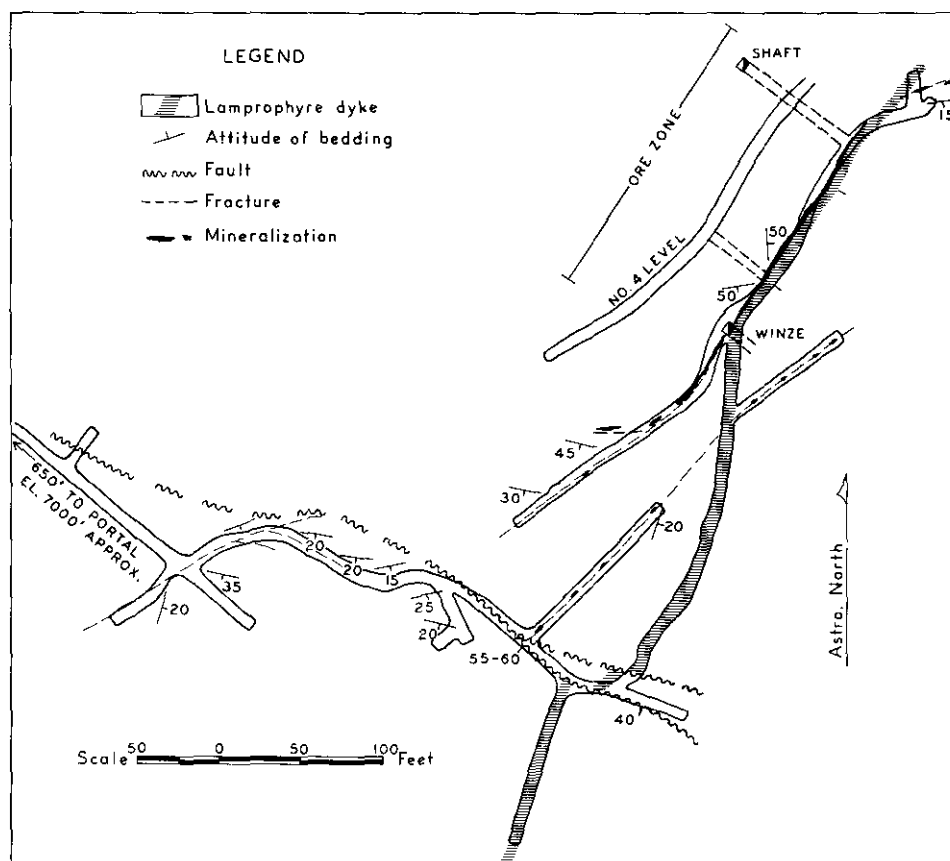


Figure 6. Geology of the Antoine ore zone.

one of a set of joints prominent in the vicinity, other members of which, not mineralized, are to be seen underground.

Continuation of the vein to the southwest is a matter of doubt. A southwest-dipping fault zone offsets the lamprophyre dyke a distance of 40 feet, but it should not be assumed that the vein is offset a similar distance by the same fault. The vein is not necessarily a single, continuous fissure, but is, rather, a locus of movement (probably no more than a few feet) that follows or is deflected into local structures. Outside the ore zone the vein movement meets the bedding at an acute angle and rolls into it, becoming distributed among the planes of bedding rather than along a single fracture. It is a significant fact that mineralization occurs where the vein movement is channelled along a joint, particularly in a situation where the sedimentary rocks are folded or are intruded by porphyry dykes. In such situations the competency of the fissure walls is increased, and, because the joint direction is one of regional tension, there is opportunity for the walls to separate and permit the formation of breccia and vein filling rather than of shearing and gouge.

The Antoine ore zone is in an enlarged member of the regional joint set in a situation where there are porphyry dykes, rolls in the bedding, which is in general flatter than the vein, and a lamprophyre dyke that locally occupies the same fissure as the vein. There is not necessarily a continuous vein to be found on No. 5 level

(or at any single horizon), but an apparently unmineralized fracture seen 775 feet from the portal of the adit may be the equivalent of the Antoine vein.

Mr. Garland discovered ore in the hangingwall of the lamprophyre dyke on No. 4 level. The winze level was extended and presumably will provide most of the immediate ore. It was water filled at the time of examination in July.

SANDON

Silver-Lead-Zinc

**Ruth-Hope
(Silmonac Mines
Limited)*** (49° 117° N.E.) Company office, 808, 602 West Hastings Street, Vancouver 2; mine office, New Denver. During the year this company was formed from the Silmonac Syndicate, which previously operated the property. Violamac Mines Limited continues to manage the venture; J. C. Black, mine manager. The company has control of a group of 59 Crown-granted claims and fractions near Sandon, formerly held by Kelowna Exploration Limited. In addition, some special rights pertaining to the Carnegie holdings are held by Silmonac Mines Limited. The mining plant, which is at the portal of the Ruth No. 5 level, is reached by 2 miles of road from Sandon. Sixteen men were employed at the mine throughout 1963, performing the work shown below:—

	Ft.
Drifts and crosscuts.....	3,022
Box-holes and raises.....	127
Diamond drilling (A core).....	3,708

The Company was formed chiefly to explore the ground west of the Silversmith-Ruth orebodies on the Ruth No. 5 level (elevation, 4,025 feet). The main Ruth-Silversmith-Slocan Star lode passes through the old Hope working (now caved) at an elevation of about 4,900 feet, and the prime target was the downward projection of the lode beneath the Hope workings.

It was presumed that the lode, west of the Ruth No. 5 orebodies, would be found to be offset to the north on one or more northwesterly trending fault zones, much as the lode is offset in the old Ruth and Silversmith workings (*see* Bull. No. 29, *Geology and Ore Deposits of the Sandon Area*, 1952, pp. 103–116). Neither the attitude nor the position of such fault or faults was known, nor was the position of the lode, in wholly unexplored ground. The work started early in 1963 and demonstrated the difficulty of geological projection in this part of the Slocan. The lode was finally encountered in September, in an unforeseen situation, and was followed west by drift for about 600 feet by the end of 1963. The lode was reported to be mineralized but not to constitute ore.

Work began 100 feet from the Kelowna Exploration face of 1946 (*see* Fig. 14, Bull. No. 29). A crosscut was driven 600 feet northwestward and then 250 feet westward without encountering the lode. The distribution of “porphyry” was not as expected. After some diamond drilling it was decided that this new face must be some distance in the footwall (north) of the lode. Consequently a return was made to the Kelowna Exploration face, and a general westerly course was followed for a total distance of about 1,650 feet. A large fault zone was encountered 250 feet from the start of this second drive, dipping 50 degrees to the southwest. This fault has produced an apparent offset of the lode of possibly as much as 700 feet, although the position of neither of the fault-lode intersections has yet been demonstrated.

* By P. E. Olson and M. S. Hedley.

**Silversmith,
Richmond-Eureka,
etc. (Carnegie
Mining Corpora-
tion Limited)*** (49° 117° N.E.) Company office, 416, 25 Adelaide Street West, Toronto; mine office, New Denver. A. W. White, president; J. C. Black, manager. Capital: 5,000,000 shares, no par value. This company is controlled by Violamac Mines Limited. The property consists of 46 Crown-granted and 6 recorded claims and fractions, which include the Silversmith, Slocan Star, Richmond-Eureka, Ruth-Hope, and Slocan King mines on Sandon Creek, south of Sandon.

Lessees E. Perepolkin and son shipped 23 tons of crude ore to the Trail smelter and 463 tons to the Carnegie mill. Concentrates produced from the latter were 25 tons of lead concentrate and 81 tons of zinc concentrate.

Lessees E. Perepolkin and J. Irwin shipped 223 tons of ore to the Carnegie mill, from which 27 tons of lead concentrate and 10 tons of zinc concentrate were produced.

During 1963 the Carnegie mill treated a total of 1,754 tons of ore and produced 159 tons of lead concentrate and 287 tons of zinc concentrate.

Diamond drilling on Carnegie ground amounted to 2,103 feet of A core in six holes and employed two men for about six months.

**Wonderful (Silver
Ridge Mining
Company Limited)*** (49° 117° N.E.) Company office, 373 Baker Street, Nelson; mine office, Sandon. H. F. Magnuson, president; R. A. Grimes, managing director. Capital: 5,000,000 shares, 50 cents par value. The property is about 1 mile west of Sandon on the Idaho Peak road. The surface plant was reconditioned, and the portals of No. 2, No. 3, and No. 4 levels were reopened. On No. 2 level 350 feet of crosscut was driven to test the downward extension of vein outcrops. Ten men were employed during the second half of 1963.

**Victor (Violamac
Mines Limited)*** (49° 117° N.E.) Company office, 416, 25 Adelaide Street West, Toronto; mine office, New Denver. A. W. White, president; J. C. Black, mine manager. Capital: 1,000,000 shares, \$1 par value. The Victor mine is 2½ miles by road southeast of Three Forks. Activity on the Victor in 1963 was limited to leasing operations. Lessees L. Fried and E. DeRosa worked on Nos. 9 and 5 levels and mined a total of 465 tons of ore; 10 tons was shipped to the Trail smelter and 455 tons was trucked to the Carnegie mill. Lessees E. Anderson and J. Stewart worked on No. 4 level of the Victor and produced a total of 627 tons of ore; 14 tons was shipped to the Trail smelter and 613 tons to the Carnegie mill. Production: 1,091 tons. Gross content in ore and concentrates: Gold, 28 ounces; silver, 23,579 ounces; lead, 178,687 pounds; zinc, 233,621 pounds; cadmium, 1,561 pounds.

SLOCAN LAKE

Silver-Lead-Zinc

**Hecla (Johnsby
Mines Limited)†** (49° 117° N.E.) Company office, Suite 1011, 2200 Yonge Street, Toronto 12; mine office, Silverton. J. C. Byrne, president; R. C. Phillips, managing director; R. T. Avison, mine superintendent. Capital: 3,500,000 shares, \$1 par value. The main shareholders in Johnsby are Rayrock Mines Limited and Faraday Uranium Mines Limited.

* By P. E. Olson.

† By M. S. Hedley and P. E. Olson.

In 1962 work was begun to explore the hangingwall branch of the Standard lode, east of the Standard mine. This hangingwall branch follows a general easterly course to the Mammoth mine, which lies about 1 mile to the east. The average dip is about 45 degrees to the south, but the lode varies considerably in both dip and strike. The Mammoth orebody has been explored from the lode apex at 6,000 feet to No. 12 level at 4,300 feet. Between the Mammoth and Standard mines are the Monarch and Hecla ore zones, which have been mined above a westerly extension of the Mammoth No. 7 level.

An adit site was chosen on the north boundary of the Standard claim at 4,166 feet elevation, west of Emily Creek, and a road was built to it from the old Standard camp. The crosscut started in 1962 was continued to the northeast in 1963, to intersect the lode on the Robin claim at a distance of 1,400 feet from the portal. The intersection is northeast of the face of the Standard No. 5 level and about 500 feet above it. The Standard-Mammoth lode was followed, mostly in the footwall but partly in the hangingwall, for 3,300 feet almost due east. Drifting was then stopped. The drift face is down dip from and about 850 feet below the general Hecla ore zone on the Mammoth No. 7 level. The drift face is also about 2,400 feet short of and about 100 feet below the intersection of the lode on the Mammoth No. 12 level crosscut.

In many places where it was encountered in the drift or in diamond-drill holes, the lode was found to be mineralized, although nowhere did the mineralization constitute ore.

A total of 3,390 feet of drifting was done, 1,215 feet of crosscutting, and 3,558 feet of diamond drilling. The average number of men employed was 16.

(49° 117° N.E.) Company office, 535 Howe Street, Vancouver 1. R. W. Liversidge, president. The property consists of nine Crown-granted mineral claims and fractions on the north side of Enterprise Creek, opposite the Enterprise mine. Peter Lewontowitz and partner drove 240 feet of tunnel under the old Westmont workings. A large portion of this drive was in overburden, which required special timber support. A total of 500 feet of diamond drilling was done on the property during the year. Two men were employed at the Westmont for seven months.

SPRINGER CREEK

Silver

(49° 117° N.E.) The Anna group is owned by Silver King Anna (Silver King Mines Limited)* Mines Limited; mine office, Slocan City. Benjamin Marasek, president and manager. The workings are located on the northern side of Springer Creek and east of the Ottawa mine. It is accessible by 5 miles of good road from Slocan City.

The mine was worked intermittently for nine months by Mr. Marasek and his son. No. 4 level was driven 56 feet, and a 15-foot crosscut was driven toward the footwall from the end of No. 4 level. A band of mineralization up to 6 inches wide, containing native silver, was encountered while drifting, but was found to be discontinuous. Six feet of winze was driven on the ore from No. 4 level about 50 feet from the face. Fifty-one tons of ore was shipped to the Trail smelter from a section of weak mineralization about 450 feet from the portal of No. 4 level.

* By P. E. Olson.

(49° 117° N.E.) Company office, 809, 525 Seymour Street, **Arlington (Arlington Silver Mines Ltd.)*** Vancouver 2. Work on the property was under the direction of B. I. Nesbitt, who controls the company. The property consists of Crown-granted and recorded mineral claims covering a 2-mile-long strip of land along the Arlington lode. The property is on the north side of Springer Creek, 6.7 miles by road from Slocan City.

The "A" and "B" levels were rehabilitated, roads to the property were repaired, and some new road was constructed. Preparatory to advancing the "B" level in 1964, 500 feet of track and compressed-air lines were laid. Some bulldozer trenching was done, and 326 tons of dump rock from the "B" level was shipped to the Trail smelter.

(49° 117° N.E.) Company office, 19 North Bernard Street, **Ottawa (Ottawa Silver Mines Ltd.)*** Spokane, Wash.; mine office, Slocan City. T. C. Hughes, president; C. Thickett, mine manager. The mine is 5 miles by good road from Slocan City. The company mill is 2½ miles from Slocan City on the same road.

In 1963, 2,521 feet of drift and 1,045 feet of raise were driven, mainly on No. 9 level. Diamond-drill holes, totalling 240 feet, were put in to test ore extensions below No. 8 level. A total of 384 tons of ore, containing about 113 ounces of silver per ton, was shipped to the Trail smelter, and about 3,000 tons of ore was stockpiled at the mine. In 1963, 16 men were employed at the mine.

Mill construction was started in June and completed late in December, but no milling was done in 1963. The flow-sheet included both flotation cells and vibrating tables. The more important components of the mill were formerly in a mill constructed at Woodbury Creek in 1953 by Can-Amer Mining & Milling Company Ltd. The mill capacity is expected to be 75 tons per day, and eight men will be employed during operation. Twenty men were engaged to construct the mill.

(49° 117° N.E.) Company office, 19 North Bernard Street, **Calumet (Slocan-Hughes Mines Ltd.)*** Spokane, Wash.; mine office, Slocan City. T. C. Hughes, president; C. Thickett, manager. Capital: 5,000,000 shares, no par value. The property consists of 11 Crown-granted claims under lease and 41 claims held by record. The property is accessible by 4 miles of road from Slocan City and is located immediately south of and across Springer Creek from the Ottawa mine. Bulldozer trenching exposed several shears near the old Calumet and Hecla mines, which were last worked in the early 1900's.

(49° 117° N.E.) Company office, 11810—112th Street, **Meteor (Cultus Explorations Ltd.)*** Edmonton; mine office, Slocan city. J. F. Sullivan, president; Tony Semeniuk, manager. The property consists of 19 Crown-granted and recorded mineral claims and fractions at the head of Tobin Creek, a tributary of Springer Creek. The mine is 9 miles by road from Slocan City.

The Meteor No. 6 level adit was rehabilitated, and new services were installed from the portal to a point 800 feet inside the level. During the rehabilitation, 265 tons of vein material was accumulated and later shipped to the Trail smelter.

* By P. E. Olson.

Some raising and stoping was done from No. 6 level, and the broken ore left in the raises. Underground diamond drilling on No. 6 level was 400 feet. Surface stripping with a bulldozer disclosed a mineralized vein about 150 feet below No. 6 level.

A Cully mill was erected near the portal of No. 6 level but was not ready for operation in 1963. The nominal capacity of this plant is 50 tons per day. Bunk-houses, a cook-house, and a combination compressor-house and dry were erected near the No. 6 level adit. About 15 men were employed throughout the year.

NORTH LARDEAU

Silver-Lead

Teddy Glacier (Sunshine Lardeau Mines Limited)* (50° 117° N.W.) Company office, 401, 1033 Davie Street, Vancouver 5. L. G. White, president; J. Sullivan, consulting engineer. The property consists of 23 claims, including the Bell and Moonlight groups, which form one contiguous block of claims. The property is situated at the head of the middle fork of Sable Creek, about 10 miles due north of Beaton.

Prior to 1924 prospectors had noted boulders of float ore containing galena and pyrite which were strewn along the slopes below the glacier. During 1924 the ice retreated sufficiently to expose a vein of the same material. Some underground exploration followed the discovery of ore in place.

During 1963 Sunshine Lardeau Mines Limited mapped and sampled the underground workings and surrounding area. Six diamond-drill holes, totalling 500 feet, were drilled near the portal of the old adit to explore the downward extension of mineralization.

Six men were engaged at the property under the direction of J. Sullivan. The operation was serviced by helicopter, which was based at Revelstoke.

MOYIE

Lead-Zinc

Stoney (The Consolidated Mining and Smelting Company of Canada, Limited)† (49° 115° N.W.) This property is 6 miles southwest of Moyie, on Stone Creek on the South side of Moyie River. It is a lead-zinc showing and comprises 15 recorded claims, which were optioned by The Consolidated Mining and Smelting Company of Canada, Limited, for exploration during the latter part of 1963. A 2½-mile road was built to the property, and approximately 2,500 cubic yards of trenching was done by bulldozer. Two men were employed under the direction of G. L. Weber, Cominco geologist.

Gold-Silver

Midway (Calix Gold Mines Ltd.)† (49° 115° N.W.) This property is adjacent to the No. 3 highway, 5 miles southwest of Moyie. It comprises 16 mineral claims, which were optioned or recorded by Moyie Mines Ltd. in 1962 for exploration. The present company, formed in 1963, optioned the property, but as yet activities have been restricted to a surface survey by a crew of two.

* By P. E. Olson.

† By D. R. Morgan.

Silver-Lead-Zinc**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 and 4 recorded claims owned by St. Eugene Mining Corporation. The property is astride lower Moyie Lake and includes the old St. Eugene mine area. The two companies jointly continued an exploration programme that was started in 1962. Two diamond-drill holes were drilled from the surface, using BX wire-line equipment. One hole was drilled 3,707 feet and the other 1,684 feet. The longer hole is believed to be a depth record in British Columbia for metallic mineral exploration. Both holes were drilled on the east side of the lake, in the vicinity of the St. Eugene mine. Eight men were employed, and the work was under the direction of R. E. Gifford, Cominco geologist.

KIMBERLEY**Silver-Lead-Zinc****Sullivan (The Con-
solidated Mining
and Smelting Com-
pany of Canada,
Limited)***

(49° 115° N.W.) Company office, Box 1510, Station B, Montreal 2; W. S. Kirkpatrick, president. Western headquarters, Trail; D. D. Morris, vice-president and general manager. Sullivan mine office, Kimberley; S. M. Rothman, general superintendent; R. M. Porter, assistant manager of mines; 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. The following report prepared by the management is a synopsis of the operations.

"During 1963 the mine produced and the concentrator treated about 2,595,000 tons of ore, 69% of which came from above the 3900 level and 31% from below the 3900. The largest blast during the year was 0-12-30, 430,000 tons.

"The concentrator operated 263 days during 1963 at an average of 9,866 tons of ore per day. Employees at the year-end totalled 721 at the mine and 309 at the concentrator.

"Approximately 9,800 tons of slag were loaded and shipped to Trail from the old smelter site at Marysville.

"The total development footage was about 34,000 feet. This includes drifting on the 2600 and 2700 levels, stope development on the 2700 level and completion of the ventilation connections from the 2600 to 2850 levels.

"The total backfill placed was 700,000 cubic yards. This consisted of 450,000 cubic yards of planned cave, 240,000 cubic yards of float rock placed in eight stopes below the 3900 level and 10,000 cubic yards of development waste.

"The ventilation system supplied and exhausted about 900,000 c.f.m. of air. A new forced air intake (No. 39 Shaft) to supplement 3900 level ventilation circuits was completed and will be ready for operation early in 1964.

"Yieldable and rigid steel arches are being used in one area of the mine for ground control.

"Experimental work in noise suppression has reached the point where all stopers, jacklegs and longhole drills are equipped with noise suppressing devices. Earplugs are in general use.

* By D. R. Morgan.

"In 1963 the Sullivan mine had 25 lost-time accidents including one fatality. There were three lost-time accidents at the Sullivan concentrator. Accident frequency at the mine was 18.4 accidents per million man-hours worked and 4.8 at the concentrator. The severity rate was 1,360 calendar days on compensation per million man-hours worked for the mine and 380 for the concentrator.

"Nine Sullivan mine and concentrator employees obtained or renewed their Industrial First Aid Certificates and ninety-five employees passed their St. John's First Aid examinations. A Sullivan mine team won the East Kootenay Senior Men's First Aid Competition. Fourteen employees obtained their Mine Rescue certificates, making a total of 301 since 1930."

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 an old forestry road leading from the open-pit area of the Sullivan mine. The property consists of 110 Crown-granted claims, which have been optioned from the Western Exploration Company Limited of Silverton, and six mineral claims held by record, at the north end of the group.

A party of three men conducted a geophysical survey on the property for a period of four weeks during the summer of 1963. The work was under the direction of Roy Anderson, chief engineer of the Pend Oreille Mines and Metals Company of Metaline Falls, Wash.

WASA

Silver-Lead-Zinc

Estella (Copper Soo Mining Company Limited)† (49° 115° N.W.) Executive office, Osoyoos; mine office, Cranbrook. T. G. Wilson, managing director; A. G. Ditto, superintendent; H. Hill & L. Starck & Associates Ltd., consulting engineers. This old property is in a basin at the head of Tracy Creek, about 5 miles east of Wasa, 11 miles north of Fort Steele. A good road leads to the mine at 6,100 feet elevation, 17 miles from Wasa.

The Estella property was located in the 1890's. Some surface work was done at an early date, and the Rover adit was driven in the vein zone. The Estella crosscut stopped short of the vein zone. The property was optioned by The Consolidated Mining and Smelting Company of Canada, Limited, in 1927, and some diamond drilling was done. An extensive examination was made of the mine area in 1944 by the same company, but nothing further was done.

In 1950 Estella Mines Limited was formed, and immediate plans were made to bring the mine into production. A 150-ton mill was built at Wasa, and milling commenced November 1, 1951. In February, 1953, the ore reserves were exhausted, and the mill was shut down. A little ore had been encountered in a prospect winze below the southeast end of the Estella (6100) level, and a two-compartment internal shaft was sunk to the 6000 level, 125 feet vertically below the Estella level. The 1953 Annual Report (p. 151) states that from the bottom of the new shaft "crosscutting to the hangingwall showed the extension of the Estella ore-body to be a narrow stringer along which subsequent drifting, to a point 100 feet

* By D. R. Morgan.

† By M. S. Hedley.

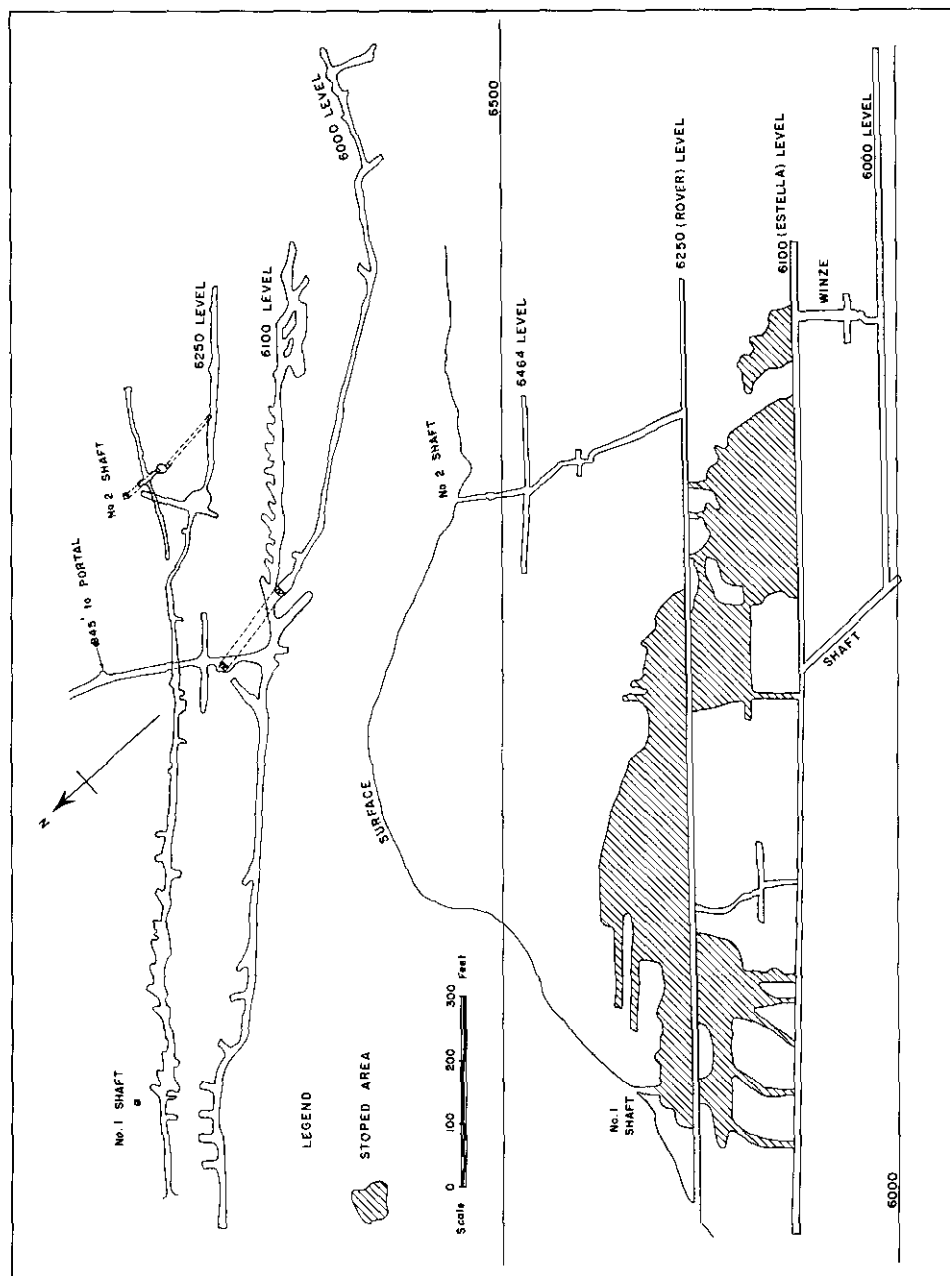


Figure 7. Estella mine—plan and section.

south of the winze, failed to find ore of commercial width or value." The operation closed completely in December, 1953. In 1955 the company was reorganized to form United Estella Mines Ltd., and some additional work was done, principally on the 6000 level.

In 1951 the Department of Mines published in the Annual Report, pages 186 to 190, the results of an examination and sampling campaign. The tonnage of "reasonably well assured" ore was calculated to be, without dilution, 47,800 tons of ore of an average width of 5.8 feet and with an average grade of: Silver, 1.9

ounces per ton; lead, 5.8 per cent; and zinc, 19.0 per cent. This same zone produced, during the life of the milling operation, 66,660 tons with an approximate average grade, calculated from the metal content of the concentrates, of: Silver, 1.6 ounces per ton; lead, 5.5 per cent; and zinc, 10.5 per cent.

A raise had been driven in 1952, part way from the 6250 (Rover) level to the old No. 2 (Rover) shaft, but ore was not encountered, in spite of the fact that good ore was reported to exist in the shaft. In 1956 H. Hill & L. Starck & Associates Ltd. made an examination that revealed that the Rover raise had been driven on a fault about 20 feet in the hangingwall of the ore. Three surface holes were diamond drilled at this time, and ore was picked up below the No. 2 shaft.

In 1962 Copper Soo Mining Company purchased the property and set about rehabilitating the mine and making a thorough examination. The downward continuation of the ore was found beneath the No. 2 shaft, and the 6464 level was driven on it for a length of about 200 feet. Ore was trucked to the railway at Wasa and shipped to the concentrator at Trail. Production started in August, 1963, and work stopped for the winter in October.

The lode is a zone of fracturing and light shearing, dipping to the southwest at angles between about 40 and 70 degrees. It is in argillites and quartzites in the Aldridge Formation and in intrusive diorite. The main ore zone rakes at a very low angle to the southeast, following in general the diorite contact, and it would appear that the contact is the over-all controlling feature. The mine was not re-examined geologically, but the 1951 Annual Report states the lode is "... semi-bedded in the sedimentary rocks and penetrating diorite in the mine workings. The over-all structure appears to be simple, but the details are not known, and minor flexures and crumples seen on the surface may or may not influence the location of orebodies. The ore is a replacement by sphalerite, galena, and pyrite, accompanied by more or less silica."

The main ore zone appears to have been worked out. Exploration on the 6000 level (not seen by the writer) has been disappointing. The present ore zone is separate from the main zone. As known, it extends from about the 6400 level to surface, a vertical distance of about 150 feet, and is 170 feet long on the 6464 level. The zone fades out at the southeast end of the 6464 level and is faulted to the north at the northwest end, where the continuation has been encountered in drill-holes. The over-all extent of the ore zone is not known. The ore is 2 to 3 feet wide for the most part, and the average grade, for 2,674 tons shipped in 1963, is: Silver, 6.2 ounces per ton; lead, 11.8 per cent; and zinc, 23.05 per cent.

The operation was active for a period of six months during 1963, and a crew of eight men was employed.

WINDERMERE

TOBY CREEK (50° 116° S.E.)

Silver-Lead-Zinc

Mineral King (Sheep Creek Mines Limited)*

Company office, 6, 490 Baker Street, Nelson; mine office, Toby Creek. J. R. Pyper, president; J. S. McIntosh, managing director; J. B. Magee, resident manager. This mine is at Toby Creek, 28 miles southwest of Atholmer. The workings are in a mountain ridge between Toby and Jumbo Creeks. They are entered by four levels, three of which, numbered 2, 3, and 7, have been driven at various elevations from the Toby Creek side, and the other, No. 9 level, from the Jumbo Creek side. There are four intermediate levels which do not extend

* By D. R. Morgan.

to the surface. The mine is operated by the open-stope method, and the workings are in four irregularly shaped orebodies known as the "A," "B," "C," and "D" zones. The main haulage system is on the No. 7 and No. 9 levels. A detailed description of the property is included in the 1959 and 1962 Annual Reports.

The mine produced 203,942 tons of lead-zinc ore during 1963, most of the ore being mined from a number of stopes above No. 4 level. The remainder was mined in the course of development work. Total development included 3,546 feet of drifting and crosscutting, 1,215 feet of raising, and 30,966 feet of diamond drilling. The newer development included further driving on the Nos. 7, 8, and 9 levels. Progress on No. 9 level was stopped for a time owing to the emission of flammable gas from a diamond-drill hole. This was later sealed.

During 1963, 1,921 tons of barite was produced, mainly from the "C" and "D" zones above No. 3 level. The reserves in this area are rapidly nearing depletion, and preparations are being made for future shipments to be made from the lower levels. The barite is sold in the crude state. It is trucked to Invermere for shipment by rail.

The mine is ventilated by both mechanical and natural means. Approximately 29,000 cubic feet of air per minute was exhausted from the workings, and of this quantity 18,000 cubic feet per minute was supplied by a 15-horsepower electrically driven fan, which is located in the No. 2 intake airway. The remainder was by natural means. This quantity was found to be sufficient for the requirements of the workings.

The concentrator operated throughout the year and produced 15,895 tons of zinc concentrates, which averaged 56.7 per cent zinc, and 5,583 tons of lead concentrates, averaging 67.5 per cent lead. There were no major changes in the concentrating methods, and the concentrates were trucked to Invermere for shipment by rail.

The number of men employed was 97, of whom 56 were employed underground.

Silver-Lead

Delphine (Western Beaver Lodge Mines Ltd.)*

Registered office, Suite 303, 1075 Melville Street, Vancouver 5. D. F. Farris, president. This property is on the north side of Delphine Creek, a tributary of Toby Creek, and is approximately 22 miles southwest of Athalmer. It consists of three Crown-granted and three recorded claims. A detailed description of the property is included in the 1915 Annual Report. The present company acquired the property in the fall of 1963 for exploration.

In 1963 a 2-mile access road was built to the property and a certain amount of geological mapping was done. There were four men employed for a period of two months, and preparations are being made to drive an adit on the vein. The work was under the direction of R. Renshaw, consulting engineer.

Silver-Copper

Ptarmigan (Belle Taxis Mines Ltd.)*

(50° 116° N.E.) Office address, 10th Floor, Credit Foncier Building, 850 West Hastings Street, Vancouver 1. This property is at an elevation of 8,600 feet, at the headwaters of Red Line Creek, a tributary of McDonald Creek, which in turn is a tributary of Horsethief Creek. It can be reached by a 29-mile logging-road leading from the village of Wilmer. The property was formerly operated by

* By D. R. Morgan.

Selkirk Ptarmigan Mines Limited and was optioned by the present company in 1963 for exploration. A description of the property has been given in past Annual Reports.

The work done in 1963 included a geological and geophysical survey, and a crew of six men drilled 10 diamond-drill holes totalling 650 feet on the surface and in the mine. The work was under the direction of D. R. Morgan, geologist.

REVELSTOKE

Lead-Zinc

(51° 118° S.E.) This property, known as the River Jordan **King Fissure, S.B., lead-zinc property, consists of 16 Crown-granted claims C.R., and Deby*** owned by Jordan Mines Limited and 11 recorded claims owned by Bralorne Pioneer Mines Limited. The office of

both companies is 355 Burrard Street, Vancouver. 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. There are two mineralized layers which strike eastward and dip at moderate angles to the south and which join at both the western and eastern ends of the property. They are thought to have the form of a syncline plunging at a low angle to the east, but the structure has not been determined with certainty. The property has been described by C. Riley in a paper in Transactions of the Canadian Institute of Mining and Metallurgy for 1961, pages 268 to 272.

The mineralization, well exposed in cliffs and outcrops between elevations of 5,800 and 7,500 feet, has been known for many years. Exploratory work since about 1950 has been mapping, trenching, and sampling. In 1963 five holes with a total length of 4,929 feet were diamond drilled to test the continuity of the mineralization in depth. The holes were steeply inclined, and the longest was 1,500 feet. Two holes intersected both lodes several hundred feet from their outcrop. The camp was serviced by helicopter from Revelstoke, and a trail to the property constructed during previous exploratory work was not used.

Eight men were employed under the direction of D. H. James, geologist.

[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.]

RUDDOCK CREEK

Lead-Zinc

(51° 118° N.W.) Exploration office, 1112 West Pender **It, In, and To Street, Vancouver 1. Alex. Smith, manager; H. R. Morris, (Falconridge Nickel geologist in charge. About 94 claims are held by record on Mines Limited)†** the southern slopes of Gordon Horne Peak, a 9,500-foot summit between the head of Ruddock Creek, which flows east into the Columbia River, and Oliver Creek, which flows north and west into the Adams River. The main showing is at the head of Ruddock Creek, at an elevation of 7,600 feet.

A tent camp at 7,000 feet was serviced entirely by helicopter, from a supply depot on the Big Bend highway 65 miles north of Revelstoke. Geological work continued in 1963, and 12,093 feet of diamond drilling was done in 25 holes. This included the main showing and showings nearly 3 miles to the west on the steep slope above Oliver Creek.

* By James T. Fyles.

† By M. S. Hedley.



Falconbridge Nickel Mines Limited. Ruddock Creek camp. Looking southwest across Oliver Creek.



Claim posts on Ruddock Creek main showing. Note helicopter in distance bringing in diamond-drill equipment.

Lead-zinc mineralization, consisting dominantly of sphalerite, occurs in schists and gneisses of the Shuswap terrain. Mineralized layers, which in places indicate remarkable continuity, appear to be bedded and are involved in intricate folding of the layered rocks. Though contorted, the rocks in general dip to the southwest at moderate angles, more or less parallel to the hillside. There is much post-mineral intrusive pegmatite that occurs as sills and dykes, and as sheets that also dip southwest with the hillside. The sheets are as much as 150 feet thick, and much layered rock has been obliterated by the pegmatite in the general area.

Mineralization of ore grade contains about five times as much zinc as lead, although in submarginal material the two metals may be about equal in amount. The ore is associated with quartz, and the better-grade material consists of abundant dark sphalerite spotted finely with grains and small clots of quartz that in at least some instances appear to consist of crushed aggregates. Pyrrhotite is about the only other sulphide. Fluorite, barite, and epidote are associated with the ore zone.

The main ore zone extends on surface for about 600 feet along the central part of a fold that has been referred to as a syncline but is actually a flat compressed crumple open to the south. The hinge line of the crumple plunges flatly in the same direction as the common lineation of the area, north 70 degrees west. The ore has been followed down dips of 35 to 40 degrees by diamond drilling to the hinge line, a distance of about 500 feet. The ore in the main zone is as much as 40 feet thick and has the appearance of a greatly thickened layer, repeated in the crumple. A second, much thinner, ore layer lies 15 to 30 feet outside the first.

Detailed mapping and diamond drilling have demonstrated a considerable tonnage of ore containing about 10 per cent zinc in holes drilled within a few hundred feet of the outcrop of the ore. Drilling farther afield, to follow westward down the plunge of the ore in the axial zone of the fold (where it is thickest), failed to locate ore beyond a north-trending fault which apparently drops the ore zone down on the west. The deepest hole was drilled to a depth of some 1,900 feet.

The ore appears to follow a horizon which is closely associated with a band of grey to white marble a few feet thick. The marble is itself in places sparingly mineralized. The ore horizon is siliceous, but it is not certain how much of the quartz represents original quartzite and how much may have been introduced. The ore is in places limy. In spite of excellent exposures, the ore structure cannot be traced continuously because of the pegmatite sheets. A locus of sphalerite mineralization, for the most part about 4 feet thick, has reportedly been traced for some 3 miles, over the ridge of Gordon Horne peak at 8,000 feet elevation, round to the north of the peak, and down the steep westerly slopes above Oliver Creek. A large fold is indicated to lie north and west of the crumple of the main showing, and it is presumably this fold that changes abruptly the direction of surface trace of mineralization west of the main showing, from westerly to northerly.

The main mineralization has the appearance of a bedded layer, for the most part about 4 feet thick, which is involved in the regional complex folding and, because of the folding, is locally greatly thickened, particularly in the core of the flat crumple in the main showing. The origin of this ore is of very great interest, as the nature of the occurrence determines not only the problems of development, but greatly affects the techniques of search for new deposits. Whatever the age of the mineralization and its ultimate origin, it is plain that it is older than the pegmatite sheets and plain also that it has to some extent been involved in the complex folding characteristic of the Shuswap terrain.

SKAGIT RIVER

Copper**A.M. (Canam
Copper Company,
Ltd.)***

(49° 121° S.E.) Company office, 405, 25 Adelaide Street West, Toronto 1. S. A. Perry, president; W. M. Sharp, resident engineer. The A.M. group, consisting of eight Crown-granted claims, is on the western boundary of Manning Park and is 4 miles by road southerly from about Mile 30 on the Hope-Princeton highway. The company also holds 54 located claims in the same area. From 1930, when the property was first located, to 1961 a considerable amount of underground exploration has been carried out from nine adit levels, from No. 3 at 5,850 feet elevation to No. 15 at 4,300 feet elevation.

Detailed descriptions of the geology of the property have been given in previous Annual Reports. The mineralization occurs in a pipe-like zone of brecciated sediments which has a known vertical range of 1,500 to 1,800 feet and a width of about 400 feet; the principal mineral of economic interest is chalcopyrite. At the end of 1961 the company estimated reserves of potential ore at 2,069,500 tons, grading 1.49 per cent copper, 0.026 ounce of gold, and 1.00 ounce of silver per ton.

In 1963 work was started on October 6th and finished on December 20th. The camp and surface buildings were rehabilitated, and No. 15 level (4300 main cross-cut) was cleaned out and retimbered where necessary. A total of 1,052 feet of diamond drilling was done in this section of the mine. Two holes totalling 133 feet were diamond drilled on the surface south of No. 7 adit.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1959, pp. 122-124; 1954, pp. 152-159; 1949, pp. 210-213.]

HOPE

Nickel-Copper**Pride of Emory
(Giant Mascot Mines
Limited)***

(49° 121° S.W.) Company office, 844 West Hastings Street, Vancouver 1; mine office, P.O. Box 820, Hope. W. Clarke Gibson, president; H. Hill & L. Starck & Associates Ltd., consulting management engineers; F. Holland, general superintendent; C. Coffey, mill superintendent; O. G. Gilroy, surface 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 10 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 adit number being the elevation above sea-level.

The ore occurs in a number of separate orebodies, the principal ones being the Pride of Emory, the Brunswick Nos. 1, 2, 5, and 7, the 2663, and 1600. The orebodies are steeply plunging pipe-like deposits and occur in an irregular stock-like intrusion of ultrabasic rocks approximately 1½ square miles in area. They comprise disseminated and massive sulphides, of which pyrrhotite, pentlandite, and chalcopyrite are the most common. 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. 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. 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 ore is drawn off at mucking-machine draw points, where it is loaded directly into cars. Six Atlas L.M. 56H loaders, one

* By A. R. C. James.

Eimco 24, and one Eimco 21 are in use. At the 2600 level the ore is loaded from the ore-pass into 6-ton Granby cars and hauled to surface by trolley locomotive.

The following is a summary of mining and development in 1963:—

	Ft.
Drifting	1,621
Crosscutting	3,154
Raising	4,260
Diamond drilling	58,647
Long-hole drilling (blast-holes)	209,206

Most production in 1963 was from the Brunswick No. 2 orebody, which has now been extensively mined above 2950 level, but substantial production was also obtained from the Brunswick No. 5 and the Pride of Emory.

Principal development work done in 1963 was as follows:—

- (1) The Pride of Emory "B" and "C" zones were fully developed and brought into production between the 3550 and 3815 levels.
- (2) Further development was done on the 1600 orebody above the 3550 level, and at the year-end this portion of the orebody was ready for production.
- (3) An exploration raise was driven up 200 feet on the 1400 orebody, and undercutting in preparation for mining was under way at the year-end.
- (4) In the 512 orebody, the B.C. Nickel raise was rehabilitated and some diamond drilling done.
- (5) On the 3250 level a crosscut was advanced to a point 800 feet north of the shaft in the Pride of Emory area. A raise was driven to the 3550 level, and diamond drilling was completed to "B," "C," and "D" zones, ready for stope development.
- (6) The 3254 crosscut was advanced to a point 2,200 feet east of the shaft in the 1600 orebody area. A raise was driven through to the 3550 level, and diamond drilling to outline the orebody started. At the year-end one drawpoint had been established in the orebody and raising in preparation for undercutting was started.
- (7) On the 2600 level a raise was driven through to the 2950 level to develop an offshoot of the 2663 orebody. This was mined and brought into production during the year.
- (8) A crosscut was advanced 600 feet to the west on the 2600 level to the Brunswick No. 2 area, a raise was driven through to 2950 level, and the Brunswick No. 2 orebody developed and prepared for production above the 2800 level.

The mill continued to produce a bulk nickel 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 1963 a total of 313,836 tons of ore was milled. A total of 20,107 tons of bulk concentrate was shipped, containing 4,250,000 pounds of nickel and 2,050,000 pounds of copper. The crew in December comprised 154 men (including staff), of whom 86 were employed underground.

Silver

Eureka Victoria (Tru-West Explorations Ltd.)*

(49° 121° S.W.) Company office, 1272 West Pender Street, Vancouver 1. W. Ferguson, president; J. Willey, manager. This company controls 4 Crown-granted claims (including the two oldest Crown grants in the Province) and 30 recorded claims on Silver Peak, 5 miles due south of Hope.

* By A. R. C. James.

The showings are at an elevation of 5,700 feet in rugged terrain. For a short period the property acquired some fame as one of the first producing lode mines in the Province, and high-grade silver shipments were made in the years 1868 to 1874.

The property is reached by turning west off the Skagit road near Silver Lake and following a series of logging-roads up the mountain. These roads terminate at an elevation of 4,100 feet, and from here a small aerial tram-line gives access to the lower adit at 5,200 feet elevation.

The present company started work in 1962, and continued in 1963. The lower adit was extended 196 feet to a point 413 feet from the portal. A survey was also made of the existing workings. A crew of six men was employed. Work was terminated on December 20th.

HARRISON LAKE

Molybdenum

(49° 121° N.W.) Company office, 1272 West Pender Street, Vancouver 1; registered office, 850 West Hastings Street, Vancouver 1. Raymond W. Caskey, president; J. A. Willey, managing director; H. H. Cohen, consulting engineer.

The property comprises 101 mineral claims held by record and situated between 2,500 and 5,000 feet elevation near the crest of the Lillooet Range at the head of Clear Creek, a tributary of Big Silver Creek. Big Silver Creek flows south into Harrison Lake, 20 miles north of Harrison Hot Springs. A four-wheel-drive vehicle can get to within 4 miles of the Gem Exploration camp on logging-roads; a foot-trail leads from the end of the road to the camp. Normally access is by helicopter from Harrison Hot Springs air-strip. The camp is at about 2,500 feet elevation.

The geology of the region in the immediate vicinity of the property has not been mapped. Geological Survey of Canada Map 737A, Hope, shows the geology to about 1 mile of the property. The main contact between the sedimentary-volcanic group and the granitic rocks passes through the western side of the property. The intruded rocks close to the granitic contact are biotite hornfels and paragneisses.

The intrusive rocks, in which the mineralization occurs, were seen by the writer for about three-quarters of a mile along Clear Creek and to about one-half mile up a southward-flowing tributary locally termed Ore Creek. The older intrusive rocks are in part gneissic, and all of them contain cordierite as well as minor garnet. The prominent and common ferromagnesian is biotite.

The oldest intrusive rock is diorite, containing hornblende in part altered to biotite. It is intruded by a gneissic biotite granite, in which no hornblende was seen in the one thin-section examined. Separated from the gneissic biotite granite by a fault is a massive quartz monzonite which may be related to the diorite. The gneissic biotite granite in turn is intruded by a massive light-coloured biotite granite. This granite lies southwest of the older granite and diorite, extending downstream along Clear Creek for more than a thousand feet and at least one-half mile up Ore Creek.

Dykes are of three kinds: a banded pegmatitic dyke with quartz along the centre, intrusive into the gneissic biotite granite; a felsite intrusive into the younger granite and containing a small amount of sanidine; and aplite, also intrusive into the younger granite. The relative ages of the dykes are not known.

* By N. D. McKechnie.

The gneissic structure strikes north 4 to 10 degrees east and dips 35 to 45 degrees east. Two faults appear to be post-mineral; one strikes north-south and dips 70 degrees west; the other strikes north 30 degrees west and dips 75 degrees southwestward.

The mineralization is molybdenite in quartz. It occurs as quartz veins from 1 to 3 feet thick, in thin stringers in joint planes, and as disseminated grains in the diorite and granites. It was not recognized in any of the dykes.

The principal quartz-molybdenite vein showings are on either side of Clear Creek at an elevation of about 3,000 feet and some 2,000 feet upstream from the camp. The exposures are on either side of a post-mineral fault which strikes north-south and dips 70 degrees west. On the southeast side of Clear Creek and about 150 feet above it in elevation, a quartz-molybdenite vein 1 to 3 feet wide is exposed, which strikes north 12 degrees east and dips 65 degrees westward. On the southeast side of the creek but on the footwall side of the fault and 60 feet lower in elevation than the first exposure, a lenticular quartz-molybdenite vein up to 1 foot wide strikes north 20 degrees east and dips 65 degrees eastward. On the northwest side of Clear Creek and on the footwall side of the fault, a thinner quartz-molybdenite vein outcrops at creek-level, strikes north 12 degrees east, and dips 80 degrees westward. About 50 feet upstream a similar quartz-molybdenite vein at creek-level strikes north 12 degrees east and dips 70 degrees westward, or almost exactly parallel to the vein on the southeast side of the creek and on the hanging-wall side of the north-south striking fault. If parts of the same vein are indicated, then the horizontal displacement along the fault is about 500 feet to the left.

Thin quartz-molybdenite stringers and molybdenite coatings in joint planes are particularly noticeable in parts of the light-coloured massive granite. In an area on the northwest side of the creek and just downstream from the adit, they are numerous enough to warrant investigation.

An adit was started on the southeast side of Clear Creek to test the north 12 degrees east, 65 degrees east quartz-molybdenite vein; the projected length was 500 feet.

A crew of five men was employed.

HOWE SOUND

Copper-Zinc

Britannia (The (49° 123° N.E.) Head office, Eighth Street, New Toronto;
Anaconda Company mine office, Britannia Beach. J. Van Der Ploeg, president;
(Canada) Ltd.)* J. D. Knaebel, general manager; B. B. Greenlee, mine manager; V. Gladman, mill superintendent. The property is on the east side of Howe Sound, 40 miles by road from Vancouver. This large mine with its extensive workings has been in operation since the beginning of the century. In January, 1963, the property was purchased by The Anaconda Company (Canada) Ltd. from the former owners, the Howe Sound Company.

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 from 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 the 2800 level to the 4100 level and include the Victoria, Empress, and other

* By A. R. C. James.

orebodies. 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. The Bluff workings extend from the 3500 level down to the 4100 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 down to the 5700 level. The present No. 8 workings extend from the 4100 level to the 5100 level. Methods of mining at Britannia include cut and fill, square-set, sublevel caving, and blast-hole methods.

The following is a summary of development work done in 1963:—

	Ft.
Drifting	10,896
Raising	10,327
Crosscutting	4,116
Diamond drilling	39,547

Important items of development work undertaken during the year include the following:—

- (1) A new ventilation raise was driven from the 4100 level to the 3500 level in the Bluff section, and a new fan was being installed at the year-end at the 2700 level. This is part of a scheme to improve ventilation in the Bluff section by conducting the return air from No. 8 section via No. 6 shaft and the new raise up to surface, and providing independent ventilation for the Bluff section.
- (2) An ore-pass raise was started from the 4100 level to tap the No. 4 shaft orebody in the Bluff mine.
- (3) Drifting and development was carried out in the west end of the Victoria section in the Empress and 179 zones.
- (4) A start was made in driving the 5250 level from No. 8 shaft for further development in the No. 8 section.
- (5) Exploratory drifting and diamond drilling was continued on the 5700 level, the deepest level of the mine, in No. 8 section.

The concentrator milled 493,700 tons of ore, from which 19,895 tons of copper concentrate and 7,045 tons of zinc concentrate was produced.

The average number of men employed was 446, of which 179 were employed underground.

SQUAMISH

Copper

High Hopes* (49° 123° N.E.) This group of four claims is held by record in the names of Harold Hopkins and Alfred W. Hendrickson, of Brackendale. It is situated on the Cheekye River about 3 miles east of its confluence with the Cheakamus River, and it is reached by a jeep-road on the north side of the river.

The mineralization is exposed in a short adit and consists of quartz carrying spotty concentrations of chalcopyrite and lesser molybdenite with pyrite and minor bornite. The quartz lies in fractures in foliated diorite and has a maximum width of about 2 feet. The fractures strike north 40 degrees west, dip 35 degrees north-eastward, and are in echelon to the left. Quartz stringers are exposed on surface to about 25 feet into the hangingwall of the adit zone. Sulphides are scarce in these stringers.

The diorite is veined by a dark-green chlorite, which is found as inclusions in the quartz. The quartz is veined by pink calcite.

* By N. D. McKechnie.

ALTA LAKE

Copper

(50° 122° S.W.) Company office, 905, 525 Seymour Street, Vancouver 2. The London group comprises Mineral Lease M9, which includes six formerly Crown-granted mineral claims and one fractional claim and five recorded claims. It is on the southwest side of Fitzsimmons Creek, about 4 miles from Alta Lake. A jeep-road connects the property with the Squamish-Pemberton motor-road. There is no published geological map of the region along Fitzsimmons Creek. The geology along the Pacific Great Eastern Railway, at the downstream end of the creek, is described in Geological Survey of Canada Summary Report for 1918, Part B, pages 12 to 28, Map 1711; the geology at the head of the creek, about 2 miles upstream from the London group, is shown on Geological Survey of Canada Map 8—1956, Pitt Lake. Map 1711 shows a band of sediments, schists, and volcanic rocks extending along the railroad about 7 miles wide. Map 8—1956 shows an area of metamorphosed sediments and volcanic rocks at the headwaters of Fitzsimmons Creek. The two areas are on line of strike and probably are on the same band of rocks. On lithologic grounds they are assigned to an Upper Palaeozoic or younger age.

Early work on the property, formerly known as the Green Lake group, was done by the Green Lake Mining and Milling Co. In 1910 this company drove an adit 527 feet on the London claim at an elevation of about 4,200 feet. No other work of any consequence was done on the group until 1963, when the present owners did geological mapping and 679 feet of diamond drilling on and near the London claim.

The rocks in the London claim area consist of schistose granitic rocks in the Fitzsimmons Creek valley below an elevation of about 4,300 feet. The granitic rocks are intrusive into metamorphosed volcanic rocks, now composed chiefly of chlorite, calcite, quartz, and pyroxene, and which possibly were basaltic flows. Interbedded with the metamorphosed basalts are discontinuous magnetite-epidote-calcite-quartz skarns and quartzose granulites. The granitic rocks are metamorphosed in varying degree to a quartz-sericite schist; they may be suitably grouped for present purposes as schistose granodiorite.

Metamorphic rocks and a small sill of schistose granodiorite about 50 feet in elevation above the portal of the London adit strike north 20 degrees west and dip 25 degrees southwestward. About 200 feet south the bedding strikes north 40 degrees east and dips 40 degrees northwestward. It is thought that the second strike and dip probably are more nearly representative of the structure for the following reasons:—

- (1) The London adit is driven on a bearing of south 40 degrees west in schistose granodiorite for its entire length; if the north 20 degrees west strike and 25-degree westerly dip were continuous, the adit would enter the volcanic rocks at less than 250 feet from the portal.
- (2) The rise of the granodiorite-volcanic contact along the side of the valley is equivalent to an apparent dip of 23 degrees northwestward; correction to a true dip on a north 40 degrees east strike gives a value of 38 degrees, the same as the dip of the bedding.

The intrusives at Alta Lake are shown on Map 1711 to have concordant relations with the intruded rock, so it is not unlikely that the granodiorite along the Fitzsimmons Creek valley is essentially a sill, and that the structure on and near

* By N. D. McKechnie.

the London claim is an assemblage of volcanic flows and granodiorite sills striking north 40 degrees east and dipping 40 degrees northwestward.

There are two directions of schistosity; one strikes north 20 degrees east to north 5 degrees west and dips 35 to 50 degrees westward, and the other strikes northwest and dips 30 to 45 degrees southwestward. There is some evidence that schist of the latter attitude curves into that of the former and may be the older.

Sulphide mineralization consists of chalcopyrite and pyrite. In the London adit it is seen occasionally in the schistose granodiorite, but at no place is it prominent. The strongest sulphide mineralization is in the magnetite skarns, which are limited bodies traceable only for tens of feet, and the nature of the control of their distribution is obscure. They are confined to the volcanic rocks, but their trend is north-south to east of south, which does not correspond to any structure apparent in these rocks. The London adit passes under the zone in which they are most numerous without showing any change of fracturing or of mineralization.

[References: *Minister of Mines, B.C., Ann. Repts.*, 1910, pp. 147-149; 1930, p. 312.]

Copper

(50° 122° S.W.) The Azure group of 107 recorded claims is owned by The Mining Corporation of Canada, Limited, 44 King Street West, Toronto. J. S. Scott, 402 West Pender Street, Vancouver 1, consulting geologist. The property is on Fitzsimmons Creek and includes both sides of the creek from its mouth at Green Lake to about 4 miles upstream. Access is by motor-road from Squamish, or by Pacific Great Eastern Railway to Alta Lake station. A jeep-road connects the property to the motor-road on the east side of Alta Lake.

During the summer of 1963, magnetometer and self-potential surveys were run, and limited geochemical work was carried out. Diamond drilling was started in September and continued to December 15th; 13 holes totalled 7,588 feet.

The geology near the railway line is described in Geological Survey of Canada Summary Report, 1917, Part B, pages 12 to 23, and Map 1711.

The principal showing at the time of the writer's visit in August was a stripped area on the west side of Fitzsimmons Creek, at creek-level and about a mile upstream from the main road. The stripping is about 500 feet long, north-south, and up to 150 feet wide.

The rocks in the stripped area are quartz-sericite schists. In only one of seven thin-sections examined is there recognizable relict texture, that of a medium-grained holocrystalline rock and probably part of the granodiorite mapped along the railway. The schist is quite uniform in composition and probably is all derived from one original rock type.

Included with the schist is a porphyritic rock comprised of phenocrysts of zoisite in a matrix of zoisite, chlorite, and carbonate; some chlorite masses have the outlines of pyroxene phenocrysts. This rock forms the footwall of a fault at the north end of the stripping and is there about 5 feet wide. It appears to be parallel to the schistosity, but the exposure is limited and the metamorphism indicates that it probably represents a pre-schist intrusive into the granitic rock. About 30 feet eastward a 2-foot width of rock darker than the normal schist has definite contacts parallel to the schistosity. Thin-section examination showed no essential difference to the rest of the quartz-sericite schist, save a somewhat finer grain size. If these rocks do represent pre-schist intrusions into the granodiorite, then there were at least two periods of pre-schist fracturing.

* By N. D. McKechnie.

The schistosity strikes north 40 degrees west and dips 50 degrees to 75 degrees southwest. Faulting, marked by thin mud seams, essentially parallels the schistosity.

Mineralization consists of quartz, chalcopyrite, and pyrite. Calcite pseudomorphous after pyrite is locally prominent. The chalcopyrite is disseminated through the schist and is associated either with fine quartz stringers or with the more highly siliceous parts of the schist. Locally the chalcopyrite is found in lenses of quartz up to 1 foot wide. The quartz is subparallel to the schist. Malachite and azurite are prominent throughout the stripped area.

Copper

(50° 122° S.W.) Company office, 905, 525 Seymour Street, Vancouver 2. The Fitzsimmons group comprises six Crown-granted mineral claims. It is held under option by New Jersey Zinc Exploration Company (Canada) Ltd. The group is situated on the east side of Fitzsimmons Creek near its outlet at Green Lake. It is reached by the Squamish-Pemberton motor-road. The group is described in the Annual Reports for 1918, page 293 and 1928, page 387. In 1951 three diamond-drill holes were drilled by The Granby Consolidated Mining, Smelting and Power Company Limited.

Between April 16 and June 15, 1963, a geological and magnetometer survey was carried out, and 800 feet of bulldozer access road was constructed. An old logging-road was cleared. Three men were employed.

TEXADA ISLAND

Iron-Copper

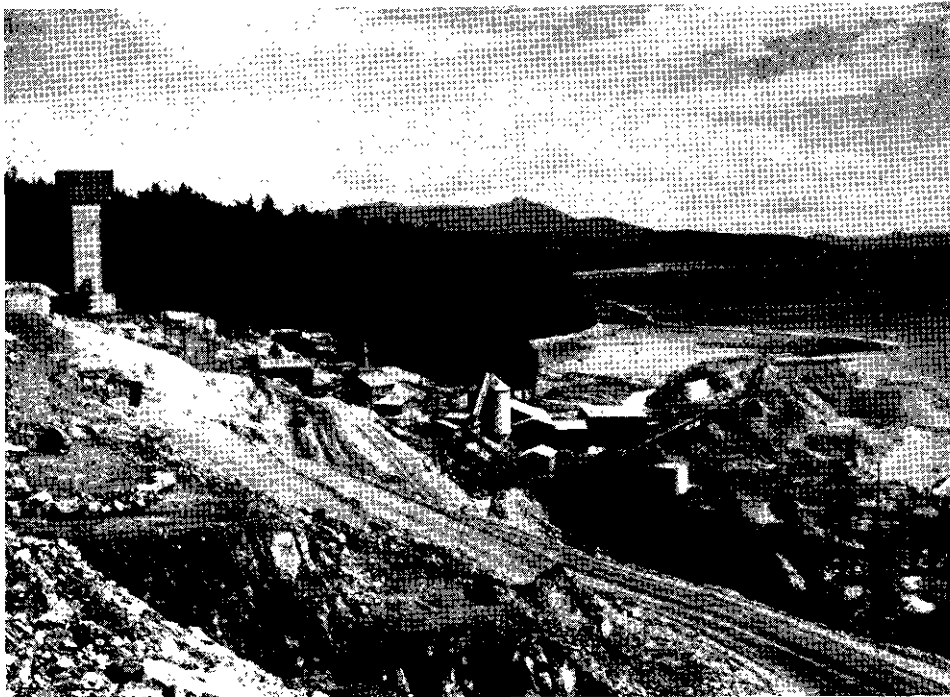
(49° 124° N.W.) Registered office, 626 West Pender Street, Vancouver 2; mine office, Box 35, Vananda. A. D. Christensen, San Francisco, president; B. L. Alexander, general manager. This property, comprising 8 Crown-granted claims, 46 recorded claims, and 1 mineral lease, is at Welcome Bay, 3 miles northwest of the mine camp at Gillies Bay, on the southwest coast of Texada Island.

The Texada mine consists of five orebodies which, from west to east, are the Prescott, Midway, Yellow Kid, Paxton, and Lake. Four are or have been mined by open pit, but the Midway, between the Prescott and Yellow Kid, does not approach the surface. Underground development is presently concerned with only the three western orebodies.

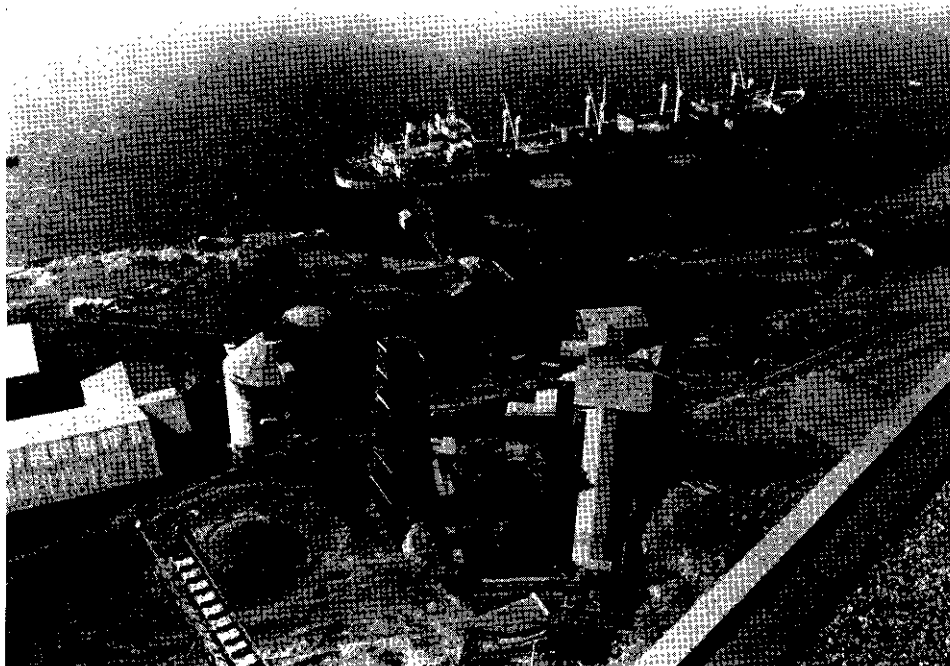
The second stage of the underground development programme, commenced in 1962, was continued for ore production by long-hole stope mining methods in the Midway and Prescott ore zones. The five-compartment shaft was sunk an additional 107 feet to a total depth of 843 feet, and the excavation of shaft stations completed on the 220 (surface), 1855, 1655, 1575, 1510, and 1455 levels. Lateral development in drifts, crosscuts, subdrifts, draw points, and scrams totalled 9,117 feet. Raising amounted to 5,010 feet and was done in providing draw points, ore and waste passes, and ventilation raises. An inclined conveyerway, 864 feet in length, was driven from just below the north or inner end of the 1455 level to the 1575 level shaft station. A total of 169,000 cubic feet of waste rock was removed in making the excavations for the crushing-chamber, the main sump, the conveyor sump, and transformer stations. Long-hole drilling was started in the Midway area to provide an immediate source of ore as soon as the mine plant equipment has been installed.

* By N. D. McKechnie.

† By J. E. Merrett.



Texada Mines Ltd. General view of mill area, looking southeast across entrance to Prescott pit. Shaft headframe on left.



Texada Mines Ltd. Looking down on mill and loading-dock from top of headframe. Greek freighter loading iron-ore concentrate for Japan.

Underground development provided 24,882 tons of iron ore, while 926,862 tons was obtained from the open pits. Ore recovery from the Yellow Kid pit was completed, and production from the Prescott pit was curtailed. Mining in the Prescott pit broke into the underground workings, but an additional surface bench of ore remains to be removed. The remainder of the open-pit ore was obtained from the Paxton and Lake bodies. Diamond drilling and stripping in the vicinity of the Lake orebody indicated a considerably larger reserve tonnage than was initially believed to be present. Exploration diamond drilling amounted to 31,800 feet, completed in 160 holes. In stripping waste material from the ore in the various open pits, a total of 1,209,855 cubic yards of rock was removed.

The mill processed 954,591 tons of ore, from which 504,446 tons of iron concentrate and 5,802 tons of copper concentrate was obtained.

A concrete reclaiming-tunnel for the surge pile was constructed at the surface plant.

At the mine camp eight staff houses were constructed, and a new fresh-water system, including an earth-fill dam and water-lines, was installed.

The average number of men employed was 336, of whom 75 were employed underground.

QUADRA ISLAND

Copper

Copper Road*

(50° 125° S.E.) This property of 38 recorded mineral claims is controlled by R. I. Bennett, of Heriot Bay. 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. At about 9 miles north of Heriot Bay a steep logging-road leads one-half mile west and north to the principal showing, which is at the east end of the property.

In February The Anaconda Company (Canada) Ltd. optioned 19 claims from Mr. Bennett for a nine-month period. This company then completed an induced potential geophysical survey of the property. This was followed by approximately 13,000 feet of AX diamond drilling in 28 drill-holes. In preparation for the drilling, 500 feet of road was constructed. The shaft, which is on the mineralized shear, was deepened from 50 to 105 feet, producing 350 tons of ore, which was sorted and stockpiled. During the period of the Anaconda option the number of men employed increased from 3 to 21.

Seven of the twenty-eight holes, Nos. 1, 5, 7, 8, 12, 13, and 14, were logged by the writer.

The diamond drilling explored the north 80 degrees west mineralized shear (1962 Ann. Rept.) for about 2,000 feet along the strike and at two approximate horizons, 150 and 750 feet below the surface.

The rocks in the drill cores are andesitic lavas. Scarcity of flow contacts and the distribution of amygdaloidal textures suggest that some of the flows are 100 feet or more in thickness. No intrusive rocks were recognized in the cores.

The mineralized shear was cut in all the drill-holes and showed widths up to 30 feet. The dip proves to be about 80 degrees northward instead of the 80 to 85 degrees southward indicated in the surface showings.

Mineralization, comprising quartz and copper sulphides, is variable in the shear. Holes drilled in the vicinity of the shaft to cut the shear at a depth of about 200 feet did not encounter the sulphide-bearing quartz exposed at the shaft; the shear is strong, but the mineralization is only sparse bornite, chalcopyrite, and native copper. At about 1,000 feet westward, where an induced polarization anomaly

* By N. D. McKechnie and J. E. Merrett.

had been obtained, a stronger mineralization occurs in the shear at depths up to 300 feet. It comprises bornite, chalcocite, chalcopyrite, and native copper with subordinate quartz. Chalcocite has not been recognized in the shaft exposures, though its occurrence elsewhere on Quadra Island has long been known. The holes cutting the shear at the 750-foot horizon do not show chalcocite; chalcopyrite and bornite are present, as is native copper.

Native copper and, less commonly, chalcopyrite occur also as isolated grains in massive andesite. Bancroft in Geological Survey of Canada Memoir 23, page 124, mentions chalcocite in vesicles at Gowlland Harbour, 7 miles to the south.

Chalcopyrite is veined by and included in bornite and in chalcocite. Bornite commonly occurs as islands in chalcocite and as intergrowths suggesting contemporaneity. Two thin stringers of chalcocite were seen to cut bornite, so the chalcocite in part at least is the younger.

A post-sulphide movement along the shear is indicated by strongly fractured and muddled mineralized rock and quartz in the drill cores. It is uncertain how much of the shearing may be a result of this later movement.

VANCOUVER ISLAND

SAYWARD (50° 125° S.W.)

Iron

Iron Mike (Inter-Can Development Company Ltd.)*

Company office, 850 West Hastings Street, Vancouver 1. A. E. Upton, president. This company has under lease the Iron Mike (Hartt) property, 4 miles southwest of Sayward and 3 miles west of the junction of the Salmon and White Rivers. A crew of three men did 450 feet of diamond drilling in eleven drill-holes, constructed, with the aid of a caterpillar bulldozer, 4,000 feet of access road, and stripped 15,000 cubic yards of overburden off the main ore-body.

NIMPKISH LAKE (50° 126° S.W.)

Iron

Nimkish, Klaanch (Nimkish Iron Mines Ltd.)*

Company office, 1012, 409 Granville Street, Vancouver 1; mine office, Camp A, Beaver Cove. S. V. Wines, project manager; H. M. Grenier, mine superintendent; R. W. Bick, mill superintendent. The camp is on Anutz Lake, immediately south of Nimkish Lake, and the pit is 5 miles farther south, on the southwest bank of Nimkish River. The crushers are immediately southeast of the pit, and the mill is across the river and adjacent to the Canadian Forest Products Limited railway. Iron concentrate was shipped by this railway to the loading-dock at Beaver Cove.

Mining of all orebodies was completed in 1963, with production of 561,675 tons of ore and 258,760 cubic yards of waste. The mill produced 307,679 tons of concentrate. The average number of men employed was 52.

PORT HARDY (50° 127° N.W.)

Copper

Little Joe (Port Hardy Copper Mines Ltd.)*

Company office, 702, 475 Howe Street, Vancouver 1; mine office, Port Hardy. John Cotowick, president and manager. This company holds 78 recorded claims in the Quatse River valley, 8 miles south of Port Hardy. Access to the property is by way of the Port Hardy airport road and the Alice Lake Logging Company road.

* By J. E. Merrett.

The mineral occurrence is a series of east-west trending limestone beds with injected bands of volcanic rocks. Skarn zones are developed in places along the limestone-volcanic contacts. The skarn zones are, in places, mineralized with magnetite, minor chalcopyrite, and rare sphalerite. Several mineralized zones have been located and in six places have been examined by extensive surface stripping and diamond drilling.

From July to December a crew of 4 to 18 men completed approximately 10 acres of surface stripping on the various outcrops and 3,000 feet of diamond drilling in 17 holes.

BENSON RIVER (50° 127° S.E.)

Iron

Empire Development Company Limited*

Company office, 1012, 736 Granville Street, Vancouver 2; mine office, Port McNeill. E. C. Oates, general manager; P. W. Billwiller, mine manager. The Empire mine lies at an elevation of 2,500 feet on the west side of the Benson River valley, approximately 2 miles south of Benson Lake and on the east side of Merry Widow Mountain. The concentrator and camp are in the valley at an elevation of 800 feet. Access to the adit is by tote-road about 3 miles in length, and ore is trucked a distance of 1 mile from the adit to a crushing plant at the top of a tram-line connecting with the concentrator. Access to the mine camp is by a 25-mile road from Port McNeill on the east coast of Vancouver Island.

A crew of 31 men, of whom 6 were underground, was employed from April 1st to October 19th; those hauling concentrate were employed to December 15th. Approximately 80,000 tons of magnetite ore was removed from the Kingfisher underground workings and trucked to the primary crusher stockpile at the top of the tram-line. The tram-line crushing plant, equipped with a magnetic conveyor-belt pulley to remove ore from waste, crushed 159,871 tons of ore. The concentrator milled 90,082 tons of ore to produce 78,428 tons of concentrate. This concentrate, together with some from the 1962 stockpile, made total shipments of 96,610 tons to Japan.

Six exploration diamond-drill holes, totalling 2,826 feet, were completed in the vicinity of the Merry Widow orebody.

Copper

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 replaced R. M. Matson as mine superintendent; J. Giovanetti, mill superintendent. The property comprises 48 Crown-granted claims extending southward from Benson Lake on the west side of Benson River, and adjoins the Empire property on the north and east. Access is by way of a 26-mile gravel road from Port McNeill, where an employee residence townsite is located.

With the exception of the retimbering of 449 feet of the inclined shaft, all development work was done on or above the 5500 or main adit level. This work comprised 68 feet of shaft raising, 4,477 feet of drifting and crosscutting, and 14,036 feet of diamond drilling. Shrinkage stope mining methods were used to produce 327,433 tons of ore, all of which was milled. Copper concentrate was trucked to the Empire Development Company loading-dock at Port McNeill for shipment to Japan.

* By J. E. Merrett.

Construction was started on the addition to the mill of a magnetite recovery plant having a daily production capacity of 250 tons of magnetite concentrate.

The average number of men employed was 180, of whom 105 were employed underground.

ZEBALLOS (50° 126° S.W.)

Iron

F.L., Ridge, Cordova (Zeballos Iron Mines Limited)*

Company office, 1012, 736 Granville Street, Vancouver 1. C. J. Oates, president; P. W. Billwiller, engineer in charge. The property, which was described in some detail in the 1962 Annual Report, comprises 13 Crown-granted and 15 recorded claims and is 4 miles north of Zeballos. The mineral showings, consisting of high-grade magnetite, outcrop on the west side of Zeballos River valley at an elevation of approximately 2,600 feet. The outcrop of magnetite extends in a north-south direction for 1,500 feet, averaging 70 feet thick, and it 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 largely of grey Quatsino limestone.

The present company commenced work on the property in 1959. Open-pit mining was begun in 1962, and by the end of that year 250,397 tons of iron concentrate had been shipped. On February 27, 1963, the property was closed down. After a complete reorganization of the company and change of control, the property was reopened on November 1st. It is now intended to abandon the open-pit operations and prepare for underground mining. Approximately 70,000 cubic yards of waste was stripped during the year, and 13 holes were diamond drilled, totalling 2,095 feet. A new bunk-house camp was being constructed at the end of 1963 to accommodate 60 men. A crew of 80 men was employed at the beginning of the year and about 15 men after reopening in November.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1962, pp. 100-103; 1960, p. 103.]

SYDNEY INLET (49° 126° S.E.)

Copper-Gold-Silver

Indian Chief, Prince (London Pride Silver Mines Ltd.)*

Company office, 611, 850 West Hastings Street, Vancouver 1. J. H. M. Greenwood, president; W. M. Sharp, engineer. Capital: 5,000,000 shares, 50 cents par value. This property, held under option, comprises 16 Crown-granted claims on the north side of Stewartson Inlet. This inlet forms the west arm of Sydney Inlet.

The Indian Chief and Prince groups were first located in 1898, and since that time considerable development work has been done, with some production of copper, silver, and gold. Between the years 1904 and 1938, a total of 71,889 tons of ore was mined, yielding in concentrates 722 ounces of gold, 54,895 ounces of silver, and 2,430,310 pounds of copper. The showings include magnetite, chalcopyrite, and bornite mineralization in a skarn zone within a gently dipping series of volcanic and sedimentary rocks.

The present company began work in June, 1963, and finished in September. Several underground holes were diamond drilled on the Indian Chief group, and three surface holes were drilled on the Prince group. Total length of holes drilled was 1,800 feet. A crew of six men was employed.

* By A. R. C. James.

Copper**HERBERT INLET (49° 125° S.W.)****Catface Copper
Mines Limited***

This newly formed company is wholly owned by Falconbridge Nickel Mines Limited (British Columbia office, 1112 West Pender Street, Vancouver 1; Alex. Smith, exploration manager). It holds about 131 recorded claims on Catface Range, about 8 miles north-northwest of Tofino, at the southwest end of a peninsula between Bedwell Sound and Herbert Inlet. The range rises abruptly to maximum elevations of about 3,000 feet and is underlain partly by diorite, quartz diorite, quartz monzonite, and other rocks intrusive into mainly volcanic rocks of the Vancouver Group. The main showing, which was visited, is in the south part of the range and occupies a southwest-facing cliff rising steeply for many hundreds of feet from its base at about 1,600 feet elevation. It is reached from the present camp at Hecate Beach by a logging-road presently under construction and thence by an up-hill trail to the old camp near the showing.

Work early in 1963 was supervised by J. J. McDougall and included 741 feet of diamond drilling, bringing the total amount of drilling done on the property to 13,243 feet, of which most is in 21 holes at the cliff showing. Between April and December a crew of five men under H. S. Lazenby did geological mapping and geophysical surveying.

The following notes on the cliff showing are based partly on the writer's observations and partly on company information. The cliff consists principally of medium-grained quartz monzonite with biotite and hornblende crystals, which is cut by irregular bodies and sheets of quartz diorite porphyry. North of the showing these rocks partly underlie and enclose metavolcanic rocks. Andesite dykes, some light coloured and others grey and porphyritic, cut the other rocks steeply in several directions. Intrusion breccias are reported to occur along some contacts and as wide intersections in drill-holes. Rock fallen from the cliff partly includes this kind of breccia, consisting of small fragments of metavolcanic rock enclosed in a dioritic, porphyritic matrix. At the base of the cliff a northerly fault dips fairly steeply eastward, and quartz monzonite in the hangingwall is partly crushed and altered and is mineralized mostly with chalcopyrite and also with bornite and small amounts of molybdenite. The rocks in the lower part of the cliff are sheeted in several directions, noticeably by joints dipping steeply southeastward and others dipping southwestward. The bulk of the rock is more or less fractured and in places is stained by malachite. Quartz, chlorite, and epidote occupy fractures and replace scattered minerals in the rocks. Plagioclase feldspar is partly rendered chalky by alteration. Sulphides have weathered at the surface but are fresh within inches of it, and were seen in most of the rock types mentioned. They occur partly in fractures containing quartz, and partly are disseminated. Flat holes drilled westward into the cliff contain mineralized intersections several hundred feet long. The mineralized zone extends some distance in a northerly direction. Other showings occur on Irishman Creek, about one-half mile farther north, and have been explored in a preliminary fashion.

[Reference: *Minister of Mines, B.C., Ann. Rept., 1962, p. 105.*]

Gold**BEDWELL RIVER (49° 125° S.W.)****Musketeer
(Copper Town
Mines Limited)†**

Company office, 510 West Hastings Street, Vancouver 2. This company controls approximately 22 claims and fractions, including the Musketeer and Shamrock groups. The property is situated south of Bedwell River on lower Sam Craig Creek, about 8 miles from the head of Bedwell Sound.

* By J. M. Carr.

† By A. R. C. James.

The showings consist of narrow quartz veins that are mineralized with pyrite, chalcopyrite, sphalerite, and galena and contain values in gold and silver. They were discovered in 1938, and since that time a considerable amount of underground development has been done on the Musketeer and Trail veins. Production up to the end of 1963, including ore from the former Buccaneer operation, was 12,241 tons of ore, yielding 6,872 ounces of gold, 2,878 ounces of silver, and some zinc, copper, and lead.

In 1963 the company entered into an agreement with Kootenay Base Metals (Consolidated) Ltd., and further underground development was done from February 16th to April 27th, after which the property remained idle for the rest of the year. The following work was completed:—

Crosscutting	Ft. 273
Drifting	11
Slashing	1,530

The mill was cleaned up and put into operation, using hydro power, but it was reported that a considerable amount of further work was necessary to restore the mill to a state of good operating order. At the latter end of the work period the bridge below the camp was washed out, making operations and access difficult.

TSOLUM RIVER (49° 125° N.E.)

Copper

Domineer Operating company, The Consolidated Mining and Smelting
(Qualicum Mines Company of Canada, Limited; exploration office, 508
Limited)* Marine Building, Vancouver 1. E. H. Caldwell, western
 district superintendent. In March this company optioned
 195 located claims and 4 Crown-granted claims named

Domineer from Qualicum Mines Limited, a private company controlled by Mt. Washington Copper Co. Ltd. (registered office, 404, 1111 West Georgia Street, Vancouver 1; G. L. Gibson, president). The property is on Mount Washington, which rises to a height of 5,215 feet, about 15 miles northwest of Courtenay, and lies within the land grant of the Esquimalt and Nanaimo Railway Company, with which, as owner of the base-metal rights, an operating agreement exists. Access to the property is by logging-roads from the gate of Comox Logging Company near the southeast end of Wolf Lake.

Work done in 1963 by a small crew under A. C. N. de Voogd included geological mapping, magnetometer surveying, a limited amount of stripping, and 9,678 feet of surface diamond drilling in 19 holes, of which 7 were near Murex Creek and the remainder near Breccia Ridge. At the time of a visit in August this work was at an early stage of completion.

The mountain is underlain at lower elevations by massive, dark volcanic rocks of Upper Triassic age and at higher elevations by quartzites and argillites assumed to be of Upper Cretaceous age. Both groups of strata are intruded by dacite porphyry and associated breccia, which together occupy most of Breccia Ridge to the north of the summit and occur also on the eastern slopes, on Murex Creek, and elsewhere. Quartz diorite intrudes volcanic rocks along the mine road on the north-eastern slopes of the mountain and may be a separate body, older than dacite porphyry and breccia.

Where unaltered the dacite porphyry is mostly a grey-green aphanitic rock with phenocrysts principally of quartz, plagioclase, and green hornblende. It is similar lithologically to the larger porphyry body which forms Constitution Hill near Wolf

* By J. M. Carr.

Lake, and which contains brown hornblende and partly has a coarser-grained groundmass. The Mount Washington porphyry contains many broken phenocrysts, which apparently broke before the rock solidified. Some porphyry on Mount Washington possesses only a few quartz phenocrysts and may be a separate type. The form of the porphyry intrusions is largely unknown. In the Cretaceous rocks some intrusions are narrow and sill-like, whereas others are larger and apparently extend to depth.

The breccias vary in composition and appearance, but in general their fabric resembles that of breccias formed elsewhere in association with porphyry intrusions, for example, at Highland Valley. Some are merely brecciated porphyry, whereas other breccias contain a varied assemblage of fragments that are both large and small and are mostly angular and unsorted. The fragments are enclosed in a plentiful silt- or sand-sized matrix which consists largely of granular quartz and feldspar together with debris of porphyry and frequently of other rocks. Porphyry fragments are invariably present and are generally accompanied by fragments of the adjacent country rocks—namely, volcanic rocks at lower elevations and quartzite and argillite at higher elevations. A type of quartz diorite was noted rarely as fragments in some breccias at lower elevations. Some breccias contain fragments of earlier breccias, and crosscutting relationships between breccias are seen in outcrop. The contacts between breccias and other rocks vary from sharp to gradational. Some breccia bodies are large, and their shapes have not been determined. Others are narrow and sheet-like.

Rock alteration is pronounced near the showings adjoining Breccia Ridge, and has produced biotite, actinolite, chlorite, epidote, and quartz. Biotite locally replaces hornblende in porphyry and also produces a brown colouration in the matrix of some breccias. Actinolite partly replaces biotite phenocrysts and also forms coarse sheaves which partly replace breccia and are accompanied by magnetite and sulphides. Chlorite and epidote are widespread in altered rocks and in veins. Quartz principally forms veins, some of which are several feet wide and are mineralized. A relationship probably exists between faults and at least part of this alteration. The altered rocks are more or less fractured and are widely, if weakly, mineralized. At the main showings the explored quartz veins are of a type involving both fracture filling and replacement, and they follow flat shears. Major faults are assumed by company geologists to exist near the showings and elsewhere on the property, but their exact locations and attitudes are unknown. Such faults may well be steep.

At the main showings, which are on or near the Domineer claims at about 4,400 feet elevation to the northeast of Breccia Ridge, a large area has been partly explored by stripping, short diamond-drill holes, and a northerly adit as described in the Annual Report for 1962. Here the quartz veins partly follow flat, sheared contacts between porphyry and Cretaceous rocks and, with the adjacent rocks, are mineralized with chalcopyrite, bornite, covellite, arsenopyrite, and pyrite. About one-quarter of a mile farther south, at about 4,600 feet elevation on the east side of Breccia Ridge, west-dipping quartz veins are exposed in a number of old short adits and newer trenches, and together with the footwall rocks are mineralized with chalcopyrite, arsenopyrite, and molybdenite.

The Murex Creek showings are at about 2,500 feet elevation nearly 2 miles east of the main showings, and include a lower showing which was explored in 1960 and a higher showing where drilling was going on when visited in August, 1963. At the higher showing, chalcopyrite and pyrite were seen both disseminated and in quartz veinlets in dacite porphyry, breccias, and volcanic rocks.

[References: Carson, D. J. T., "Geology of Mount Washington, Vancouver Island, British Columbia," unpublished thesis on file at the *University of British Columbia*, 1960; *Minister of Mines, B.C.*, Ann. Repts., 1956, p. 119; 1957, p. 69; 1959, pp. 135-157; 1960, pp. 111-113; 1962, pp. 105-107.]

BUTTLE LAKE (49° 125° N.W.)

Gold-Silver-Copper-Lead-Zinc

**Lynx, Paramount,
Price (Western
Mines Limited)***

Company office, 802, 850 West Hastings Street, Vancouver 1; mine office, Box 8000, Campbell River. 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 grants, 2 claims held by mineral leases, and 123 claims by record. The ground covers a rectangular area approximately 2 miles wide and nearly 5 miles long at the south end of Buttle Lake in Strathcona Provincial Park, central Vancouver Island. The area can be reached by road from Campbell River to Buttle Lake and then by boat for approximately 20 miles up the lake.

The Lynx property is on the north side of Myra Creek, approximately 2½ miles west of the south end of Buttle Lake. The surface mineral occurrences are at several locations between elevations of 1,200 and 1,700 feet above sea-level. The mine has been developed underground from two adits, the main or 1225 level and the 1350 level, with portals at the respective elevations. A four-compartment vertical shaft of outside dimension 7 feet 3½ inches by 26 feet 3¾ inches and located underground was sunk to 850 feet elevation, and stations were cut at the 1,075- and 925-foot level elevations. The shaft was raised 172 feet and a station cut on the 1350 level. In conjunction with the shaft operation, a total of 396 feet of raising was completed in the rope, ore-bin, and waste-bin raises. The major portion of the 3,344 feet of drifting and crosscutting was completed on the 1225 and 1350 levels, although small amounts of crosscutting were completed on the 1075 and 825 levels. In addition to the raising done in the shaft area, 484 feet of exploration raise was completed and 17,685 feet of diamond drilling was done in 78 underground holes.

On the surface an area of 25 acres was cleared for the construction of the mine plant. Two prefabricated Armco buildings were erected, one 32 by 56 feet to house shops and one 50 by 60 feet for use as a power-house. In the latter building three diesel-electric generators of 750 kilowatts total capacity and a 1,000-cubic-feet-per-minute compressor were installed.

Midway between the mine and the lake a trailer camp was installed to accommodate 88 men. The average number of men employed was 71, of whom 24 were employed underground.

The Paramount property is on the north slope of Myra Mountain and on the south side of Myra Creek, opposite the Lynx holdings of Western Mines Limited at the south end of Buttle Lake. Myra Falls Mines Ltd., which was formed in March, 1963, is a wholly owned subsidiary of Western Mines Limited. Exploration work on the 1350 level, with portal at that elevation, was done by a crew under hire from Western Mines Limited. This work comprised 1,040 feet of drifting and crosscutting and 2,772 feet of diamond drilling completed in 16 holes.

The Price property is on the east slope of Myra Mountain and 1½ miles south of the south end of Buttle Lake. Price Creek Mines Ltd., formed in March, is a wholly owned subsidiary of Western Mines Limited.

* By W. G. Jeffery and J. E. Merrett.

The sulphide orebodies at the Lynx and Paramount properties are contained within a thick series of rocks, composed mainly of volcanic breccias, agglomerates, and tuffs together with lesser amounts of fine-grained andesitic flow rocks. The base of the thick volcanic pile is not seen, but, providing there is no repetition by undetected faults, the sequence must be at least 10,000 feet thick. Lithologic variation is considerable, but the lower part of the sequence is mainly composed of well-bedded and laminated green, brown, and purple cherty tuffaceous rocks that have a siliceous appearance and conchoidal fracture. These bedded rocks change upward in a gradational manner to massive volcanic breccias and more coarsely bedded tuffs. The whole sequence is intruded by large sills of fine- to coarse-grained brown and green gabbroic rocks.

The volcanic rocks are overlain by a limestone unit with minor sandstone and argillite with a total thickness of 1,100 feet. R. W. Yole has found from palaeontological studies that this limestone is early Permian (Wolfcampian-Leonardian (?)) in age. Gabbroic sills are abundant and are believed to be associated with the overlying volcanic rocks.

The volcanic rocks above the limestone lie conformably on the sedimentary rocks and form the lower part of the Karmutsen Group, usually regarded as Triassic in age because the next overlying fossiliferous unit contains Upper Triassic fossils. The Karmutsen rocks consist dominantly of pillow lavas, breccias, and basaltic flows.

Approximately 2 miles west of the operations of Western Mines Limited is a large mass of granodiorite and granite that intrudes all the rocks described above.

The regional folding has been broad and gentle in character apart from local conditions adjacent to faults or intrusive contacts. Consequently, over most of the area, dips rarely exceed about 30 degrees. There are a number of gentle flexures that combine to give an over-all anticlinal structure to the region though there is no single dominant anticlinal axis.

Faults are more important than folds in any explanation of the regional structure. Wherever the limestone unit is encountered, the fault pattern can be seen readily. Where limestone is absent, the volcanic rocks are sufficiently similar in appearance to render faulting inconspicuous, and this is particularly true in the valleys where alluvium and heavy forest-cover combine to obscure the geology. There are three main sets of faults and directions of shearing, as follows:—

- (1) Northwest-southeast.
- (2) North-south.
- (3) East-west.

All these faults are vertical or have steep dips and their strikes vary within a few degrees of the directions given above. Field observations indicate that the northwest-trending faults are the oldest set and they may be offset by the other faults. No clear age relations between the north and east faults are yet known, but the east-trending faults offset the granite contact. In addition to the three main directions, a smaller number of faults striking northeast were observed.

The mineralization at the main property of Western Mines, the Lynx zone, is associated with chlorite-sericite schists that form a wide zone striking northwest and with steep dips to the southwest and northeast. Other rocks exposed in the 1225 and 1350 levels are massive tuff, agglomerate, fine-grained green andesite rocks and greenstone dykes. The tuff and agglomerate texture can in places be identified in the chlorite-sericite schists. The contact between the schists and massive rocks is quite sharp along the southwest boundary of the shear zone but appears gradational in character to the northeast, so that the boundary has not yet been defined by the underground exploration. However, the zone is at least 300 feet wide in the vicinity

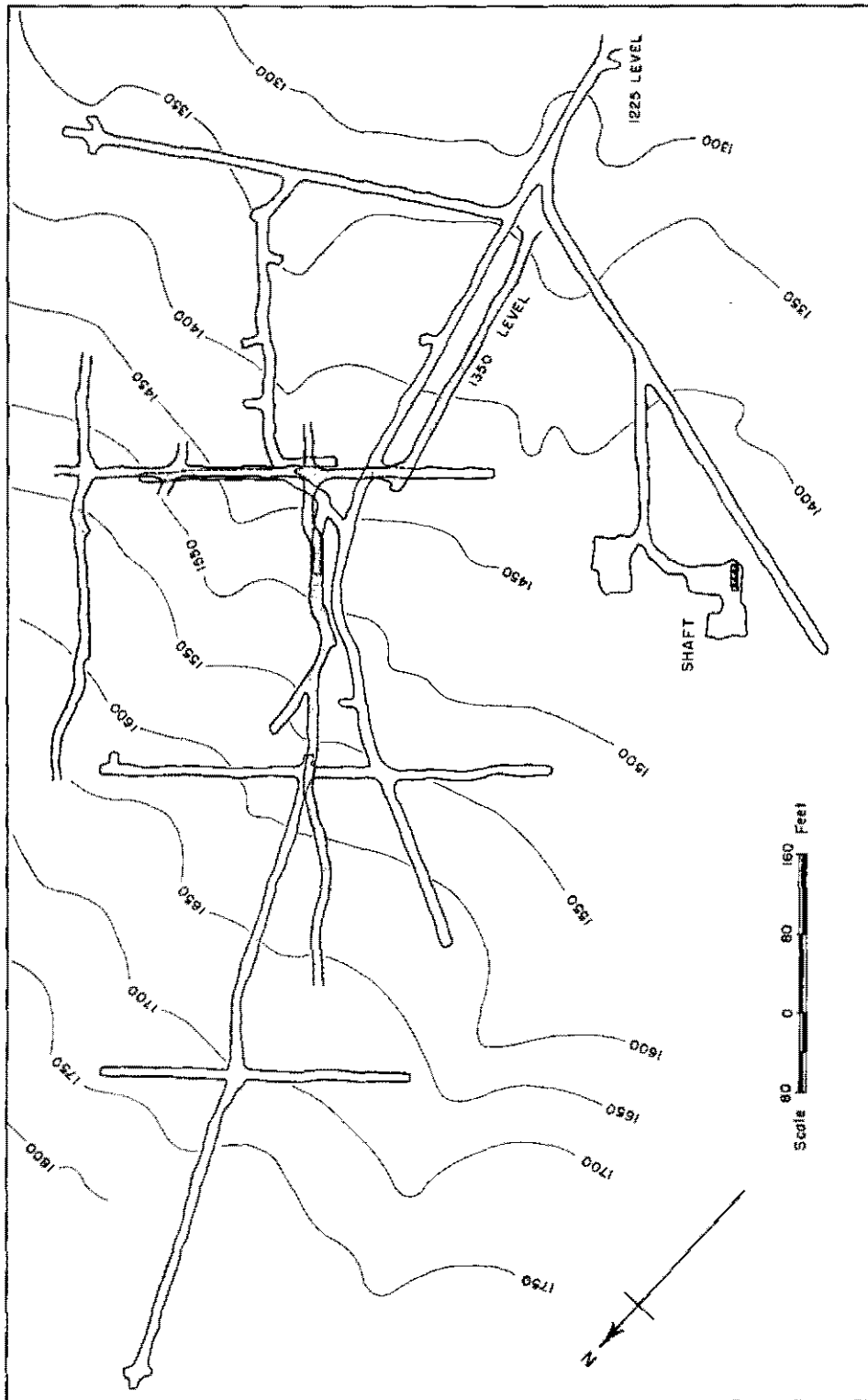


Figure 8. Western Mines Limited. Plan of Lynx workings.

of the Lynx showings, and intermittent mineralization has been indicated over a strike length of about 1,200 feet.

Northwest-trending shear zones similar in character to, but varying in the intensity of, schistosity and alteration from that on the Lynx property have been observed elsewhere in the area.

Lynx.—At the Lynx zone massive and disseminated sulphide occurs within the schists or along the western contact of the shear zone. The sulphides consist of pyrite, sphalerite, chalcopyrite, galena, and bornite. Gangue minerals consist of sericite, chlorite, quartz, calcite, and barite. The ore along the western contact is fairly regular and follows the contact closely, whereas the sulphide bodies enclosed within the shear zone appear to have irregular shapes and vary sharply in extent over short distances. The structural controls on these lenses and separate masses may be connected with folds within the schists that have a predominant gentle plunge to the north, although there are southerly plunges also.

The company's annual report for 1963 quotes the following average grade including dilution: Gold, 0.07 ounce per ton; silver, 3.1 ounces per ton; copper, 2.5 per cent; lead, 1.3 per cent; zinc, 11.1 per cent.

The sulphides are finely banded in many places. There are thin pyrite-rich, sphalerite-rich, and chalcopyrite-rich layers about 1 millimetre wide commonly superimposed on zones of the order of 2 centimetres wide that are dominantly pyrite or chalcopyrite or sphalerite but which include thin layers of the other minerals. Curved, folded, and flowage types of banded texture can be observed. In addition to this regular banding, some parts of the sulphide show banding that is clearly cataclastic in origin with granulated pyrite grains and boudin structures.

Commonly in the massive sulphide, rounded to lenticular-shaped inclusions form about 2 per cent of the ore. The equant inclusions range from about 1 to 4 millimetres across with rare larger sizes. The lenticular forms may be 1 to 2 centimetres across and 3 to 7 centimetres in length, and all the long axes lies in the ore with steep attitudes concordant with the over-all structure. The lenticular forms are schistose. No definite relation of any inclusion to the sulphide banding was seen in the visits made by the writer. All the inclusions have sharp clean contacts with massive sulphide, and in many cases parts or all of the surface of an inclusion were polished as though movement had occurred on the surface. Thus, apart from their being friable, careful excavation allowed recovery of whole inclusions, and 13 were collected. Two inclusions were too small to obtain representative thin-sections. Three of the schistose inclusions are essentially sericite schists. The remaining eight are composed dominantly of sericite and quartz with foliated but not schistose textures. Quartz occurred as streaky aggregates separated by sericite, as an equigranular texture with interstitial micaceous minerals, and also as a cataclastic texture with foliated sericite fretting the grain boundaries rather than flowing round quartz grains.

Inference from this information is not conclusive as to the origin of the inclusions, except that the idea that they represent original fragments of a volcanic breccia is not proven.

The strike of the mineralization at the Lynx property is between north 45 and 50 degrees west, and the Paramount property is in reasonable alignment along this direction, about 4,000 feet southeast of the Lynx workings. However, the over-all strike of the mineralization at the Paramount is between north 20 and 25 degrees west, and there is possibly an east-trending fault along the Myra Creek valley that may cut northwest-trending shear zones. The area between the Lynx and the Paramount properties has not been explored.

Paramount.—The underground workings at the Paramount are in the 1350 adit level, and the rocks exposed comprise quartz-sericite schist and dyke rocks, although massive volcanic breccias occur in diamond-drill cores. The over-all attitude of the foliation is vertical or dips steeply northeast.

The mineralization as exposed along the 1350 level is similar to that at the Lynx. It is mostly massive sulphide with sharp contact against the schists, and there is a very limited amount of disseminated sulphide in the schist, so that the wallrock is seldom economic. The width of the sulphide zone varies irregularly along the drive, the sulphide in places lensing along the foliation and also cutting across the schistosity. Faults cut the ore with apparent displacements of the order of 2 feet, causing abrupt changes in width, as seen in the back of the drift. The massive sulphide surrounds lenses of rock, some of which may be dyke rock, that have sharp contacts and appear to be unreplaced by the sulphides. Banding in the sulphides can be observed in places. Ore exposures appear sharper and more distinct than at the Lynx property, but the environment and characteristics are essentially similar.

A drift was driven southwest of the ore zone for diamond-drilling purposes. The rock exposed is quartz-sericite schist, and in a part of the drive a section of the schist contains disseminated sulphide. The mineralization consists of pyrite, chalcopyrite, and some tetrahedrite that occurs as wispy irregular veinlets and specks concordant with the foliation of the schist. It was reported that in places this rock contains between 1 and 2 per cent copper but that gold and silver values are negligible.

**The Buttle Lake
Mining Company
Limited***

Company office, 1121 Marine Building, 355 Burrard Street, Vancouver 1. This company holds two groups of claims in the area at the south end of Buttle Lake. The Jay group consists of 48 claims adjoining the Lynx property of Western Mines Limited on the northwest. Southeast of Western Mines Limited there are 41 claims named the Buttle Bell, Rose, and Rick groups. From May to September, 1963, a crew of three men under the direction of P. Chilcott carried out line cutting and geological mapping.

TRANQUIL INLET (49° 125° S.W.)

Gold

**Fandora and Gold
Flake (Tofino
Mines Ltd.)†**

The key claims of this property comprise five Crown-granted claims situated on the northwest side of Tranquil Creek about 2 miles from the head of Tranquil Inlet. From a beach camp near the mouth of Tranquil Creek, a jeep-road 2 miles long follows the valley of the creek to a point from which a steep trail, tractor-road, and light tram-line lead to the mine and camp-site at an elevation of 1,500 feet. The property, owned by Moneta Porcupine Mines, Limited, has in recent years been leased to W. E. McArthur, Sr., but in March, 1963, the lease was sold to New Hamil Silver Lead Mines Ltd., which has operated the property since that time.

The gold-quartz veins were discovered in the late 1930's, when surface work disclosed the veins in a shear zone adjacent to an andesite dyke. The property has been developed intermittently since 1946, and some small shipments have been made. Four adit levels have been driven at 1,500, 1,700, 1,900, and 2,100 feet elevation respectively. The quartz veins are commonly narrow and strike north 70 degrees west and dip about 75 degrees to the north.

* By W. G. Jeffery.

† By A. R. C. James.

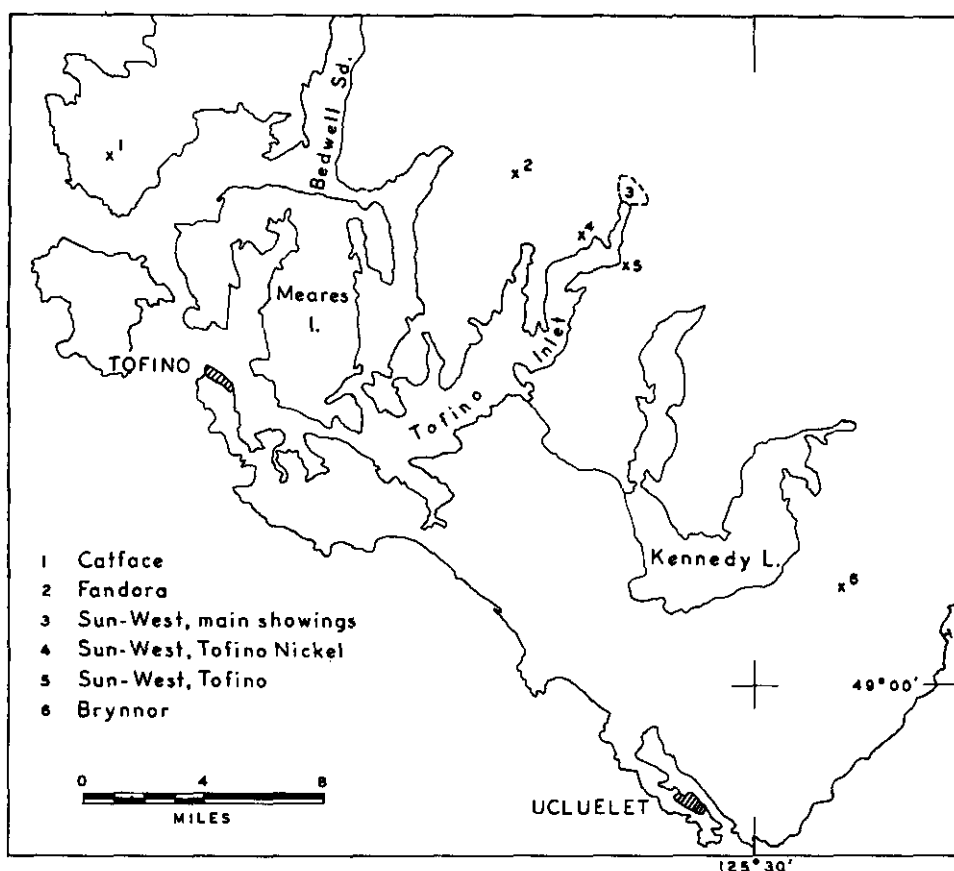


Figure 9. Properties referred to in the general Tofino area.

During the first two months of the year Mr. McArthur shipped 46½ tons of ore to the Trail smelter. This ore was mined in 1962. The 15-12 raise (driven from the 1500 level) was extended from 116 to 121 feet above the level, and two box-holes were driven to provide ore-passes for the stope. At the beach camp at the lower end of Tranquil Creek, the cabin was rebuilt on higher ground, and a telephone wire was laid from the lower camp to the mine. New Hamil Silver Lead Mines Ltd. commenced work on May 1st. This company reports the following work accomplished by the end of 1963:—

- (1) The 1700 level was repaired and retimbered where required and was driven a further 700 feet. The 15-12 raise was driven a further 186 feet, and when work was temporarily stopped the head of the raise was within a short distance of the 1700 level.
- (2) A 30- to 35-ton mill, comprising a rod mill, Denver jig, and three flotation cells, was erected near the 1500 level portal.
- (3) A diesel-driven 125-kva. generator unit and a 600-cubic-foot portable air compressor was installed.
- (4) A tailings pit was excavated, for use in the event of a change-over to the cyanide process.
- (5) The kitchen was enlarged to accommodate a crew of 20 men, and a dry and two new bunk-houses were built.

- (6) A tractor-road about a mile long was built from the bottom of the tram-line to the 1500 portal.

In December a crew of 17 men was employed under the supervision of H. Tomlinson.

TOFINO INLET (49° 125° S.W.)

Copper-Molybdenum

Sun West Minerals Limited*

Company office, Box 111, Tofino. Lorne Hansen, president; F. C. Buckland, director; G. Lemay, foreman. This company owns 58 recorded claims at the head of Tofino Inlet on the west coast of Vancouver Island. The claims are in three blocks, as shown on Figure 10. The principal block, of 34 claims and fractions, lies across the lower courses of Tofino (Deer, Clear) and Onad (Copper) Creeks. It includes the Lida, Foremost, Foremost Copper, Canyon, Clear Creek, Velvet, and Copper Creek groups. Most of the showings are in this block. The second block comprises the Tofino Nickle group of 17 claims on the northwest side of Tofino Inlet just below Deer Bay. The third block comprises the Tofino group of 7 claims on the east side of the inlet at the entrance to Deer Bay. Access is from Tofino by boat for 18 miles up Tofino Inlet and Deer Bay. At high tide small boats with outboard motors can travel up Tofino Creek to the camp at the first bend. Larger boats must land on the east side of Deer Bay just below the mouth of Onad Creek. From this landing a tractor-road leads to the camp. Other tractor-roads lead out from the camp to many of the showings.

The area has had occasional prospecting and development since 1898. The Hetty Green group was located apparently astride the second bend of Tofino Creek. Some open cuts were made and several adits driven. In 1905 a wagon-road was built to tidewater, and 215 tons of copper ore was shipped to the Ladysmith smelter. All work ceased after 1910, and the claims were allowed to lapse. The Copper King group for a time covered roughly the same ground. In 1916 the White group, also known as the Douglas group, was located by W. Walton along the lower part of the bluffs north of the old Hetty Green ground. Intermittent prospecting and development were carried on through 1930, at least three adits being driven and a quantity of copper ore being stockpiled. The Jumbo was located in 1898 around the lowest falls on Onad Creek, where it enters the flat around the head of Deer Bay. In 1899 the Jumbo Mining Syndicate sank a 42-foot shaft, drove a 25-foot adit, and built a flume for water power. By 1916 a second shaft had been sunk 67 feet, and considerable drifting had been done from it. The Crow group was located in 1898 above the Jumbo on the south side of Onad Creek. Tofino Copper Co. drove a second adit on it in 1916.

Since 1950 the ground covered by these old claims has been staked several times and the properties have had several owners. Hansen and Buckland located the Foremost and Clear Creek groups in 1952-53. In 1954 F. C. Buckland organized Clear Creek Copper Mines Ltd. and Taiga Mines Ltd. to explore and develop the property. A new adit was driven at the south end of the old White showings, some diamond drilling was done there and on the Tofino Nickle group, and a tractor-road was built from the northwest corner of Deer Bay to the vicinity of the White and Hetty Green showings. In 1960 the property was reacquired by Hansen, and in 1962 all extant claims were made over to Sun West Minerals Limited. In 1961 and 1962 a large number of showings were stripped with a bulldozer. In 1962, 650 feet of diamond drilling was done in four holes. In 1963 a further 950 feet of diamond drilling was done in two additional holes, and small test-pits were blasted in several of the showings.

* By G. E. P. Eastwood.

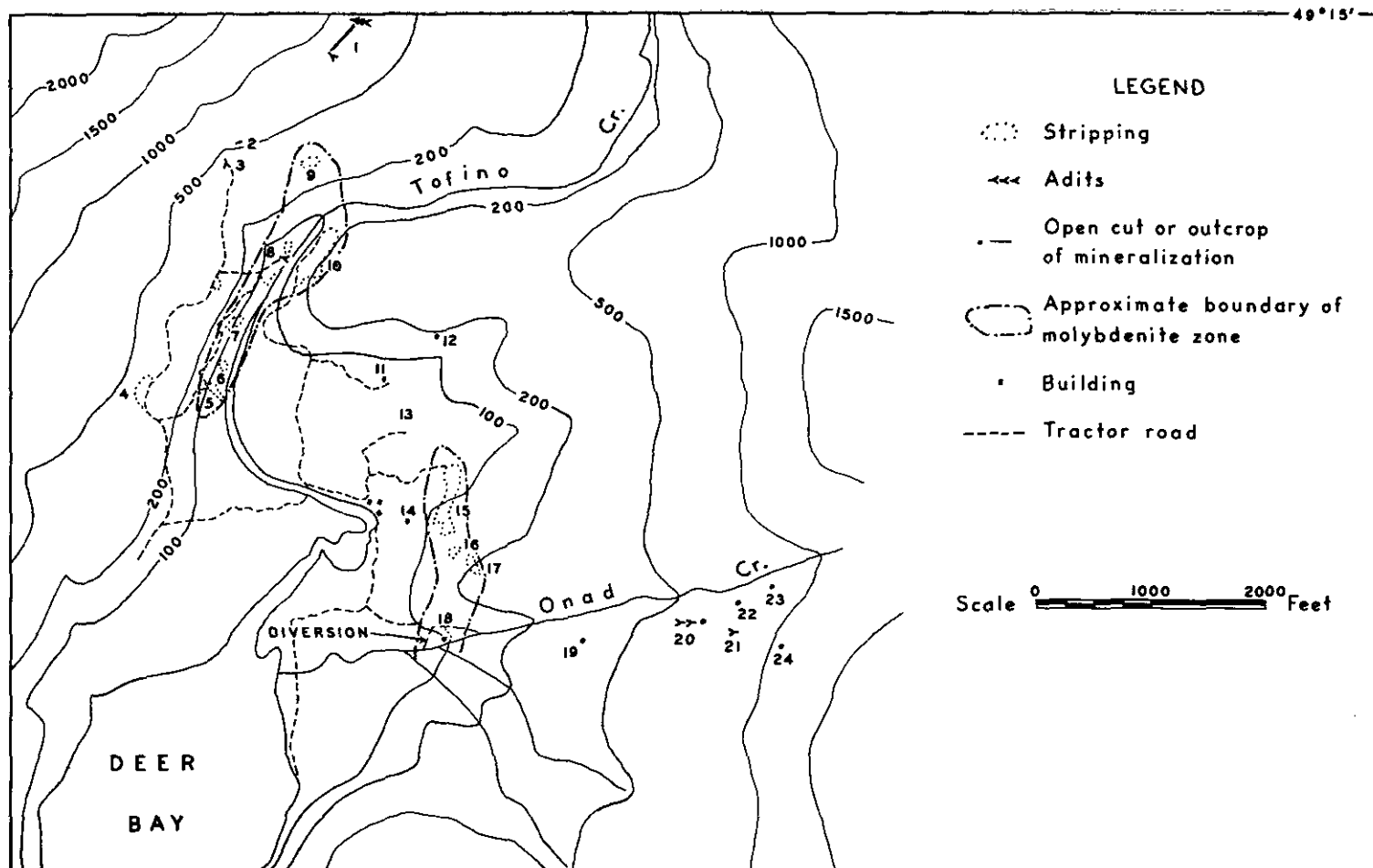


Figure 10. Mineral showings on Tofino and Onad Creeks.

Main Showings

A broad, partly alluvial flat at the head of Deer Bay terminates northward against a low transverse ridge known locally as the Horse Hump. To the east and west the flat passes into moderate mountain slopes. Northwest of the Horse Hump moderate lower slopes pass up into precipitous bluffs. Natural exposures are small and scattered away from these bluffs. The area has a high annual precipitation and is thickly covered with timber.

The geology has not been mapped and can be described only in very general terms, based on observations incidental to examination of the showings. The valley flat is underlain by an intrusive complex consisting of a greenstone complex and successive intrusions of diorite, granodiorite, minor granite, and porphyry. The greenstone complex may be partly volcanic and partly intrusive. The dominant rock type in it is dark green, fine grained, and featureless. Here and there a similar rock contains small white bodies that may have been amygdules. Another rock that occurs sporadically through the greenstone complex is fine grained, medium grey in colour, and contains both white and dark spots. A thin-section disclosed that the white spots are labradorite phenocrysts and the dark spots are aggregates of pyroxene, epidote, and chlorite. The rock is porphyritic basalt or, more likely, basalt porphyry. Here and there a dark-green gabbroic rock appears to intrude the other greenstones; it is pre-skarn and may be pre-diorite.

The greenstone complex has been broken up and pervaded by coarse-grained rocks ranging from dark diorite to white granite. In a few places these coarse-grained rocks form fairly large masses, but commonly they occur as irregular dykes a few feet or tens of feet across and as reticulate dykelets a few inches thick. The lighter varieties tend to intrude the darker. Considerable feldspar has been introduced into the greenstones near the contacts. These coarse-grained rocks have been intruded in turn by dykes of green basalt porphyry which contain large, highly altered plagioclase phenocrysts. The porphyry contacts are sharp, and the marginal zones are commonly chilled against all other rocks.

The lower walls of the valley consist predominantly of featureless greenstone and grey to white crystalline limestone. These rocks are intruded by scattered diorite bodies which are generally sill-like in form. Small lenses of limestone also occur here and there in the complex or the valley flat. The structure and ages of the rocks are unknown.

The greenstone complex and coarse-grained intrusives are in places irregularly altered to or veined by garnet - epidote - pyroxene - amphibole - calcite skarn. The limestone is little altered, containing only a few scattered crystals of garnet. The young porphyry does not show any alteration to skarn and is probably younger. The over-all distribution of the skarn is not known. Nearly all the exposures on the valley flat contain at least a little skarn, but on the lower valley walls skarn appears to be restricted to greenstone or diorite along contacts with limestone. Within outcrops or stripped areas on the valley flat the skarn distribution is irregular. Some of the skarn is in veins. Some is in irregular masses that either lie against a contact or feather out in all directions. Some skarn is disseminated through the rock. Possibly the greenstone complex has been more extensively altered, but the coarse-grained rocks have certainly been attacked, and where the intrusive pattern is intricate it is difficult to tell which rocks have been wholly replaced by skarn. The garnet is commonly yellow to light brown in colour, but in one drill core a few crystals of red garnet were seen in the yellow variety. The epidote is commonly fine grained, granular, but locally is coarse grained and euhedral. The pyroxene is consistently pale green and closely associated with the garnet. The

amphibole is coarse grained and commonly dark green to greenish black, but here and there a bluish variety is also present. The calcite is very coarse grained, but is sporadic and interstitial to the other skarn minerals. Quartz veinlets are widely scattered.

Associated with the skarn are pockets, irregular masses, and disseminations of molybdenite, chalcopyrite, magnetite, and locally bornite. Pyrite and pyrrhotite are also present in some showings. The mineralized exposures examined are shown in Figure 10. The mineralization is so irregular that any term which implies a definite body of mineral or mineralized rock is apt to be misleading. The term "zone" is here used, in a rather extended sense, to signify an area in which a given mineral occurs that can be shown at the scale of Figure 10. Where exposure is good, as in the larger stripped areas, more detailed mapping would show sub-zones that are separated by extensive barren areas, and the metal content would vary widely within the sub-zones. In some of the copper and molybdenum showings the irregularity of distribution extends right down to the hand specimen. The main molybdenite, chalcopyrite, and magnetite zones overlap, and chalcopyrite may be found closely associated with either of the other minerals, but magnetite and molybdenite have not been found together.

Two molybdenite zones are roughly outlined on Figure 10. The boundaries drawn are only approximate, mainly due to poor exposure but also due to lack of detailed mapping. A very few molybdenite crystals may be found outside these zones, but all significantly known molybdenite mineralization has been included in them. There is no evident structural control of the zones. The molybdenite does not occur uniformly through the zones, but rather in small, scattered, relatively high-grade patches and more extensive low-grade areas which are separated by areas of barren rock. The high-grade patches contain walnut-sized aggregates of molybdenite crystals and scattered individual crystals about 4 millimetres across. The low-grade areas contain smaller crystals that are more sparsely disseminated. Molybdenite is about equally common in skarn and in the coarse-grained intrusives, less common in unaltered greenstone. It has not been found in younger porphyry or limestone and does not show the tendency to occur near limestone that is demonstrated by chalcopyrite and especially magnetite. The aggregates seem to occur preferentially with coarse-grained epidote. In a few places a canary-yellow earthy substance, probably molybdic oxide, is associated with the molybdenite. Powellite has been identified in a number of places from its greenish-yellow fluorescence in ultraviolet light. It cannot be distinguished from white feldspar in ordinary light, and its distribution is not properly known. It seems to occur preferentially in granitic dykelets.

The molybdenite is difficult to evaluate. Very extensive sampling would be required to determine average grades for the surfaces of the zones, or of appreciable parts of the zones. Six holes have been diamond drilled in the east zone, two of about 450 feet at the north end and four short holes at the south end. The two longer holes passed out of molybdenite mineralization within 180 feet of the surface, but continued in and out of skarn. In view of the irregular mineralization it seems that a great deal of drilling would be required to determine whether there are blocks of ground of sufficient size and grade to make ore.

Chalcopyrite is scattered across the valley of Tofino Creek from the bluffs northwest of the Horse Hump to Onad Creek, and a little more is associated with magnetite uphill on the south side of Onad Creek. Disregarding this minor copper mineralization south of Onad Creek, the known copper mineralization occurs in two zones that coincide with the molybdenite zones and extend beyond them to the north.

The chalcopyrite occurs in skarn, greenstone, coarse-grained intrusives, and locally in limestone. It is associated with molybdenite, with magnetite, and it occurs alone. It forms high-grade pockets and lenses and is also disseminated through considerable volumes of rock. The more massive bodies are generally along contacts of limestone lenses or bands. The principal individual showings are Nos. 1, 10, and 18. Bornite was noted only at No. 18.

Magnetite occurs principally on the northwest and southeast edges of the mineralized area. The individual bodies are small bands and lenses and are not considered ore at this time. The magnetite on the northwest side occurs alone or is associated with chalcopyrite, whereas on the southeast side it is commonly associated with pyrite and pyrrhotite.

Brief descriptions of most of the individual showings follow:—

- (1) White showing. A limestone band nearly 100 feet thick dips gently into the bluff face. Greenstone has been altered to skarn for several feet in the hangingwall of the limestone, and in the immediate hangingwall has been intensively replaced by chalcopyrite. Parts of this contact are covered or are inaccessible in the bluff face; therefore, it is uncertain whether the mineralization is continuous for the over-all length of 600 feet. Where seen, the chalcopyrite band is 5 to 10 feet wide. A grab sample of chalcopyrite containing remnants of skarn assayed: Gold, 0.02 ounce per ton; silver, 4.9 ounces per ton; copper, 24.22 per cent. Chalcopyrite and magnetite occur locally in the limestone footwall. One crib and about 20 sacks of chalcopyrite were seen below the north end of the showing. There are reported to be other cribs of sorted ore on this hillside.
- (2) A band of magnetite 6 feet wide dips 75 degrees southeast between a diorite footwall and a limestone hangingwall. The band passes under cover at both ends.
- (3) An 8-foot band of magnetite and chalcopyrite dips steeply west beneath a band of limestone. A thick band of skarn in the limestone hangingwall has a little chalcopyrite in its own hangingwall. Magnetite with minor chalcopyrite and pyrrhotite occurs at the portal of an adit, some 30 feet in the footwall of the main band.
- (5) Molybdenite is sparsely disseminated through a complex of diorite and granodiorite which is somewhat altered to skarn.
- (6) Greenstone along the footwall of a thin limestone band is somewhat altered to skarn and contains a little chalcopyrite, malachite, and magnetite.
- (7) Greenstone in the hangingwall of a limestone band dipping gently into the hillside is partly altered to skarn and contains a little chalcopyrite and magnetite. Diorite in the greenstone hangingwall is slightly altered and contains sparsely disseminated molybdenite.
- (8) A limestone band dips irregularly into the hillside. Along the footwall, greenstone and locally diorite are intensively mineralized with magnetite. At the adit shown in Figure 10 the greenstone along the immediate hangingwall of the limestone is intensively mineralized with chalcopyrite and pyrrhotite, and farther out in the hangingwall it is largely altered to skarn, which contains a few specks of molybdenite. About 100 feet to the north this skarn is in contact with the limestone and contains also veinlets of molybdenite.

- (10) Main Hetty Green showing. The rocks form a typical intrusive complex and contain some ribbons of limestone beside the creek. Pockets of massive chalcopyrite and magnetite occur along these ribbons. The complex is irregularly altered to skarn and mineralized with chalcopyrite, magnetite, molybdenite, and powellite.
- (11) A limestone band appears to lie on a small open anticline plunging northeast, and has 6 to 12 inches of massive chalcopyrite in its hangingwall.
- (12) A limestone band has 20 inches of massive chalcopyrite in its hangingwall. This may be the same band as in No. 11.
- (14) A quartz vein containing pockets and disseminations of magnetite is exposed over a length of 50 feet and a width of 5 to 10 feet.
- (15-17) Typical intrusive complex is irregularly altered to skarn and mineralized with molybdenite. Chalcopyrite is sporadic.
- (18) Jumbo showing. Ribbons of limestone dip upstream in the intrusive complex, which is rather intensively altered to skarn. Pockets and veins of massive chalcopyrite and bornite occur along the limestone contacts. Some chalcopyrite also occurs with disseminated molybdenite and powellite in the altered rocks above the limestone ribbons.
- (19) A small open cut exposes two 5-foot bands of magnetite striking southwest through diorite and granodiorite.
- (20) Main Crow workings. An open cut has been driven on 5 feet of magnetite, containing minor chalcopyrite and pyrite, along the north contact of a steep greenstone dyke in limestone. A 70-foot adit 40 feet below exposes only greenstone and limestone, but about 5 tons of magnetite is piled at the portal. A second adit, about 50 feet lower, has been driven about 140 feet in barren greenstone, limestone, and diorite.
- (21) A 10-foot adit exposes 3 to 6 feet of magnetite in limestone and skarn.
- (22) A small open cut exposes 1 foot of magnetite with minor chalcopyrite and malachite in skarn.
- (23) Nearly massive pyrrhotite-bearing magnetite is exposed over a face 30 feet wide and 15 feet high in the creek bed.
- (24) A small open cut exposes 2 feet of massive magnetite in greenstone near a tongue of limestone.

Tofino Nickle Group

A small mineralized zone lies between 1,200 and 1,270 feet elevation on the northwest side of Tofino Inlet opposite Similar Island (*see* Fig. 9). The zone is less than 50 feet wide and consists of pyrrhotite, chalcopyrite, and magnetite in a gneissic complex of granodiorite and greenstone. Much of the material in the zone gives a reaction for nickel with dimethyl glyoxime. A grab sample of rock well mineralized with pyrrhotite and chalcopyrite assayed: Gold, trace; silver, 1.4 ounces per ton; platinum, trace; palladium, 0.18 ounce per ton; copper, 3.60 per cent; nickel, 3.55 per cent. One speck of molybdenite was seen.

Tofino Group

East of Tofino Inlet, due east of Woman Island, a large composite quartz vein is exposed at about 100 feet elevation. Narrow bands of greenstone in it dip 40 degrees to the west-southwest. The over-all attitude of the vein may parallel these bands. The exposed length is 220 feet and the width 30 feet. Pyrite and less chalcopyrite are disseminated through the quartz. Two pieces of quartz showing

the most sulphides assayed: Gold, *nil*; silver, 0.2 ounce per ton; copper, 0.04 per cent. Three specks of molybdenite were seen.

[References: *Minister of Mines, B.C.*, Ann. Repts.; 1898, p. 1133; 1899, p. 792; 1905, p. 212; 1910, p. 152; 1916, pp. 332-333 and 362; 1917, p. 292; 1918, p. 264; 1919, p. 198; 1921, pp. 212-213; 1922, p. 231; 1926, p. 302; 1927, p. 344; 1928, pp. 371-372; 1930, pp. 293-294; 1955, p. 78; 1961, p. 104; 1962, p. 111.]

KENNEDY LAKE

Iron

Brynnor Mines Limited*

(49° 125° S.E.) Company office, Room 1700, Bank of Nova Scotia Building, 44 King Street West, Toronto 1; British Columbia office, Suite 105, 2256 West 12th Avenue, Vancouver 9; mine office, Ucluelet. R. V. Porritt, president; T. R. Wearing, manager; D. W. Burns, mine superintendent; A. W. Haggerty, mill superintendent; W. I. Nelson, Jr., geologist. This company is a wholly owned subsidiary of Noranda Mines, Limited.

The mine camp is on the Kennedy highway on the south shore of Kennedy Lake, about 8 miles from the junction with the Ucluelet-Tofino road. The mine is reached by 2½ miles of MacMillan, Bloedel, and Powell River Limited logging-road, which leaves the highway about 2 miles east of the camp. The open pit and crusher building are on the west side of Draw Creek, and the mine office is on the east side. Crushed ore is trucked 8 miles down Draw Creek and past Maggie Lake to the mill at New York Point on Toquart Bay. Magnetite concentrate is loaded from a storage pile onto ore-carriers for shipment to Japan.

The mining by standard benching methods and the milling by grinding and magnetic separation are described in the Annual Report for 1962. The highest point on the pit rim, at the south end, has an elevation of 455 feet. A safety berm has been established along the south and west sides at 300 feet elevation. By mid-September of 1963 mining above 210 feet had been virtually finished, and a bench at 150 feet elevation had been started. The mill treated 968,106 tons of ore, producing 750,901 tons of magnetite concentrate. Waste rock trucked from the open pit to the waste dump amounted to 2,275,000 tons.

Nearly 2,000 feet of diamond drilling was done in six holes from various sites on the pit floor.

Excavation preparatory to the sinking of a shaft was begun in August. The collar is south of the open pit at 389 feet elevation. By the end of the year the shaft had been sunk 102 feet.

About 150 men were employed in the first half of the year, and the total was increased to 164 during shaft sinking. About 90 were accommodated in the camp on Kennedy Lake. The remainder lived in Ucluelet and in a small trailer camp near the office.

The oldest rocks in the pit are limestone and tuff of the Quatsino Formation. The limestone occurs in the east part of the pit, and the tuff in the west. It is now known that the over-all structure is anticlinal and that the tuff overlies the limestone. The layered rocks have been intruded by many small dykes and sills, and the tuff by two small stocks, of andesite. One stock extends into the middle of the pit from the southwest. The other stock is exposed in the southeast corner of the pit, in fault contact with tuff and limestone, and is known to extend a considerable distance beyond.

The layered rocks have been further injected by diorite and by two series of late dykes. A small stock of diorite extends into the pit from the west, and diorite has

* By G. E. P. Eastwood.



Brynnor Mines Limited open pit. Buildings are on dam built to divert Draw Creek from pit area.



Brynnor Mines Limited. Fine-ore bin, mill, and concentrate stockpile on shore of Toquart Bay.

been rather pervasively introduced into tuff and some andesite dykes along the northwest side, causing considerable metamorphism. The late dykes are all gabbroic in composition; one series of dykes is light to medium grey in colour and has large feldspar phenocrysts, whereas the other series is very dark grey to greenish black and even grained. The dark late dykes clearly traverse skarn and magnetite and have been little affected by faulting. They are small and few. The porphyry dykes were previously thought by the writer to be basic offshoots of the diorite because the coarser parts of the dykes resembled it and because their relations with skarn and magnetite appeared inconclusive. It is now clear that they are younger than both diorite and mineralization. Here and there the porphyries have been seen transecting magnetite, and in one deep drill-hole a porphyry dyke was found cutting granodiorite, which in turn is known to be slightly younger than the diorite.

An anticline has been outlined for some distance northeast of the pit, with limestone in its core and tuff on its flanks. The limestone-tuff contact passes through the pit in a broad U-shaped curve, as though the anticline plunges southwest. However, the pit exposures and diamond-drill cores indicate that the dip of the contact around the base of the U is generally to the northeast below about 230 feet elevation. The fold structure cannot be outlined in detail because in many of the drill-holes the limestone and tuff are separated by considerable thicknesses of intrusive rock or ore, and the position of the original contact cannot be placed accurately. The rocks have also been broken by several faults. However, the tuff-limestone contact has been located in enough places to permit the drawing of segments of several structural contours on it. In general, the contact is almost vertical on the northwest limb of the anticline near the north end of the pit. In the central and south parts of the pit the contact dips gently southwest above about 230 feet elevation and about 55 degrees northeast between 230 and 50 feet. Between 50 feet above sea-level and 300 feet below, the mean dip is more steeply to the northeast, the steepening possibly due in part to faulting. The minus 300 structural contour can be followed in the drill core for 800 feet east from the pit, and the over-all dip there is to the north. A little farther east, intersections in two drill-holes suggest that the strike is northeast and the dip northwest.

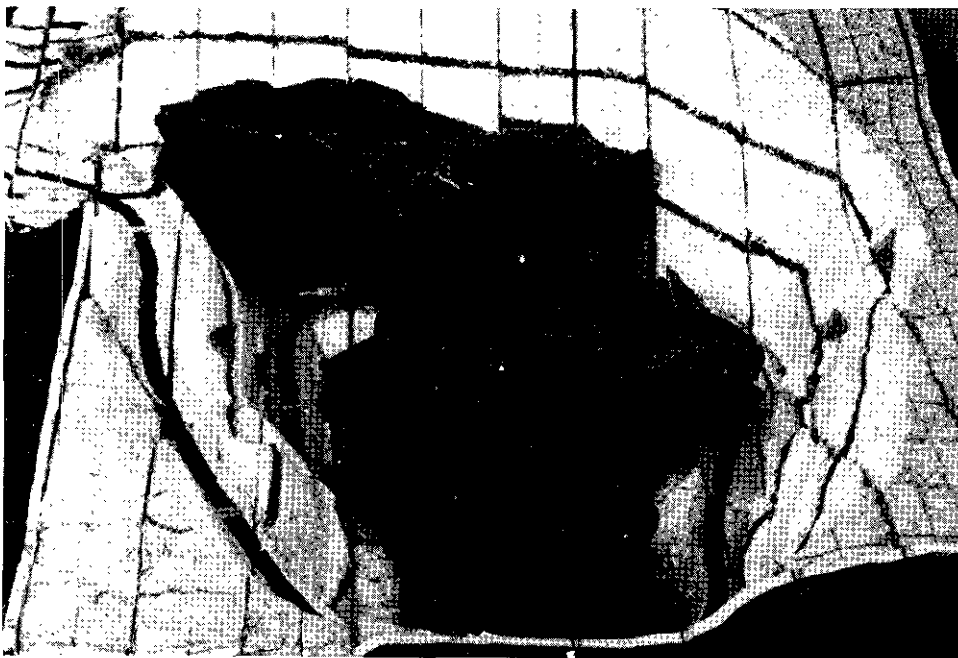
The northeastern dip of the contact on the southwest end of the anticline is believed to result from buckling of the anticline. A fault cannot be ruled out entirely, but there is no direct evidence of one, and it would be difficult to fit into the sequence of geological events. The anticlinal axis may originally have been flat or have plunged gently southwest. The structure appears to have been buckled downward and slightly backward, wracking the limestone beds and causing them to flow in places. Exploration has not been carried deep enough to show whether the buckle reverses at depth or whether the tuff continues to dip under the limestone as far as intrusive rock, which is thought to underlie the pit at depth.

The tuff has been locally replaced by skarn and magnetite, and the limestone has been locally replaced by magnetite. The small diorite stock in the west part of the pit has been slightly altered to skarn. The magnetite in turn has been grooved and polished along numerous fractures. Some serpentine has been deposited along these fractures, and it, too, is grooved and polished. Some of the limestone near magnetite has been replaced by serpentine. The principal skarn mineral is light-brown garnet. Epidote and pyroxene are less abundant but are widely distributed through the altered and mineralized tuff. The magnetite is normally dense, but it becomes visibly grained against serpentine.

The magnetite occurs as two large bodies lying more or less along the tuff-limestone contact and as several small lenses and pods. One body is currently being



Model of Brynnor open-pit orebody. Looking southwest.



Model of Brynnor open-pit orebody. Looking south.

mined in the open pit. The second lies east-southeast of the pit and has been more or less outlined by diamond drilling. It is more deeply buried than the first and is to be developed for underground mining from the shaft. The open-pit orebody has an irregular shape.

The accompanying two photographs are of a model of the orebody, built for the company by A. C. E. Mitchell. The heavy black lines represent contours on the walls of the pit as it is proposed ultimately to be excavated. In 1963 mining had not reached the level where the orebody is continuous, and the major upward projections appeared as three separate orebodies. These are termed sections in this report. Each of these sections terminates in the north against a cross-fault. There is no evidence that the magnetite has been appreciably displaced on these faults; rather, it seems that the faults helped to localize the upward projections. The south section also lies in the hangingwall of a northwest-striking fault which dips about 45 degrees southwest. The model shows that at a certain depth magnetite appears below this fault, and at greater depth spreads out and merges with the main part of the orebody. Several small isolated pods and pockets of magnetite occurred above the orebody and in the pit wall to the west and south of it.

The open-pit orebody transgresses the tuff-limestone contact slightly in plan. The north section is almost entirely in limestone, whereas most of the south section is in altered tuff. Near the north end of the south section the contact swings sharply east toward the fault contact with the second andesite stock, whereas the axis of the orebody swings only slightly. In section the orebody generally follows the contact down around the buckle, passing beneath limestone to the east and northeast, but it extends a short distance down into the altered tuff. The structural relationships bear some resemblance to those at the F.L. property near Zeballos.

[References: *Minister of Mines, B.C.*, Ann. Repts., 1961, pp. 104–110; 1962, pp. 111–124.]

GREAT CENTRAL LAKE (49° 125° S.E.)

Gold

Apex, Morning (Sileurian Chieftain Mining Company Limited)*

Company office, Ninth Floor, 850 West Hastings Street, Vancouver 1. Walter Eilers, president. The company holds 20 claims, including the former Apex and Morning groups, north of Doran Lake between Sproat and Great Central Lakes, 26 miles west of Alberni. The showings comprise quartz veins mineralized mainly with pyrite and pyrrhotite and lesser amounts of galena, sphalerite, and chalcopyrite, and carrying gold values. A small amount of surface and underground work was done in the years 1932 to 1934. In 1960 the present company drilled four X-ray diamond-drill holes totalling 430 feet and located about 50 feet below the main Apex vein.

In 1963 the company drilled four diamond-drill holes totalling 309 feet. The work was discontinued when it was found that gold values were low.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1934, p. F4.]

NANAIMO LAKES (49° 124° S.E.)

Gold

Vulcan (Sileurian Chieftain Mining Company Limited)*

Company office, Ninth Floor, 850 West Hastings Street, Vancouver 1. Walter Eilers, president. The property consists of three claims in the vicinity of Deadhorse Creek on the west slope of Mount de Cosmos, 5 miles northwest of Nanaimo Lakes. Access to the property is by the Nanaimo

* By A. R. C. James.

Lakes road and by logging-roads within the Nanaimo Lakes operations of Crown Zellerbach (Canada) Limited.

The Vulcan property is described in some detail in the Annual Report for 1937. The mineralization, which is reported to carry values in gold and minor values in silver, occurs in a strong shear zone in altered volcanics. A shaft, believed to be 105 feet deep, was sunk many years ago, and a drift 138 feet long was driven northeastward from a point 16 feet below the collar of the shaft.

In the autumn of 1963 the present company contracted for the driving of a drift on the mineralized zone. By the end of the year approximately 100 feet of drifting had been completed. The portal was about 20 feet below the level of the collar of the old shaft. A connection underground was made with the shaft for ventilation purposes. A crew of three men was employed under the supervision of William Balez.

LADYSMITH (49° 123° S.W.)

Copper-Molybdenum

Molly*

This group of four recorded claims is owned by F. W. Wilson and Malcolm Keeble, 577 Fifth Street, Nanaimo. It is situated on the northeast slope of Mount Hayes, 1½ miles west of the head of Ladysmith Harbour. The showings are at an elevation of 600 feet, about 350 feet higher than the road which leads from the Island Highway at Cassidy airport, about 1 mile west and 3 miles south, to the foot of Mount Hayes. On the mountain, parts of an old wagon-road to the showings are still recognizable.

The occurrence is described in Geological Survey of Canada Memoir 51, 1914, page 125, as the Thistle claim.

The showing consists of a quartz-feldspar vein in a fracture in Saanich granodiorite striking north 25 degrees west and dipping 40 degrees to the southwest. An aplite dyke about 6 inches wide forms the footwall of the vein, which is mineralized with bornite, pyrite, and chalcopyrite and to a lesser degree with molybdenite. The maximum vein width observed was about 1 foot; it is exposed for a length of about 100 feet; the quartz pinches out at both ends. Some minor sheared rock was seen, but it seemed evident that movement along the fracture had been slight.

The workings comprise two adits 20 feet in elevation apart. In the lower adit the vein is exposed for 100 feet; the maximum width observed was 4 inches. A small stope lies above this adit. In the upper adit the vein is exposed for 20 feet and the maximum observed width was 1 foot.

COWICHAN LAKE (48° 124° N.E.)

Copper

Alpha, Beta, etc. (Albeta Mines Ltd.)†

Company office, 732 Cowichan Lake Road, Lake Cowichan. Allan H. Harder, president and managing director; George E. Apps, general manager. The property consists of 3 Crown-granted and 18 recorded mineral claims and fractions, as well as a mining agreement with Canadian Pacific Oil and Gas Limited covering some 4,850 acres, all situated in the Robertson River valley, approximately 7 miles south of Mesachie Lake.

A crew of three men extended the adit a distance of 340 feet to a total length of 766 feet, and completed 149 feet of raise and 67 feet of subdrift. A total of 652 feet of underground diamond drilling was completed in seven holes. In addition, 590 tons of ore with a grade of 4 per cent copper was mined and shipped to the Anaconda company concentrator at Britannia Beach.

* By N. D. McKechnie.

† By J. E. Merrett.

On the surface, reconnaissance prospecting and geological mapping was done on parts of the holdings covered by the mining agreement. Self potential geophysical surveying was done in areas of specific interest.

Anomaly*

This group of eight recorded claims is owned by W. E. Fraser, of North Surrey. It is situated on Long Creek, a southwesterly flowing tributary of Robertson River about 5 miles south of Mesachie Lake Post Office.

The mineral showings are on the Anomaly claim and are about 1½ miles from the Robertson River. There are two principal exposures about 300 feet apart; the easterly exposure is on the bank of Long Creek and the westerly one extends to about 600 feet from the creek. The workings consist of 20 feet of stripping on the easterly exposure and 150 feet on the westerly exposure. Ten diamond-drill holes totalling 500 feet were drilled—six at the westerly showing, three at the easterly, and one about half-way between.

The mineralization is pyrrhotite and chalcopyrite in a sheared zone 8 to 10 feet wide, striking north 85 degrees west and dipping 75 degrees south. The sheared rock is composed chiefly of actinolite with minor garnet. The hangingwall is a chloritized fine-grained lithic tuff composed chiefly of actinolite-rich fragments; a very thin well-defined banding is seen in thin-section. The footwall is a chloritized lapilli tuff composed of andesitic fragments; no banding was recognized, even in thin-section. Amygdaloidal basalt is exposed south of the stripping. The bedding attitude was not determined, but it seems likely that the shear represents a bedding-plane fault since the wallrocks remain the same throughout the exposures.

Drill cores were not available to the writer, but, according to data supplied by Mr. Fraser, sulphides in holes 1, 3, 4, 7, 8, and 10 appear to be distributed along a plane striking nearly east-west and dipping 40 degrees south. These holes include both the easterly and westerly workings. This is in agreement with the observed strike of the shear but is 35 degrees flatter than the observed dip. Of the remaining four holes, No. 2 encountered malachite and pyrrhotite at a point which agrees with neither the observed nor the calculated planes, No. 5 appears to have been drilled too far north, No. 6 was stopped short of the objective, and No. 9, drilled close to the westerly stripping, encountered sulphides in line with the 75-degree dip. Except for No. 9, none of the holes was drilled deep enough to have cut the shear zone on the steep dip, so it is not known whether there are in fact two zones parallel in strike or whether the apparent dip in the stripping represents only a subsidiary plane.

Assays obtained by Mr. Fraser indicated a maximum of the order of 3.5 per cent copper across 3 feet; in No. 4 hole an assay of 2.03 per cent copper and 4.46 per cent zinc across 3 feet was reported.

NITINAT (48° 124° N.W.)

Copper

Mal*

The Mal group of seven recorded mineral claims is owned by Marshall Creek Copper Co. Ltd.; registered office, 205 Canada Permanent Building, Victoria. The property is situated on Marchand Creek, which flows westward into Nitinat Lake 5½ miles from the head of the lake. Access is by logging company roads, either from Port Alberni or from Lake Cowichan, to the head of Nitnat Lake and from there by boat to the property. Marshall Creek Copper Co. Ltd. maintains a small camp at the lake-head.

* By N. D. McKechnie.

At the site of the mineral showing on Marchand Creek, about 1,000 feet inland from the lake, the rock is a well to highly saussuritized and silicified granitic rock. The relict textures indicate an original medium-grained holocrystalline rock. This rock is intruded by dykes of fine-grained green andesite porphyry, which in thin-section show appreciable alteration to sericite, chlorite, and calcite. Both the altered granitic rock and the andesite dykes are cut by light-grey to pinkish quartz monzonite, which shows relatively minor alteration in thin-section.

The mineralization occurs in a fault zone about 25 feet wide striking north 50 degrees west and dipping 75 degrees northeastward. The fault cuts all three rock types; a few light-coloured granitic stringers an inch or so wide and perhaps related to the quartz monzonite were intruded along the fault.

Chalcopyrite, sphalerite, and pyrite occur in the fault in bands or lenses up to about 2 feet wide. The gangue consists of quartz, chlorite, clinozoisite, actinolite, hypersthene, and a black opaque iron-aluminum silicate thought to be thuringite. The sphalerite is a dark variety and veins the thuringite, so that in hand specimen it may not be possible to estimate the proportions of sphalerite and thuringite. In the limited exposures available at the time of the writer's visit in December, it was not possible to estimate what proportion of the fault might contain high-sulphide zones.

WW*

This group of four claims is held by record by James McNulty and Wayne McNulty, 2838 Bryn Maur Road, Langford. The group is on Coleman Creek, 3½ miles east of Alberni Canal.

It is reached by logging-roads from Port Alberni or, alternatively, by logging-roads from Cowichan Lake and Little Nitinat River. Mineralization exposed on the side of the logging-road consists of chalcopyrite, pyrite, and pyrrhotite in a fault about 2 feet wide striking north 80 degrees east and dipping 50 degrees north. The hangingwall is andesite and the footwall is limestone. The rock within the fault is composed chiefly of actinolite. The fault has been traced to about 100 feet down hill.

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. Oswood G. MacDonald, president; J. R. Billingsley, mine manager. This property is on the Jordan River about 1 mile upstream from its mouth and is reached by a road which leaves the Victoria highway about one-half mile east of the River Jordan Post Office. An operating lease was obtained by Cowichan Copper Co. Ltd. from Sunro Mines Limited (controlled by The Consolidated Mining and Smelting Company of Canada, Limited) to remove ore from 18 claims which include the Cave, Central, and River ore zones.

All development work and ore removal was done in the "B" and "C" orebodies of the River ore zone. The "B" orebody produced 90 per cent of the mill tonnage. No. 1 shaft was sunk to a depth of 486 feet below the 5100 level to permit the development of three levels in the "B" orebody. The shaft was raised a distance of 50 feet above the 5100 level to provide room for the installation of a Canadian Westinghouse friction hoist with a 4-ton load-carrying capacity. At the 4700 level in No. 1 shaft a crushing-station was excavated, and a 29- by 36-inch Kue-Ken crusher with ancillary equipment was installed.

* By N. D. McKechnie.

† By J. E. Merrett.

A raise was driven from the 5700 level or River adit to the 5900 or uppermost level in developing the upper part of the "C" orebody. Considerable drifting and raising was done in developing this orebody on the 5300, 5400, and 5500 levels.

In the crushing-plant area, excavations were made and equipment installed to convey the crushed ore from No. 1 shaft to a newly installed 4¼-inch Simons cone crusher which replaced the former No. 2 crusher.

In February caving developed in the vicinity of 5,430 feet elevation in the "B" stope. In spite of considerable efforts to rock bolt the crown pillar over this stope, caving continued intermittently until December 5th, when the pillar collapsed, permitting Jordan River to flow into the mine. All persons were evacuated without incident, but no further production was possible to the end of 1963 as the river had not been diverted from the mine at that date.

Development work comprised 536 feet of shaft sinking and raising, 2,703 feet of raising, 3,394 feet of drifting, and 13,954 feet of diamond drilling completed in 116 holes. Except for development mining of the orebodies, all ore was removed by blast-hole mining methods, and to that end 79,134 feet of long-hole drilling was done. The total amount of ore mined was 340,142 tons, and 270,142 tons was milled to produce 15,782 tons of copper concentrate, which was shipped to Japan.

A crew of 150 men was employed, of whom 116 were employed underground, mining or in the crushing and milling operations.

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, 1963

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
49° 117°	N.E.	AG Group Robert E. Chaplin. Robert E. Chaplin. February 18, 1963.	472	—	—	×
49° 120°	N.E.	Miss and Primer Groups McIntyre Porcupine Mines, Limited. J. W. MacLeod. June 12, 1963.	493	—	—	×
49° 120°	N.W.	K.R. Nos. 1-6 Plateau Metals Limited. C. Riley, Kol Lovang, and C. A. R. Lammle. October 8, 1963.	517	—	×	×
49° 120°	N.W.	K.R. Nos. 7-11 Plateau Metals Limited. Christopher Riley. November 19, 1963.	530	—	—	×
49° 120°	S.E.	G.E. Group Climax Copper Mines Limited. E. B. Nicholls. July 22, 1963.	488	—	×	—
49° 123°	N.E.	Bob Nos. 1-12 and Phil 4 Western Surf Inlet Mines Limited. Herbert Parliment. April 2, 1963.	494	×	—	×
49° 123°	N.E.	Bob Nos. 1-18 and Phil 1-6 Western Surf Inlet Mines Limited. J. P. Sheridan. February 22, 1963.	496	—	×	—
49° 125°	N.W.	Buttle Lake Group The Buttle Lake Mining Company Limited. P. Chilcott. December 3, 1963.	533	×	—	—
49° 126°	S.E.	Ormond and Contact Groups Van-West Minerals, Limited. D. B. Sutherland. February 18, 1963.	465	—	×	—

REPORTS CREDITED FOR ASSESSMENT, 1963—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
50° 117°	N.W.	Sid, Arrow, and Sproat Claims Canadian Johns-Manville Company Limited. R. Jury and R. J. Janes. February 15, 1963.	469, 470	×	×	—
50° 120°	S.W.	Betty Lou Group Canex Aerial Exploration Ltd. N. Patterson and P. Walcott. October 17, 1963.	516	—	×	—
50° 120°	S.W.	Gem Nos. 1-6 and Bob Nos. 1-28 Jericho Mines Ltd. E. B. Nicholls. May 16, 1963.	483	—	×	—
50° 120°	S.W.	H.A.R. Nos. 1-8 Mid-West Copper & Uranium Mines Ltd. R. B. Richards. November 19, 1963.	531	—	×	—
50° 120°	S.W.	Kan Group Canex Aerial Exploration Ltd. D. N. Hillhouse. October 24, 1963.	519	—	×	×
50° 120°	S.W.	Mid Group Mid-West Copper & Uranium Mines Ltd. B. R. Richards. June 24, 1963.	492	—	×	—
50° 120°	N.W.	S.D. and Dave Groups Huestis Mining Corporation Ltd. E. B. Nicholls and E. L. Gregotski. September 6, 1963.	512	—	×	—
50° 120°	S.W.	T.M., J, and A Groups Toluma Mining and Development Co. Ltd. D. B. Sutherland. September 20, 1963.	503	—	×	—
50° 121°	S.E.	Bethsaida Group The Buttle Lake Mining Company Limited. J. Sullivan. December 18, 1963.	537	×	—	—
50° 121°	S.E.	Empire The Buttle Lake Mining Company Limited. A. O. Hall. July 17, 1963.	490	×	×	—
50° 121°	S.E.	K.T.I. No. 1 Claim Group Kennco Explorations, (Western) Limited. R. W. Stevenson. January 30, 1963.	477	—	×	—
50° 122°	S.W.	Azure Group The Mining Corporation of Canada, Limited. D. D. Smellie. October 22, 1963.	508	—	×	—
50° 122°	S.W.	Black and Blackwater P. Weishaupt, R. Fegan, and Bralorne Pioneer Mines Limited. E. B. Nicholls. July 4, 1963.	485	—	×	—
50° 125°	S.E.	Allen No. 1 Menzies Bay Mining Syndicate. E. B. Nicholls. July 4, 1963.	491	—	×	—
50° 125°	S.E.	RIB Nos. 1-4 Robert I. Bennett. Sigmund D. Schwartz. March 22, 1963.	478	—	×	—
50° 127°	S.E.	Minerva Fraction Consolidated Exploration Company, Ltd. F. J. Hemsworth. October 2, 1963.	502	×	×	×

REPORTS CREDITED FOR ASSESSMENT, 1963—*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
50° 128°	N.E.	Rick Nos. 1-4 Holberg Mines Ltd. P. G. Hallof and D. B. Sutherland. April 5, 1963.	497	—	×	—
51° 118°	S.E.	Robina 1-12 Great West Mining Corporation Ltd. F. L. Price. September 13, 1963.	539	—	×	—
51° 118°	S.W.	Zan Group Falconbridge Nickel Mines Limited. H. R. Morris. July 17, 1963.	486	—	—	×
51° 121°	S.E.	Pat Nos. 1-56 Kennco Explorations, (Western) Limited. C. S. Ney. November 27, 1963.	528	×	—	×
51° 123°	S.E.	Bur and Top Copper Ridge Mines Ltd. S. J. Melihersik. October 1, 1963.	527	×	—	×
51° 123°	S.W.	Chita Nos. 1-68 Phelps Dodge Corporation of Canada, Limited. D. C. Malcolm. March 15, 1963.	473	×	—	—
51° 123°	N.E.	Nichol Nos. 1-20 Phelps Dodge Corporation of Canada, Limited. W. Meyer (endorsed by John DeLeen). December 30, 1963.	534	×	×	×
51° 131°	N.W.	Bud Nos. 1, 2, and 4-8 John Miller Russell. H. R. Morris. April 23, 1963.	482	—	×	—
51° 131°	N.W.	Bud Nos. 9-13 John Miller Russell. H. R. Morris. April 23, 1963.	481	—	×	—
52° 122°	S.E.	G.G. Group Keevil Mining Group Limited. E. G. Thompson. May 9, 1963.	487	—	—	×
52° 122°	S.E.	Zephyr Group Keevil Mining Group Limited. A. R. Clark. January 2, 1963.	468	—	×	—
53° 132°	S.W.	Magnet Nos. 1-11 Mastodon-Highland Bell Mines Limited. W. R. Bacon. May 27, 1963.	495	×	×	—
54° 124°	S.W.	KO Group Julian Mining Co. Ltd. Roderick Macrae. October 17, 1963.	521	—	—	×
54° 124°	N.W.	Snowbird, Graybird, Topside, Campsite, Ebba, Shaft Fr., and Bob Julian Mining Co. Ltd. Roderick Macrae. October 17, 1963.	520	—	×	—
54° 125°	S.E.	Bingo Nos. 1-10 and 31-40 Endako Mines Ltd. C. W. Ball, C. E. Dunn, and R. E. Cribbs. September 5, 1963.	515	×	—	×
54° 125°	S.E.	Bingo Nos. 11-30 Copper Ridge Mines Ltd. C. W. Ball, R. E. Cribbs, C. E. Dunn, and H. Paulson. August 27, 1963.	500	×	—	×

REPORTS CREDITED FOR ASSESSMENT, 1963—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° 125°	S.W.	Dat Group Julian Mining Co. Ltd. Roderick Macrae. November 15, 1963.	523	—	×	—
54° 125°	S.E.	Dis Group Julian Mining Co. Ltd. Roderick Macrae. June 23, 1963.	498	—	×	—
54° 125°	S.E.	Elk and Deer Groups Julian Mining Co. Ltd. Roderick Macrae. November 15, 1963.	525	—	—	×
54° 125°	S.E.	Joe Nos. 1-12 and 14-21 Copper Ridge Mines Ltd. C. W. Ball, C. E. Dunn, and R. E. Cribbs. October 2, 1963.	526	×	—	×
54° 125°	S.E.	Pal and B.M. Groups Copper Ridge Mines Ltd. C. W. Ball, R. E. Cribbs, and C. E. Dunn. October 11, 1963.	518	×	—	×
54° 125°	S.E.	RAC Group Copper Ridge Mines Ltd. R. E. Cribbs. November 15, 1963.	524	—	—	×
54° 125°	S.E.	Rob Nos. 1-22 Utica Mines Ltd. C. W. Ball, C. E. Dunn, and R. E. Cribbs. September 5, 1963.	507	×	—	×
54° 126°	N.E.	East and West Groups The Granby Mining Company Limited. K. C. Fahrni. November 19, 1963.	529	×	—	—
54° 126°	N.W.	Mineral Hill and Huber Groups W. D. Yorke-Hardy. R. E. Anderson. October 10, 1963.	509, 510	—	×	×
54° 127°	N.E.	Goat, Beaver, Lynx, Fox, and Coyote Groups Climax Molybdenum (B.C.) Ltd. M. Klugman. February 19, 1963.	471	×	—	—
54° 127°	N.W.	Mamie, Canary, Payroll, Homerun, Jay, and Torrent Sil-Van Mines Limited. W. J. Scott. October 20, 1963.	505	—	×	—
54° 127°	N.E.	May Nos. 1-20 and Bob Nos. 1 and 2 W. D. Yorke-Hardy, H. Haftner, and Cyril Mehaffy. R. Wollvertson and B. O. Brynelsen. September 26, 1963.	514	—	—	×
54° 128°	N.E.	Fossil Nos. 1-4 I. Shulman. W. E. Selnes. January 4, 1963.	466	—	—	×
55° 115°	N.E.	Valley Claim Group Kennco Explorations, (Western) Limited. P. G. Halloff and R. W. Stevenson. July 5, 1963.	504	—	×	—
55° 125°	N.E.	Duckling No. 1 Claim Group Kennco Explorations, (Western) Limited. P. G. Halloff. July 16, 1963.	513	—	×	—
55° 125°	N.E.	Duckling Nos. 1 and 3 Claim Groups Kennco Explorations, (Western) Limited. R. W. Stevenson. July 12, 1963.	511	—	×	—

REPORTS CREDITED FOR ASSESSMENT, 1963—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
55° 125°	N.E.	Lorrex No. 1 Group. Keneco Explorations, (Western) Limited. P. G. Halloff. September 4, 1963.	506	—	X	—
55° 125°	N.E.	Rhonda Nos. 1-4. Keneco Explorations, (Western) Limited. R. W. Stevenson. December 31, 1963.	532	—	—	X
55° 130°	N.E.	JO Group. Newconex Canadian Exploration Limited. Joseph Sullivan. May 28, 1963.	489	X	X	—
55° 130°	N.E.	JO Group. Newconex Canadian Exploration Limited. R. A. Knudson. October 17, 1963.	522	—	X	X
56° 126°	N.E.	Savage Arjay Group. W. D. Savage. G. L. Holbrooke. October 22, 1962.	475	X	—	—
56° 130°	S.E.	Dawson Ross, John Bull, Arbee, and Can Groups. Donald F. Ross, Wendell Dawson, and Stanley Bishop. G. D. Towle and E. F. Lahmeyer. June 18, 1963.	499	X	—	—
56° 130°	N.E.	Ken Nos. 2-4. Newmont Mining Corporation of Canada, Limited. Gordon Guttrath and G. W. H. Norman. October 22, 1963.	536	X	X	—
56° 130°	S.E.	North Group. London Pride Silver Mines Ltd. D. Davidson. May 30, 1963.	484	X	—	—
57° 131°	S.W.	J.W. Nos. 1-14. Keneco Explorations, (Western) Limited. G. H. Rayner and C. S. Ney. September 3, 1963.	501	—	X	X
57° 131°	N.W.	Poke Nos. 1-24. Keneco Explorations, (Western) Limited. P. G. Halloff. October 16, 1963.	535	—	X	—
58° 127°	S.E.	West Group. Conwest Exploration Company Limited. A. S. Ashton and W. P. Hammond. February 27, 1963.	467	—	X	—
58° 132°	S.E.	Fae Nos. 1-24. Keneco Explorations, (Western) Limited. C. S. Ney. August 5, 1963.	476	X	—	X

Placer

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ATLIN

There is no specific information regarding placer-mining operations in the Atlin region. Activity declined somewhat in 1963, but changes in Departmental personnel prevented visiting the ground.

OMINECA*

LOWER OMINICA RIVER (56° 124° S.E.)

Leases held by Western Gold Corporation Limited, of Vancouver, on the Omineca River downstream from the junction of the Osilinka were tested under the supervision of R. E. Legg.

MANSON CREEK (55° 124° N.W.)

Rizzie Brothers, of Germansen River Placers, produced 100 ounces of placer gold during 1963.

SKEENA*

LORNE CREEK (54° 128° N.E.)

James Bremner worked alone on his placer lease on Lorne Creek.

* By H. Bapty.

FIDDLER CREEK (54° 128° N.E.)

Bruce Webb dug test-pits and did a small amount of mining on his Fiddler Creek placer lease.

CARIBOO*

HIXON CREEK (53° 122° S.W.)

Hixon Placers Inc. Company office, 2032 Third Avenue, Seattle, Wash., U.S.A.; mine office, Hixon. H. W. Hargood, president; N. R. Buntten, superintendent. This company holds 21 placer leases on Hixon Creek. No work was done on this property in 1963. A watchman was employed at the camp.

WILLOW RIVER (53° 121° S.W.)

Tregillus Creek.—Eric North hydraulicked 1,600 yards of gravel on his leases from May 1st to July 15th.

Mosquito Creek.—Jack Gunn continued further hydraulicking on his lease at the upper end of Mosquito Creek.

Big Valley Creek.—Nolan Fisher sluiced gravel on his lease on the south side of Big Valley Creek near Nine Mile Lake.

Coffey Creek.—Arthur Delorme ground-sluiced on his lease on Coffey Creek.

WILLIAMS CREEK (53° 121° S.W.)

**Williams Creek
Hydraulic Mines
Ltd.**

Company office, Box 745, Prince George. F. M. Jamieson, president; Vern Saur, foreman. This company continued to rework the old tailings on Devlin's Bench on P.M.L. 3534, about midway between Wells and Barkerville and approximately one-half mile up the road to Bowron Lake. The tailings were excavated by a Bucyrus Monaghan dragline with a 100-foot boom and a 4½-yard bucket. The gravel was loaded directly into the dump box, which fed it onto portable steel sluice-boxes fitted with rail, Hungarian, and punch-plate riffles. Water for the sluice-boxes was supplied from a 16-inch centrifugal pump powered by a D-8 Caterpillar diesel motor. The tailings were stacked by a bulldozer. Work this season was begun on April 30th and concluded on September 15th. It is reported that approximately 90,000 yards of gravel was put through the sluice-boxes. A crew of four men was employed under the supervision of Vern Saur.

Emory Gulch.—Frank Dumont did some hydraulicking on his P.M.L. 4729.

ANTLER CREEK (53° 121° S.E.)

China Creek.—John Kelly built a new cabin and workshop and did some testing on his lease.

California Gulch.—Peter McLanders hydraulicked on P.M.L. 5665.

**Kamloops Copper
Company Ltd.**

Company office, 105 Seymour Street, Kamloops. R. W. Kennedy, president; R. W. Larsen, superintendent. This company controls four leases on Beggs Gulch. Underground exploration was begun in 1962 and continued in 1963 in an attempt to find a buried channel at the lower end of Beggs Gulch. Three drifts

* By A. R. C. James, except as noted.

totalling 175 feet and an incline 30 feet long have so far been driven. A crew of six men was employed from June 8th to November 15th under the supervision of Eric Larsen.

Grouse Creek.—Andrew McGuire and partner worked on his lease on the upper section of Grouse Creek. Ground testing was done with a small boomer dam and flume.

L. K. Koopman and partner worked on the south side of Grouse Creek removing overburden and testing ground.

Company office, 506, 615 West Pender Street, Vancouver 2.
Grouse Creek Mines Ltd. D. G. McCrae, general manager. Capital: 3,000,000 shares, no par value. This company holds four leases in the vicinity of Grouse Creek, and is a successor to the former private company Grouse Creek Barkerville Gold Ltd. The objective of this company is to discover and mine the downstream extension of a rich channel worked by the Heron Company almost a century ago. According to reports the Heron channel was mined for over 400 feet and yielded gold valued at \$750,000 at 1867 prices. The workings were said to have been abandoned because of difficulty in coping with slum and water. Subsequent attempts to find the extension of the Heron workings met with failure.

The predecessor of the present company, Grouse Creek Barkerville Gold Ltd., began work in 1962, when two shafts were sunk 50 and 55 feet deep respectively. These failed to find the channel, and in the summer of 1963 a new programme of exploration was started under the supervision of Dolmage, Mason & Stewart, consulting engineers. A hammer refraction seismic survey was carried out, starting in the area immediately adjacent to the old Heron channel itself, in an endeavour to determine the depths from surface to bedrock and if possible to indicate the position of the buried channel. The seismic survey, according to company reports, gave an indication of a channel trending north 80 degrees east from the end of the Heron workings. After the completion of the seismic survey, 11 churn-drill holes were drilled to delineate the profile of the channel with more precision. At a point 735 feet from the presumed end of the Heron workings, drill-holes indicated a deep gutter 112 feet to bedrock. It was decided to sink a shaft at this point to explore the channel by underground drifting. The work of shaft sinking and the driving of a water drainage tunnel was in progress at the year-end. The shaft is a two-compartment shaft 9½ by 5½ feet in size. A crew of from two to five men has been employed.

LIGHTNING CREEK (53° 122° S.E.)

Company office, 204, 569 Howe Street, Vancouver 1; mine office, Wingdam. R. A. Brossard, president; J. McIntyre, general superintendent. This company controls leases along Lightning Creek at Wingdam, 30 miles by road from Quesnel.
Wingdam & Lightning Creek Mining Co. Ltd.* The company's objective is to reopen the old Melvin workings and resume mining in the deep lead gravels of Lightning Creek.

A short history of the property was given in the 1961 Annual Report. Throughout 1963 rehabilitation of the main drifts, raises, and sublevel crosscuts in the Melvin shaft area was continued. Gravel in the planned working areas was drained by drilling 3-inch percussion-drill holes, mainly from the drifts in bedrock.

* By W. C. Robinson.

During 1963 an explosive magazine and an addition to the dry were constructed. An additional Caterpillar 250-kilowatt diesel-driven generator set was installed in the power-house. An average crew of 40 men was employed.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1961, pp. 131-132.]

Simmons Mining Ltd.

Company office, 13515—115th Avenue, Edmonton. F. Simmons, president. This company operated on leases held by Hannandor Gold Ltd. in the vicinity of Mostique and Lightning Creeks. They used the plant which has been on the property since 1960-61; this comprises a Lorain dragline with a 1½-yard bucket and a washing plant consisting of a hopper, 48-inch trommel screen, gravity separation tables, and sluice-boxes. A stacking conveyor removes the oversize material. A D-7 Caterpillar bulldozer was also used. The equipment was used on the south side of Lightning Creek about a mile below Mostique Creek. The company reports that 23,500 cubic yards of gravel was washed during the season. Three men were employed under the supervision of D. McLellan.

Wingdam Creek.—C. F. Estabrook did some stripping and testing on the Cavadini lease at the lower end of Wingdam Creek. An International front-end loader, D-7 Caterpillar bulldozer, and a screening and gold-washing plant were used. A total of 920 yards of gravel is reported to have been washed.

Lost Channel Mines Ltd.—Company office, Vanderhoof. This company holds two special leases in the vicinity of Lightning Creek near its confluence with the Cottonwood River. The company reports that in 1963 three test-holes were drilled, totalling 971 feet.

SWIFT RIVER (52° 122° N.E.)

McMartin Explorations Ltd.

Company office, 1232 Flury Road, Richmond. N. Pentecost, president. This company holds leases on McMartin Creek, a tributary of Swift River. Work in 1963 was confined to the construction of a road about 5 miles long from Little Snowshoe Creek to the property. This road connects with the Keithley Creek road. By the end of the season the road was completed to within about one-half mile of the property. A crew of four men was employed under the supervision of N. Pentecost and R. Grant.

COTTONWOOD RIVER (53° 122° S.E.)

Mary Creek.—James Coreau hydraulicked and sluiced gravel on his lease on Mary and Norton Creeks.

QUESNEL RIVER (52° 121° N.W.)

Spanish Placers Ltd.

Registered office, 703, 470 Granville Street, Vancouver 2; mine office, Likely. D. Harris, president. This company holds 11 leases, 5 of which are adjacent to the north fork of the Quesnel River and 6 are on Spanish Creek. In 1963 D. R. Harris and F. P. Clark operated a hydraulic pit on the south bank of the river and reached by about a mile of rough jeep-road running north from the Likely-Keithley Creek road. A large portable Cummins diesel unit driving a Byron Jackson pump supplied water for a No. 2 monitor. Work began on March 28th and continued until October 14th. It was reported that 6,000 yards of gravel was washed.

Cedar Creek Percy Ogden washed some gravel on his leases to the north of Cedar Creek. Mr. Ogden holds four leases on the high ground north of Cedar Creek, where a shallow buried channel runs almost at right angles to the present drainage system. He has, for a number of years, been mining out sections of the channel but has now reached a position where he has considerable difficulty in disposing of tailings from his small monitor. Ogden reports he has optioned the leases to Edmonton interests, who may set up a larger plant.

KEITHLEY CREEK (52° 121° N.E.)

Keithley Creek Ernest Lang worked with one man on his lease 1,700 feet below the confluence of Snowshoe and Keithley Creeks. The underground workings driven over the past four years were temporarily abandoned in 1963, and a new 4- by 6-foot shaft was sunk from surface to bedrock at a point believed to be in the centre of the old channel of Keithley Creek. At the time of the writer's visit in July the shaft was down 18 feet.

Four Mile Creek.—Lee Fournier ground-sluced on his lease in the Placer Engineers pit near the mouth of the creek.

Harvey Creek Mines Ltd. Company office, 203, 955 West Hastings Street, Vancouver 1. Austin C. Taylor, president. This company holds seven leases on Nigger Creek. In 1963 a flume and pipe-line was installed and 60,000 yards of gravel was hydraulicked. An average crew of five men was employed under the supervision of Barney Boe.

CRANBROOK*

Monilee (49° 116° S.W.) This lease is near the falls on the Moyie River, 14 miles southwest of Cranbrook. It is held by D. J. Oscarson, of Kimberley, and operated by two parties of workmen who subleased the property in 1958. Work is done on week-ends, and the main activities are directed to the drivage of two adits toward and below an old course in the river.

T. O. Bloomer and partner drove the No. 1 adit a further distance of 50 feet on level course in the gravel and another 20 feet on an inclination of 40 degrees in the direction of the footwall. There was no recovery of gold.

P. Kotush and two partners drove the No. 2 adit a further 80 feet in gravel, 30 feet in a direction upstream and a further 50 feet cross-stream. There was no recovery of gold.

FORT STEELE*

Pundata Mining Limited (49° 115° N.W.) R. A. Coppage, manager, General Delivery, Cranbrook. This property, comprising four placer-mining leases, is near the confluence of Fisher Creek and the Wildhorse River. It is 5 miles northwest of Fort Steele, and was formerly owned and operated by the Wildhorse Golds Limited, of Edmonton, Alta. The present company purchased the property and equipment in 1963. Most of the activities in 1963 were on the west side of the river, where several cuts and test-holes were made by bulldozer, and a crew of four men washed 1,500 yards of gravel. Some gold was recovered.

* By D. R. Morgan.

MAUS CREEK (49° 115° N.W.)

For four weeks a crew of two men under the direction of G. R. Castles, of Lethbridge, Alta., continued to sink a small shaft toward bedrock.

KIMBERLEY***LISBON CREEK (49° 115° N.W.)**

A placer-mining lease near the confluence of Lisbon and Perry Creeks, 9 miles south of Kimberley, was worked by R. E. Williams and W. Kludash, of Kimberley, during week-ends. They made a few cuts, but water prevented any further work being done in the adit.

COLUMBIA RIVER†**GRAHAM CREEK (51° 118° N.W.)**

Ardua Mines Ltd. Company office, Box 393, Revelstoke. A. E. Horne, manager. This property lies on the headwaters of Graham Creek, a tributary of French Creek. The property is accessible by jeep-road from Mile 57 on the Big Bend highway. A crew of four men was employed at this hydraulic operation.

* By D. R. Morgan.

† By W. C. Robinson.

Structural Materials and Industrial Minerals

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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; J. G. Berry, general superintendent. The property is 86 miles by road southwesterly from Mile 648.8 on the Alaska Highway. The mine is on Mount McDame at an elevation of approximately 6,200 feet. The mill and townsite are in Troutline Creek valley at 3,500 feet elevation. The property has been described in the 1960 Annual Report.

During 1963 mining was continuous. Ore was mined from benches at elevations 6,150, 6,115, 6,080, 6,050, 6,020, and 5,990 feet in the open pit. A total of 756,574 tons of ore and 2,863,659 tons of waste were broken. During the summer 3,700 feet of surface diamond drilling, of NX core size, was done from the cirque. The rock reject plant at the mine treated 597,202 tons of ore and rejected 219,825 tons of waste. The mill operated for 325 days to process 588,762 tons of ore, which yielded 62,233 tons of fibre.

Plant construction included the installation of a new crushing plant at the mine. New construction at the townsite included the erection of three privately owned dwellings and a covered skating-rink.

Sproat Mountain (Canadian Johns- Manville Company Limited)†

(50° 117° N.W.). Office, 1955 West Fourth Avenue, Vancouver 9. In 1963 this company held the following 17 claims: Sid and Sid 1 to 6, Arrow 6 and 9A, and Sproat 1, 3, 5 to 9, and 16. Access to the property is by logging-road about 4½ miles long that branches off the main road 1 mile north of Sidmouth. A limited amount of stripping and geo-

* By W. C. Robinson.

† By David Smith.

logical mapping was done in 1963 by a crew of four men under the direction of R. H. Janes.

[Reference: *Minister of Mines, B.C.*, Ann. Rept., 1962, p. 146.]

BARITE*

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 (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 Brisco operation was active for nine months during 1963, and a crew of three men mined, quarried, crushed, and shipped 5,061 tons of barite to the company's processing plant at Lethbridge. A further 3,500 tons was stockpiled on the property. Most of the production was mined from an underground open stope below No. 1 quarry. The remainder came from No. 2 quarry.

The Parson operation was active for eight months. During this time a crew of four men mined and shipped 1,029 tons of chemical-grade barite to Montreal, and 195 tons to the company's processing plant at Lethbridge. A further 1,500 tons of barite was stockpiled on the property. The barite was mined from the drift that was opened in 1958.

Baroid of Canada, Ltd.

(50° 116° N.E.). Company office, 44 King Street West, Toronto, Ont. J. A. Martino, president; H. K. Beggs, plant superintendent. This company 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 centred on the recovery of barite from a tailings dump left by the former operators. The tailings are trucked to the old mill and crushed to a slurry by a new unit installed in 1960. A barite concentrate is then recovered by a new set of separation tables and dewatered by a Dorrcro filter.

During 1963 a crew of eight men treated and recovered 4,500 tons of barite. The barite was trucked to a siding on the Kootenay Central Railway at Spillimacheen, and was shipped by rail to the company's processing plant at Onoway, Alta. The men were employed for four months, and the work was suspended for the winter in October. The mill superintendent and a mechanic remained on the property during the winter.

Allan Mining and Exploration Co.

Invermere (50° 116° S.E.). Company office, 927 Third Avenue Northwest, Calgary, Alta. W. M. Allan, president. This company operated the top quarry on the Larrabee property, near Invermere, for a period of two months in the summer of 1963. A small quantity of barite was quarried and loaded for shipment to Lethbridge, Alta., following which the operation was suspended. There were three men employed.

BUILDING-STONE

International Marble & Stone Company Limited†

Sirdar (49° 116° S.W.). Company office, 4344 MacLeod Trail, Calgary, Alta.; plant office, Sirdar. W. R. Rookes, president; H. Rennich, manager. Capital: 3,000,000 shares, 50 cents par value. This company owns a crushing and bagging plant, which is 2 miles north of Sirdar on the Kootenay

* By D. R. Morgan.

† By P. E. Olson.

Bay—Creston highway. During 1963 the company operated quarries at Sirdar (950 tons of granite) and Crawford Bay (3,337 tons of dolomite). The company also owns other pits, from which 17 tons of flagstone was produced.

Products derived from dolomite were stucco chips (2,164 tons), exposed aggregates (383 tons), structural stone (424 tons), and sand (366 tons). Granite is used chiefly to produce poultry grit. Most of these products were marketed on the Prairies. Some improvements were made to the processing plant at Sirdar to increase the production of the plant and improve the quality of the bagged product. Seven men were employed by the company in 1963.

Riverside*

(49° 117° S.E.) A. Endersby, of Fruitvale, produced and sold 50 tons of decorative facing-stone, which was quarried from the Riverside Crown grant on Sheep Creek. The stone splits readily and evenly along cleavage planes containing sericite. All production was sold in the Nelson district.

**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. A crew of seven men produced approximately 8,000 tons of granite products, including poultry grits, stucco dash, and sand-blast materials.

**Inland Quarries
Ltd.‡**

Company office, 5498 Fraser Street, Vancouver 15. W. E. Chandler, president; R. W. Hamilton, quarry superintendent. This company, employing two men, operated quarries for three-month periods at Agassiz, Sechelt, and Pitt Meadows. The Agassiz quarry (49° 121° S.W.) is adjacent to the Canadian Pacific Railway, 1 mile east of Agassiz. A shipment of 98 tons of light-coloured granite for dimension-stone purposes was made to the Vancouver plant from the quarry.

The Sechelt quarry (49° 123° N.W.) is near the west end of Nor'west Bay road. About 20 tons of diorite was shipped to the Vancouver plant from this quarry. After being cut and polished, this material was found to contain too many flaws to be satisfactory for dimension stone.

Trial quarrying of dimension stone from a light-coloured granite was done at Sheridan Hill (49° 122° S.W.), 3½ miles northeast of Pitt Meadows. A shipment of rubble was made to the Vancouver plant.

Evans, Coleman & Evans Limited (Gilley Quarry).‡—Pitt River (49° 122° S.W.). Company office, 902 Columbia Street, New Westminster. E. Thorson, production manager; Francis J. MacDonald, quarry superintendent. The quarry is on Pitt River immediately south of its confluence with Munro Creek. During a three-month operating period a crew of eight men produced and shipped 23,777 tons of quartz diorite.

**Richmix Clays
Limited‡**

McNabb Creek (49° 123° N.E.). Office, 2890 Kent Avenue, Vancouver 12; quarry, McNabb Creek. G. W. Richmond, manager. The quarry, which produces slate, is on the shore of Howe Sound 2 miles west of McNabb Creek. Two men, working on contract, mined and crushed 6,219 tons of slate, which was shipped to the company plant to be used for asphalt-shingle surfacing granules.

* By P. E. Olson.

† By A. R. C. James.

‡ By J. E. Merrett.

CEMENT*

British Columbia Cement Company Limited.—Bamberton (48° 123° N.W.). Head office, 540 Burrard Street, Vancouver 1. W. F. Foster, president; B. M. Brabant, executive vice-president; R. E. Haskins, vice-president in charge of production. During 1963 this company operated its cement plant at partial capacity.

Lafarge Cement of North America Ltd.—Lulu Island (49° 123° S.E.). This company operated its cement plant at partial capacity during 1963.

CLAY AND SHALE†

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 one underground and two open-pit operations. Five men employed at the Kilgard Fireclay mine produced 11,669 tons of clay. Three men employed at the Kilgard No. 9 pit, on the mountain above the Fireclay portal, produced 22,906 tons of clay, while three men working in the Selby pit, 2½ miles east of Abbotsford, produced 15,088 tons of clay.

Richmix Clays Limited.—Kilgard (49° 122° S.E.). Office and plant, 2890 Kent Avenue, Vancouver 12; quarry, Kilgard. G. W. Richmond, manager. The quarry was extended in a westerly direction by stripping the overburden, and one man mined and trucked 6,594 tons of fireclay to the Vancouver plant.

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 and surface scraping area adjacent to the plant, which is on the north bank of the Fraser River. From these two areas, 7,371 tons of clay was removed and stockpiled in dry storage. Twenty-six men were employed in the plant.

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 1,214 tons of clay 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 and other types of blocks, shapes, and high-temperature cements. Local and imported raw materials were used.

British Columbia Lightweight Aggregates Ltd.*—Saturna Island (48° 123° N.E.). This company operated a shale expanding plant intermittently throughout the year at Lyall Harbour on Saturna Island.

* By J. W. McCammon.

† By J. E. Merrett, except as noted.

DIATOMITE

Fairey & Company Limited* Quesnel (53° 122° S.E.). Company office and plant, 661 Taylor Street, Vancouver 3. L. T. Fairey, president. Fifteen carloads (222 tons) of diatomite was quarried on Lot 6182, on the east bank of the Fraser River about 6 miles north of Quesnel. This is the largest production for some years and is nearly four times the 1962 production. The material was excavated by a local contractor. It is used to make insulating brick and as a concrete admixture.

DOLOMITE†

International Marble & Stone Company Limited Crawford Creek (49° 116° N.W.). Head office, 4344 MacLeod Trail, Calgary, Alta. This company quarries white dolomite marble from a deposit on the east bank of Crawford Creek 3 miles upstream from the creek mouth. The deposit is in the southeast quarter of Lot 5023. It is 100 yards east of a road that leaves No. 3 highway just south of the Crawford Creek bridge, runs up the east bank 3 miles, crosses the creek, and runs back down the west bank to rejoin the highway at Crawford Bay settlement.

The dolomite is part of the Lower Cambrian Badshot Formation. It forms a north-striking and steeply west-dipping band 150 to 200 feet thick interlayered with schist and pegmatite. The rock is white and medium to coarse grained. The chief visible impurities consist of scattered flakes and thin seams of pale brown phlogopite and occasional thin patches of wollastonite. At the surface the rock is penetrated by large mud-filled fractures, near which staining has occurred. During quarrying the discoloured material is sorted out, and only clean white rock is shipped to the processing plant.

The present quarry extends for 160 feet across the strike of the dolomite parallel to and 100 feet or so from the creek. It is worked in two benches. The top bench is 50 feet wide and has a maximum face height of 10 feet. The bottom bench is 30 feet wide and has a face height of 20 feet.

Rock from the quarry is truck-hauled 40 miles to a crushing plant at Sirdar, where it is made into granules and bird grits.

Late in the year, because of difficulties encountered in mining so near the creek, a new pit was opened one-quarter mile south of the old pit.

FLUORITE‡

Rexspar Minerals & Chemicals Limited Birch Island (51° 119° N.W.). Head office, Suite 1007, 36 Toronto Street, Toronto, Ont.; mine office, Birch Island. Dr. Philip Joseph, president; J. W. Scott, mine manager.

This company owns the Rexspar property, located on a ridge 2,800 feet above and 3 miles south of Birch Island, a Canadian National Railway flag stop 81 miles north of Kamloops. The showings are readily accessible by means of a 7-mile-long road from Birch Island, which, in turn, is on Provincial Highway No. 5. Different parts of the property have been investigated at various times since 1918 as possible sources of fluorite, silver-lead, manganese, and uranium.

Previous work on the fluorite mineralization outlined a zone reported to contain 1½ million tons of rock with an average content of 25 to 30 per cent fluorite.

* By A. R. C. James.

† By J. W. McCammon and P. E. Olson.

‡ By J. W. McCammon.

Much strontium and significant amounts of caesium, lanthanum, ytterbium, and yttrium are associated with the fluorite. During the 1962 winter and 1963 spring the company excavated 14 trenches and drilled more diamond-drill holes to check former results and to see if additional or better fluorite mineralization could be found. The work confirmed previous estimates of the size and grade of the deposit but failed to add significantly to fluorite reserves.

The fluorite mineralization is in a fine-grained foliated breccia zone in highly feldspathic porphyritic rock. The zone extends across the ridge on a strike that ranges from north 20 to 65 degrees east, averaging north 35 degrees east, and it dips northwesterly from 20 to 60 degrees, averaging 38 degrees. It is about 1,000 feet long and is terminated at each end by the topography. Within the zone the fluorite occurs in irregular lenses of markedly variable concentrations. The lenses change thickness rapidly and are drawn out both along and up and down the foliation. The fluorite of possible economic interest is concentrated in a band with a surface width averaging 125 feet that forms the southwestern two-thirds of the length of the mineralized zone. Fluorite grades out to the northeast, and its place is taken by lenses of a highly micaceous material that contains relatively little fluorite. Diamond-drill cores indicate that the fluorite disappears and mica often takes its place in the same way at distances of 150 to 400 feet down the dip of the foliation from the surface. Fluorite is present in the country rock for some distance laterally on either side of the concentrated band, but in minor quantities. It is generally in small irregular streaks parallel to the foliation or in scattered hairline veinlets. One vein, 12 to 20 inches wide, that consists of massive white and purple fluorite with quartz, can be traced for 250 feet parallel to the main mineralized band about 20 to 30 feet southeast of it.

The host rock in and immediately adjacent to the mineralized area consists essentially of feldspar with variable amounts of sericite and scattered pyrite. The feldspar is present as phenocrysts, as much as one-half inch long, mostly microcline, and as felted masses of microlites. In all thin-sections examined the rock was composed of crystal and trachytic porphyry fragments in a crushed fine-grained matrix. This fragmental nature is not always apparent in hand specimens. Most crystals exhibit undulatory extinction.

The fluorite occurs as variable-sized angular fragments mixed with pyrite, feldspathic rock, and celestite. In the more highly concentrated lenses, fluorite makes up most of the mass and forms a dark-purple to blackish almost vein-like massive matrix surrounding the other materials. In other lenses the grain size is small and the fluorite is evenly distributed throughout, giving the whole rock a purple coloration. In still other and lower grade lenses, the fluorite is more thinly distributed, and the resulting coloration is pale blue to mauve. Celestite, at times as abundant as fluorite, occurs chiefly as very small crystals around the fluorite grains and filling fractures in them. The rare-earth mineral bastnaesite has been identified as being irregularly distributed with the fluorite and celestite.

The micaceous rock that appears to displace the fluorite mineralization consists of saogenitic biotite, pyrite, minor fluorite, and rock fragments. It is scarce at the southwest end of the shear zone, begins to be conspicuous near the central part of the zone, and is relatively abundant at the northeastern extremity. The material forms drawn-out discontinuous lenses like the fluorite mineralization. It is quite similar in appearance to the uraniferous mineralization found elsewhere on the property. Checks on the larger exposures at the north end of the zone gave Geiger counts of about six times background.

On the whole, the attitude of the foliation is quite consistent, but there does appear to be a slight swing in the strike to the southwest at the south end of the zone and a general steepening of the dip toward the southeast edge. No close folding was recognized in any of the exposures examined.

A few minor cross-faults can be seen in the open cuts, but no major dislocations are evident.

Joints are well developed at variable spacings over most of the area. They bear no apparent relationship to the mineralization. There are two main sets—one strikes between north 15 to 45 degrees west, and the other strikes between north 45 to 90 degrees east. All joints are vertical or have very steep dips.

During the spring of 1963 the company excavated 14 trenches on the fluorite showings. These were dug across the obvious mineralization perpendicular to the foliation and spaced at 75-foot intervals along the shear zone. The trenches were sampled in 10-foot sections across the parts where fluorite was abundant enough to look interesting. Assays of the samples agreed well with former results obtained from drill-core analyses.

Test work on bulk samples has shown that a metallurgical grade concentrate of better than 85 per cent CaF_2 content can be prepared from the rock, but an extremely fine grind is required. This results in a fine-grained product which would require some form of briquetting for metallurgical use.

[References: *Minister of Mines, B.C.*, Ann. Rept., 1949, p. 250; 1954, p. 108; *Munitions Resources Commission, Canada*, Final Report, 1920, p. 49; *Geol. Surv., Canada*, Econ. Geol. Series No. 16, 1962, p. 205; *Canadian Mining Journal*, 77 (7), 1956, p. 59; Mineral Processing Div., Mines Br., *Dept. Mines and Tech. Surv., Ottawa*, various reports.]

GYPSUM*

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 operates a large gypsum property on the north side of Windermere Creek, 8 miles east of Windermere. The property was formerly owned and operated by the Columbia Gypsum Company but was bought by the present company in 1957. The claims worked are the Blue Grouse 1-15729 and Blue Grouse 2-15731. A description of the property has been given in past Annual Reports.

The 1963 production was mined from the No. 2 quarry, which was opened in 1958. The quarry is at an elevation of 4,450 feet. The gypsum is mined in 15-foot lifts, loaded by power-shovel, and trucked 11 miles by private road to the crushing plant, located on a spur line of the Kootenay Central Railway near Wilmer. Other activities included the opening of a new quarry, located approximately 1½ miles southeast of the present quarry. The new quarry is at an elevation of 3,500 feet. A large quantity of overburden was removed by bulldozer, and it is estimated over 90,000 tons of gypsum has been exposed. At the mill-site a second spur line and car-mover were installed, and a new workshop measuring 30 by 50 feet was built by the office.

The total production during 1963 was 194,619 tons, of which 162,095 tons was shipped by rail and 32,524 tons placed on stockpile near the mill. Most of the production was sent to the company's processing plants at Calgary and Vancouver. Smaller shipments were sent to the Domtar Construction Materials Limited

* By D. R. Morgan.

at Calgary and New Westminster; Inland Cement Company at Edmonton; Canada Cement Company at Exshaw and Clover Bar, Alta.; Greenacres Gypsum Company at Austin, Wash.; and the Lehigh Portland Cement Company at Metaline Falls, Wash.

The quarry operated for 10 months. A total of 12 men was employed, most of whom were on contract.

**Domtar Construc-
tion Materials
Limited**

Canal Flats (50° 116° S.W.). Office address, Box 506, Sta. F., Toronto 5, Ont. For the past two years this company has held an option for exploration on a number of claims owned by A. H. Nichols and Mrs. B. Iverson, of Kimberley. The property is near the confluence of Roam Creek and the Lussier River, 16 miles southeast of Canal Flats, and can be reached by a 21-mile rough road leading from No. 95 highway north of Skookumchuck. A number of bulk samples were taken from the area that was drilled in 1962, and it is understood the property has now been purchased by the company.

LIMESTONE

LIMESTONE NEAR TULAMEEN (49° 120° N.W.)*

Two limestone occurrences were examined during a search for deposits of this rock in the Tulameen area.

The largest showings are at Law's Camp, an old mining property 7 miles northwest of Tulameen. The camp is reached by 1 mile of jeep-road from the sawmill on the Skwum Creek forest access road. Eastwood published a map showing the geology and distribution of outcrops in the area on page 54 in the Annual Report of the Minister of Mines and Petroleum Resources for 1960. The limestone is associated with schists, which are considered to be part of the Upper Triassic Nicola Group of rocks. Dykes and sills of feldspar porphyry and a small granodiorite body intrude the Nicola rocks. Outcrops are relatively small and discontinuous, so structural relations are not clear. The limestone, however, seems to form either one band repeated by folding or possibly two bands with a northwesterly strike and 40 to 45 degree dip to the southwest. The outcrops form topographic highs, being along the crests of narrow ridges or on the tops of isolated hillocks. In the most southeasterly exposure the rock is thin-banded bluish-grey and white coarse-grained marble interlayered with several streaks of schist. The other exposures are of coarse-grained cream to white marble. Toward the north and west, ¼- to ½-inch-wide veinlets and pods of quartz are relatively abundant. One sample was collected from the large showing 500 feet southwest of the Liverpool adit. Bare rock is exposed over a width of 110 feet for more than 500 feet along a small ridge. The sample consisted of chips obtained across 110 feet near the centre of the exposure. It had the following percentage analysis: Insol.=1.90, R₂O₃=0.52, Fe₂O₃=0.32, MnO=0.02, MgO=0.39, CaO=53.92, P₂O₅=0.037, S=0.008, Ig. Loss=43.09, H₂O=0.05.

The other limestone showing examined is in a cut on the Tulameen River road 9.8 miles upstream from Tulameen village. It consists of two parallel 12-foot-thick beds of white and grey crystalline limestone about 300 feet apart. The beds strike northwesterly across the road and dip 60 degrees southwest. They lie between gneissic wallrocks. The western limestone bed can be traced for 150 feet southeast of the road and 400 feet northwest of it. The other bed is exposed for only a few

* By J. W. McCammon.

feet on either side of the road. Siliceous bands and pods one-eighth inch wide are scattered through the limestone at 6- to 8-inch intervals. A chip sample cut perpendicular to the bedding across 12 feet of the western band in the road cut had the following percentage analysis: Insol.=1.92, R_2O_3 =1.22, Fe_2O_3 =0.32, MnO =0.003, MgO =0.71, CaO =53.29, P_2O_5 =0.34, S =0.06, Ig. Loss=42.42, H_2O =0.03.

[Reference: *Minister of Mines, B.C., Ann. Rept., 1960, p. 54.*]

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 limestone is blasted from a 30-foot face and transported to a crushing plant by a mobile loader. The products are sold for agricultural use and as an industrial filler. A crew of seven men was employed. Total production in 1963 was 5,220 tons of limestone products.

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. The quarry, crushing plant, and loading-dock are on the northeast shore of Texada Island, 1 mile south of Vananda. Open-pit benching was used to produce limerock, of which 566,000 tons was crushed and shipped. A crew of 24 men was employed.

Ideal Cement Company Limited† Vananda (49° 124° N.W.). British Columbia office, 1155 West Georgia Street, Vancouver 5; quarry office, Vananda. W. S. Beale, manager, Rock Products Division; J. K. Johnson, superintendent. Limerock was quarried by open-pit benching on Lot 25, 2 miles south of Vananda. The broken rock was trucked to the crushing, screening, and washing plant at the Marble Bay quarry. The Marble Bay plant facilities were extended by the installation of a new shuttle-conveyor loading-boom capable of loading the largest barges available for hauling limerock. Production consisted of 232,000 tons of limerock, of which 122,800 tons was crushed and screened, and 100,000 tons was shipped.

Imperial Limestone Company Limited† Vananda (49° 124° N.W.). Office, 7309½ East Marginal Way, Seattle 8, Wash.; quarry office, Vananda. J. A. Jack, president; E. Jack, superintendent. The quarry is at the summit of a small hill 1 mile west of Spratt Bay on the northeast coast of Texada Island. A new crushing plant and loading-dock have been erected at Spratt Bay. A crew of 12 men produced 59,241 tons and shipped 51,600 tons of limerock.

Lime Division (Domtar Chemicals Limited)† Blubber Bay (49° 124° N.W.). British Columbia office, 1105 West Pender Street, Vancouver 1; quarry office, Blubber Bay; lime plant, Vancouver. J. M. Greenaway, Blubber Bay plant manager. The quarry is approximately 2 miles south of Blubber Bay at the north end of Texada Island. The

* By A. R. C. James.

† By J. E. Merrett.

lime plant was closed in April, but the production of crushed limerock was increased. A crew of 50 men was employed. Open-pit bench mining methods were used to produce 700,000 tons of limerock, of which 650,000 tons was crushed and shipped.

Koeye River (Widsten Marine Services Limited).*—Koeye River (51° 127° N.W.). Company office, Bella Bella; quarry, Koeye River. A. O. Widsten, manager. Limestone is quarried by benching methods from the west pit of two adjacent quarries on the north side of Koeye River, less than a mile from its mouth on Fitz Hugh Sound, 6 miles south of Namu. In an eight-month period a crew of four men produced 13,000 tons of limerock for shipment to the Crown Zellerbach Canada Limited paper-mill at Ocean Falls.

British Columbia Cement Company Limited.†—Cobble Hill (48° 123° N.W.). Head office, 540 Burrard Street, Vancouver 1. W. F. Foster, president; B. M. Brabant, executive vice-president; R. E. Haskins, vice-president in charge of production. Limestone for the Bamberton cement plant is quarried by this company from a deposit at Cobble Hill on Vancouver Island.

MARL‡

Cheam Marl Products

Popkum (49° 121° S.W.). 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.

In 1963 an extensive cleanout was carried out on the canal which keeps the old Cheam Lake bed drained. According to the company, this lowered the water-table by about 29 inches, facilitating extraction and recovery of marl.

Production in 1963 was 39,002 tons of marl, an increase of 32 per cent on the 1962 production. Over the past 1½ years the company has endeavoured to build up an export market to Skagit and Whatcom Counties in the State of Washington. In 1963, 4,900 tons of marl was exported to these areas, and a further expansion of this trade is expected in 1964. A crew of three men was employed at the property.

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.

† By J. W. McCammon.

‡ By A. R. C. James.

Sand and Gravel Pits

Location	Operator	Equipment and Plant	Men	Production
Fort St. John—				
(1) Boundary Lake	C. B. Harden Cartage Ltd.	Front-end loader and screening plant	5	RP and SA.
(2) Boundary Lake	D. Bonk	Front-end loader	10	RP.
(3) North bank of Peace River south of Fort St. John	Blair Sand & Gravel	Loader and screening plant	9	RP and SA.
Taylor	Norby Bros. Construction Ltd.	Loader, crushing, screening, and washing	6	WS.
Chetwynd	Department of Highways and other operators			
Kitimat	Kitimat Concrete Products (1961) Ltd.	Sauerman dragline, crushing, screening, washing, and ready-mix concrete	10	RP, WS, and RM.
Prince George—				
(1) North Nechako Road	Central Sand and Gravel Ltd. (J. W. Philips, president)	Scoopmobile, jaw and roll crusher, screening plant, and ready-mix plant	3	RP, WS, and RM.
(2) Parcel Y, Lot 2507, Plan 833, Central Fort George	Northwest Paving Co. Ltd.	Crushing, screening, and loading plant	2	AA.
(3) Parcel Y, Lot 2507, Central Fort George	W. E. Robertson Construction Co. Ltd.		6	
Creston—Goat River bank	Louis Salvador & Son	Crushing, screening, and washing	3	WS.
Wynndel—Duck Creek	Louis Salvador & Son	Loading and screening	2 ¹	SA.
Nelson—Anderson Creek	Premier Sand and Gravel Company Limited (A. S. Shrieves, president)	Loading, crushing, and screening	4	SA and RM.
Trail—McGauley Pit, Casino Road, 2 miles south of Trail	McGauley Ready-Mix Concrete Company (J. McGauley, owner)	Scraping, washing, screening, crushing, and ready-mix	3	WS and RM.
Salmo—Erie Creek	Valley Concrete Products Limited (Brian Mitchell, manager)	Loading, screening, and concrete plant	2 ¹	SA.
Alexandra Lodge—Government pit	Columbia Bitulithic Limited	Asphalt paving plant	—	AP=1,500 tons.
Hope—Hockin's pit	Columbia Bitulithic Limited	Asphalt paving plant	—	AP=29,000 tons.
Vancouver—Granville Island	Columbia Bitulithic Limited	Paving plant	—	AP=46,000 tons.
North Vancouver—West end of East Keith Road, east of Seymour Creek	E. R. Taylor Construction Co. Ltd., 2645 Dollarton Highway, North Vancouver	Gas shovel, paving plant	6 ¹	RP and AP=29,900 yd.
Indian Arm—Bishop Creek	Capilano Crushing Co. Ltd., 107 East First Ave., Vancouver	Bulldozer, crushing, washing, and screening	8 ¹	RP=8,900 yd., Jan. 1st to Apr. 30th.
Port Moody—Barnet Road No. 2 pit	Scott Bros. Gravel Co. Ltd., Box 220, Port Coquitlam (George Scott, manager)	Bulldozer, shovel, front-end loader, crushing, washing, and screening	—	RP, SA, and WS. See No. (10), Coquitlam Municipality, for total production.
Coquitlam Municipality—				
(1) Scott Creek, No. 4 pit	Scott Bros. Gravel Co. Ltd., Box 220, Port Coquitlam	Bulldozer, shovel, front-end loader, crushing, washing, and screening	—	RP, SA, and WS. See No. (10), Coquitlam Municipality, for total production.
(2) West end of Westwood Road	Corporation of the District of Coquitlam	Front-end loader, portable crushing and screening	—	RP and SA.
(3) Pipeline Road, Coquitlam River, 1 mile north of Lougheed Highway	Deeks-McBride Ltd., 1051 Main St., Vancouver	Shovel, 600-tons-per-day crushing, washing, and screening plant; ready-mix concrete	18	RP, SA, and WS=230,212 yd.
(4) ½ mile west of Deeks-McBride pit	Columbia Bitulithic Limited	Asphalt mixing plant	—	AP=34,500 tons.

¹ Part-time employment.

Sand and Gravel Pits—Continued

Location	Operator	Equipment and Plant	Men	Production
Coquitlam Municipality— <i>Continued</i>				
(5) Westwood Road	G. H. Phillips Contracting Co. Ltd., 4271 Graveley St., Burnaby	Front-end loader	—	SA=4,600 yd.
(6) Pipeline Road, 2½ miles north of Lougheed Highway	S & S Sand & Gravel Ltd., 1101 Eighth Ave., New Westminster	Shovel	7	RP.
(7) Pipeline Road, 2¾ miles north of Lougheed Highway	Central Gravel Co. Ltd., Box 129, Mission	Shovel, front-end loader, portable screening plant		Sub-contracting production for S & S Sand & Gravel from that company's pit.
(8) Pipeline Road, 3¼ miles north of Lougheed Highway	S & S Sand & Gravel Ltd., 1101 Eighth Ave., New Westminster	Front-end loader, portable crushing, screening, and washing plant		RP, SA, and WS=108,911 yd.
(9) Pipeline Road, 3½ miles north of Lougheed Highway	Jack Cewe Ltd., 309 Cedar St., New Westminster	Shovel, front-end loader, crushing and screening plant	12	RP, SA, and AP=90,000 yd.
(10) East side of Coquitlam River, 2½ miles north of Lougheed Highway.	Scott Bros. Gravel Co. Ltd., Box 220, Port Coquitlam	Front-end loader, shovel, screening, crushing, and washing plant	50	RP and WS=295,000 yd.
Port Coquitlam—Fraser River at Mary Hill, 2 miles south of Port Coquitlam	Evans, Coleman & Evans Limited, 902 Columbia St., New Westminster	Shovels, 500-tons-per-hour processing plant, barge-loading facilities	33	WS=800,000 yd.
Pitt Meadows Municipality—				
(1) 1 mile northwest of Port Hammond	Haney Brick & Tile Ltd.	Front-end loader	11	Sand=1,964 yd.
(2) Bonson Road, 1 mile north of Fraser River	Lasser Trucking Co., Box 38, Pitt Meadows	Front-end loader	21	RP=4,000 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, Box 245, Haney	Shovel, crushing and screening plant	5	RP and SA=15,000 yd.
(3) Grant Hill, north of McIntosh pit	Henry Van Boeyen, Albion	Shovel	11	RP=3,269 yd.
(4) Grant Hill, 1 mile north of Municipal pit	Fred Worfolk, Haney	Shovel, paving plant (Columbia Bitulithic Limited)	—	AP=54,000 tons.
(5) Lougheed Highway, south of Grant Hill	Valley Ready Mix, Albion	Shovel, front-end loader, crushing, screening, and washing plant	2	WS and RM=15,000 yd.
(6) East end of No. 27 Road, Alouette River	Kirkpatrick Sand and Gravel Ltd., 22357 McIntosh Street, Haney	Shovel, crushing, screening, and washing plant	2	WS and RP=13,068 yd.
(7) Lougheed Highway, 1 mile east of Whonock	Ralph E. George	Front-end loader	11	RP=1,580 yd.
Mission Municipality—				
(1) 1 mile and 3 miles east of Stave Falls 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	31	RP=1,897 yd.
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 Chilliwack Municipality— (1) Chilliwack Creek	Dannielson Contractors Ltd.	Front-end loader	—	RP=6,000 yd.
(2) Rosedale Indian Reserve	Valley Aggregates Ltd.	Scraping from river bottom, screening and washing	21	WS=12,051 yd.
Sumas Municipality— (1) Northeast slope of Sumas Peak (2) At foot and east of Taggart Peak	Columbia Bitulithic Limited	Asphalt paving plant	—	AP=14,000 tons.
(3) Vye Road pit, 3 miles south of Abbotsford	Department of Highways and local operators	Shovel	—	Highway fill.
(4) Department of Highways pit 1½ miles east of Abbotsford	Corporation of the District of Matsqui	Shovel, front-end loader, and screening plant	—	RP and SA=117,238 yd.
Matsqui Municipality— (1) 1 mile east of Abbotsford	Columbia Bitulithic Limited	Shovel	—	RP.
(2) Tretheway Road, ¼ mile north of Clearbrook, two adjoining pits	Blackham's Construction Limited	Screening and crushing	3	AP=112,000 tons.
(3) Tretheway Road, ½ mile north of Clearbrook and on 12th Ave. ¼ mile west of Clearbrook Road	Department of Highways	Front-end loader	—	RP and SA=16,292 yd.
(4) Clearbrook Road, ½ mile north of border	Valley Rite-Mix Ltd., Box 430, Clearbrook	Front-end loader; screening, washing, and crushing plants; ready-mix plants	9	RP, SA, WS, and RM=33,477 yd.
(5) Corner of King (16th Ave.) and Foy (316th St.)	Abbotsford Gravel Sales Ltd.	Scraper, front-end loader; screening, washing, and ready-mix plant of Totem Trucking Ltd.	—	WS, RP, and RM=27,746 yd.
(6) Lefevre Road at Eighth Ave.	Lepp Trucking, Abbotsford	Front-end loader	—	RP=10,000 yd.
(7) Ross Road	Corporation of the District of Matsqui	Shovel	—	RP.
Langley Municipality— (1) Northwest corner of Jackman Road and Eighth Ave.	Columbia Bitulithic Limited	Asphalt paving plant	—	AP=34,000 tons.
(2) ½ mile west of Carvolth Road, north of 24th Ave.	Corporation of the Township of Langley	Shovel	—	RP.
(3) North of the northeast corner of Jackman Road and Eighth Ave.	Corporation of the Township of Langley	Shovel	—	RP.
(4) ¼ mile north of the corner of Jackman Road and Eighth Ave.	Aldergrove Cement Tile Product (S. Omelianiec, manager)	Front-end loader	11	RP=1,000 yd.
(5) Dogwood Ave. off Brown Road	J. Craig, Trans-Canada Highway, Langley	Front-end loader	—	RP=1,247 yd.
(6) Bradshaw and Berry Roads (Gun Club pit)	Kitsul Bros., 24306 Trans-Canada Highway, R.R. 3, Langley	Front-end loader	2	RP=15,000 yd.
(7) 2962 Lambert Road (Highland pit)	B & B Trucking, Cloverdale	Shovel	6	RP=67,000 yd.
(8) 32nd Ave. at Kinch Road	Evans, Coleman & Evans Limited	Shovel, crushing, screening, and washing plant	3	RP and WS=49,000 yd.
(9) Boundary Road at Surrey boundary	Oscar W. Rees	Shovel	21	RP=10,000 yd.
(10) 16th Ave. at Surrey boundary	Border Sand and Gravel Ltd.	Front-end loader, crushing, screening, and washing	3	RP and WS=18,168 yd.
(11) 8802 Hudson Bay Road, Fort Langley	Department of Highways	Shovel	—	Fill.
	H. G. Clark, Box 145, Fort Langley	Front-end loader, screening, washing, and ready-mix	1	SA and RM=4,770 yd.

¹ Part-time employment.

Sand and Gravel Pits—Continued

Location	Operator	Equipment and Plant	Men	Production
Surrey Municipality—				
(1) East end of Stokes Road (20th Ave.)	Corporation of the District of Surrey	Shovel	—	Fill.
(2) Larsen Road (28th Ave.) at 193rd St.	Deeks-McBride Ltd., 1051 Main St., Vancouver	Scraper, screening, crushing, washing, and ready-mix	8	WS, RP, and RM=79,675 yd.
(3) 19417 Eighth Ave., South Surrey	C. E. Shuler, White Rock Sand and Gravel, 2546—176th St., R.R. 2, Cloverdale	Shovel, screening	21	RP and SA=21,693 yd.
(4) South of McLellan Road at Delta boundary	Corporation of the District of Surrey	Shovel and asphalt plant	—	RP and AP.
(5) 53rd Ave. at Delta boundary	Colebrook Sand and Gravel Company, Limited	Front-end loader, crushing, screening, and washing	2	RP and WS=6,000 yd.
(6) 15945—112th Ave., North Surrey	Richmond Sand and Gravel Ltd.	Front-end loader, washing, and screening	2	RP and WS=41,150 yd.
(7) 112th Ave. east of Pike (160th) St.	United Sand and Gravel Ltd. (Steeves and Mann Equipment Ltd.)	Screening	—	—
(8) Wilson Townline road, ½ mile west of Surrey boundary	United Contractors Ltd.	Scraper, front-end loader, crushing, and screening	—	Highway fill.
(9) ½ mile north of Wilson Townline (96th Ave.) and 190th St.	Dawson Construction Co.	Front-end loader	—	Highway fill.
(10) Wilson Townline road at Surrey boundary	Dawson Construction Co.	Dragline, front-end loader, crushing, and screening	—	Highway fill.
Delta Municipality—				
(1) ¼ mile south of west end of 72nd Ave.	Lock Holmes, 5508—47th Ave., Ladner	Pit leased from Industrial Peat Products Ltd., shovel	11	RP=21,425 yd.
(2) ½ mile west of Scott Road at 68th Ave.	Lintons Construction Co. Ltd.	Shovel	2	RP and SA=79,737 yd.
Howe Sound—				
(1) Purry Creek	Routledge Gravel Ltd.	Front-end loader, crushing, washing, and screening plant	5	WS, RP, and SA=200,000 yd.
(2) Britannia Beach	Construction Aggregates Ltd.	Scraper, crushing, screening, and washing	22	WS, RP, and SA=636,275 yd.
(3) Shannon Falls	Express Ready-Mix Co. Ltd., Squamish	Front-end loader, ready-mix plant	—	RP and RM.
(4) Mamquam River	PaCo Cement Products Ltd., Goss Contracting Ltd.	Front-end loader, screening and crushing	11	WS and RM=19,598 yd.
(5) Hastings Creek, 1 mile south of Port Mellon	Evans, Coleman & Evans Ltd., north foot of Columbia St., Vancouver	Shovel, crushing, screening, and washing	22	WS=305,000 yd.
Powell River—				
(1) Haslam Lake Road, 3 miles northwest of Westview	G. & H. Sand and Gravel Co. Ltd.	Shovel, screening, washing, and ready-mix	3	WA and RM=5,000 yd.
(2) Allen Road, 3 miles northeast of Westview	P. Nassichuk	Screening	11	RP and SA=4,975 yd.
Vancouver Island—				
(1) 2½ miles west of Courtenay	Island Ready-Mix Ltd.	Mobile loader, rotary screening	—	SA and RM=6,975 yd.
(2) Adjacent to Island Highway at Cassidy	Evans, Coleman & Evans Limited, 900 Wharf St., Victoria	Front-end loader, washing and screening	4	WS=37,800 yd.
(3) 4 miles from Duncan on the Lake Cowichan road	Butler Brothers Supplies (Duncan) Ltd.	Front-end loader, washing, sizing, and ready-mix	—	RP, WS, and RM.

¹ Part-time employment.

SEMI-PRECIOUS STONES

AMETHYST*

(54° 128° N.W.) A group of four mineral claims is on
Lavender Queen Highway No. 16, 1 mile east of Terrace at the Skeena River
 bridge. These are held by R. H. Bates and associates, of
 Terrace. An adit has been collared and 60 pounds of amethyst recovered. The
 occurrence has attracted the attention of the rock-hounds of the area.

JADE†

The growing interest in lapidary work and greater awareness by more and more
 people of the mode of occurrence of nephrite has led to the recent discovery of sev-
 eral new occurrences of alluvial jade.

Lillooet Mining Division.—In 1963 nephrite boulders up to several tons
 weight were being recovered from Jim Creek, which drains into Marshall Lake from
 the northeast. Shulaps ultrabasic rocks outcrop extensively in the Jim Creek drain-
 age basin.

Omineca Mining Division.—When prospecting in the autumn of 1962, J. B.
 Thurber and Metro Kindrat found jade on Vital Creek about half a mile upstream
 from the bridge. With the help of Bruce Russel, a local trucker, three nephrite
 boulders weighing about 5,000, 2,000, and 800 pounds were hauled out from the
 creek. It is reported that another boulder has been found on Quartz Creek, a tribu-
 tary of Fall River.

In the autumn of 1963 Bruce Russel, of Fort St. James, found alluvial jade on
 his Placer Mining Lease No. 1476 on Kwanika Creek. He found seven boulders
 ranging in weight from 400 pounds to 7 or 8 tons and hauled out about 4½ tons
 in October. A cut from a 400-pound boulder was exhibited at the "Rock Show"
 in Vancouver in October and was said to be the best jade yet found in British
 Columbia.

The large area of serpentinized ultrabasic rocks on Mount Sidney Williams
 west of Middle River and north of Trembleur Lake was visited by W. Ericksen, of
 Victoria; R. Purvis, of Lillooet; and A. Bell, of Prince George. Jade boulders were
 found by them on Baptiste and Van Decar Creeks. Other areas of ultrabasic rocks
 in the Takla Lake area no doubt should yield jade on careful search.

Liard Mining Division.—Alluvial jade boulders were found on a small creek
 that enters the east side of Dease Lake at Steamboat Point, about 2½ miles south
 of Beady Creek. It is reported that a large number of large nephrite boulders occur
 on the two placer-mining leases recorded in November, 1963, by Benedikt Seywerd,
 of Victoria, and Josef Seywerd, of Chilliwack.

SILICA

Valemount (52° 119° N.E.). Company office, 736 Gran-
Alba Sands Ltd.‡ ville Street, Vancouver 2. D. S. Bigelow, president; J. F.
 McIntyre, project engineer. This company holds a lease on
 a deposit of silica sand about 1 mile west of Valemount. During 1963 a washing
 plant was built near the deposit. A total of 150 tons of material was produced and

* By H. Bapty.

† By Stuart S. Holland.

‡ By W. C. Robinson.

sold mainly for sand blasting. The product was trucked to a rail siding at Valemount. Four men were employed during an eight-month period.

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 silica property on Moberly Mountain, 5 miles northeast of Golden. In 1963 a new quarry was opened 100 yards west of the lowest of the older workings. A trial shipment of lump rock for the ferro-silicon market was made.

Winlaw (Silica Minerals Limited)† (49° 117° N.E.) Company office, Nelson. Harry Ebert, president; James Harrington, secretary. This is a private company controlled by Holm Machinery Sales Limited, Leduc, Alta. The quarry is being operated under agreement with the former owner, Harold Avis, of Winlaw. The claims are at 5,000 feet elevation on the east side of the north fork of Winlaw (Cedar) Creek, 2¼ miles upstream from the fork. Road construction to the property was completed in 1963 to permit truck haulage of a test run of 200 tons of material. This road leaves Highway No. 6 at the Winlaw General Store and is approximately 5½ miles long. Crushed silica was shipped to Edmonton and sold chiefly for stucco chips on an experimental basis. Mr. Garnet Norris was in charge of the operation at Winlaw.

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, 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. Estimated production for the year was 50,000 tons, and shipments made were 9,000 tons sacked and 41,000 tons in bulk. The washing plant, completed in 1962, worked continuously in 1963 and shipped 38,000 tons of bulk material. Thirty-one persons were employed.

* By J. W. McCammon.

† By P. E. Olson.

‡ By David Smith.

Petroleum and Natural Gas

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GENERAL ADMINISTRATION

For purposes of administration of the *Petroleum and Natural Gas Act*, the Department is divided between a General Administrative Section and the 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," made 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, 1963, 36,919,417 acres, or approximately 57,686 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	349	24,902,690
Natural-gas licences	3	74,987
Drilling reservations	29	641,919
Leases (all types)	3,392	11,299,821
Total		36,919,417

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 and 1962 will be found in the Annual Reports for those years.

The area of major land-holding interest, development, and production lies in the northeastern corner of the Province, in that segment of British Columbia roughly flanked by the Rocky Mountain Trench. Other acreage is held in the Prince Rupert and Fernie Land Recording Districts, in areas generally referred to as the Groundhog Basin area and Flathead River area respectively.

In June, 1963, 132 petroleum and natural-gas exploration permits were issued to Shell Oil Company of Canada Ltd. over offshore lands comprising a total of

13,084,685 acres. The permits extend from the British Columbia-United States boundary at the entrance to the Strait of Juan de Fuca and extend northwestward along the west coast of Vancouver Island through Queen Charlotte Sound into Hecate Strait. The approximate northerly boundary of this group of permits would lie on a line drawn eastward from Rose Point, which is the northeasterly tip of Graham Island.

The first exploration permits over offshore lands were issued in Hecate Strait by the Province in 1957. In 1960 the Federal Government created regulations governing the administration of, and at the same time claimed the mineral rights in, offshore lands. In consequence the companies concerned were compelled to obtain permits from both Federal and Provincial Governments in order to protect their activities. Shell Oil Company of Canada Ltd. also holds title issued by the Federal Government over the acreage covered by the permits mentioned above.

The question of jurisdiction of offshore mineral rights—the word “mineral” is used here in its broadest sense—has been under examination by agencies of both Governments, and it is expected a decision, made by proper authority, will be reached in 1964.

During 1963, land disposition was changed by the following transactions:—

	Issued	Terminated	Decrease (—) or Increase (+)
Permits	134	82	+52
Natural-gas licences	3	3	—
Drilling reservations	14	11	+3
Leases—			
Petroleum and natural gas	662	97	+565
Natural gas	6	—	+6
Petroleum	—	—	—

Petroleum and natural-gas revenue for the year 1963 was as follows:—

Rentals and fees—

Permits	\$1,638,748	
Drilling reservations	121,632	
Natural-gas licences	4,738	
Petroleum, natural-gas, and petroleum and natural-gas leases	5,957,533	
Total rentals and fees		\$7,722,651

Sale of Crown reserves—

Permits	\$79,519	
Drilling reservations	1,585,935	
Leases	5,426,555	
Total Crown reserve sales		7,092,009

Royalties—

Gas	\$1,531,977	
Oil	3,858,985	
Processed products	115,042	
Total royalties		5,506,004

Miscellaneous fees 29,376

Total petroleum and natural-gas revenues \$20,350,040

Details of yearly revenue, 1947 to 1962, inclusive, are tabled on page 168 of the Annual Report for 1962.

Cumulative totals, April 1, 1947, to December 31, 1963, are as follows:—

Rentals and fees—

Permits	\$35,883,771
Drilling reservations	525,977
Natural-gas licences	63,788
Petroleum, natural-gas, and petroleum and natural-gas leases	21,147,722

Total rentals and fees	\$57,621,258

Sales of Crown reserves—

Permits	\$15,625,551
Drilling reservations	10,949,617
Leases	24,774,263

Total Crown reserve sales	51,349,431

Royalties—

Gas	\$5,795,956
Oil	7,064,043
Processed products	551,346

Total royalties	13,411,345

Miscellaneous fees	164,406

Total petroleum and natural-gas revenues	\$122,546,440

GENERAL REVIEW

Geophysical exploration exceeded that in 1962, and there was an increase in both the number of geological parties in the field and the number of structure test-holes drilled. Seismic operations increased 15 per cent to 422 crew-weeks. Most of the exploration activity was confined to the northeastern part of the Province. Exceptions were one exploratory well which continued drilling near Chilliwack and seismic operations in the Fernie area and near Vancouver Island.

In 1963, 43 per cent of the footage drilled was by development wells, compared to 64 per cent in 1962. The 1963 development footage was 62 per cent less than the 1962 total. The annual footage drilled in the Province decreased 42 per cent to 898,720 feet, chiefly due to the delineation of the Boundary Lake oil field in 1962 and the lack of other proven areas for development.

Only one-fifth as many oil wells were completed in 1963 as in 1962. There were 6 more gas completions, 8 less service wells, and 12 less abandonments than in 1962. At the close of 1963 there were 853 potential producers, 389 oil wells and 464 gas wells.

Oil production increased by 40 per cent owing to the fact that the Western Pacific Products and Crude Oil Pipeline was in operation for its first full year. Production in 1963 totalled 12,528,681 barrels. Monthly production exceeded 1,000,000 barrels in eight different months. During December 350 of the 389 potential oil wells were on production.

Although total gas production, including associated gas produced with oil, increased 4 per cent to 133,748,722 M s.c.f., the production of wet gas decreased by almost 4 per cent, and dry gas by approximately 1 per cent. The percentage

of produced gas flared and used on leases increased from 7 per cent in 1962 to 12.5 per cent, due chiefly to the increased production of associated gas for which no market existed. The volume of Alberta dry gas transported by Westcoast Gas Transmission Company Ltd. for export to the United States increased by 27 per cent, although the combined exports of both British Columbia and Alberta gas via that pipe-line increased less than 1 per cent. Exports of British Columbia gas decreased by 5 per cent, while consumption within the Province increased by 10 per cent. As many of the potential gas wells are located beyond the present pipe-line facilities, only 213 of the 464 capable gas wells were producing during December.

Only two major changes were made in 1963 to the gas-plant, oil-refining, and pipe-line installations. The British Columbia oil transmission system was extended about 15 miles to the Aitken Creek oil field. The throughput of the Western Pacific pipe-line was increased to 33,575 barrels per day with the addition of two more compressor stations.

Reserves of oil, gas, and the various by-products were increased during 1963. Crude-oil reserves increased 3.8 per cent to 153,583,411 barrels; disposable natural gas increased 5.5 per cent to 7.06 trillion cubic feet; gas liquids increased 9.1 per cent to 138,148,800 barrels; and sulphur increased 5.3 per cent to 3,637,428 short tons.

FIELD OFFICE

FIELD WORK

The field administration of the "Regulations Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas" is done by the field staff, headquartered at Charlie Lake. During periods of localized activity a temporary office trailer was employed in the Fort Nelson, Jedney, and Boundary Lake areas.

The field staff carried out inspections on all phases of the drilling and production industry and, upon the request of the Chief Petroleum and Natural Gas Commissioner, investigated complaints relative to seismic and pipe-line operations. A total of 91,986 miles was driven by the field personnel in the performance of the inspection work. One inspection by aeroplane was made of isolated drilling rigs in conjunction with the Departments of Public Works and Finance. Vehicles available to the field staff are two passenger cars, two pick-up trucks, one four-wheel-drive truck, and one panel truck which is equipped as a bottom-hole unit.

There were 633 "fast check" and 60 "complete check" inspections made at meters which measure the gas production. Seventy-nine inspections were made at oil batteries. A total of 807 inspections was made at abandoned, producing, and potential well locations. The lease equipment on all producing wells and most of the potential producers was catalogued in detail during the last quarter of 1963.

During 1963 the Department of Mines and Petroleum Resources purchased an improved bottom-hole unit for running pressure and temperature surveys. There were 119 surveys made by Branch personnel. These surveys are computed at the field office, and the results are used in Branch engineering studies and to verify data submitted by operating companies.

Field personnel witnessed 39 tests on oil wells and 64 open-flow tests on gas wells. All production tests are calculated at the Charlie Lake office and forwarded to Victoria for approval.

A 10,000-pounds-per-square-inch Coleman tester and water bath, located at the field office, serves as the standard for bottom-hole pressure and temperature

bombs used in British Columbia. During 1963, 129 calibrations were made with this equipment on various bombs used by the industry.

There were 140 rig inspections made to examine the equipment, review the drilling procedures employed, and assess the general safety of the installation. The field staff attempt to inspect each rig once while each hole is being drilled.

GEOLOGICAL SECTION

The Geological Section continued compilation of the surface and subsurface geology of the sedimentary basins of the Province. Special attention was paid to recording geologic data and defining rock units of the oil and gas productive zones of northeastern British Columbia. Main sources of information for the subsurface studies were geophysical well logs, rock cuttings, and cores.

The Section also participated in the routine preparation of reservoir maps of the producing fields of British Columbia. Studies of the upper part of the Middle Devonian sequence were brought to a conclusion. Investigations were made into the conditions of oil accumulation in the Mississippian to Cretaceous fields of the Fort St. John area.

During 1963 staff geologists studied core and samples at the Branch Laboratory at Charlie Lake and at the Core Storage Centre of the Alberta Oil and Gas Conservation Board, Calgary.

In July two staff geologists measured and reported on Palæozoic-Mesozoic rocks in the Trimble Lake area of northeastern British Columbia. A mimeographed report of this study may be obtained from the Department.

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 1963, 2,547 boxes of core from 175 wells were received at the laboratory.

Present core-storage facilities provide space for approximately 20,000 core boxes. At the end of 1963, 19,419 boxes from 944 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 laboratory 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.

During 1963, samples were received at the laboratory from 208 wells. This represented over 800,000 feet of drilling, mainly in northeastern British Columbia. A total of 176,061 10-foot samples was washed and bottled in 1963.

Core and Sample Examination

The use of core- and sample-examination facilities at the geological laboratory, Charlie Lake, continued to increase in 1963. In November a record number of 1,800 boxes of core was examined. The strata receiving the greatest attention were the Middle Devonian carbonate and the Triassic carbonate and sandstone of northeastern British Columbia. Some work was done also on the Mississippian carbonate and the Jurassic and Cretaceous sandstones. A nominal fee is charged for the use of the core- and sample-examination facilities provided by the Department.

In 1963, 10,743 boxes of core from 500 wells were studied by oil company personnel and other interested individuals. Approximately 600 boxes of core from significant wells were examined by Department geologists. Cores from 52 wells were temporarily removed from the laboratory by the operators for re-analysis or other studies. Samples from 89 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, 23,570 boxes of core from 1,187 wells have been removed from the racks for examination.

EXPLORATION

Twenty-one oil and gas companies did seismic work in northeastern British Columbia in 1963; one of these also had a crew in the Fernie area and another operated a marine seismic survey in the Vancouver Island-Queen Charlotte Islands area. Most of the seismic crews used the reflection technique, although some refraction seismic work was done in northeastern British Columbia and the Fernie area (Table 1). In northeastern British Columbia 423 seismic crew-weeks were completed. One company conducted a gravity survey in northeastern British Columbia during January, February, and March (Table 1).

Fifteen companies had surface geological parties in the field in northeastern British Columbia. Of these companies, two also did surface geology in the Fernie area and one worked in the Vancouver Island-Queen Charlotte Islands area (Table 2). Four companies drilled 35 test-holes in northeastern British Columbia in 1963 (Table 3).

Sixty-three exploratory wildcat wells were spudded during 1963. Five of these were still drilling at the end of 1963, and two were suspended, prior to reaching the proposed final depth, making a total of 56 drilled exploratory wells. Fifty-five of these were in northeastern British Columbia east of the Rocky Mountains. The other well was in the Fraser Valley near Chilliwack.

Exploratory drilling in northeastern British Columbia was concentrated along the developing trends of Devonian gas reservoirs in the northern plains region and Triassic oil reservoirs in the southern plains region. Exploration also continued in the foothills region.

During 1963, 20 new hydrocarbon accumulations were discovered, 2 oil pools, and 18 natural-gas pools. Exploratory drilling was responsible for the discovery of both oil pools and 11 of the gas pools. The other seven gas pools were discovered by development drilling.

The two oil discoveries were in the southern plains region northeast of Fort St. John. Union HB Sinclair Bulrush d-78-F discovered oil in the Triassic Halfway Formation, 4 miles east of the Peejay oil field, and Union KCL ROC Nettle d-67-A discovered oil in the Lower Cretaceous Gething Formation, 8 miles northeast of the Beaton River oil field.

A significant number of the 1963 natural-gas discoveries were made in the general northern plains region in carbonate reservoirs of Devonian age. The wells West Nat et al Yoyo b-24-L and b-29-I discovered gas in the Devonian Pine Point Formation, 4 and 10 miles respectively west of the Kotcho Lake gas field. IOE Junior c-3-C discovered Pine Point-Sulphur Point gas approximately 30 miles south of the Kotcho Lake gas field. Further discoveries in the Devonian Slave Point Formation were made by West Nat IOE S Clarke d-29-K, 3 miles south of the Clarke Lake gas field, and by West Nat et al Milo d-55-E, 9 miles southwest of the same field. Pacific Gunnel b-5-D discovered Slave Point gas between the Clarke Lake and Kotcho Lake gas fields following the trend of these reservoirs. The Slave Point Formation also yielded gas, 24 miles northwest of Kotcho Lake in the well West Nat Cabin b-40-A and 35 miles northeast of Kotcho Lake in the well SOBC Helmet b-49-G.

Five new natural-gas pools were discovered in the Triassic Halfway Formation along the trend of oil and gas fields which parallels the depositional edge of this formation. Natural-gas pools were discovered by the wells Pure et al W Milligan c-50-G, 2 miles west of the Milligan Creek oil field; Pacific SR CanDel W Dede b-45-K, 10 miles west of the Peejay oil field; Lobitos Black d-57-F, 24 miles northwest of the Beaton River oil field; Union HB Sinc Pac Currant d-37-C, 6 miles southeast of the Peejay oil field; and Texaco NFA N Boundary 7-3-87-14, 3 miles northwest of the Boundary Lake oil field.

The Triassic Baldonnel Formation continued to provide new gas pools in 1963, with new discoveries at the wells Pan Am Dome Sikanni b-43-B, located 7 miles west of the Beg gas field; Altair Sarcee C&E Zeke c-34-L, 5 miles north of the Buick Creek West gas field; and CDR Fireweed d-31-G, 9 miles south of the Nig Creek gas field.

Two of the natural-gas discoveries were in rocks of Lower Cretaceous age. Gas was obtained from the Dunlevy Formation at Texaco NFA E Osborn a-45-J and from the Bluesky-Gething Formation at Tenn Osborn 6-23-88-16. These wells are approximately 35 miles northwest of Fort St. John.

RESERVOIR SECTION

MAXIMUM PERMISSIBLE RATES

In 1963 the Reservoir Section established 33 maximum permissible rates for oil wells, of which 24 were initial rates, 8 were interim rates, and 1 was a revision of a previously established M.P.R.

Eight applications for pool maximum permissible rates were received. Seven were approved. Two applications by Union Oil Company of Canada Limited dealt with increases in the M.P.R. of the Halfway pool of the Milligan Creek field, based on evidence of increased recovery resulting from water injection.

An application by Union for a pool M.P.R. of 582 barrels per day from the Aitken Creek field was approved. Approval was given to Union's application for a pool M.P.R. of 1,100 barrels per day from the Upper Halfway sand of the Wildmint field.

An application by Pacific Petroleum Ltd. for a pool M.P.R. of 4,425 barrels per day from the Halfway pool of the Peejay field was rejected when a problem of equity arose. A subsequent application for a pool M.P.R. of 2,018 barrels per day for the south part of the field was approved.

The application of Sun Oil Company for a pool M.P.R. of 4,600 barrels per day for the Mississippian horizon of the Blueberry field was approved.

Triad Oil Company Limited was granted approval for a pool M.P.R. of 1,940 barrels per day from the Halfway pool of the Beaton River field.

Approved maximum permissible rates at December 31, 1963, are given in Table 7.

PRESSURE MAINTENANCE

The trend to pressure maintenance of producing oil pools, first evident in 1962, became more marked in 1963.

Seven applications for schemes associated with pressure maintenance were studied during the year. Six were approved, and one was rejected. An application for a gas-conservation plant was studied and approved. An outline of the applications follows.

Texaco Exploration Company applied on behalf of the Northern Foothills Agreement group for approval to inject 100,000 barrels of water into the Boundary zone of the Boundary Lake field through a well in Legal Subdivision 12, Section 6, Township 86, Range 13, west of the 6th meridian. In order to obtain information on the injection characteristics of the zone for the selection of an optimum flood pattern, rates up to 1,800 barrels per day were requested. Notice of the application was published in the British Columbia Gazette on January 3rd and 10th, and the application was subsequently approved by the Chief of the Branch.

Triad Oil Co. Ltd. applied for a scheme of pressure maintenance to inject up to 2,000 barrels of water per day into the Halfway sand of the Beaton River field. Notice of the application was published in the Gazette on April 4th and 10th, and the application was subsequently approved by the Chief of the Branch.

Imperial Oil Limited applied on behalf of itself and its partners for an amendment to the approval, granted in 1962, for a pilot water-injection scheme to inject 100,000 barrels of water at a maximum rate of 500 barrels per day into the Boundary zone of the Boundary Lake field. The amendment, requested on the basis of experience gained from the 1962 project, was for an increase from 500 barrels per day to a rate to be determined by good engineering practice. A further request was made to increase the total injection from 100,000 barrels to an amount sufficient to allow response from the associated producing wells. This would permit evaluation of the flood performance. Notice of the application was published in the Gazette on June 6th and 13th, and the application was subsequently approved by the Chief of the Branch.

Pacific Petroleum Ltd. applied on behalf of the working-interest owners in the proposed Peejay Unit Number One for a scheme of pressure maintenance to water-flood the Halfway reservoir of the Peejay field. Notice of the application was published in the Gazette on August 8th and 15th. A question of equity arose, and the application was rejected by the Chief of the Branch.

Imperial Oil Limited applied on behalf of itself, Pacific Petroleum Ltd., and Sinclair Canada Oil Company for a scheme of pressure maintenance of a part of the Boundary pool of the Boundary Lake field, under an area equivalent to 35¾ sections. Notice of the application was published in the Gazette on September 5th and 12th, and the application was subsequently approved by the Chief of the Branch.

Pacific Petroleum Ltd. applied on behalf of itself and Sinclair Canada Oil Company for approval of pressure maintenance of the south part of the Peejay field by water injection into the Halfway sand. Notice of the application was published in the Gazette on November 7th and 14th, and the application was subsequently approved by the Chief of the Branch.

Western Natural Gas Company Inc. applied on behalf of itself, Fargo Oils Ltd., General American Oils Ltd., and Sun Oil Company for approval of gas conservation and partial pressure maintenance by returning to the gas cap of the Mississippian oil pool of the Blueberry field up to 2,500 M c.f. per day of produced Mississippian gas. Notice of the application was published in the Gazette on November 21st and 28th, and the application was subsequently approved by the Chief of the Branch.

Imperial Oil Limited applied for approval of a gas conservation scheme for produced gas from the Boundary zone of the Boundary Lake field. The scheme envisaged construction of a gathering system and gas plant to process 17,000 M c.f. per day of casing-head gas for disposal to a pipe-line. The scheme was approved in principle by the Chief of the Branch.

GAS-OIL RATIO ADJUSTMENT FACTORS

The volume of associated gas produced with each barrel of oil increased as oil production increased during the year, and it became evident that there was need for a degree of control over rising gas-oil ratios. To meet this need, Order in Council No. 1710 was approved on July 5, 1963, making B.C. Regulation 122/63 effective on October 1st. This regulation establishes gas-oil ratio adjustment factors which allow rising gas-oil ratios to be checked by restricting oil production from wells when the gas-oil ratio exceeds 1,000 cubic feet per barrel. Control of the produced gas-oil ratio of an oil well is undertaken to protect inter-well equity, to conserve gas that would otherwise be flared, and to prevent loss of potentially recoverable oil.

RESERVES

Proved recoverable reserves of oil and established reserves of gas increased during 1963. A summary of these reserves with explanatory notes is given in Table 6.

Proved reserves of crude oil increased 12.2 per cent over the 1962 figure. Production in 1963 was 8.4 per cent of the 1962 reserves, giving a net increase of 3.8 per cent.

Established reserves of natural gas increased 5.5 per cent over the 1962 figure. Production in 1963 was 2 per cent of the 1962 reserves, giving a net increase of 3.5 per cent.

Oil and gas reservoir data, as compiled at the 1963 year-end, are given in Tables 4 and 5.

DEVELOPMENT SECTION

DRILLING

A decrease in the annual drilling operations was recorded in 1963, for the first time since the petroleum industry became active in British Columbia. The decrease was primarily due to the completion of development drilling in the Boundary Lake oil field. Exploratory drilling was less, relative to 1962, and did not locate any areas to attract large-scale drilling programmes by the oil companies.

Nearly all aspects of drilling decreased, compared to 1962. Fifty-five drilling rigs, owned by 18 different contractors who were employed by 43 oil companies, were operated in 1963. This compares with 66 rigs, 20 contractors, and 39 oil

operators that were active in 1962. The increase of participating oil companies indicates a growing interest by the smaller companies during 1963.

One well drilling in the Fraser Valley area continued operations throughout 1963. The remainder of the work was done in northeastern British Columbia.

The greatest decrease was in the number of completed oil wells. In 1963, 31 wells were completed as potential oil-producers, and in 1962, 163 oil wells were completed. This is a reduction of 81 per cent. In the Boundary Lake area there were 10 completed oil wells in 1963 and 119 in 1962.

Other types of completions were less than in 1962, as follows: 70 gas wells, down 9 per cent; 82 abandonments, down 15 per cent; and 3 service wells, down 66 per cent. There were 186 completed wells in 1963, compared with the all-time high of 345 completed wells in 1962. For convenience in compilation, each zone of a multiple completion is counted as one completion. In 1963 the actual number of wells completed was 180, of which 6 were completed as multiple gas wells.

At the end of 1963, 13 wells were drilling and 2 were suspended, pending further deepening to the objective depth.

Wells drilled and drilling during 1963 are listed in Table 8.

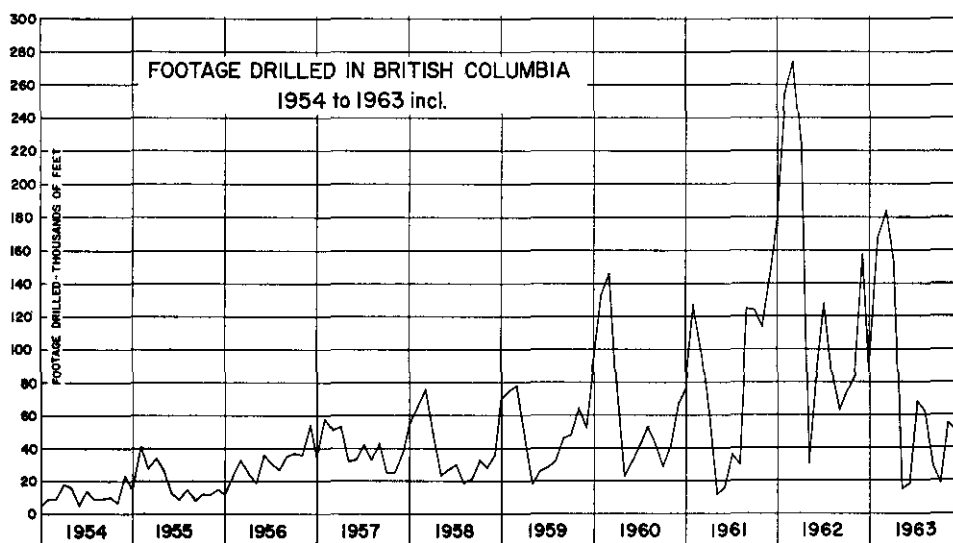


Figure 11. Footage drilled in British Columbia wells, 1954-63.

Footage totals for each well classification were also less than in 1962. Development-well footage was 376,298, down 62 per cent; exploratory outpost footage was 197,102, down 10 per cent; and exploratory wildcat footage was 325,320, down 6 per cent. The total footage drilled in 1963 was 898,720 feet, down 42 per cent.

A graph of the monthly footages drilled since 1954 is given in Figure 11. This graph indicates the annual seasonal fluctuations and the substantial increase recorded during 1962.

Work-overs to increase productivity, repair subsurface installations, or abandon potential wells were performed at 98 completed wells in 1963.

During 1963 quarterly revisions of the Branch field designations accounted for 4 new fields and 19 amendments to existing fields. The designated fields at December 31, 1963, numbered 42; they are listed in Table 9. A map showing the location of the fields and the discovery wells is given in Figure 12.

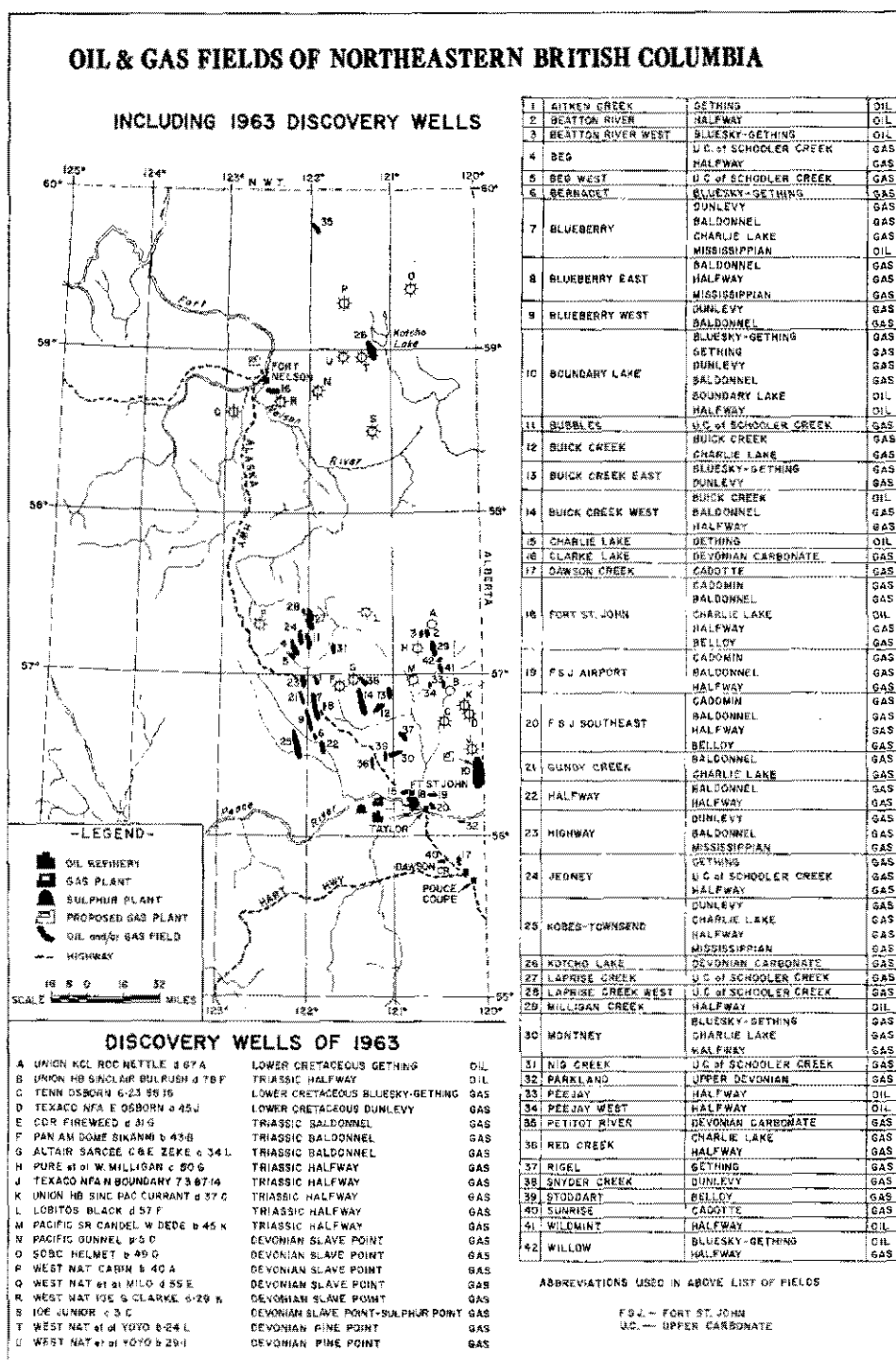


Figure 12. Petroleum and natural-gas fields, 1963.

The Development Section is responsible for the study and approval of all submissions made to the Branch relative to drilling operations. These applications include the permission to drill a well, to change the name of a well, to abandon a well, or to make any alteration to a completed well.

During 1963, drilling authorities were issued for 175 approved applications. Upon receipt of each application, the proposed engineering programme, the title under which the petroleum and natural-gas rights are held and the various geological requirements are reviewed. The well-location survey, required with each application, is computed to verify the stated position. A spacing area is assigned to each well. Letters of agreement must be received from any participants that share a spacing area. When these requirements are satisfied, the operator is assigned a drilling authority number and permission is granted to commence drilling.

In addition to the assignment of a spacing area, each well is classified as development, exploratory outpost, or exploratory wildcat. A development well may be defined as being in a location that is within a spacing area which is contiguous to a completed well. When a location is greater than $4\frac{1}{2}$ miles from a completed well, it is called an exploratory wildcat location. Locations between wildcat and development wells are called exploratory outpost locations. For classification purposes a well is considered completed if it is either physically able to produce or is a potential producer still requiring completion work. Development wells may be further classified as deep-pool or shallow-pool tests when an undeveloped pool below or above the known pool is explored. These classifications are used as the basis for the requirements of various reports submitted to the Branch.

Applications to alter equipment in a well are handled in the same manner as applications to drill a well. All details of the alteration must be examined and given approval by the various sections of the Branch. Abandonment programmes may be approved by the Branch field engineer, but all other programmes are reviewed by the staff at Victoria, where the official records are filed.

Each drilling and servicing rig that operates in the Province must hold a valid rig licence. During 1963 the Development Section issued 5 and renewed 61 rig licences.

The Well-names Register contains the official names of all approved well locations in the Province. The official well name is given at the time of approval of the drilling authority and must conform with the instructions issued by the Branch. The established system divides the well name into three basic parts:—

- (1) The full or abbreviated name of the company or companies responsible for the well.
- (2) Reference to the general or specific area in which the well is located. This part of the name refers to the geographic area, a topographic feature, or to an established survey position such as a triangulation station. When a definite reference is not possible, some other basis is used to select an area name.
- (3) Reference to the survey system recognized in the area. This part of the name indicates either the legal subdivision, section, township, and range or, in areas not divided into townships, the quarter-unit, unit and block as described in the publication entitled "Permit and Lease 'Grid' System." The National Topographic System map numbers given in this publication are not included in the official well name but are recorded by the Branch for reference purposes.

Various maps are prepared by the Development Section for distribution. Maps showing the designated fields and well locations are kept up to date and are available upon request. During 1963, 56 maps showing the location and status of wells were distributed to oil companies. Field maps, up-dated quarterly, were sent to the regular subscribers.

One serious fire, resulting in the death of two workmen and injury to two others, occurred at the well Altair Sarcee C&E Zeke c-34-L on August 6, 1963. During completion of the well by a service rig, an explosion of leaking gas took place. In order to quell the flames, a fire-fighting expert and specialized equipment were employed.

The salt-water disposal well located in the Fort St. John field at Pacific Ft St John 3-30-83-18(6) received 13,465 barrels during 1963. The salt water is produced at nearby gas wells, transported to the disposal well, and returned to the Belloy Formation. Other salt water produced in the Province and totalling 235,906 barrels was contained near the producing wells in surface pits for disposal by evaporation.

Drilling and geophysical operations are a significant factor in the opening of new lands for settlers. Many areas that were previously isolated now have year-round access to the populated centres.

The Provincial Government constructed permanent bridges across the Nelson and Beaton Rivers to allow improved access for the oil companies and for prospective settlers.

PRODUCTION

There were 12,528,681 barrels of crude oil produced in 1963. This was an increase of 40 per cent over the 1962 production and was obtained during the first full year that the Western Pacific pipe-line was in operation. The Boundary Lake field produced 7,726,776 barrels or 63 per cent of the annual production. Other fields which produced over 1,000,000 barrels were Blueberry with 1,279,318 barrels and Milligan Creek with 1,638,473 barrels.

Gas production for 1963 was 133,748,722 M s.c.f., an increase of almost 4 per cent over that of 1962. The four largest producing fields were Beg, Jedney, Laprise Creek, and Nig Creek, which produced over 10,000,000 M s.c.f. each. Other fields which produced in excess of 5,000,000 M s.c.f. were Bubbles, Buick Creek, Fort St. John, Fort St. John Southeast, Kobes-Townsend, and Rigel.

The well count at the end of 1963 of producing and producible wells is given in Table 10.

Monthly crude-oil and natural-gas production by fields and pools, 1963, is given in Tables 11 and 12.

Graphical presentations of the monthly production from 1954 to 1963 are shown in Figures 13 and 14. These graphs show crude-oil and natural-gas production measured at the well-heads. The gas produced in association with the crude oil and not recovered is excluded.

The 1963 marketed sales of natural gas, including gas imported from Alberta, totalled 136,593,277 M s.c.f., of which 99,955,132 M s.c.f. was exported to the United States. The marketed sales of natural gas distributed within the Province was 35,654,133 M s.c.f., which was divided as follows: Residential, 13,460,363 M s.c.f.; commercial, 4,534,641 M s.c.f.; and industrial, 17,659,129 M s.c.f.

The 1963 volume of condensate/pentanes plus produced in the field was 13,671 barrels, while 841,740 barrels was produced at the gas plant. A total of 652,902 barrels was exported to the United States.

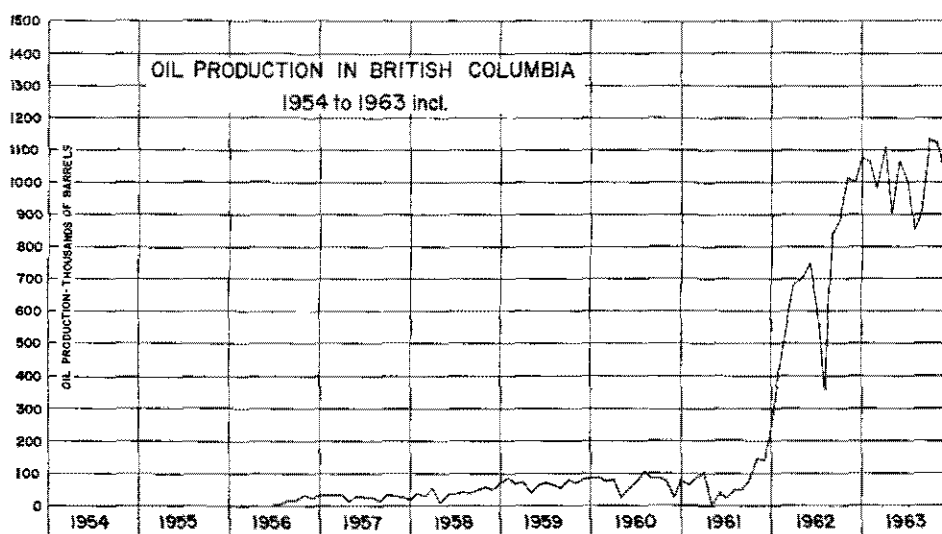


Figure 13. Petroleum production, 1954-63.

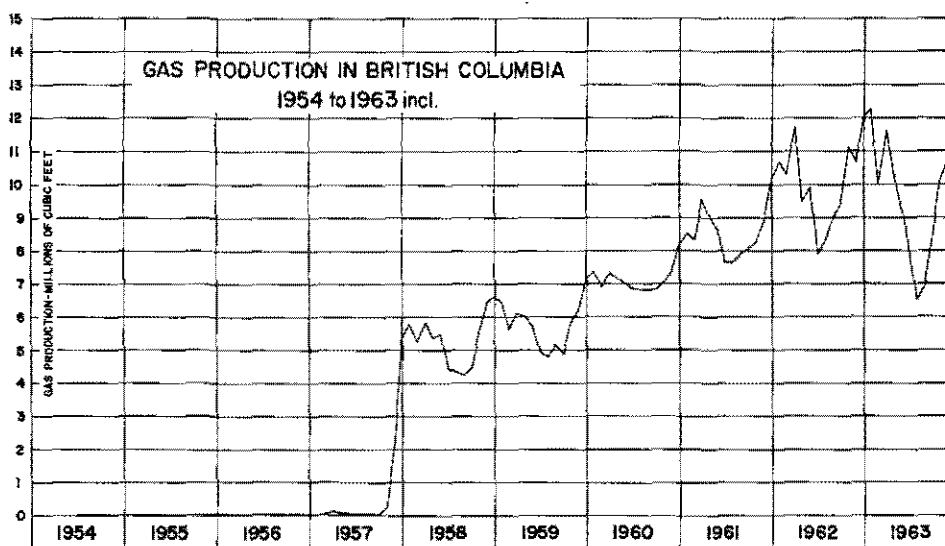


Figure 14. Natural-gas production, 1954-63.

Butane and propane production by the British Columbia refineries was 153,186 and 256,607 barrels respectively. These products were produced at the gas plant in the following volumes: Butane, 409,087 barrels, and propane, 205,162 barrels. There was 138,359 barrels of the Provincially produced butane sold in British Columbia and 373,322 barrels of the propane.

Sulphur produced decreased 13 per cent to 60,372 short tons. There was 51,618 short tons of sulphur exported and 24,181 short tons used in the Province.

General statistics showing well operation and production data are given in Table 13. The monthly disposition of the various petroleum products are shown in Tables 14, 15, and 16. The monthly values to the producers are given in Table 17.

PIPE-LINES

Gas-gathering System

During 1963 Gas Trunk Line of British Columbia extended its gas-gathering system in the Beg West, Laprise Creek, and Jedney fields. Westcoast Transmission Company increased its pipe-line network in the Bernadet, Buick Creek East, Parkland, and Rigel fields. Additional compressors were installed in the Buick Creek West, Fort St. John, and Kobes-Townsend fields to maintain the gas supply.

Gas-transmission System

In 1963 one compressor was added at Chetwynd to the main Westcoast line, which runs from Taylor to Huntingdon. This installation was made to maintain the present capacity of the line and for use when the proposed line to Fort Nelson is completed.

Gas-distribution System

Three of the gas-distribution systems were extended in 1963. Inland Natural Gas Co. Ltd. added 12.3 miles to its system in the Interior area of the Province, Northland Utilities (B.C.) Ltd. added 2.1 miles of pipe-line to its facilities in the Dawson Creek area, and Plains Western Gas and Electric Co. Ltd. increased its Fort St. John system by 3.6 miles.

Oil-gathering System

British Columbia Oil Transmission Company made a substantial increase to its gathering system by the addition of 14.6 miles of pipe-line to the Aitken Creek field.

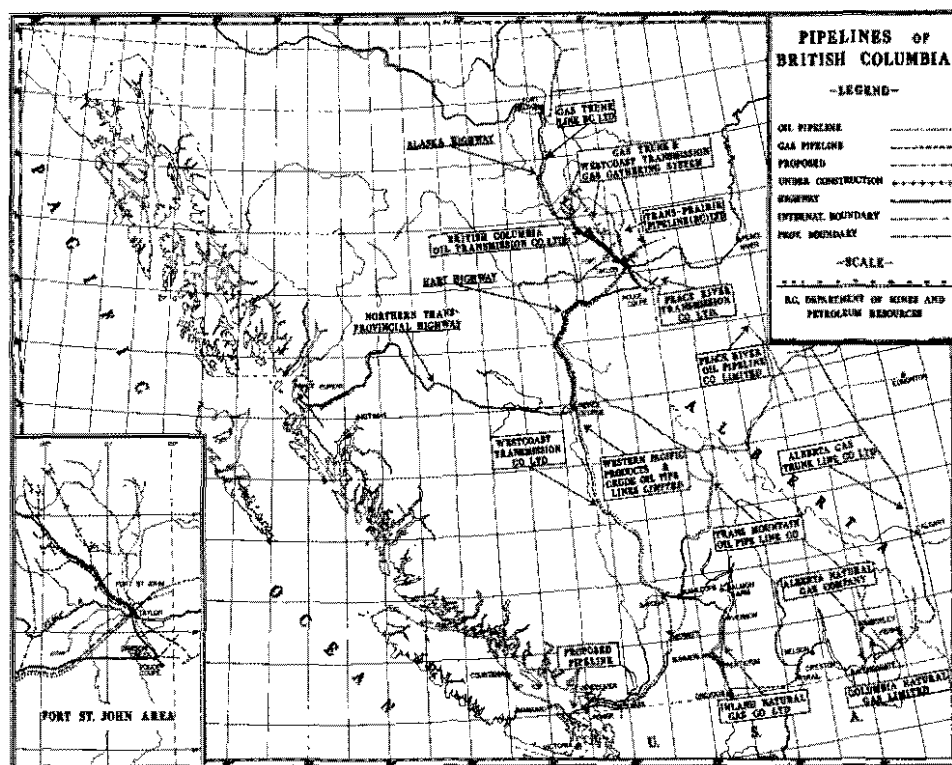


Figure 15. Petroleum and natural-gas pipe-lines.

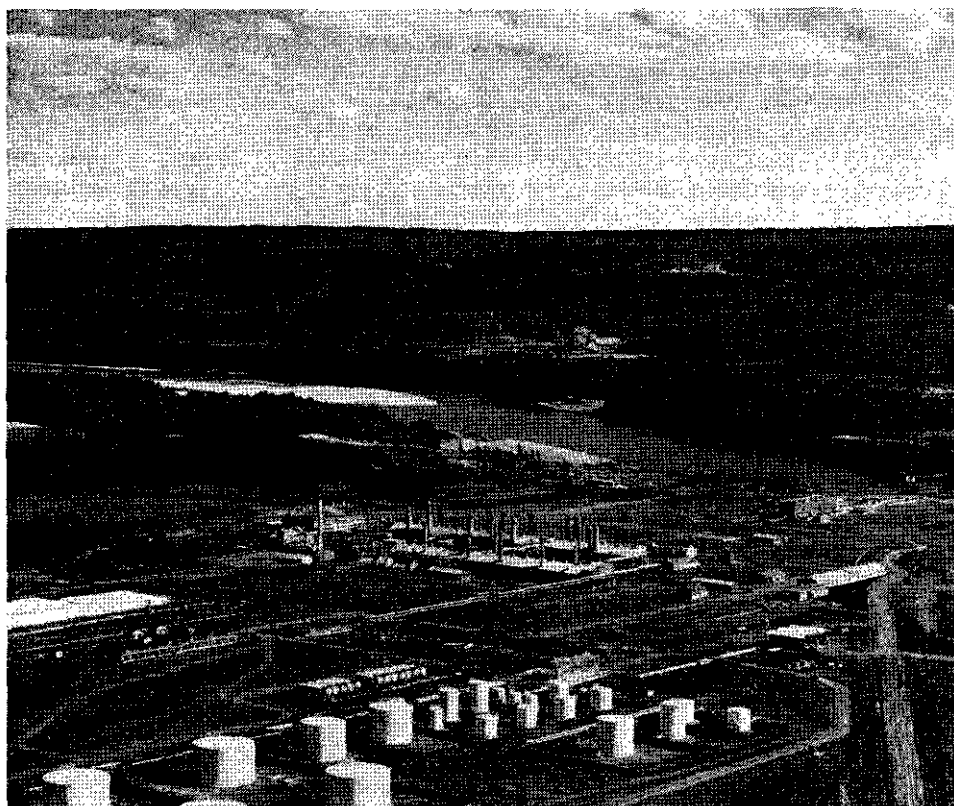
Oil-transmission System

The Western Pacific oil pipe-line, connecting the fields in northeastern British Columbia to the Trans Mountain pipe-line, was increased in throughput to 33,575 barrels per day. This was accomplished by "looping" part of the line and adding two pumping stations.

A map showing the petroleum and natural-gas pipes is given in Figure 15.

GAS-PROCESSING PLANTS

In 1963 the Pacific Petroleum gas plant at Taylor increased its inlet and outlet capacities to 435,000,000 and 400,000,000 cubic feet per day respectively.



(Courtesy Westcoast Transmission Company.)

Gas-processing plant at Taylor.

OIL REFINERIES

No changes were reported in 1963 in the refining facilities at the six British Columbia oil refineries.

SULPHUR PLANT

No change was made in 1963 at the sulphur plant located adjacent to the gas-processing plant at Taylor.

Tables 18, 19, 20, 21, and 22 provide the basic information at the end of 1963 on the pipe-lines, gas plants, sulphur plants, and oil refineries located in British Columbia.

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 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.

At the annual meeting of this committee, the model forms, prepared in 1962, were up-dated. The Petroleum and Natural Gas Branch has adopted many features of these model forms and use the following applications and reports:—

Form No.

Form Name

- *1. Well-names Register.
2. Application for a Drilling Authority.
3. Application to Amend a Drilling Authority.
4. Application to Change a Well Name.
5. Application to Abandon a Well.
6. Application to Alter a Well.
7. New Oil Well Report.

• For Department use only.

Form No. Form Name

8. New Gas Well Report.
9. Application for M.P.R.-Oil.
10. Application to Commingle Production before Measurement.
Application to Amend Approval No. to Commingle Production before Measurement.
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.
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.
- S 1. Monthly Production Report.
- S 2. Monthly Disposition and Crown Royalty Statement.
- *7A. Well Inspection Report.
- *7B. Rig Inspection Report.
- *7C. Meter Inspection Report.
- *7D. Battery Inspection Report.
- †Monthly Natural Gas Distributors Statement.
- ‡Monthly Report on Oil Pipeline Gathering Operations.

The Branch has representation on the Provincial-Federal Committee on Oil and Gas Statistics, which held one meeting during 1963. 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, drilling authority 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, wire-line tests, and geological markers as given by the operator and the Branch.

* For Departmental use only.

† Used in conjunction with the Dominion Bureau of Statistics.

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) Suspended wells.
- (10) Abandoned wells.
- (11) Completed wells.
 - (a) Oil wells.
 - (b) Gas wells.
 - (c) Injection wells.
- (12) Work-overs.
- (13) Summary of well count giving the following totals:—
 - (a) Oil wells.
 - (b) Gas wells.
 - (c) Abandoned wells.
 - (d) Injection wells.
 - (e) Disposal wells.
 - (f) Completed wells.
 - (g) Locations drilled.
 - (h) Multiple wells.
 - (i) Drilling wells.
 - (j) Suspended wells.
 - (k) Approved but not spudded wells.
 - (l) Locations in good standing.
 - (m) Locations approved.
 - (n) 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. Comparisons of these monthly amounts to the totals for the preceding year.
 - (2) Monthly summary of the drilling and completion activity with cumulatives for the year and comparisons to 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.
 - (5) Production of crude oil, natural gas, and water by field and pool.
 - (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) Water disposition.
 - (10) Tabulation of nominations and estimated requirements for British Columbia crude oil, condensate/pentanes plus.
 - (11) Approved maximum permissible rates.
 - (12) Natural-gas disposition.
 - (13) Value of natural gas to British Columbia producers and distributors.
 - (14) Production and disposition of condensate/pentanes plus, butane, propane, and sulphur.
 - (15) Value of sales of natural-gas liquids and sulphur to British Columbia producers.
 - (16) Water flood operations.
- 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 comparisons to the same month of the preceding year.
- (2) Summary of the well count, giving the following totals:—
 - (a) Locations drilled.
 - (b) Oil wells.
 - (c) Gas wells.
 - (d) Abandoned wells.
 - (e) Injection wells.
 - (f) Disposal wells.
 - (g) Wells completed.
- (3) Drilling authorities approved.
- (4) Locations cancelled.
- (5) Locations outstanding.
- (6) Changes of well status.
- (7) Changes of well classifications.
- (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) Operator's licenses 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

The following publications are available from the Petroleum and Natural Gas Branch, Department of Mines and Petroleum Resources, Victoria:—

<i>Petroleum and Natural Gas Act</i>	\$0.35 per copy
Geophysical Regulations	.25 per copy
Permit and Lease Grid System	1.00 per copy
Official Specifications of Geographic Position of a Petroleum and Natural Gas Permit (approximately 200 permit specifications)	.10 per permit
List of Released Geological Reports on Oil and Gas permits	.50 per list
List of Leases in Peace River District Showing Lease No., Lessee, Acreage, Issue Date, Years, and Ex. Permit No.	2.50 per list
Regulations Governing the Drilling of Wells and the Production and Conservation of Oil and Natural Gas	.50 per copy
Oil and Gas Production Report (monthly)	\$6.00 per calendar year or \$0.75 per copy
Drilling and Land Report (monthly)	\$6.00 per calendar year or \$0.75 per copy
Schedule of Wells Drilled for Oil and Natural Gas (1906–1959), Volume I	7.50 per copy
Schedule of Wells Drilled for Oil and Natural Gas (Annual), volumes subsequent to Volume I	5.00 per copy
Descriptions of Branch Designated Fields (quarterly)	.50 per copy
Plats Showing Branch Designated Field Boundaries	.50 per copy
Representative Well Logs of Northeastern British Columbia	2.00 per copy
Stratigraphic Correlation Chart, Northeastern British Columbia	1.25 per copy
Regional Well Map Showing Well Locations and Status (Scale, 1"=4 miles)	7.00 per set
Annual Report reprints	.25 per copy
List of Branch Publications and Services	No charge

TABLES

TABLE 1.—GEOPHYSICAL EXPLORATION, 1963

Seismic Surveys

NOTE.—Unless otherwise shown, the exploration method used is the 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
<i>January</i>			
Amerada Petroleum	94-G-1, 2; 94-J-2	1	5
Atlantic Refining	94-I-5, 6, 7, 11, 12	1	4.5
British American	94-A-6	1	3
	94-P-12, 13	1	1
Calgary & Edmonton	94-P-4	1	3
	94-I-12	1	5
Canada Southern	93-P-6	1	4
Hudson's Bay	94-B-10, 15	1	4
Imperial Oil	94-I-11, 12	1	4
	94-G-1, 8; 94-H-4, 5	}	2
	Tp. 80, 81, R. 14-16, W. of 6th M.		
Monsanto Oil	Tp. 87, 88, R. 15-17, W. of 6th M.	1	3
Pacific Petroleums	94-A-11, 14	1	1
	94-G-9; 94-H-5	1	3
	94-J-2, 16	2	4
	94-P-14	1	4
Pure Oil	94-H-2	1	4
	94-I-14	1	3
Shell Oil	94-G-6, 11	2	2.5
	94-N-1, 2	2	1.5
Sinclair Canada	94-G-2, 7	1	1.5
	94-I-10, 11, 14, 15	1	2.5
Socony Mobil	94-I-12, 13	1	4
Tenneco Oil	Tp. 87, R. 15, W. of 6th M.	1	1
Texaco Exploration	94-I-11, 12; 94-O-10, 11	2	6
Triad Oil	94-H-2, 7	2	4
	94-I-11, 12	1	3
	94-J-8	1	2
Union Oil	94-G-10, 14, 15	2	4
<i>February</i>			
Amerada Petroleum	94-J-2	1	4
Atlantic Refining	94-I-5	1	2
	94-P-2	1	2
British American	94-O-6	1	4
Calgary & Edmonton	94-P-4, 5	1	3.5
	94-I-12	1	4.5
Canada Southern	93-P-6	1	1
Hudson's Bay	Tp. 83-87, R. 23-25, W. of 6th M.	1	4
Imperial Oil	94-I-11, 12, 16	1	3
	94-O-4	1	3
	94-H-4, 5; 94-I-10, 16	1	4
Pacific Petroleums	94-P-3, 5, 12	3	3
	94-I-13; 94-J-2	2	3
	94-G-16; 94-A-11, 14	2	6
Pure Oil	94-H-2, 4	1	3.5
	Tp. 86, R. 16, W. of 6th M.	1	4
Shell Oil	94-N-1, 2	2	4
Sinclair Canada	94-G-1, 2	2	2.5
	94-G-2	1	1.5
	94-G-10, 11	2	2.5
Socony Mobil	94-I-12, 13	1	4
Tenneco Oil	94-H-5	1	2
Texaco Exploration	94-O-10, 11; 94-J-12, 13; 94-I-10, 11	2	8
Triad Oil	94-J-8; 94-I-5	2	4
	94-H-5, 7	2	4
Union Oil	94-G-15	1	2
	94-P-3	1	2

TABLE 1.—GEOPHYSICAL EXPLORATION, 1963—Continued.

Company	Location of Exploration	Number of Seismic Crews	Number of Crew-weeks
<i>March</i>			
Amerada Petroleum	94-I-3	1	4
Atlantic Refining	94-I-6, 7, 11	1	3.5
British American	94-O-9, 10; 94-J-9	2	4
Calgary & Edmonton	94-J-9	1	1.5
	94-H-5	1	2.25
	94-P-7	1	9.25
Hudson's Bay	Tp. 83-87, R. 23-25, W. of 6th M.	1	4
Imperial Oil	94-I-5, 6, 11	1	4
	94-O-2, 3, 5, 6	1	3
	94-I-2, 3, 7, 10	1	3
Pacific Petroleum	94-I-14	1	1
	94-J-10	1	1
	94-A-2, 6, 8, 11, 12	4	6
Pure Oil	94-H-4	1	1
Shell Oil	94-G-11	1	2.5
	94-N-2	1	1.5
Sinclair Canada	94-G-10, 11	2	1.75
	Tp. 81, 82, R. 14, 15, W. of 6th M.	1	0.75
Socony Mobil	94-I-11, 14	1	4
Texaco Exploration	94-J-12, 13; 94-K-9, 16; 94-I-6, 10, 11, 12	2	7
Triad Oil	94-I-5	1	2
	94-H-4, 5, 7	2	2
Union Oil	94-P-1, 2	1	1.5
	94-P-6, 7	1	1
<i>April</i>			
British American	94-G-6, 7	1	41
Calgary & Edmonton	94-J-9	1	2.5
	94-P-7	1	2.5
Shell Oil	92-C, D, E	2	22
<i>May</i>			
British American	94-G-6, 7, 11	1	41
Shell Oil	92-C, D, E	2	82
<i>June</i>			
British American	94-A-3	1	4
Pan American	94-G-9, 10, 15, 16	1	4
Shell Oil	102-I, P	2	82
Triad Oil	93-O-8, 9; 93-P-4, 5	1	3
<i>July</i>			
Atlantic Refining	94-K, N	2	2.5
Canada Southern	93-P-12	1	3
Imperial Oil	94-H-6	1	4
Pan American	94-G-10	1	3
Shell Oil	102-I, O, P; 103-A, B, G	2	82
Triad Oil	93-O-8, 9; 93-P-4, 5	1	51
<i>August</i>			
British American	94-A-3	1	3
	82-G-10	1	31
Canada Southern	93-P-12	1	1
Imperial Oil	94-H-6	1	4
Pan American	94-G-9	1	3
Richfield	93-I-1, 7, 8, 10, 11	3	6
Shell Oil	102-I; 103-B, G	2	62
Triad Oil	93-O-8, 9; 93-P-4, 5	1	41
<i>September</i>			
British American	82-G-7, 10	1	41
Hudson's Bay	Tp. 79, 80, R. 22, 23, W. of 6th M.	1	4
Pan American	94-J-12	1	3
Richfield	93-I-1, 7, 8, 10, 11	3	1
<i>October</i>			
British American	82-G-6, 12	1	0.51
California Standard	94-J-10, 14, 15	1	1.5
Pan American	94-J-12	1	3

1 Refraction.

2 Marine.

TABLE 1.—GEOPHYSICAL EXPLORATION, 1963—*Continued.*

Company	Location of Exploration	Number of Seismic Crews	Number of Crew-weeks
<i>November</i>			
British American	94-G-6	1	2
Calgary & Edmonton	94-H-4	2	4.5
California Standard	94-A-12, 13	1	3
Pacific Petroleum	94-B-16	1	3
Pan American	94-J-5	2	7
Tenneco	94-H-4, 5	2	4
Triad Oil	94-H-4, 5	1	4
<i>December</i>			
Atlantic Refining	94-I-6	1	2
Calgary & Edmonton	94-H-4	1	2.5
Canadian Keweenaw	94-J-10	1	2
French Petroleum	Tp. 79, R. 23, W. of 6th M.	1	2
Pacific Petroleum	94-A-5; 94-B-16; 94-G-15	3	4
Sinclair Canada	94-I-14; 94-J-6, 16; 94-O-1	3	6
Tenneco	94-A-1; 94-G-2; 93-P-16	2	4
Triad Oil	94-H-4	1	3
Triad Oil	94-H-4, 5; 94-I-12	2	3.5

Gravity Surveys

Company	Location of Survey	Number of Crews	Crew-weeks
<i>January</i>			
Socony Mobil	94-J-9, 16	1	4
<i>February</i>			
Socony Mobil	94-I-11, 14	1	4
<i>March</i>			
Socony Mobil	94-I-13, 14	1	1

TABLE 2.—SURFACE GEOLOGICAL EXPLORATION, 1963

Company	Location	Number of Geologists	Two-man Party-weeks
<i>April</i>			
Shell Oil	Vancouver Island - Queen Charlotte Islands Area	3	2
<i>May</i>			
Shell Oil	Vancouver Island - Queen Charlotte Islands Area	3	4
<i>June</i>			
Atlantic Refining	94-G; 94-J	2	2
Calgary & Edmonton	94-K-9, 14, 15	2	4
California Standard	93-I-1	5	5
Central-Dei Rio	94-J-3, 6; 94-G-14	2	3
Hudson's Bay	93-P-13	2	1
Pan American	93-O-15; 93-P-2, 3	5	5.5
	94-K-9	5	2.5
Shell Oil	93-I	2	4
	Vancouver Island - Queen Charlotte Islands Area	3	4
Texaco Exploration	94-K-7, 8; 94-J-5	4	4
Triad Oil	93-O-9	1	2
<i>July</i>			
British American	82-G-6, 7, 10, 11	2	2
Calgary & Edmonton	94-B-4, 5, 6, 12, 13; 94-G-4, 5, 12, 13; 94-F-16; 94-K-1	2	4
Pan American	94-K-9, 10, 15, 16	5	11
Shell Oil	93-I	8	16
	82-J	5	4
	103-B, C, F	3	3
Texaco Exploration	94-N-2, 3, 4; 94-K-9, 10, 11, 13, 14, 15; 94-J-12	5	10
Triad Oil	93-O-8, 9	1	1
<i>August</i>			
British American	82-G-6, 7, 10, 11	3	5
California Standard	93-O	6	4.5
Pan American	93-O-15, 16	5	9
	93-I-8	5	4
	94-K-9, 10, 15, 16	5	3
Richfield	93-I-1, 7, 8, 10, 11	3	6
Shell Oil	93-I	8	16
	92-K, L	3	3
	82-J	5	4
Sohio Petroleum	94-J-4; 94-K-8	4	2
Texaco Exploration	94-N-5, 6, 7, 10, 11, 12	6	6
<i>September</i>			
California Standard	94-B, 94-C	6	7.5
Hunt Sands	93-O	4	2
Husky	93-O-7, 10, 11, 14	2	2
Pan American	93-I-8	5	2
Shell Oil	93-I	8	12
	82-J	5	4
	92-K, L	3	2
Sohio	94-G-3	2	1
	94-B-1, 10	4	2
	93-O-9; 93-P-12	2	1
<i>October</i>			
Hudson's Bay	94-G-14	2	0.5

TABLE 3.—EXPLORATORY TEST-HOLES DRILLED, 1963

Company	No.	Location	Section	Township	Range
<i>February</i>					
Sinclair Canada	1	S. 786 E. 2,047 N.E. corner	20	81	21
	2	S. 120 W. 470 N. E. corner	27	81	21
	3	S. 870 W. 4,875 N.E. corner	3	82	21
	4	S. 4,280 W. 2,940 N.E. corner	6	82	20
	5	S. 4,440 W. 4,280 N.E. corner	7	82	20
	6	S. 3,400 W. 3,230 N.E. corner	18	82	20
	7	S. 3,980 W. 870 N.E. corner	31	82	20
<i>March</i>					
Hudson's Bay Oil & Gas	1	S. 3,370 W. 3,090 N.E. corner	18	85	23
	2	S. 1,720 W. 1,970 N.E. corner	12	85	24
	4	S. 3,500 W. 1,670 N.E. corner	6	85	23
	7	S. 3,340 W. 1,455 N.E. corner	27	85	24
	8	S. 5,100 E. 3,341 N.W. corner	26	85	24
	10	S. 4,290 W. 1,930 N.E. corner	30	84	23
	11	S. 1,300 W. 2,600 N.E. corner	29	84	23
	12	N. 1,290 E. 720 N.E. corner	29	84	23
	13	S. 4,510 W. 3,480 N.E. corner	27	84	23
	15	S. 4,800 W. 2,060 N.E. corner	15	84	23
	16	N. 70 N.E. corner	33	84	23
	17	W. 40 N.E. corner	8	84	23
Pure Oil	A-7	39-E/94-H-4	—	—	—
	A-13	46-E/94-H-4	—	—	—
	A-18	a-6-E/94-H-4	—	—	—
	A-24	d-93-A/94-G-1	—	—	—
	A-30	76-A/94-G-1	—	—	—
	B-4	63-D/94-H-4	—	—	—
	B-9	56-D/94-H-4	—	—	—
	B-13	38-D/94-H-4	—	—	—
<i>June</i>					
Hudson's Bay Oil & Gas	18	N. 350 W. 520 N.E. corner	1	84	23
	19	S. 5 E. 45 E $\frac{1}{4}$ corner	36	83	23
	22	S. 400 W. 620 N.E. corner, Lsd. 5	19	83	22
	23	S. 620 W. 270 N.E. corner, Lsd. 7	14	83	23
	24	N. 20 W. 2,100 N.E. corner	13	83	23
<i>September</i>					
Altair Oil & Gas	1	Lsd. 10	7	87	19
	2	Lsd. 13	13	88	23
	3	a-86-K/94-A-12	—	—	—
	4	a-49-D/94-A-13	—	—	—

TABLE 4.—OIL-FIELD RESERVOIR DATA AS OF DECEMBER 31, 1963

Field	Pool	Rock Type	Age	Trap	Drive Mechanism	Av. Porosity (per Cent)	Av. Net Thickness (Ft.)	Av. Permeability (Md.)	Av. Water Saturation (per Cent)	Shrinkage Factor (Stock Tank Barrel per Reservoir Barrel)	Gravity Degrees (A.F.I.)	Original Pressure (Psig.)	Av. M.P.R. (Bbl./Day)
Aitken Creek	Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	Depletion with gas cap	11.0	17.0	1,993.0	25.0	0.765	38.0	1,548	86
Beaton River	Halfway	Sandstone	Triassic	Structural-stratigraphic	Depletion	17.5	13.0	130.0	25.0	0.86	40.0	1,190	132
Beaton River West	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	Depletion and gas cap	13.3	13.0	65.0	25.0	0.80	42.0	1,040	82
Blueberry	Mississippian	Limestone	Mississippian	Structural-stratigraphic	Gas cap and partial water	9.1	63.0	31.1 ¹	25.0	0.745	40.0	2,710	235
Boundary Lake	Boundary Lake	Limestone	Triassic	Structural-stratigraphic	Depletion with small gas cap	19.2	14.2	45.0	5.0	0.77	35.0	1,825	125
Boundary Lake	Halfway	Sandstone	Triassic	Structural	Water with partial gas cap	13.2	19.0	13.9	30.0	0.75	42.6	1,696	69
Charlie Lake	Gething	Sandstone	Lower Cretaceous	Stratigraphic	Depletion	10.0	8.0		25.0	0.832	34.4	1,134	36
Fort St. John	Charlie Lake	Sandstone	Triassic	Stratigraphic	Gas cap	13.8	6.4	570.0	25.0	0.79	36.0	1,950	37
	Belloy	Limestone	Permian	Structural-stratigraphic	Depletion	10.0	21.0	23.0	25.0	0.75	43.0	2,770	85
Milligan Creek	Halfway	Sandstone	Triassic	Structural-stratigraphic	Depletion	23.0	21.0	23.0	8.0	0.86	41.0	1,190	279
Peejay	Halfway	Sandstone	Triassic	Stratigraphic	Depletion	24.0	20.0	81.0	30.0	0.86	39.0	1,426	170
Peejay West	Halfway	Sandstone	Triassic	Stratigraphic	Depletion	24	20	81	30	0.86	39.0	1,426	170
Wildmint	Halfway	Sandstone	Triassic	Structural-stratigraphic	Depletion	20.0	15.8	380.0	8.0	0.86	39.0	1,208	145
Willow	Bluesky	Sandstone	Lower Cretaceous	Stratigraphic	Depletion	28.0	10.0		13.0	0.82	42.0	937	122

¹ Plus fractures.

TABLE 5.—GAS-FIELD RESERVOIR DATA AS OF DECEMBER 31, 1963

Field	Pool	Rock Type	Age	Trap	Av. Porosity (per Cent)	Av. Net Thickness (Ft.)	Av. Permeability (Md.)	Av. Water Saturation (per Cent)	Compressibility Factor	Specific Gravity (Air=1.0)	Original Pressure (P _{sig})	Av. A.O.F.P. (M ³ C.F./Day)
Beg	U.C. of Sch. Cr.	Carbonate	Triassic	Structural	9.5	88.3	64.7 ¹	20.8	0.861	0.670	1,630	2,950
Beg	Halfway	Sandstone	Triassic	Structural	10.3	105.0	8.5	34.9	0.836	0.674	1,826	4,370
Beg West	U.C. of Sch. Cr.	Carbonate	Triassic	Structural	9.8	76.0	10.6 ¹	22.6	0.836	0.666	1,674	2,850
Bernadet	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	8.0	13.0	—	15.0	0.847	0.646	1,196	1,075
Blueberry	Dunlevy	Sandstone	Lower Cretaceous	Structural	10.9	60.0	10.3	25.0	0.820	0.650	1,366	1,365
Blueberry	Baldonnel	Carbonate	Triassic	Structural	10.6	23.8	37.1	29.6	0.810	0.687	1,639	4,443
Blueberry	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	9.9	31.0	—	30.0	0.823	0.645	2,380	—
Blueberry	Mississippian	Carbonate	Mississippian	Structural	15.9	55.0	106.4	20.0	0.841	0.670	2,792	17,000
Blueberry East	Baldonnel	Carbonate	Triassic	Structural	11.1	22.0	47.7	25.0	0.781	0.684	1,886	7,100
Blueberry East	Halfway	Sandstone	Triassic	Structural	10.0	39.0	7.3	25.0	0.767	0.733	2,066	6,400
Blueberry East	Mississippian	Carbonate	Mississippian	Structural	12.3	30.0	32.5	30.5	0.871	0.612	2,686	3,575
Blueberry West	Dunlevy	Sandstone	Lower Cretaceous	Structural	9.5	39.0	61.8	25.0	0.821	0.658	1,406	5,250
Blueberry West	Baldonnel	Carbonate	Triassic	Structural	9.7	24.0	83.7	22.8	0.819	0.648	1,726	5,400
Boundary Lake	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.7	15.0	—	19.3	0.844	0.634	1,276	3,925
Boundary Lake	Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	15.8	63.0	—	32.5	0.830	0.641	1,393	11,700
Boundary Lake	Baldonnel	Carbonate	Triassic	Structural	12.9	24.5	—	35.1	0.814	0.670	1,453	4,616
Boundary Lake	Halfway	Sandstone	Triassic	Structural	6.4	8.6	—	23.4	0.841	0.632	1,686	—
Bubbles	U.C. of Sch. Cr.	Carbonate	Triassic	Structural	9.9	133.4	33.3	17.7	0.831	0.665	1,596	11,098
Buick Creek	Buick Creek	Sandstone	Lower Cretaceous	Structural-stratigraphic	13.3	38.0	139.8	23.7	0.847	0.646	1,286	12,580
Buick Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	8.0	5.0	—	10.4	0.834	0.670	1,536	7,887
Buick Creek East	Bluesky	Sandstone	Lower Cretaceous	Structural-stratigraphic	10.0	10.0	—	47.0	0.872	0.639	1,096	2,000
Buick Creek East	Dunlevy	Sandstone	Lower Cretaceous	Structural-stratigraphic	11.0	15.2	125.0	29.0	0.849	0.648	1,289	7,524
Buick Creek West	Buick Creek	Sandstone	Lower Cretaceous	Structural-stratigraphic	10.9	73.7	165.0	31.9	0.854	0.693	1,309	26,890
Buick Creek West	Baldonnel	Carbonate	Triassic	Stratigraphic	11.4	19.8	44.9	11.5	0.829	0.675	1,521	3,250
Buick Creek West	Halfway	Sandstone	Triassic	Structural	12.3	69.9	20.8	49.8	0.750	0.773	1,715	8,500
Clarke Lake	Devonian	Carbonate	Devonian	Stratigraphic	9.7	150.0	247.8	13.2	0.935	0.670	2,886	75,000
Dawson Creek	Cadotte	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.3	50.3	31.0	35.0	0.921	0.580	686	5,733
Fort St. John	Cadomin	Sandstone	Lower Cretaceous	Structural	12.4	12.0	421.0	40.0	0.844	0.610	1,340	29,000
Fort St. John	Baldonnel "A"	Carbonate	Triassic	Structural	16.2	33.0	120.4	28.0	0.809	0.670	1,604	13,960
Fort St. John	Baldonnel "A/B"	Carbonate	Triassic	Structural	10.7	62.3	101.6	27.0	0.818	0.686	1,604	19,480
Fort St. John	Charlie Lake	Sandstone	Triassic	Stratigraphic	10.9	5.0	—	30.0	0.802	0.670	1,882	—
Fort St. John	Halfway	Sandstone	Triassic	Structural	11.1	37.4	22.6	25.0	0.808	0.679	2,006	10,000
Fort St. John	Belloy	Carbonate	Permian	Structural-stratigraphic	11.1	44.5	59.3	25.0	0.828	0.670	2,756	13,500
Fort St. John Airport	Cadomin	Sandstone	Lower Cretaceous	Structural	17.5	25.0	—	40.0	0.832	0.640	1,443	—
Fort St. John Airport	Baldonnel "A"	Carbonate	Triassic	Structural	10.0	25.0	—	28.0	0.813	0.670	1,614	—
Fort St. John Airport	Halfway	Sandstone	Triassic	Structural	10.0	15.0	—	25.0	0.804	0.670	2,039	1,400
Fort St. John Southeast	Cadomin	Sandstone	Lower Cretaceous	Structural	15.8	22.0	64.2	40.0	0.847	0.620	1,376	2,400

¹ Plus fractures.

PETROLEUM AND NATURAL GAS

TABLE 5.—GAS-FIELD RESERVOIR DATA AS OF DECEMBER 31, 1963—Continued

Field	Pool	Rock Type	Age	Trap	Av. Porosity (per Cent)	Av. Net Thickness (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)
Fort St. John Southeast	Baldonnel "A"	Carbonate	Triassic	Structural	14.7	35.0	30.0	28.0	0.813	0.670	1,626	13,680
Fort St. John Southeast	Halfway	Sandstone	Triassic	Structural	9.8	37.8	14.5	25.0	0.798	0.670	2,107	11,083
Fort St. John Southeast	Belloy	Carbonate	Permian	Structural-stratigraphic	9.2	23.3	62.2	25.0	0.871	0.626	2,814	15,500
Gundy Creek	Dunlevy	Sandstone	Lower Cretaceous	Structural	15.6	8.0	—	23.0	0.822	0.626	1,650	805
Gundy Creek	Baldonnel	Carbonate	Triassic	Structural	8.9	22.0	69.3	19.2	0.840	0.636	1,790	4,150
Gundy Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	6.5	10.0	—	25.0	0.813	0.653	2,339	5,500
Halfway	Baldonnel	Carbonate	Triassic	Structural	7.9	32.3	5.9 ¹	35.0	0.812	0.653	1,646	10,860
Halfway	Halfway	Sandstone	Triassic	Structural	12.0	62.0	49.1	25.0	0.800	0.670	2,223	3,300
Highway	Dunlevy	Sandstone	Lower Cretaceous	Structural	8.7	20.0	84.9	25.0	0.839	0.650	1,346	540
Highway	Baldonnel	Carbonate	Triassic	Structural	10.0	22.0	124.0	25.1	0.812	0.663	1,666	5,812
Highway	Mississippian	Carbonate	Mississippian	Structural	11.0	83.0	104.7	19.7	0.898	0.611	3,145	41,000
Jedney	Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	10.6	10.0	—	24.0	0.870	0.663	1,126	7,575
Jedney	U.C. of Sch. Cr.	Carbonate	Triassic	Structural	8.8	124.0	33.7	19.0	0.852	0.693	1,553	12,764
Jedney	Halfway	Sandstone	Triassic	Structural	12.7	151.0	16.4	19.5	0.842	0.673	1,692	10,580
Kobes-Townsend	Dunlevy	Sandstone	Lower Cretaceous	Structural	12.5	101.6	17.9	19.8	0.797	0.651	1,486	3,526
Kobes-Townsend	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	16.3	76.6	—	25.0	0.812	0.646	2,586	5,160
Kobes-Townsend	Halfway	Sandstone	Triassic	Structural-stratigraphic	7.6	289.0	5.1	28.0	0.810	0.650	2,636	10,895
Kobes-Townsend	Mississippian	Carbonate	Mississippian	Structural-stratigraphic	4.9	30.0	10.4	16.2	0.859	0.640	3,025	7,500
Kotcho Lake	Devonian Carbonate	Carbonate	Devonian	Stratigraphic	10.0	50.0	45.7	11.8	0.885	0.670	2,550	—
Laprise Creek	U.C. of Sch. Cr.	Carbonate	Triassic	Structural-stratigraphic	10.0	58.0	130.0	19.0	0.843	0.679	1,539	7,912
Laprise Creek West	U.C. of Sch. Cr.	Carbonate	Triassic	Structural-stratigraphic	10.3	75.0	47.7	23.0	0.864	0.656	1,286	3,600
Montney	Bluesky-Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	17.0	15.0	—	45.0	0.862	0.620	1,266	895
Montney	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	20.0	37.0	—	30.0	0.817	0.670	1,746	4,900
Montney	Halfway	Sandstone	Triassic	Structural	14.6	20.0	67.1	33.5	0.757	0.730	1,846	10,000
Nig Creek	U.C. of Sch. Cr.	Carbonate	Triassic	Structural-stratigraphic	10.8	69.5	61.3	21.5	0.849	0.678	1,613	15,559
Parkland	Upper Devonian	Carbonate	Devonian	Structural-stratigraphic	19.0	72.0	—	13.7	1.014	0.620	4,900	16,200
Petitot River	Devonian Carbonate	Carbonate	Devonian	Structural-stratigraphic	8.6	70.0	—	12.6	0.929	0.674	2,782	198,500
Red Creek	Charlie Lake	Sandstone	Triassic	Structural-stratigraphic	18.0	5.0	—	32.0	0.788	0.668	1,741	2,400
Red Creek	Halfway	Sandstone	Triassic	Structural	13.3	16.0	18.1	25.0	0.698	0.810	2,089	3,500
Rigel	Gething	Sandstone	Lower Cretaceous	Structural-stratigraphic	15.9	17.0	25.1 ¹	21.9	0.848	0.646	1,274	11,740
Synder	Dunlevy	Sandstone	Lower Cretaceous	Structural-stratigraphic	12.0	10.5	—	30.0	0.858	0.623	1,275	9,900
Stoddart	Belloy	Carbonate	Permian	Structural-stratigraphic	15.8	26.0	105.9 ¹	12.0	0.822	0.680	2,411	21,000
Sunrise	Cadotte	Sandstone	Lower Cretaceous	Structural-stratigraphic	20.6	69.0	36.2	35.0	0.909	0.590	686	5,700
Willow	Halfway	Sandstone	Triassic	Stratigraphic	23.0	11.0	169.0	18.0	0.871	0.640	1,227	(²)

¹ Plus fractures.² Not available.

TABLE 6.—PROVED RESERVES OF CRUDE OIL AND ESTABLISHED RESERVES OF NATURAL GAS AND NATURAL-GAS PRODUCTS, DECEMBER 31, 1963

	Crude Oil ¹ (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 (Barrels of 34.97 Imperial Gallons at 60° F.)	Sulphur (Short Tons)
Reserves remaining at December 31, 1962	147,994,689	6,691.3	126,602,300	3,453,784
Revisions and extensions ³	+18,117,403	474.6	+14,127,240	+265,911
Production, December 31, 1962, to December 31, 1963	12,528,681	105.5	2,580,740	82,267
Reserves remaining at December 31, 1963	153,583,411	7,060.4	138,148,800	3,637,428

¹ Crude oil reserves include only proved drilled reserves. There are an additional 14,840,100 barrels of probable reserves which are in effect proved undrilled reserves.

² Associated gas is included only for pools from which gas is gathered.

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, sweet and sour, and are not the quantities actually extracted. The actual quantity of gas delivered to the transmission-line and distributed in 1963 was 105,525,373 M s.c.f., and the amounts of natural-gas liquids and sulphur actually extracted were 1,469,660 barrels and 60,372 short tons respectively.

TABLE 7.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1963

Field	Drilling Authority 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	582 ¹
	1205	Union Aitken d-34-L	d-34-L/94-A-13	Gething	
	1227	Union Aitken d-35-L	d-35-L/94-A-13	Gething	
	485	Union Aitken Creek b-42-L	b-42-L/94-A-13	Gething	
	1173	Union Aitken d-43-L	d-43-L/94-A-13	Gething	
Beaton River	1186	Union Aitken d-44-L	d-44-L/94-A-13	Gething	1,940 ¹
	1224	Triad Beaton b-28-J	b-28-J/94-H-2	Halfway	
	396	Triad Beaton River d-28-J	d-28-J/94-H-2	Halfway	
	395	Triad Beaton River d-29-J	d-29-J/94-H-2	Halfway	
	309	Triad Beaton River b-38-J	b-38-J/94-H-2	Halfway	
	393	Triad Beaton River d-39-J	d-39-J/94-H-2	Halfway	
	869	Triad et al Beaton d-41-K	d-41-K/94-H-2	Halfway	
	896	Triad Beaton d-49-J	d-49-J/94-H-2	Halfway	
	816	Triad Beaton d-50-J	d-50-J/94-H-2	Halfway	
	1038	Triad Beaton b-59-J	b-59-J/94-H-2	Halfway	
Beaton River West	538	Triad West Beaton River d-38-K	d-38-K/94-H-2	Bluesky-Gething	109
	408	Triad West Beaton River d-39-K	d-39-K/94-H-2	Bluesky-Gething	47
	441	Triad West Beaton River d-48-K	d-48-K/94-H-2	Bluesky-Gething	94
	515	Triad West Beaton River d-57-K	d-57-K/94-H-2	Bluesky-Gething	78
	512	Triad West Beaton River d-59-K	d-59-K/94-H-2	Bluesky-Gething	78
Blueberry	1333	Decalta Blueberry d-57-D	d-57-D/94-A-13	Mississippian	97
	943	Sun et al Blueberry d-9-K	d-9-K/94-A-12	Mississippian	4,600 ¹
	785	Sun et al Blueberry d-19-K	d-19-K/94-A-12	Mississippian	
	549	Sun et al Blueberry c-A29-K	c-29-K/94-A-12	Mississippian	
	746	Sun et al Blueberry d-30-K	d-30-K/94-A-12	Mississippian	
	783	Sun et al Blueberry d-40-K	d-40-K/94-A-12	Mississippian	
	242	Sun et al Blueberry d-50-K (13)	d-50-K/94-A-12	Mississippian	
	851	Sun et al Blueberry b-60-K	b-60-K/94-A-12	Mississippian	
	948	Sun et al Blueberry c-71-L	c-71-L/94-A-12	Mississippian	
	205	Sun et al Blueberry d-82-L (11)	d-82-L/94-A-12	Mississippian	
	1072	Sun et al Blueberry b-92-L	b-92-L/94-A-12	Mississippian	
	1242	Sun et al Blueberry d-93-L	d-93-L/94-A-12	Mississippian	
	1258	Sun et al Blueberry b-24-D	b-24-D/94-A-13	Mississippian	
	1169	Sun et al Blueberry d-25-D	d-25-D/94-A-13	Mississippian	
	1146	Sun et al Blueberry b-35-D	b-35-D/94-A-13	Mississippian	
	960	Sun et al Blueberry d-36-D	d-36-D/94-A-13	Mississippian	
	745	Sun et al Blueberry 6-25-88-25	6-25-88-25 W6M	Mississippian	
	850	Sun et al Blueberry 14-25-88-25	14-25-88-25 W6M	Mississippian	
	272	Sun et al Blueberry d-46-D (16)	d-46-D/94-A-13	Mississippian	78 ²

¹ Pool.² Included in pool M.P.R. but not to exceed individual M.P.R.

590	Amerada Cr BC-B Boundary 14-18-85-13	14-18-85-13 W6M	Boundary Lake	151
628	Amerada Boundary Lake 16-18-85-13	16-18-85-13 W6M	Boundary Lake	181
563	Amerada Cr BC-C Boundary 14-20-85-13	14-20-85-13 W6M	Boundary Lake	164
591	Amerada Cr BC-C Boundary 6-29-85-13	6-29-85-13 W6M	Boundary Lake	125
771	Amerada Boundary 14-29-85-13	14-29-85-13 W6M	Boundary Lake	146
629	Amerada Boundary Lake 14-13-85-14	14-13-85-14 W6M	Boundary Lake	125
580	Amerada Cr BC-B Boundary 16-13-85-14	16-13-85-14 W6M	Boundary Lake	137
639	Amerada Boundary Lake 6-24-85-14	6-24-85-14 W6M	Boundary Lake	89
608	Amerada Cr BC-D Boundary 8-24-85-14	8-24-85-14 W6M	Boundary Lake	131
692	Amerada Boundary 11-24-85-14	11-24-85-14 W6M	Boundary Lake	36
736	Amerada Boundary 16-24-85-14	16-24-85-14 W6M	Boundary Lake	163
736	Amerada Boundary 16-24-85-14	16-24-85-14 W6M	Halfway	96
918	Basin Boundary 6-17-86-13	6-17-86-13 W6M	Boundary Lake	73
962	Basin Boundary 14-17-86-13	14-17-86-13 W6M	Boundary Lake	74
361	Decalta Boundary Lake 14-32-85-13	14-32-85-13 W6M	Boundary Lake	93
624	Dome Boundary Lake 6-12-85-14	6-12-85-14 W6M	Boundary Lake	187
625	Dome Boundary Lake 8-12-85-14	8-12-85-14 W6M	Boundary Lake	194
602	Dome Boundary Lake 16-12-85-14	16-12-85-14 W6M	Boundary Lake	171
603	Dome Boundary Lake 8-13-85-14	8-13-85-14 W6M	Boundary Lake	181
1033	Dome Boundary 6-22-85-14	6-22-85-14 W6M	Boundary Lake	119
768	Dome Boundary 8-22-85-14	8-22-85-14 W6M	Boundary Lake	130
575	Dome Boundary Lake 6-26-85-14	6-26-85-14 W6M	Boundary Lake	138
550	Dome Boundary Lake 8-26-85-14	8-26-85-14 W6M	Boundary Lake	127
573	Dome Boundary Lake 14-26-85-14	14-26-85-14 W6M	Boundary Lake	186
465	Dome Boundary Lake 16-26-85-14	16-26-85-14 W6M	Boundary Lake	167
1022	Dome Boundary 16-34-85-14	16-34-85-14 W6M	Boundary Lake	188
574	Dome Boundary Lake 6-35-85-14	6-35-85-14 W6M	Boundary Lake	149
488	Dome Boundary Lake 8-35-85-14	8-35-85-14 W6M	Boundary Lake	118
528	Dome Boundary Lake 14-35-85-14	14-35-85-14 W6M	Boundary Lake	69
606	Dome Boundary Lake 16-35-85-14	16-35-85-14 W6M	Boundary Lake	144
642	Dome Boundary Lake 8-2-86-14	8-2-86-14 W6M	Boundary Lake	13
1064	Dome Boundary 14-2-86-14	14-2-86-14 W6M	Boundary Lake	66
605	Dome Boundary Lake 16-2-86-14	16-2-86-14 W6M	Boundary Lake	120
1156	Dome Boundary 8-3-86-14	8-3-86-14 W6M	Boundary Lake	108
1142	Dome Boundary 6-11-86-14	6-11-86-14 W6M	Boundary Lake	30
764	Dome Boundary 8-11-86-14	8-11-86-14 W6M	Boundary Lake	131
765	Dome Boundary 16-11-86-14	16-11-86-14 W6M	Boundary Lake	59
808	Dome Boundary 8-14-86-14	8-14-86-14 W6M	Boundary Lake	68
1070	Dome Boundary 16-14-86-14	16-14-86-14 W6M	Boundary Lake	73
1041	Homestead et al Boundary 6-18-84-13	6-18-84-13 W6M	Boundary Lake	99
1108	Homestead et al Boundary 8-18-84-13	8-18-84-13 W6M	Boundary Lake	122
1104	Imp Pac Boundary 14-18-84-13	14-18-84-13 W6M	Boundary Lake	28
1098	Imp Pac Boundary 6-19-84-13	6-19-84-13 W6M	Boundary Lake	91
1078	Imp Pac Boundary 8-19-84-13	8-19-84-13 W6M	Boundary Lake	64
998	Imp Pac Boundary 14-19-84-13	14-19-84-13 W6M	Boundary Lake	80
1018	Imp Pac Boundary 16-19-84-13	16-19-84-13 W6M	Boundary Lake	64

TABLE 7.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1963—Continued

Field	Drilling Authority No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Boundary Lake	1117	Imp Pac Boundary 6-20-84-13	6-20-84-13 W6M	Boundary Lake	41
	296	Imp Pac Boundary 14-20-84-13	14-20-84-13 W6M	Boundary Lake	105
	1386	Imp Pac Boundary 16-20-84-13	16-20-84-13 W6M	Boundary Lake	120
	1091	Imp Pac Boundary 6-29-84-13	6-29-84-13 W6M	Boundary Lake	118
	1060	Imp Pac Boundary 14-29-84-13	14-29-84-13 W6M	Boundary Lake	82
	1061	Imp Pac Boundary 8-30-84-13	8-30-84-13 W6M	Boundary Lake	94
	975	Imp et al Boundary 14-30-84-13	14-30-84-13 W6M	Boundary Lake	144
	1062	Imp et al Boundary 16-30-84-13	16-30-84-13 W6M	Boundary Lake	101
	931	Imp et al Boundary 6-31-84-13	6-31-84-13 W6M	Boundary Lake	140
	930	Imp et al Boundary 8-31-84-13	8-31-84-13 W6M	Boundary Lake	120
	888	Imp Pac Boundary 14-31-84-13	14-31-84-13 W6M	Boundary Lake	165
	369	Imp Pac Boundary 16-31-84-13	16-31-84-13 W6M	Boundary Lake	154
	965	Imp Pac Boundary 6-32-84-13	6-32-84-13 W6M	Boundary Lake	120
	991	Imp Pac Boundary 8-32-84-13	8-32-84-13 W6M	Boundary Lake	30
	935	Imp Pac Boundary 14-32-84-13	14-32-84-13 W6M	Boundary Lake	149
	939	Imp Pac Boundary 16-32-84-13	16-32-84-13 W6M	Boundary Lake	194
	813	Imp Pac Boundary 6-5-85-13	6-5-85-13 W6M	Boundary Lake	180
	878	Imp Pac Boundary 8-5-85-13	8-5-85-13 W6M	Boundary Lake	193
	832	Imp Pac Boundary 14-5-85-13	14-5-85-13 W6M	Boundary Lake	166
	882	Imp Pac Boundary 16-5-85-13	16-5-85-13 W6M	Boundary Lake	72
	789	Imp Pac Boundary 6-6-85-13	6-6-85-13 W6M	Boundary Lake	138
	795	Imp Pac Boundary 8-6-85-13	8-6-85-13 W6M	Boundary Lake	113
	792	Imp Pac Boundary 14-6-85-13	14-6-85-13 W6M	Boundary Lake	152
	796	Imp Pac Boundary 16-6-85-13	16-6-85-13 W6M	Boundary Lake	157
	763	Imp Pac Boundary 6-7-85-13	6-7-85-13 W6M	Boundary Lake	165
	807	Imp Pac Boundary 8-7-85-13	8-7-85-13 W6M	Boundary Lake	194
	368	Imp Pac Boundary 14-7-85-13	14-7-85-13 W6M	Boundary Lake	172
	775	Imp Pac Boundary 16-7-85-13	16-7-85-13 W6M	Boundary Lake	206
	847	Imp Pac Boundary 6-8-85-13	6-8-85-13 W6M	Boundary Lake	161
	906	Imp Pac Boundary 8-8-85-13	8-8-85-13 W6M	Boundary Lake	162
	767	Imp Pac Boundary 14-8-85-13	14-8-85-13 W6M	Boundary Lake	165
	889	Imp Pac Boundary 16-8-85-13	16-8-85-13 W6M	Boundary Lake	152
	760	Imp Pac Boundary 6-17-85-13	6-17-85-13 W6M	Boundary Lake	16
	738	Imp Pac Boundary 14-17-85-13	14-17-85-13 W6M	Boundary Lake	165
	734	Imp Pac Boundary 6-18-85-13	6-18-85-13 W6M	Boundary Lake	165
	523	Imp Pac Boundary 8-18-85-13	8-18-85-13 W6M	Boundary Lake	76
	524	Imp Pac Boundary 6-20-85-13	6-20-85-13 W6M	Boundary Lake	164
	774	Imp Pac Boundary 8-20-85-13	8-20-85-13 W6M	Boundary Lake	57
	1166	Imp Pac Boundary 14-2-84-14	14-2-84-14 W6M	Boundary Lake	73

1369	Imp Pac Boundary 14-4-84-14	14-4-84-14 W6M	Boundary Lake	74
1358	Imp Pac Boundary 16-4-84-14	16-4-84-14 W6M	Boundary Lake	80
1357	Imp Pac Boundary 16-7-84-14	16-7-84-14 W6M	Boundary Lake	80
1164	Imp Pac Boundary 14-8-84-14	14-8-84-14 W6M	Boundary Lake	61
1367	Imp Pac Boundary 8-9-84-14	8-9-84-14 W6M	Boundary Lake	64
1133	Imp et al Boundary 16-9-84-14	16-9-84-14 W6M	Boundary Lake	92
843	Imp Pac Boundary 14-10-84-14	14-10-84-14 W6M	Boundary Lake	69
1079	Imp Pac Boundary 16-10-84-14	16-10-84-14 W6M	Boundary Lake	58
1127	Imp Pac Boundary 6-11-84-14	6-11-84-14 W6M	Boundary Lake	110
1136	Imp Pac Boundary 8-11-84-14	8-11-84-14 W6M	Boundary Lake	92
1080	Imp Pac Boundary 14-13-84-14	14-13-84-14 W6M	Boundary Lake	62
1085	Imp Pac Boundary 16-13-84-14	16-13-84-14 W6M	Boundary Lake	104
1059	Imp Pac Boundary 14-14-84-14	14-14-84-14 W6M	Boundary Lake	111
1175	Imp Pac Boundary 16-14-84-14	16-14-84-14 W6M	Boundary Lake	108
1084	Imp Pac Boundary 6-15-84-14	6-15-84-14 W6M	Boundary Lake	101
1076	Imp Pac Boundary 8-15-84-14	8-15-84-14 W6M	Boundary Lake	114
1035	Imp et al Boundary 6-16-84-14	6-16-84-14 W6M	Boundary Lake	154
1128	Imp et al Boundary 8-16-84-14	8-16-84-14 W6M	Boundary Lake	64
1143	Imp Pac Boundary 14-16-84-14	14-16-84-14 W6M	Boundary Lake	59
1112	Imp Pac Boundary 16-16-84-14	16-16-84-14 W6M	Boundary Lake	82
1102	Imp Pac Boundary 6-17-84-14	6-17-84-14 W6M	Boundary Lake	82
1151	Imp Pac Boundary 8-17-84-14	8-17-84-14 W6M	Boundary Lake	75
1220	Imp Pac Boundary 14-17-84-14	14-17-84-14 W6M	Boundary Lake	80
1158	Imp Pac Boundary 16-17-84-14	16-17-84-14 W6M	Boundary Lake	71
1273	Imp Pac Boundary 8-18-84-14	8-18-84-14 W6M	Boundary Lake	142
1343	Imp Pac Boundary 16-18-84-14	16-18-84-14 W6M	Boundary Lake	84
1189	Imp Pac Boundary 8-20-84-14	8-20-84-14 W6M	Boundary Lake	87
1228	Imp Pac Boundary 16-20-84-14	16-20-84-14 W6M	Boundary Lake	37
1157	Imp Pac Boundary 6-21-84-14	6-21-84-14 W6M	Boundary Lake	131
1120	Imp Pac Boundary 8-21-84-14	8-21-84-14 W6M	Boundary Lake	96
1172	Imp Pac Boundary 14-21-84-14	14-21-84-14 W6M	Boundary Lake	139
1122	Imp Pac Boundary 16-21-84-14	16-21-84-14 W6M	Boundary Lake	129
250	Imp Pac Boundary 1-23-84-14	1-23-84-14 W6M	Boundary Lake	50
1017	Imp Pac Boundary 6-23-84-14	6-23-84-14 W6M	Boundary Lake	115
929	Imp Pac Boundary 14-23-84-14	14-23-84-14 W6M	Boundary Lake	154
997	Imp Pac Boundary 16-23-84-14	16-23-84-14 W6M	Boundary Lake	141
1036	Imp Pac Boundary 6-24-84-14	6-24-84-14 W6M	Boundary Lake	91
978	Imp Pac Boundary 8-24-84-14	8-24-84-14 W6M	Boundary Lake	111
1010	Imp Pac Boundary 14-24-84-14	14-24-84-14 W6M	Boundary Lake	156
872	Imp Pac Boundary 16-24-84-14	16-24-84-14 W6M	Boundary Lake	96
979	Imp Pac Boundary 6-25-84-14	6-25-84-14 W6M	Boundary Lake	131
928	Imp Pac Boundary 8-25-84-14	8-25-84-14 W6M	Boundary Lake	50
1077	Imp et al Boundary 14-25-84-14	14-25-84-14 W6M	Boundary Lake	102
1063	Imp et al Boundary 16-25-84-14	16-25-84-14 W6M	Boundary Lake	139
927	Imp Pac Boundary 6-26-84-14	6-26-84-14 W6M	Boundary Lake	146
966	Imp Pac Boundary 8-26-84-14	8-26-84-14 W6M	Boundary Lake	147

TABLE 7.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1963—Continued

Field	Drilling Authority No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Boundary Lake	1111	Imp et al Boundary 14-26-84-14	14-26-84-14 W6M	Boundary Lake	117
	1099	Imp et al Boundary 16-26-84-14	16-26-84-14 W6M	Boundary Lake	163
	1019	Imp Pac Boundary 6-30-84-14	6-30-84-14 W6M	Boundary Lake	97
	861	Imp Pac Boundary 8-34-84-14	8-34-84-14 W6M	Boundary Lake	160
	883	Imp Pac Boundary 14-34-84-14	14-34-84-14 W6M	Boundary Lake	97
	846	Imp Pac Boundary 16-34-84-14	16-34-84-14 W6M	Boundary Lake	145
	833	Imp Pac Boundary 6-35-84-14	6-35-84-14 W6M	Boundary Lake	131
	815	Imp Pac Boundary 8-35-84-14	8-35-84-14 W6M	Boundary Lake	153
	805	Imp Pac Boundary 14-35-84-14	14-35-84-14 W6M	Boundary Lake	158
	797	Imp Pac Boundary 16-35-84-14	16-35-84-14 W6M	Boundary Lake	152
	804	Imp et al Boundary 6-36-84-14	6-36-84-14 W6M	Boundary Lake	48
	814	Imp et al Boundary 8-36-84-14	8-36-84-14 W6M	Boundary Lake	124
	793	Imp et al Boundary 14-36-84-14	14-36-84-14 W6M	Boundary Lake	122
	798	Imp et al Boundary 16-36-84-14	16-36-84-14 W6M	Boundary Lake	147
	761	Imp et al Boundary 6-1-85-14	6-1-85-14 W6M	Boundary Lake	122
	770	Imp et al Boundary 8-1-85-14	8-1-85-14 W6M	Boundary Lake	104
	521	Imp et al Boundary 14-1-85-14	14-1-85-14 W6M	Boundary Lake	202
	776	Imp et al Boundary 16-1-85-14	16-1-85-14 W6M	Boundary Lake	129
	501	Imp et al Boundary 6-2-85-14	6-2-85-14 W6M	Boundary Lake	125
	788	Imp Pac Boundary 8-2-85-14	8-2-85-14 W6M	Boundary Lake	149
	493	Imp Pac Boundary 14-2-85-14	14-2-85-14 W6M	Boundary Lake	243
	777	Imp Pac Boundary 16-2-85-14	16-2-85-14 W6M	Boundary Lake	186
	362	Imperial Pacific Boundary 6-3-85-14	6-3-85-14 W6M	Boundary Lake	198
	379	Imperial Pacific Boundary 8-3-85-14	8-3-85-14 W6M	Boundary Lake	209
	363	Imperial Pacific Boundary 14-3-85-14	14-3-85-14 W6M	Boundary Lake	154
	359	Imperial Pacific Boundary 16-3-85-14	16-3-85-14 W6M	Boundary Lake	218
	267	Imperial Pacific Boundary 16-4-85-14	16-4-85-14 W6M	Boundary Lake	189
	360	Imperial Pacific Boundary 8-10-85-14	8-10-85-14 W6M	Boundary Lake	188
	227	Imperial Pac Boundary 11-10-85-14	11-10-85-14 W6M	Boundary Lake	113
	282	Imperial Pacific Boundary 6-11-85-14	6-11-85-14 W6M	Boundary Lake	128
	769	Imp Pac Boundary 8-11-85-14	8-11-85-14 W6M	Boundary Lake	67
	821	Imp Pac Boundary 14-11-85-14	14-11-85-14 W6M	Boundary Lake	274
	356	Imperial Pac Boundary 16-11-85-14	16-11-85-14 W6M	Boundary Lake	155
	759	Imp Pac Boundary 14-12-85-14	14-12-85-14 W6M	Boundary Lake	176
	758	Imp Pac Boundary 6-13-85-14	6-13-85-14 W6M	Boundary Lake	130
	1124	Imp Pac Boundary 6-14-85-14	6-14-85-14 W6M	Boundary Lake	295
	848	Imp Pac Boundary 8-14-85-14	8-14-85-14 W6M	Boundary Lake	177
	1368	Imp Pac Boundary 6-15-85-14	6-15-85-14 W6M	Halfway	100
	618	Marathon Boundary 6-19-85-13	6-19-85-13 W6M	Boundary Lake	147

632	Marathon Boundary 8-19-85-13	8-19-85-13 W6M	Boundary Lake	117
635	Marathon Boundary 14-19-85-13	14-19-85-13 W6M	Boundary Lake	131
636	Marathon Boundary 16-19-85-13	16-19-85-13 W6M	Boundary Lake	32
898	Marathon Boundary 14-5-86-13	14-5-86-13 W6M	Boundary Lake	68
949	Marathon Boundary 6-8-86-13	6-8-86-13 W6M	Boundary Lake	98
604	Marathon Boundary 14-8-86-13	14-8-86-13 W6M	Boundary Lake	70
1037	Marathon Boundary 14-12-84-14	14-12-84-14 W6M	Boundary Lake	67
989	Marathon Boundary 6-13-84-14	6-13-84-14 W6M	Boundary Lake	110
1068	Marathon Boundary 8-13-84-14	8-13-84-14 W6M	Boundary Lake	51
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	Boundary Lake	229
895	Pacific Boundary 16-14-85-14	16-14-85-14 W6M	Halfway	102
961	Pacific Boundary 16-15-85-14	16-15-85-14 W6M	Boundary Lake	120
982	Sinclair et al Boundary 6-3-84-14	6-3-84-14 W6M	Boundary Lake	64
941	Sinclair Boundary 8-3-84-14	8-3-84-14 W6M	Boundary Lake	103
969	Sinclair et al Boundary 14-3-84-14	14-3-84-14 W6M	Boundary Lake	87
942	Sinclair Boundary 16-3-84-14	16-3-84-14 W6M	Boundary Lake	107
841	Sinclair Boundary 14-11-84-14	14-11-84-14 W6M	Boundary Lake	114
865	Sinclair Boundary 16-11-84-14	16-11-84-14 W6M	Boundary Lake	146
803	Sinclair Boundary 6-14-84-14	6-14-84-14 W6M	Boundary Lake	121
866	Sinclair Boundary 8-14-84-14	8-14-84-14 W6M	Boundary Lake	64
755	Sinclair Boundary 14-15-84-14	14-15-84-14 W6M	Boundary Lake	80
752	Sinclair Boundary 16-15-84-14	16-15-84-14 W6M	Boundary Lake	129
780	Sinclair Boundary 6-22-84-14	6-22-84-14 W6M	Boundary Lake	96
742	Sinclair Boundary 8-22-84-14	8-22-84-14 W6M	Boundary Lake	166
794	Sinclair Boundary 14-22-84-14	14-22-84-14 W6M	Boundary Lake	134
727	Sinclair Boundary 16-22-84-14	16-22-84-14 W6M	Boundary Lake	105
802	Sinclair Boundary 6-27-84-14	6-27-84-14 W6M	Boundary Lake	127
743	Sinclair Boundary 8-27-84-14	8-27-84-14 W6M	Boundary Lake	133
853	Sinclair Boundary 14-27-84-14	14-27-84-14 W6M	Boundary Lake	133
753	Sinclair Boundary 16-27-84-14	16-27-84-14 W6M	Boundary Lake	126
646	Sun Boundary Lake 6-23-85-14	6-23-85-14 W6M	Boundary Lake	181
646	Sun Boundary Lake 6-23-85-14	6-23-85-14 W6M	Halfway	83
652	Sun Boundary Lake 8-23-85-14	8-23-85-14 W6M	Boundary Lake	73
643	Sun Boundary Lake 14-23-85-14	14-23-85-14 W6M	Boundary Lake	172
719	Sun Boundary 16-23-85-14	16-23-85-14 W6M	Boundary Lake	219
1137	Texaco NFA Boundary 6-30-85-13	6-30-85-13 W6M	Boundary Lake	166
1097	Texaco NFA Boundary 8-30-85-13	8-30-85-13 W6M	Boundary Lake	139
1097	Texaco NFA Boundary 8-30-85-13	8-30-85-13 W6M	Halfway	56
1171	Texaco NFA Boundary 14-30-85-13	14-30-85-13 W6M	Boundary Lake	163
183	Texaco NFA Boundary L 6-31-85-13	6-31-85-13 W6M	Boundary Lake	107
1150	Texaco NFA Boundary 8-31-85-13	8-31-85-13 W6M	Boundary Lake	131
167	Texaco NFA Boundary L 14-31-85-13	14-31-85-13 W6M	Boundary Lake	100
218	Texaco NFA Boundary L 16-31-85-13	16-31-85-13 W6M	Boundary Lake	136
101	Texaco NFA Boundary L 6-6-86-13 (1)	6-6-86-13 W6M	Boundary Lake	114
972	Texaco NFA Boundary 8-6-86-13	8-6-86-13 W6M	Boundary Lake	92

TABLE 7.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1963—Continued

Field	Drilling Authority No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Boundary Lake	152	Texaco NFA Boundary L 14-6-86-13	14-6-86-13 W6M	Boundary Lake	87
	1009	Texaco NFA Boundary 16-6-86-13	16-6-86-13 W6M	Boundary Lake	156
	862	Texaco NFA Boundary 6-7-86-13	6-7-86-13 W6M	Boundary Lake	92
	953	Texaco NFA Boundary 8-7-86-13	8-7-86-13 W6M	Boundary Lake	99
	1100	Texaco NFA Boundary 14-7-86-13	14-7-86-13 W6M	Boundary Lake	130
	844	Texaco NFA Boundary 16-7-86-13	16-7-86-13 W6M	Boundary Lake	193
	811	Texaco NFA Boundary 6-18-86-13	6-18-86-13 W6M	Boundary Lake	200
	995	Texaco NFA Boundary 8-18-86-13	8-18-86-13 W6M	Boundary Lake	147
	1116	Texaco NFA Boundary 14-18-86-13	14-18-86-13 W6M	Boundary Lake	181
	1066	Texaco NFA Boundary 16-18-86-13	16-18-86-13 W6M	Boundary Lake	68
	1074	Texaco NFA Boundary 6-19-86-13	6-19-86-13 W6M	Boundary Lake	126
	1049	Texaco NFA Boundary 8-19-86-13	8-19-86-13 W6M	Boundary Lake	120
	1123	Texaco NFA Boundary 14-19-86-13	14-19-86-13 W6M	Boundary Lake	69
	901	Texaco NFA Boundary 16-19-86-13	16-19-86-13 W6M	Boundary Lake	127
	1167	Texaco NFA Boundary 8-30-86-13	8-30-86-13 W6M	Boundary Lake	201
	1050	Texaco NFA Boundary 6-30-86-13	6-30-86-13 W6M	Boundary Lake	85
	1073	Texaco NFA Boundary 14-22-85-14	14-22-85-14 W6M	Boundary Lake	20
	823	Texaco NFA Boundary 16-22-85-14	16-22-85-14 W6M	Boundary Lake	137
	656	Texaco NFA Boundary Lake 14-25-85-14	14-25-85-14 W6M	Boundary Lake	78
	1144	Texaco NFA Boundary 16-25-85-14	16-25-85-14 W6M	Boundary Lake	131
	1144	Texaco NFA Boundary 16-25-85-14	16-25-85-14 W6M	Halfway	22
	924	Texaco NFA Boundary 6-27-85-14	6-27-85-14 W6M	Boundary Lake	119
	845	Texaco NFA Boundary 8-27-85-14	8-27-85-14 W6M	Boundary Lake	157
	971	Texaco NFA Boundary 14-27-85-14	14-27-85-14 W6M	Boundary Lake	158
	812	Texaco NFA Boundary 16-27-85-14	16-27-85-14 W6M	Boundary Lake	152
	857	Texaco NFA Boundary 8-34-85-14	8-34-85-14 W6M	Boundary Lake	209
	662	Texaco NFA Boundary Lake 6-36-85-14	6-36-85-14 W6M	Boundary Lake	30
	1058	Texaco NFA Boundary 8-36-85-14	8-36-85-14 W6M	Boundary Lake	70
	657	Texaco NFA Boundary Lake 14-36-85-14	14-36-85-14 W6M	Boundary Lake	156
	206	Texaco NFA Boundary L 16-36-85-14	16-36-85-14 W6M	Boundary Lake	127
	663	Texaco NFA Boundary Lake 6-1-86-14	6-1-86-14 W6M	Boundary Lake	112
	1083	Texaco NFA Boundary 8-1-86-14	8-1-86-14 W6M	Boundary Lake	196
	664	Texaco NFA Boundary Lake 14-1-86-14	14-1-86-14 W6M	Boundary Lake	110
	860	Texaco NFA Boundary 16-1-86-14	16-1-86-14 W6M	Boundary Lake	112
	829	Texaco NFA Boundary 16-12-86-14	16-12-86-14 W6M	Boundary Lake	96
	1096	Texaco NFA Boundary 8-12-86-14	8-12-86-14 W6M	Boundary Lake	109
	900	Texaco NFA Boundary 14-12-86-14	14-12-86-14 W6M	Boundary Lake	117
	593	Texaco NFA Boundary L 16-12-86-14	16-12-86-14 W6M	Boundary Lake	155
	880	Texaco NFA Boundary 6-13-86-14	6-13-86-14 W6M	Boundary Lake	115

	1101	Texaco NFA Boundary 8-13-86-14	8-13-86-14 W6M	Boundary Lake	84
	952	Texaco NFA Boundary 14-13-86-14	14-13-86-14 W6M	Boundary Lake	46
	858	Texaco NFA Boundary 16-13-86-14	16-13-86-14 W6M	Boundary Lake	89
	885	Texaco NFA Boundary 6-24-86-14	6-24-86-14 W6M	Boundary Lake	91
	1086	Texaco NFA Boundary 8-24-86-14	8-24-86-14 W6M	Boundary Lake	93
	633	Texaco NFA Boundary Lake 14-24-86-14	14-24-86-14 W6M	Boundary Lake	107
	1029	Texaco NFA Boundary 16-24-86-14	16-24-86-14 W6M	Boundary Lake	74
	1024	Texfel Boundary 6-10-84-14	6-10-84-14 W6M	Boundary Lake	92
	1023	Texfel Boundary 8-10-84-14	8-10-84-14 W6M	Boundary Lake	92
Charlie Lake	269	Imp Pac Charlie 13-5-84-18	13-5-84-18 W6M	Gething	36
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
Milligan Creek	216	Pacific Ft St John 9-23-83-18 (78)	9-23-83-18 W6M	Charlie Lake	65
	409	Union HB Milligan Creek d-42-G	d-42-G/94-H-2	Halfway	10,000 ¹
	435	Union HB Milligan Creek d-43-G	d-43-G/94-H-2	Halfway	
	983	Union HB Milligan d-44-G	d-44-G/94-H-2	Halfway	
	401	Union HB Milligan Creek d-52-G	d-52-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	
	957	Union HB Milligan b-72-G	b-72-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	
	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	
Peejay	1025	Medallion Ashland Peejay d-61-H	d-61-H/94-A-15	Halfway	48
	981	Medallion AORCO Blair Peejay d-60-E	d-60-E/94-A-16	Halfway	54
	1026	Medallion Ashland Peejay d-68-E	d-68-E/94-A-16	Halfway	45
	902	Medallion Ashland Peejay d-69-E	d-69-E/94-A-16	Halfway	84
	903	Medallion Ashland Peejay d-70-E	d-70-E/94-A-16	Halfway	122
	725	Pacific SR West Cdn Peejay d-33-I	d-33-I/94-A-15	Halfway	5
	1329	Pacific SR CanDel Peejay d-79-E	d-79-E/94-A-16	Halfway	65
	569	Pacific SR West Cdn Peejay d-80-E	d-80-E/94-A-16	Halfway	60
	954	Pacific SR West Cdn Peejay d-90-E	d-90-E/94-A-16	Halfway	151

¹ Pool.

TABLE 7.—AUTHORIZED MAXIMUM PERMISSIBLE RATES TO DECEMBER 31, 1963—Continued

Field	Drilling Authority No.	Well Name	Location	Pool	Maximum Permissible Rate (Bbl./Day)
Peejay	612	Sinclair et al Peejay d-18-E	d-18-E/94-A-16	Halfway	2,018 ¹
	589	Sinclair et al Peejay d-28-E	d-28-E/94-A-16	Halfway	
	543	Sinclair et al Peejay d-29-E	d-29-E/94-A-16	Halfway	
	578	Sinclair et al Peejay d-38-E	d-38-E/94-A-16	Halfway	
	418	Sinclair Pac Peejay d-39-E (B8-3)	d-39-E/94-A-16	Halfway	
	577	Sinclair et al Peejay d-48-E	d-48-E/94-A-16	Halfway	
	588	Sinclair et al Peejay d-49-E	d-49-E/94-A-16	Halfway	
	1006	Sinclair et al Peejay d-19-B	d-19-E/94-A-16	Halfway	
	915	Sinclair et al Peejay d-47-E	d-47-E/94-A-16	Halfway	
	914	Sinclair et al Peejay d-58-E	d-58-E/94-A-16	Halfway	
	881	Sinclair et al Peejay d-59-E	d-59-E/94-A-16	Halfway	
	1008	Pacific SR CanDel W Peejay d-44-G	d-44-G/94-A-15	Halfway	
Peejay West	956	Pacific SR West Cdn W Peejay d-54-G	d-54-G/94-A-15	Halfway	149
Wildmint	1304	Husky Colo Wildmint d-16-A	d-16-A/94-A-15	Halfway	207
	1206	Husky Colo Wildmint b-23-A	b-23-A/94-A-15	Halfway	79
	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
	1184	Tenn Wildmint d-6-A	d-6-A/94-H-2	Halfway	237
	1289	Texcan Wildmint d-94-I	d-94-I/94-A-15	Halfway	167
	919	Union HB Wildmint d-25-A	d-25-A/94-H-2	Halfway	1,100 ¹
	810	Union HB Wildmint d-45-A	d-45-A/94-H-2	Halfway	
	530	Union HB Wildmint d-46-A	d-46-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	
	840	Union HB Wildmint b-24-A	b-24-A/94-H-2	Halfway	
	1195	Union HB Wildmint b-34-A	b-34-A/94-H-2	Halfway	
	984	Union HB Wildmint d-15-A	d-15-A/94-H-2	Halfway	
	1226	Union HB Wildmint d-24-A	d-24-A/94-H-2	Halfway	
	449	Union HB Willow d-20-H	d-20-H/94-H-2	Bluesky-Gething	122
Willow	1162	Dome Boundary 16-35-83-15	16-35-83-15 W6M	Boundary Lake	57
Other areas	933	Hunt Sands Pac Imp Coplin 7-16-86-23	7-16-86-23 W6M	Baldonnel	152
	831	Sinclair et al Flatrock 9-22-83-14	9-22-83-14 W6M	Boundary Lake	31
	1267	Union HB Sinclair et al Bulrush d-78-F	d-78-F/94-A-16	(³)	(³)
	1321	Union KCL ROC Nettle d-67-A	d-67-A/94-H-7	(³)	(³)
	963	Union HB Wildmint d-26-A	d-26-A/94-H-2	(³)	(³)

¹ Pool.² Included in pool M.P.R. but not to exceed individual M.P.R.³ Confidential at December 31, 1963.

TABLE 8.—WELLS DRILLED AND DRILLING, 1963

Drilling Authority No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1963 Footage	Status at Dec. 31, 1963
1360	Altair W Mineral Buick c-32-C	July 14, 1963	July 25, 1963	4,065	4,065	Lower Cretaceous Buick Creek gas well.
1383	Altair et al Stoddard 10-11-86-20	Oct. 31, 1963	Dec. 9, 1963	6,327	6,327	Abandoned—dry.
1332	Altair Sarcee C&E Zeke c-34-L	June 30, 1963	July 25, 1963	4,949	4,949	Triassic upper carbonate of Schooler Creek gas well.
1282	Amerada Sojer d-33-D	Feb. 9, 1963	Mar. 20, 1963	4,530	4,530	Triassic upper carbonate of Schooler Creek gas well.
1378	Amerada Sojer d-77-D	Oct. 15, 1963	Oct. 30, 1963	4,341	4,341	Triassic upper carbonate of Schooler Creek gas well.
1337	Amerada Sojer a-7-E	May 26, 1963	June 16, 1963	4,400	4,400	Triassic upper carbonate of Schooler Creek gas well.
1390	Ashland et al Rigel b-70-K	Nov. 7, 1963	Nov. 19, 1963	3,733	3,733	Abandoned—dry.
1265	BA Pan Am Klenteh c-15-I	Feb. 2, 1963	Mar. 27, 1963	9,300	9,300	Abandoned—dry.
1255	BA Pan Am Playmate b-6-G	Jan. 22, 1963	May 16, 1963	9,432	9,432	Abandoned—dry.
1393	BA HB W Pocketknife d-33-I	Nov. 30, 1963			1,940	Drilling.
1376	Basin Montney 10-6-87-19	Oct. 17, 1963	Nov. 9, 1963	4,800	4,800	Abandoned—dry.
1397	Cdn Sup Fina Alminex Trutch a-75-C	Dec. 24, 1963			1,270	Drilling.
1243	Cdn Sup Fina Alminex Trutch d-79-J	Jan. 7, 1963	Jan. 23, 1963	3,453	3,453	Abandoned—dry.
1248	Cdn Sup Fina Alminex Trutch c-67-K	Jan. 26, 1963	Feb. 11, 1963	3,492	3,492	Abandoned—dry.
1384	CDR Fireweed d-31-G	Oct. 26, 1963	Dec. 8, 1963	5,280	5,280	Triassic upper carbonate of Schooler Creek and Baldonnel gas well.
1318	CDR Union Pinto d-79-F	Mar. 10, 1963	Apr. 6, 1963	4,618	4,618	Abandoned—dry.
1356	CDR Union W Pinto a-83-E	June 27, 1963	July 25, 1963	4,899	4,899	Abandoned—dry.
1236	CDR Pac Sinc Prophet d-21-B	Dec. 12, 1962	Mar. 8, 1963	10,272	9,942	Abandoned—dry.
1404	CDR Prophet a-61-J	Dec. 17, 1963			2,384	Drilling.
1333	Decalta Blueberry d-57-D	Apr. 14, 1963	June 5, 1963	7,405	7,405	Mississippian oil well.
1344	Decalta et al Buick d-73-I	June 7, 1963	June 18, 1963	3,685	3,685	Lower Cretaceous Buick Creek gas well.
1345	Decalta et al E Buick c-74-A	June 9, 1963	June 25, 1963	3,855	3,855	Lower Cretaceous Dunlevy oil well.
1372	Denison Rigel 6-31-87-16	Oct. 20, 1963	Oct. 29, 1963	3,652	3,652	Lower Cretaceous Gething gas well.
1351	Dome Provo Buick b-84-J	June 21, 1963	June 20, 1963	3,720	3,720	Abandoned—dry.
1251	Dome Provo Laprise c-40-E	Jan. 7, 1963	Jan. 27, 1963	4,500	4,500	Triassic upper carbonate of Schooler Creek gas well.
1225	Dome Provo Laprise c-70-E	Dec. 14, 1962	Jan. 2, 1963	4,146	Nil	Triassic upper carbonate of Schooler Creek gas well.
1308	Dome Provo Laprise d-72-H	Mar. 16, 1963	Apr. 7, 1963	4,380	4,380	Abandoned—dry.
1235	Fina et al Swat a-81-A	Jan. 4, 1963	Mar. 23, 1963	8,386	8,386	Abandoned—dry.
611	Fraser Valley Chilliwack 14-19-26	Nov. 30, 1959			3,717	Drilling.
1396	Gray Oil PRP NW Grizzly c-25-A	Nov. 30, 1963			6,267	Drilling.
1339	HB Cypress a-65-C	June 8, 1963	July 21, 1963	4,635	4,635	Triassic upper carbonate of Schooler Creek gas well.
1326	HB Cypress d-87-C	Mar. 14, 1963	Apr. 24, 1963	4,940	4,940	Triassic upper carbonate of Schooler Creek gas well.
1325	Hunt Sands Sun Boulder b-74-D	Mar. 18, 1963	July 20, 1963	4,820	4,820	Abandoned—dry.
1307	Hunt Sands Coplin 11-22-85-23	Mar. 10, 1963	Mar. 27, 1963	4,036	4,036	Abandoned—dry.
1304	Husky Colo Wildmint d-16-A	Feb. 27, 1963	Mar. 16, 1963	3,850	3,850	Triassic Halfway oil well.
1414	Imp Pac Boundary 8-20-84-13	Dec. 28, 1963			3,208	Drilling.
1386	Imp Pac Boundary 16-20-84-13	Oct. 29, 1963	Nov. 8, 1963	4,444	4,444	Triassic Boundary Lake oil well.
1400	Imp Pac Boundary 8-29-84-13	Dec. 5, 1963	Dec. 14, 1963	4,405	4,405	Triassic Boundary Lake oil well.
1369	Imp Pac Boundary 14-4-84-14	Aug. 30, 1963	Sept. 9, 1963	4,490	4,490	Triassic Boundary Lake oil well.
1358	Imp Pac Boundary 16-4-84-14	July 9, 1963	July 19, 1963	4,515	4,515	Triassic Boundary Lake oil well.

TABLE 8.—WELLS DRILLED AND DRILLING, 1963—Continued

Drilling Authority No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1963 Footage	Status at Dec. 31, 1963
1362	Imp Pac Boundary 8-7-84-14	July 21, 1963	July 31, 1963	4,191	4,191	Abandoned—dry.
1357	Imp Pac Boundary 16-7-84-14	June 29, 1963	July 7, 1963	4,075	4,075	Triassic Boundary Lake oil well.
1367	Imp Pac Boundary 8-9-84-14	Aug. 2, 1963	Aug. 11, 1963	4,486	4,486	Triassic Boundary Lake oil well.
1273	Imp Pac Boundary 8-18-84-14	Jan. 22, 1963	Feb. 1, 1963	4,084	4,084	Triassic Boundary Lake oil well.
1353	Imp Pac Boundary 14-18-84-14	June 18, 1963	June 26, 1963	4,154	4,154	Abandoned—dry.
1343	Imp Pac Boundary 16-18-84-14	June 4, 1963	June 14, 1963	4,090	4,090	Triassic Boundary Lake oil well.
1228	Imp Pac Boundary 16-20-84-14	Dec. 22, 1962	Jan. 1, 1963	4,150	.....	Triassic Boundary Lake oil well.
1368	Imp Pac Boundary 6-15-85-14	Aug. 13, 1963	Aug. 26, 1963	4,610	4,610	Triassic Halfway oil well.
1312	Imp Fina Rigel 8-1-88-17	Feb. 26, 1963	Mar. 10, 1963	3,670	3,670	Lower Cretaceous Gething gas well.
1385	Imp Fina Rigel 6-28-88-17	Nov. 2, 1963	Nov. 13, 1963	3,645	3,645	Lower Cretaceous Gething gas well.
1295	Imp et al Rigel 6-31-88-17	Feb. 13, 1963	Feb. 24, 1963	3,571	3,571	Abandoned—dry.
1250	IOE Beaverskin c-55-G	Jan. 14, 1963	Mar. 22, 1963	8,088	8,088	Abandoned—dry.
1403	IOE et al Beg b-2-B	Dec. 12, 1963	.....	.....	4,690	Drilling.
1331	IOE Dunedin d-75-E	Mar. 22, 1963	Sept. 24, 1963	.....	12,789	Suspended.
1249	IOE Junior c-3-C	Jan. 15, 1963	Mar. 22, 1963	7,285	7,285	Middle Devonian Carbonate gas well.
1238	IOE Junior c-60-E	Dec. 27, 1962	Mar. 18, 1963	8,112	6,687	Abandoned—dry.
1355	IOE Pac Parkland 10-26-81-16	July 8, 1963	.....	.....	13,119	Drilling; whipstocked hole.
1277	IOE Pac Siphon 5-20-86-15	Jan. 31, 1963	Apr. 13, 1963	10,332	10,332	Abandoned—dry.
1290	IOE Pan Am Viscount a-77-D	Feb. 10, 1963	July 23, 1963	10,460	10,460	Abandoned—dry.
1382	KCL Pure N Aitken d-15-E	Oct. 26, 1963	Nov. 27, 1963	5,210	5,210	Abandoned—dry.
1232	Kewanee et al Osborn d-49-K	Jan. 13, 1963	Feb. 2, 1963	4,060	4,060	Abandoned—dry.
1247	Kewanee et al Stoddart 7-14-86-20	Jan. 17, 1963	Mar. 7, 1963	6,320	6,320	Abandoned—dry.
1315	Lobitos Black d-57-F	Mar. 5, 1963	Mar. 21, 1963	4,125	4,125	Triassic Halfway gas well.
1246	Marathon Boundary 6-5-86-13	Jan. 16, 1963	Jan. 28, 1963	4,260	4,260	Abandoned—dry.
1026	Medallion Ashland Peejay d-68-B	Feb. 17, 1963	Feb. 27, 1963	3,890	3,890	Triassic Halfway oil well.
1025	Medallion Ashland Peejay d-61-H	Feb. 4, 1963	Feb. 15, 1963	3,875	3,875	Triassic Halfway oil well.
1354	Monsanto Rigel 6-36-87-17	July 2, 1963	July 13, 1963	3,823	3,823	Lower Cretaceous Gething gas well.
1286	Mic Mac et al Buick d-17-D	Feb. 19, 1963	Mar. 2, 1963	3,640	3,640	Lower Cretaceous Dunlevy gas well.
1359	Pacific Imperial Beg c-24-B	July 20, 1963	Aug. 31, 1963	5,787	5,787	Triassic upper carbonate of Schooler Creek and Triassic Halfway multi-gas well.
1340	Pacific IOE Bubbles a-1-I	June 1, 1963	June 27, 1963	5,545	5,545	Abandoned—dry.
1323	Pacific Buick a-85-I	Mar. 12, 1963	Mar. 23, 1963	3,658	3,658	Lower Cretaceous Buick Creek gas well.
1253	Pacific SR CanDel Dede b-87-J	Jan. 15, 1963	Feb. 2, 1963	3,980	3,980	Abandoned—dry.
1271	Pacific SR CanDel W Dede b-45-K	Jan. 19, 1963	Feb. 22, 1963	3,918	3,918	Triassic Halfway gas well.
1305	Pacific Imp Grewatsch b-21-F	Mar. 3, 1963	Mar. 16, 1963	5,393	5,393	Abandoned—dry.
1239	Pacific Gunnel b-5-D	Jan. 3, 1963	Feb. 15, 1963	7,695	7,695	Middle Devonian Carbonate gas well.
1375	Pacific Imperial Jedney d-44-C	Oct. 8, 1963	Nov. 4, 1963	5,554	5,554	Triassic upper carbonate of Schooler Creek and Triassic Halfway multi-gas well.
1366	Pacific Imperial Jedney a-95-C	Sept. 5, 1963	Oct. 5, 1963	5,380	5,380	Lower Cretaceous Gething and Triassic Halfway multi-gas well.
1256	Pacific Imperial Jedney d-68-H	Jan. 11, 1963	Jan. 27, 1963	5,440	5,440	Triassic Halfway gas well.

1276	Pacific et al W Jedney b-6-C	Jan. 31, 1963	Mar. 1, 1963	5,630	5,630	Triassic Halfway gas well.
1379	Pacific et al Julienne b-69-D	Oct. 15, 1963	Nov. 11, 1963	6,499	6,499	Abandoned—dry.
1322	Pacific IOE Laprise b-66-C	Mar. 10, 1963	Mar. 31, 1963	4,935	4,935	Abandoned—dry.
1364	Pacific IOE Laprise d-11-E	Aug. 19, 1963	Sept. 1, 1963	4,550	4,550	Triassic upper carbonate of Schooler Creek gas well.
1341	Pacific Imperial Laprise a-99-E	June 8, 1963	July 5, 1963	4,493	4,493	Triassic upper carbonate of Schooler Creek gas well.
1153	Pacific Imperial Parkland 10-28-81-15	Aug. 29, 1962	Jan. 18, 1963	11,505	Nil	Middle Devonian Carbonate gas well.
1329	Pacific SR Can Del Peejay d-79-E	Mar. 18, 1963	Mar. 30, 1963	3,861	3,861	Triassic Halfway oil well.
1293	Pacific Rigel 6-35-87-17	Feb. 25, 1963	Mar. 10, 1963	3,591	3,591	Lower Cretaceous Gething gas well.
1190	Pacific Stoddart 11-10-86-20	Nov. 20, 1962	Jan. 5, 1963	6,492	1	Permo Carboniferous Belloy gas well.
1280	Pan Am Tenn Cordova b-34-C	Feb. 7, 1963	Mar. 16, 1963	6,500	6,500	Abandoned—dry.
907	Pan Am Phillis a-65-G	Jan. 23, 1962	Feb. 21, 1963	9,217	580	Abandoned—dry.
1335	Pan Am Dome Sikanni b-43-B	May 11, 1963	July 13, 1963	6,935	6,935	Triassic Baldonnel gas well.
976	Pan Am Trail d-68-H	Feb. 9, 1962	Feb. 1, 1963	8,955	657	Abandoned—dry.
1231	Pure Pacific Klowee c-37-A	Dec. 16, 1962	Mar. 1, 1963	7,921	4,681	Abandoned—dry.
1272	Pure S Kotcho c-98-G	Jan. 23, 1963	Mar. 21, 1963	7,310	7,596	Abandoned—dry; whipstocked hole.
1266	Pure et al W Milligan c-50-G	Jan. 19, 1963	Feb. 14, 1963	3,930	3,930	Triassic Halfway gas well.
1268	Richfield Sohio Beg d-13-B	Feb. 20, 1963	Mar. 13, 1963	5,670	5,670	Triassic Halfway gas well.
1233	Richfield Sohio Beg d-77-B	Dec. 31, 1962	Feb. 14, 1963	5,399	5,358	Triassic Halfway gas well.
1401	Richfield Pure Donis a-27-F	Dec. 15, 1963	Dec. 31, 1963	3,930	3,930	Abandoned—dry.
1300	Richfield Pure Donis d-11-E	Feb. 18, 1963	Mar. 6, 1963	3,880	3,880	Abandoned—dry.
1075	Richfield Pure Pt Roberts 6-3-5	June 16, 1962	Jan. 25, 1963	14,792	377	Abandoned—dry.
1381	Richfield et al Rigel 10-19-88-18	Oct. 15, 1963	Oct. 27, 1963	3,584	3,584	Lower Cretaceous Gething gas well.
1347	Samedan Pac Haven 9-33-83-19	June 6, 1963	June 27, 1963	4,461	4,461	Abandoned—dry.
1350	Sinclair et al Beg b-88-B	June 29, 1963	Aug. 28, 1963	5,320	5,320	Triassic Halfway gas well.
1260	Sinclair et al Datin b-39-H	Jan. 15, 1963	Feb. 16, 1963	6,170	6,170	Abandoned—dry.
1261	Sinclair et al Dogrib c-60-L	Feb. 25, 1963	Apr. 15, 1963	5,485	5,485	Abandoned—dry.
1155	Sinclair Pink c-90-C	Nov. 9, 1962	Oct. 18, 1963	4,049	1,173	Abandoned—dry; whipstocked hole.
1330	Sinclair Pink d-13-E	May 8, 1963	Oct. 19, 1963	7,123	7,680	Abandoned—dry; whipstocked hole.
1334	Skelly Jedney a-39-F	June 8, 1963	Aug. 8, 1963	4,590	4,590	Triassic upper carbonate of Schooler Creek and Triassic Halfway multi-gas well.
1279	SOBC Helmet b-49 G	Jan. 31, 1963	Mar. 29, 1963	6,347	6,347	Middle Devonian Carbonate gas well.
946	SOBC HB Trimble c-98-L	Jan. 19, 1962	Mar. 31, 1963	9,242	3,282	Abandoned—dry.
1210	Sun et al Chetwynd 14-20-77-23	Nov. 20, 1962	Dec. 9, 1963	9,403	5,866	Abandoned—dry; whipstocked hole.
1324	Sun Rigel 10-24-88-18	Mar. 21, 1963	Apr. 4, 1963	3,075	3,075	Lower Cretaceous Gething gas well.
1285	Tenn Hunt d-97-H	Feb. 14, 1963	Feb. 28, 1963	4,180	4,180	Abandoned—dry.
1254	Tenn La Garde 6-19-87-15	Jan. 12, 1963	Jan. 30, 1963	4,289	4,289	Abandoned—dry.
1371	Tenn Monsanto Laprise d-79-C	Oct. 2, 1963	Oct. 13, 1963	4,300	4,300	Triassic upper carbonate of Schooler Creek gas well.
1316	Tenn Osborn 6-19-88-15	Mar. 3, 1963	Mar. 16, 1963	4,205	4,205	Triassic Baldonnel gas well.
1275	Tenn Osborn 6-23-88-16	Feb. 4, 1963	Feb. 24, 1963	4,220	4,220	Lower Cretaceous Bluesky-Gething and Triassic Baldonnel multi-gas well.
1388	Tenn Monsanto Sojer b-28-C	Nov. 5, 1963	Nov. 26, 1963	4,647	4,647	Triassic upper carbonate of Schooler Creek gas well.
1259	Tenn Redeye d-35-L	Jan. 16, 1963	Feb. 10, 1963	3,825	3,825	Abandoned—dry.
1240	Tenn Wildmint d-86-I	Dec. 31, 1962	Jan. 11, 1963	3,725	3,592	Abandoned—dry.
1352	Texaco Texcan Blair d-71-I	June 25, 1963	Sept. 26, 1963	7,080	7,080	Abandoned—dry.
1284	Texaco NFA Boundary 12-6-86-13	Mar. 10, 1963	Mar. 22, 1963	4,430	4,430	Injection.
1395	Texaco NFA N Boundary 7-3-87-14	Nov. 28, 1963	Dec. 15, 1963	4,680	4,680	Triassic Halfway gas well.

TABLE 8.—WELLS DRILLED AND DRILLING, 1963—Continued

Drilling Authority No.	Well Name	Date Spudded	Date Rig Released	Total Depth	1963 Footage	Status at Dec. 31, 1963
1348	Texaco NFA Buick a-63-I	June 9, 1963	June 18, 1963	3,460	3,460	Lower Cretaceous Buick Creek gas well.
1346	Texaco NFA E Buick d-93-A	June 6, 1963	June 14, 1963	3,750	3,750	Lower Cretaceous Dunlevy gas well.
1391	Texaco NFA W La Garde 6-21-87-16	Nov. 5, 1963	Nov. 29, 1963	4,228	4,228	Abandoned—dry.
1380	Texaco NFA N Nig c-63-K	Oct. 21, 1963	Nov. 16, 1963	4,670	4,670	Abandoned—dry.
1288	Texaco NFA Osborn b-28-L	Feb. 15, 1963	Mar. 7, 1963	4,255	4,255	Abandoned—dry.
1319	Texaco NFA E Osborn 6-33-88-14	Dec. 26, 1963			3,567	Drilling.
1257	Texaco NFA E Osborn a-45-J	Jan. 22, 1963	Mar. 9, 1963	5,036	5,036	Lower Cretaceous Dunlevy gas well.
1222	Texaco NFA Rigel 10-29-88-18	Dec. 13, 1962	Jan. 4, 1963	3,865	<i>Nil</i>	Lower Cretaceous Gething gas well.
1370	Texaco NFA Rigel a-28-K	Sept. 14, 1963	Sept. 28, 1963	3,660	3,660	Lower Cretaceous Gething gas well.
1299	Texaco Siphon 10-13-86-17	Feb. 18, 1963	Mar. 15, 1963	4,620	4,620	Abandoned—dry.
1281	Texaco NFA S Tsea b-87-F	Feb. 5, 1963	Apr. 4, 1963	7,820	7,820	Abandoned—dry.
1289	Texcan Wildmint d-94-I	Feb. 7, 1963	Feb. 25, 1963	3,700	3,700	Triassic Halfway oil well.
1224	Triad Beaton b-28-J	Feb. 10, 1963	Feb. 28, 1963	3,810	3,810	Triassic Halfway oil well.
1223	Triad Beaton b-39-J	Dec. 21, 1962	Jan. 7, 1963	3,803	893	Injection.
1399	Triad Beaton b-46-J	Dec. 20, 1963			3,560	Drilling.
1264	Triad BP N Beaton d-48-B	Jan. 15, 1963	Jan. 27, 1963	3,785	3,785	Abandoned—dry.
1314	Triad BP N Beaton b-49-B	Mar. 3, 1963	Mar. 15, 1963	3,800	3,800	Abandoned—dry.
1301	Triad BP N Beaton b-16-E	Feb. 18, 1963	Mar. 1, 1963	4,142	4,142	Abandoned—dry.
1262	Triad BP N Beaton d-34-C	Jan. 24, 1963	Feb. 6, 1963	3,837	3,837	Abandoned—dry.
1270	Triad BP N Beaton d-53-D	Mar. 4, 1963	Mar. 23, 1963	3,905	3,905	Abandoned—dry.
1327	Triad W Beaton d-49-K	Mar. 17, 1963	Mar. 24, 1963	3,430	3,430	Lower Cretaceous Bluesky-Gething oil well.
1398	Triad W Beaton d-58-K	Dec. 6, 1963	Dec. 17, 1963	3,465	3,465	Lower Cretaceous Bluesky-Gething oil well.
1278	Triad BP Birley c-36-A	Feb. 1, 1963	Feb. 15, 1963	4,106	4,106	Abandoned—dry.
1402	Triad Sohio Jackfish c-21-K	Dec. 23, 1963			2,386	Drilling.
1392	Triad et al Sojer d-37-C	Nov. 11, 1963	Dec. 2, 1963	4,149	4,149	Triassic upper carbonate of Schooler Creek gas well.
1244	Union Aitken d-23-L	Jan. 2, 1963	Jan. 19, 1963	4,533	4,533	Abandoned—dry.
1338	Union Aitken d-25-L	July 6, 1963	July 21, 1963	4,569	4,569	Lower Cretaceous Gething gas well.
1363	Union Aitken d-26-L	July 23, 1963	Aug. 5, 1963	4,428	4,428	Abandoned—dry.
1227	Union Aitken d-35-L	Jan. 20, 1963	Feb. 9, 1963	4,570	4,570	Lower Cretaceous Gething oil well.
1310	Union Aitken d-45-L	Feb. 26, 1963	Mar. 11, 1963	4,480	4,480	Lower Cretaceous gas well.
1291	Union Aitken d-64-L	Feb. 12, 1963	Feb. 24, 1963	4,500	4,500	Abandoned—dry.
1302	Union HB Beaverdam d-34-L	Feb. 20, 1963	Mar. 3, 1963	3,855	3,855	Abandoned—dry.
1328	Union HB Sinc Pac Bulrush d-57-F	Mar. 16, 1963	Mar. 25, 1963	3,825	3,825	Abandoned—dry.
1267	Union HB Sinc Bulrush d-78-F	Jan. 21, 1963	Feb. 11, 1963	3,850	3,850	Triassic Halfway oil well.
1409	Union HB Sinc Pac Bulrush d-79-F	Dec. 21, 1963	Jan. 1, 1964	3,803	3,803	Abandoned—dry.
1394	Union HB Sinc Pac Bulrush d-89-F	Nov. 28, 1963	Dec. 9, 1963	3,831	3,831	Triassic Halfway oil well.
1283	Union HB BA Canuck a-6-I	Feb. 13, 1963	Feb. 22, 1963	3,505	3,505	Abandoned—dry.
1311	Union HB Cranberry a-12-D	Feb. 23, 1963	Mar. 4, 1963	3,620	3,620	Abandoned—dry.
1269	Union HB Sinc Pac Currant d-37-C	Jan. 27, 1963	Feb. 7, 1963	4,080	4,080	Triassic Halfway gas well.
1320	Union HB Sinc Pac Currant d-39-C	Mar. 3, 1963	Mar. 15, 1963	4,037	4,037	Triassic Halfway oil well.
1389	Union HB Milligan d-93-G	Nov. 14, 1963	Nov. 22, 1963	3,745	3,745	Injection.

1241	Union HB Mink d-82-L	Jan. 4, 1963	Jan. 19, 1963	3,785	3,785	Abandoned—dry.
1321	Union KCL ROC Nettle d-67-A	Mar. 7, 1963	Mar. 25, 1963	3,885	3,885	Lower Cretaceous Bluesky-Gething oil well.
1296	Union KCL ROC Scot d-87-I	Feb. 23, 1963	Mar. 5, 1963	3,732	3,732	Abandoned—dry.
1252	Union HB Skwat a-75-J	Jan. 9, 1963	Jan. 26, 1963	3,825	3,825	Abandoned—dry.
963	Union HB Wildmint d-26-A	Nov. 1, 1963	Nov. 12, 1963	3,792	3,792	Triassic Halfway oil well.
1387	Union HB Wildmint b-46-A	Dec. 10, 1963	Dec. 20, 1963	3,820	3,820	Triassic Halfway oil well.
1292	Union HB Willow d-11-G	Feb. 9, 1963	Feb. 19, 1963	3,780	3,780	Triassic Halfway gas well.
1410	Union HB Willow d-9-H	Dec. 22, 1963	Dec. 31, 1963	3,745	3,745	Abandoned—dry.
1237	Union HB Woodrush a-63-H	Dec. 28, 1962	Jan. 7, 1963	3,718	385	Abandoned—dry.
1287	Union KCL ROC Yew d-97-A	Feb. 9, 1963	Feb. 22, 1963	3,856	3,856	Abandoned—dry.
1258	West Nat et al Blueberry b-24-D	Jan. 19, 1963	Mar. 19, 1963	7,191	7,191	Mississippian oil well.
1317	West Nat et al Blueberry d-41-L	Mar. 4, 1963	Apr. 9, 1963	6,677	6,677	Mississippian oil well.
1072	West Nat et al Blueberry b-92-L	Nov. 11, 1962	Jan. 3, 1963	6,823	Nil	Mississippian oil well.
1242	West Nat et al Blueberry d-93-L	Jan. 6, 1963	Feb. 26, 1963	6,740	6,740	Mississippian oil well.
1245	West Nat Cabin b-40-A	Jan. 7, 1963	Feb. 25, 1963	7,047	7,047	Middle Devonian Carbonate gas well.
1406	West Nat Cabin a-19-G	Dec. 20, 1963			3,238	Drilling.
1274	West Nat IOE S Clarke d-29-K	Feb. 6, 1963	Apr. 11, 1963	6,457	6,457	Middle Devonian Carbonate gas well.
1147	West Nat Kotcho d-12-C	Oct. 6, 1962	Feb. 5, 1963	6,890	4,810	Middle Devonian Carbonate gas well.
1309	West Nat et al Louise d-100-E	Mar. 2, 1963	Apr. 2, 1963	7,015	7,015	Abandoned—dry.
1297	West Nat et al Milo d-55-E	Feb. 21, 1963	Apr. 13, 1963	7,300	7,300	Middle Devonian Carbonate gas well.
1373	West Nat Nig a-3-B	Sept. 29, 1963	Oct. 20, 1963	4,365	4,365	Triassic upper carbonate of Schooler Creek gas well.
1298	West Nat et al Wildboy b-6-A	Feb. 12, 1963	Mar. 29, 1963	7,164	7,164	Abandoned—dry.
1405	West Nat Yoyo b-98-E	Dec. 18, 1963			3,176	Drilling.
1230	West Nat et al Yoyo b-29-I	Dec. 19, 1962	Mar. 3, 1963	7,368	5,793	Middle Devonian Carbonate gas well.
1313	West Nat et al Yoyo b-24-L	Mar. 1, 1963	Apr. 13, 1963	7,299	7,299	Middle Devonian Carbonate gas well.
1342	Whitehall et al Balsam 6-1-88-14	Dec. 3, 1963	Dec. 17, 1963	4,650	4,650	Abandoned—dry.
1303	Whitehall E Buick b-62-A	Mar. 2, 1963	Mar. 12, 1963	3,632	3,632	Lower Cretaceous Dunlevy gas well.
1349	Whitehall et al E Buick c-40-C	June 16, 1963	June 25, 1963	3,565	3,565	Abandoned—dry.
1234	Whitehall Rigel 11-18-88-16	Jan. 5, 1963	Jan. 14, 1963	3,610	3,610	Lower Cretaceous Gething gas well.
1263	White Rose IOE et al Slave b-57-B	Jan. 15, 1963	Suspended		4,560	Suspended.
1361	Williamson Pac Bougie d-31-F	Aug. 17, 1963	Sept. 29, 1963	5,779	5,779	Abandoned—dry.
1374	Williamson Pac Bougie d-A31-F	Oct. 2, 1963	Dec. 6, 1963	9,408	9,408	Abandoned—dry.
1365	Wintershall Rigel 10-34-87-17	Aug. 5, 1963	Aug. 14, 1963	3,595	3,595	Lower Cretaceous Gething gas well.

TABLE 9.—OIL AND GAS FIELDS DESIGNATED AS OF DECEMBER 31, 1963

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	9	{ Union Aitken Creek b-42-L, oil Union Aitken Creek a-53-L, gas }	3 3
Beaton River	Aug. 7, 1959	Jan. 1, 1962	N.T.S. 94-H-2	11	10	{ Triad Beaton River b-38-J, oil Triad Beaton d-60-J, gas }	11 11
Beaton River West	Aug. 7, 1959	Jan. 1, 1961	N.T.S. 94-H-2	2	7	Triad West Beaton River d-39-K, oil	2
Beg	July 1, 1961	{ Jan. 1, 1962 Apr. 1, 1962 July 1, 1962 Apr. 1, 1963 }	N.T.S. 94-G-1, 94-G-8	8, 11	21	{ Sinclair et al Beg b-17-K, gas Sinclair et al Beg d-10-G, gas }	8 11
Beg West	Apr. 1, 1962	Oct. 1, 1963	N.T.S. 94-G-1	8	3	Sinclair et al W Beg a-79-F, gas	8
Bernadet	Oct. 1, 1963		{ Tp. 87, 88, R. 13, W. of 6th M. Tp. 87, 88, R. 14, W. of 6th M. }	2	1	Sun 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, 7, 9, 13	31	{ Sun et al Blueberry c-32-D (2), gas Sun et al Blueberry d-87-D (1), gas Sun et al Blueberry a-61-L, gas Sun et al Blueberry d-82-L (11), oil Sun et al Blueberry a-34-D (10), gas Sun et al E Blueberry b-38-C (7), gas Sun et al E Blueberry b-36-C (17), gas Sun et al W Blueberry d-82-I (9), gas Sun et al W Blueberry d-19-L (12), gas }	5 7 9 13 13 7, 11 13 5 13 7
Blueberry East	Dec. 22, 1958		N.T.S. 94-A-13	7, 11, 13	2		
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, 7	3		
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 Feb. 15, 1960 May 27, 1960 Jan. 1, 1961 Aug. 7, 1959 Jan. 1, 1961 July 1, 1961 Oct. 1, 1961 Jan. 1, 1963 July 1, 1963 }	{ Tp. 83, 84, 85, 86, 87, R. 13, W. of 6th M. Tp. 83, 84, 85, 86, R. 14 W. of 6th M. }	2, 3, 7, 10, 11	268	{ Pacific Boundary 8-15-85-14, gas Pacific Boundary 12-10-85-14, gas Texaco NFA Boundary L 6-6-86-13 (1), oil Sun Boundary Lake 6-23-85-14, oil }	2, 7 3 10 11
Bubbles	Nov. 24, 1959	{ Feb. 15, 1960 May 27, 1960 Jan. 1, 1961 Aug. 7, 1959 Jan. 1, 1961 July 1, 1961 Oct. 1, 1961 Jan. 1, 1963 July 1, 1963 }	N.T.S. 94-G-1, 94-G-8, 94-H-4	8	13	Pacific Imperial Bubbles b-33-I, gas	8
Buick Creek	Feb. 7, 1958	{ Jan. 1, 1961 Oct. 1, 1961 Jan. 1, 1963 July 1, 1963 }	N.T.S. 94-A-11, 94-A-14	6, 9	18	{ Texaco NFA Buick Creek d-98-I (1), gas Texaco NFA Buick Creek d-83-J (4), gas }	6 9

Buick Creek East	Jan. 1, 1963	{ Apr. 1, 1963 Oct. 1, 1963	N.T.S. 94-A-10, 94-A-11, 94-A-14, 94-A-15	2, 5	8	{ Texaco NFA E Buick c-80-D, gas	2
Buick Creek West	Feb. 7, 1958	{ Jan. 6, 1959 Feb. 15, 1960	N.T.S. 94-A-11, 94-A-14	6, 7, 11	15	{ Texaco NFA E Buick a-31-A, gas	5
Charlie Lake	Jan. 1, 1961		Tp. 84, R. 18, W. of 6th M.	3	1	{ Pacific W Buick Creek c-83-K (13A), oil	6
Clarke Lake	Feb. 15, 1960	{ May 27, 1960 Jan. 1, 1961 Apr. 1, 1962	N.T.S. 94-J-9, 94-J-10, 94-J-15, 94-J-16	15	8	{ Pacific West Buick Creek b-78-C (2), gas	6
Dawson Creek	Feb. 7, 1958		Tp. 79, R. 15, W. of 6th M.	1	4	{ Pacific West Buick Creek d-58-C (8), gas	7
Fort St. John	Aug. 22, 1955	{ Feb. 7, 1958 Feb. 15, 1960 Jan. 1, 1961	Tp. 83, R. 18, W. of 6th M.	4, 7, 9, 11, 12	26	{ Pacific West Buick Creek b-23-E (1), gas	11
Fort St. John Airport	Feb. 7, 1958		Tp. 83, R. 17, W. of 6th M.	4, 7, 11	3	{ Imp Pac Charlie 13-5-84-14, oil	3
Fort St. John Southeast	Feb. 7, 1958		Tp. 82, 83, R. 17, W. of 6th M.	4, 7, 11, 12	15	{ West Nat Imp Clarke Lake d-88-L, gas	15
Gundy Creek	Feb. 7, 1958	Jan. 6, 1959	N.T.S. 94-B-16	7, 9	4	{ Pacific Sc Dawson Ck 1-15-79-15 (1), gas	1
Halfway	Dec. 22, 1958		Tp. 86, 87, R. 25, W. of 6th M.	7, 11	3	{ Pacific Ft St John A3-29-83-18 (31), gas	4
Highway	Feb. 7, 1958		N.T.S. 94-B-16	5, 7, 13	5	{ Pacific Ft St John 14-15-83-18 (7), gas	7
Jedney	Aug. 7, 1959	{ Nov. 24, 1959 Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1961	N.T.S. 94-G-1, 94-G-8	3, 8, 11	27	{ Pacific Ft St John 3-14-83-18 (9), oil	9
Kobes-Townsend	Dec. 22, 1958	Feb. 15, 1960	N.T.S. 94-B-8, 94-B-9	5, 9, 11, 13	9	{ Pacific Ft St John 1-20-83-18 (30), gas	11
Kotcho Lake	Apr. 1, 1962		N.T.S. 94-I-14	15	3	{ Imp Pac Ft St John 9-19-83-18 (45), oil	12
Laprise Creek	Feb. 15, 1960	{ Jan. 1, 1961 Apr. 1, 1961	N.T.S. 94-G-8, 94-H-5	8	22	{ Pacific Ft St John 14-21-83-18 (4), gas	12
Laprise Creek West	July 1, 1962		N.T.S. 94-G-8	8	2	{ Pacific Airport 8-32-83-17 (3), gas	4
Milligan Creek	Feb. 7, 1958	{ Aug. 7, 1959 Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1962	N.T.S. 94-H-2	11	21	{ Pacific Airport 9-32-83-17 (97), gas	7
						{ Pacific Airport 12-34-83-17 (10), gas	11
						{ Pac Ft St John SE 10-31-82-17 (80), gas	4
						{ Pac Ft St John SE A4-10-83-17 (55), gas	7
						{ Pac Ft St John SE 10-33-82-17 (22), gas	11
						{ Pac Ft St John SE 4-10-83-17 (12), gas	12
						{ West Nat Gundy Creek c-80-A, gas	7
						{ West Nat Gundy Creek b-69-A, gas	9
						{ Sun et al Halfway 5-1-87-25, gas	7
						{ Sun et al Halfway 8-11-87-25, gas	11
						{ Sun et al Highway b-3-I, gas	5
						{ Phillips Highway b-25-I (1), gas	7
						{ Phillips Highway a-90-I (4), gas	13
						{ Pacific Pan Am Dome Jedney c-8-F, gas	3
						{ Pacific et al Jedney b-88-J, gas	8
						{ Pacific Imp Jedney d-99-J, gas	11
						{ Phillips Kobes a-3-A (4), gas	5
						{ Phillips Kobes d-94-I (1), gas	9, 11
						{ Phillips Townsend a-20-H (A-1), gas	13
						{ West Nat Kotcho c-67-K, gas	15
						{ Dome Basco Laprise Ck a-35-H, gas	8
						{ Dome CDP C&E W Laprise c-82-G, gas	8
						{ Union H.B. Milligan Creek d-73-G, oil	11
						{ Whitehall et al Milligan d-75-G, gas	11

TABLE 9.—OIL AND GAS FIELDS DESIGNATED AS OF DECEMBER 31, 1963—Continued

Field	Date Designated	Date(s) Revised	Field Location	Pool(s)	Number of Wells Capable of Production	Discovery Well(s)	Pool(s) Discovered
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, 9, 11	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 9 11
Nig Creek	Aug. 7, 1959	{ Feb. 15, 1960 Jan. 1, 1961 Apr. 1, 1961 Jan. 1, 1962 Apr. 1, 1962	N.T.S. 94-A-13, 94-H-4	8	16	Texaco NFA Nig Creek a-79-B (1), gas	8
Parkland (formerly Kiskatinaw)	Feb. 7, 1958	July 1, 1963	Tp. 81, R. 15, W. of 6th M.	14	2	Pacific Imp Parkland 6-21-81-15, gas	14
Peejay	Feb. 15, 1960	{ May 27, 1960 Jan. 1, 1961 Jan. 1, 1962 Apr. 1, 1962	N.T.S. 94-A-15, 94-A-16	11	24	{ Sinclair Pac Peejay d-39-E (B8-3), oil Pacific SR West Cdn Peejay d-52-I, gas	11 11
Peejay West	Jan. 1, 1963		N.T.S. 94-A-15	11	2	Pacific SR West Cdn W Peejay d-54-G, oil	11
Petitot River	Apr. 1, 1961		N.T.S. 94-P-12, 94-P-13	15	3	West Nat Petitot River d-24-D, gas	15
Red Creek	Feb. 7, 1958	{ Aug. 7, 1959 Feb. 15, 1960	Tp. 85, R. 21, W. of 6th M.	9, 11	2	Pacific Red Creek 5-27-85-21 (36), gas	9, 11
Rigel	Oct. 1, 1962	{ Jan. 1, 1963 Apr. 1, 1963	{ 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.	{ 3	24	Imp Fina Rigel 4-27-88-17, gas	3
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	Tp. 86, R. 20, W. of 6th M.	12	2	Pacific Stoddart 4-24-86-20 (85), gas	12
Sunrise	Feb. 7, 1958	Jan. 1, 1961	Tp. 78, 79, R. 16, W. of 6th M.	1	3	Pacific Sunrise 10-7-79-16 (3), gas	1
Wildmint	Jan. 1, 1962	{ July 1, 1962 Jan. 1, 1963	N.T.S. 94-A-15, 94-H-2	11	18	{ Union HB Wildmint d-46-A, oil Tenn Wildmint d-4-A, gas	11 11
Willow	July 1, 1963		N.T.S. 94-H-2	2, 11	3	{ Union HB Willow d-20-H, oil Union HB Willow b-10-H, gas	2 11

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. Lower Cretaceous Buick Creek sandstone.
7. Triassic Baldonnel carbonate (includes Baldonnel "A" and "B" of Fort St. John area).
8. Triassic upper carbonate of Schooler Creek.
9. Triassic Charlie Lake sandstone and carbonate.
10. Triassic Boundary Lake carbonate.
11. Triassic Halfway sandstone.
12. Permian Belloy carbonate.
13. Mississippian Rundle carbonate.
14. Upper Devonian Wabamun carbonate.
15. Middle Devonian carbonate.

TABLE 10.—NUMBER OF PRODUCING AND PRODUCIBLE WELLS AT
DECEMBER 31, 1963¹

Field and Foot	Oil Wells		Natural-gas Wells	
	Producing	Producible	Producing	Producible
Aitken Creek field—Gething	6	6	—	3
Beaton River field—Halfway	9	9	—	1
Beaton River West field—Bluesky-Gething	4	7	—	—
Beg field—				
Upper Carbonate of Schooler Creek	—	—	10	17
Halfway	—	—	7	16
Field totals	—	—	17	33
Beg West field—Upper Carbonate of Schooler Creek	—	—	2	3
Bernadet field—Bluesky-Gething	—	—	1	1
Blueberry field—				
Dunlevy	—	—	5	6
Baldonnel	—	—	2	4
Charlie Lake	—	—	—	2
Mississippian	19	20	—	1
Field totals	19	20	7	13
Blueberry East field—				
Baldonnel	—	—	—	1
Halfway	—	—	—	1
Mississippian	—	—	—	1
Field totals	—	—	—	3
Blueberry West field—				
Dunlevy	—	—	2	2
Baldonnel	—	—	—	1
Field totals	—	—	2	3
Boundary Lake field—				
Bluesky-Gething	—	—	—	2
Gething	—	—	1	2
Dunlevy	—	—	—	1
Baldonnel	—	—	5	6
Boundary Lake	251	258	—	—
Halfway	6	7	—	1
Field totals	257	265	6	12
Bubbles field—Upper Carbonate of Schooler Creek	—	—	10	13
Buick Creek field—				
Buick Creek	—	—	11	18
Charlie Lake	—	—	1	1
Field totals	—	—	12	19
Buick Creek East field—				
Bluesky-Gething	—	—	1	1
Dunlevy	—	—	6	7
Buick Creek	—	1	—	—
Field totals	—	1	7	8
Buick Creek West field—				
Buick Creek	—	2	7	9
Baldonnel	—	—	1	3
Halfway	—	—	—	1
Field totals	—	2	8	13
Charlie Lake field—Gething	1	1	—	—
Clarke Lake field—Devonian Carbonate	—	—	1	8
Dawson Creek field—Cadotte	—	—	1	4
Fort St. John field—				
Cadomin	—	—	—	2
Baldonnel "A"	—	—	5	5
Baldonnel "A/β"	—	—	6	6
Halfway	—	—	5	6
Charlie Lake	4	4	—	1
Belloy	—	1	2	2
Field totals	4	5	18	22
Fort St. John Airport field—				
Cadomin	—	—	—	1
Baldonnel "A"	—	—	—	1
Halfway	—	—	—	1
Field totals	—	—	—	3

¹ Each zone of a multiple completion is counted as a well.

TABLE 10.—NUMBER OF PRODUCING AND PRODUCIBLE WELLS AT
DECEMBER 31, 1963¹—Continued

Field and Pool	Oil Wells		Natural-gas Wells	
	Producing	Producible	Producing	Producible
Port St. John Southeast field—				
Cadomin	—	—	1	1
Baldonnel "A"	—	—	2	2
Halfway	—	—	2	6
Belloy	—	—	4	6
Field totals	—	—	9	15
Gundy Creek field—				
Baldonnel	—	—	—	4
Charlie Lake	—	—	—	1
Field totals	—	—	—	5
Halfway field—				
Baldonnel	—	—	1	3
Halfway	—	—	1	1
Field totals	—	—	2	4
Highway field—				
Dunlevy	—	—	1	1
Baldonnel	—	—	1	4
Mississippian	—	—	1	1
Field totals	—	—	3	6
Jedney field—				
Gething	—	—	1	2
Upper Carbonate of Schooler Creek	—	—	14	20
Halfway	—	—	16	23
Field totals	—	—	31	45
Kobes-Townsend field—				
Dunlevy	—	—	3	3
Charlie Lake	—	—	5	5
Halfway	—	—	2	2
Mississippian	—	—	2	2
Field totals	—	—	12	12
Kotcho Lake field—Devonian Carbonate	—	—	—	3
Laprise Creek field—Upper Carbonate of Schooler Creek	—	—	23	23
Laprise Creek West field—Upper Carbonate of Schooler Creek	—	—	1	2
Milligan Creek field—Halfway	20	22	—	1
Montney field—				
Bluesky-Gething	—	—	—	1
Charlie Lake	—	—	—	1
Halfway	—	—	1	2
Field totals	—	—	1	4
Nig Creek field—Upper Carbonate of Schooler Creek	—	—	13	16
Parkland field—				
Upper Devonian	—	—	1	1
Wabamun	—	—	1	1
Field totals	—	—	2	2
Peejay field—Halfway	17	22	—	2
Peejay West field—Halfway	1	2	—	—
Petitot River field—Devonian Carbonate	—	—	—	3
Red Creek field—				
Charlie Lake	—	—	1	1
Halfway	—	—	1	2
Belloy	—	—	—	1
Field totals	—	—	2	4
Rigel field—Gething	—	—	16	25
Snyder Creek field—Dunlevy	—	—	1	1
Stoddart field—Belloy	—	—	2	2
Sunrise field—Cadotte	—	—	—	3
Wildmint field—Halfway	8	17	—	1
Willow field—Bluesky-Gething	1	1	—	2

¹ Each zone of a multiple completion is counted as a well.

TABLE 10.—NUMBER OF PRODUCING AND PRODUCIBLE WELLS AT
 DECEMBER 31, 1963¹—Continued

Field and Pool	Oil Wells		Natural-gas Wells	
	Producing	Producible	Producing	Producible
Other areas—				
Cadotte.....	—	—	—	2
Notikewin.....	—	—	—	1
Bluesky-Gething.....	—	1	—	7
Gething.....	—	—	—	3
Dunlevy.....	—	—	—	5
Jurassic-Triassic.....	—	—	—	1
Schooler Creek.....	—	—	—	4
Upper Carbonate of Schooler Creek.....	—	—	3	13
Baldonnel.....	—	1	—	15
Baldonnel "A".....	—	—	—	1
Charlie Lake.....	—	—	—	5
Boundary Lake.....	—	2	—	1
Halfway.....	3	5	—	21
Permo-Carboniferous.....	—	—	—	3
Belloy.....	—	—	1	2
Mississippian.....	—	—	—	11
Kiskatinaw.....	—	—	—	1
Devonian Carbonate.....	—	—	—	25
Areas totals.....	3	9	4	121
Total fields and areas.....	350	389	213	464

¹ Each zone of a multiple completion is counted as a well.

TABLE 11.—MONTHLY CRUDE-OIL PRODUCTION BY FIELDS AND POOLS, 1963
(Quantities in barrels.)

Field and Pool	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Aitken Creek field—Gething	10,941	11,139	14,945	16,087	16,455	16,004	16,430	16,384	15,757	14,885	12,699	14,228	175,954
Beaton River field—Halfway	27,243	26,553	32,323	32,743	33,031	33,874	28,770	34,500	29,501	30,817	29,485	33,790	372,630
Beaton River West field—Bluesky-Gething	6,306	5,417	7,398	6,912	7,205	6,892	6,855	6,864	6,746	6,523	6,184	6,330	79,632
Bernadet field—Bluesky-Gething ¹			4	22	86	21	31	17	92				273
Blueberry field—													
Dunlevy				75	49	60	25	30	51	98	52	96	536
Dunlevy ¹	27	16	4	53	258	39	68	59	260	94	25	25	928
Baldonnel ¹										115			115
Mississippian	80,886	69,722	73,823	102,211	126,116	123,528	122,818	123,996	100,908	121,820	111,304	116,023	1,273,155
Mississippian ¹	76	65	30	184	1,434	190	172	172	1,005	261	366	629	4,584
Field totals	80,989	69,803	73,857	102,523	127,857	123,817	123,083	124,257	102,224	122,388	111,747	116,773	1,279,318
Blueberry West field—													
Dunlevy ¹	9	13	4	3			1	1					31
Baldonnel ¹	39	29	13	14				1					96
Field totals	48	42	17	17			1	2					127
Boundary Lake field—													
Charlie Lake													
Boundary Lake	712,391	650,747	724,040	512,833	730,144	679,238	437,318	459,204	712,792	686,619	648,730	674,405	7,628,461
Halfway	8,942	8,663	10,072	6,452	10,692	9,421	4,293	4,805	10,742	9,282	7,747	7,204	98,315
Field totals	721,333	659,410	734,112	519,285	740,836	688,659	441,611	464,009	723,534	695,901	656,477	681,609	7,726,776
Buick Creek field—Buick Creek ¹	193	808	690	84	75	97	146	327	42	508	1,653	3,021	7,644
Buick Creek West field—Buick Creek													
Charlie Lake field—Gething	65	855	705	339		830	837	597	291	482	446	388	5,835
Fort St. John field—													
Charlie Lake	4,465	4,077	4,685	4,462	4,646	4,497	4,631	4,507	4,527	3,483	3,445	3,596	51,021
Belloy													
Field totals	4,465	4,077	4,685	4,462	4,646	4,497	4,631	4,507	4,527	3,483	3,445	3,596	51,021
Milligan Creek field—Halfway	119,630	115,109	127,120	122,017	124,881	126,234	133,796	152,723	152,198	155,560	153,882	155,323	1,638,473
Pecjay field—Halfway	61,101	56,315	61,112	58,573	62,314	60,674	53,837	63,698	55,727	57,225	55,948	58,490	705,014
Pecjay West field—Halfway	475	510	1,037	1,477	837	1,708	1,597	1,732	1,340	1,019	588	585	12,905
Wildmint field—Halfway	29,012	31,906	39,637	37,352	43,400	40,040	35,539	41,459	36,713	29,346	29,849	30,504	424,757
Willow field—Bluesky-Gething	4,040	3,435	3,892	3,715	3,772	3,648	3,831	3,762	2,759	3,489	3,011	3,147	42,501
Other areas—													
Bluesky-Gething			214	642									856
Baldonnel			443										443
Boundary Lake					139	119	36						294
Halfway		418	618									3,192	4,228
Areas totals		418	1,275	642	139	119	36					3,192	5,821
Totals	1,065,841	985,797	1,102,809	906,250	1,165,534	1,107,114	851,031	914,838	1,131,451	1,121,626	1,065,414	1,110,976	12,528,681

¹ Condensate

TABLE 12.—MONTHLY NATURAL-GAS PRODUCTION BY FIELDS AND POOLS, 1963
(Quantities in M s.c.f.)

Field and Pool	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Beg field—													
Upper Carbonate of Schooler Creek	647,713	458,158	493,702	458,618	326,984	476,240	477,837	362,362	493,662	658,391	419,377	469,633	5,742,677
Halfway	440,646	315,815	335,988	431,197	379,887	347,904	293,981	319,224	389,877	451,166	206,717	380,790	4,293,192
Field totals	1,088,359	773,973	829,690	889,815	706,871	824,144	771,818	681,586	883,539	1,109,557	626,094	850,423	10,035,869
Beg West field—Upper Carbonate of													
Schooler Creek	14,346	26,660	45,708	36,110	36,872	30,945	20,114	33,630	31,615	40,917	34,382	22,445	373,744
Bernadet field—Bluesky-Gething	2,282	8,368	15,414	21,634	18,556	19,978	19,203	16,104	12,590	29,225	16,518	29,435	209,307
Blueberry field—													
Dunlevy	115,772	96,678	100,245	111,705	114,272	85,753	59,050	91,605	81,195	120,215	92,083	108,288	1,176,861
Baldonnel	69,833	33,401	39,342	44,018	45,146	10,617	29,189	33,816	41,375	74,256	27,450	24,417	472,860
Charlie Lake		9,466			26,984	28,992	11,847	5,541			1,427		84,257
Mississippian													
Field totals	185,605	139,545	139,587	155,723	186,402	125,362	100,086	130,962	122,570	194,471	120,960	132,705	1,733,978
Blueberry East field—													
Baldonnel	57,178	61,808	58,439	52,168	51,545	36,485	43,442	30,315	27,615	38,832	40,937		498,764
Halfway													
Mississippian													
Field totals	57,178	61,808	58,439	52,168	51,545	36,485	43,442	30,315	27,615	38,832	40,937		498,764
Blueberry West field—													
Dunlevy	9,884	14,120	10,693	2,225		365	230	8,467	5,295	12,226	8,827	14,263	86,595
Baldonnel	37,054	32,882	33,053	7,888	9,136	7,933		4,043	992	880			133,861
Field totals	46,938	47,002	43,746	10,113	9,136	8,298	230	12,510	6,287	13,106	8,827	14,263	220,456
Boundary Lake field—													
Bluesky-Gething													
Gething	90,639	78,201	56,942	84,814	48,616	48,058	33,707	80,092	73,811	77,431	61,152	72,132	805,595
Baldonnel	174,173	169,635	152,384	170,266	201,682	86,314	60,525	181,116	196,908	143,416	132,521	135,611	1,804,551
Field totals	264,812	247,836	209,326	255,080	250,298	134,372	94,232	261,208	270,719	220,847	193,673	207,743	2,610,146
Bubbles field—Upper Carbonate of													
Schooler Creek	928,342	755,639	852,243	743,661	842,293	239,129	295,407	147,072	145,957	994,564	595,350	851,032	7,390,689
Buick Creek field—													
Buick Creek	738,833	507,416	705,894	729,599	678,547	586,846	429,764	570,244	610,036	643,978	942,183	903,024	8,046,364
Charlie Lake	64,255	24,448	58,475	52,891	3,837	9,633		13,611	43,101	45,349	44,804	29,099	389,503
Field totals	803,088	531,864	764,369	782,490	682,384	596,479	429,764	583,855	653,137	689,327	986,987	932,123	8,435,867
Buick Creek East field—													
Bluesky-Gething	42,494				21,201	41,433	45,548	21,211	20,165	64,703	40,110	3,557	300,422
Dunlevy	231,111	49,439	121,235	73,276	150,968	290,240	328,809	336,022	272,556	231,509	249,192	306,125	2,640,482
Field totals	273,605	49,439	121,235	73,276	172,169	331,673	374,357	357,233	292,721	296,212	289,302	309,682	2,940,904

TABLE 12.—MONTHLY NATURAL-GAS PRODUCTION BY FIELDS AND POOLS, 1963—Continued

(Quantities in M s.c.f.)

Field and Pool	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Buick Creek West field—													
Buick Creek	483,520	407,376	307,800	284,234	299,180	98,965	86,567	156,867	331,267	83,068	490,980	543,090	3,572,914
Baldonnel	59,115	52,067	55,185	52,524	38,627	14,316	13,799	16,465	48,903	90	48,939	55,408	455,638
Halfway													
Field totals	542,635	459,443	362,985	336,758	337,807	113,481	100,366	173,332	380,170	83,158	539,919	598,498	4,028,552
Clarke Lake field—Devonian Carbonate	9,656	7,141	7,073	5,234	3,435	2,452	4,471	4,950	4,970	5,526	9,094	9,933	73,935
Dawson Creek field—Cadotte	41,238	47,649	51,264	56,487	37,483	3,630	8,558	27,530	12,162	27,820	30,406	30,812	375,039
Fort St. John field—													
Cadomin													
Baldonnel "A"	253,227	229,505	248,810	166,619	173,175	213,152	100,107	121,764	183,297	136,318	88,532	68,253	1,982,759
Baldonnel "A/B"	335,216	276,206	288,525	274,546	227,405	222,208	40,696	110,215	227,952	122,026	189,787	246,503	2,561,285
Halfway	246,300	203,738	229,368	204,579	171,842	112,388	33,585	43,658	164,556	61,847	94,226	182,184	1,748,271
Belloy	59,633	40,641	50,139	44,537	42,321	24,966	13,954	12,556	52,573	16,283	16,481	45,717	419,801
Field totals	894,376	750,090	816,842	690,281	614,743	572,714	188,342	288,193	628,378	336,474	389,026	542,657	6,712,116
Fort St. John Southeast field—													
Cadomin	63,484	55,578	58,374	53,020	41,816	49,510	11,037	15,705	36,182	10,052	24,453	46,538	465,749
Baldonnel "A"	63,794	55,190	55,586	67,745	63,943	59,479	3,633	21,098	76,899	18,885	38,023	64,080	589,355
Halfway	129,628	114,308	139,315	106,280	94,604	75,330	12,855	21,995	102,976	41,886	65,121	92,001	996,299
Belloy	441,400	422,131	440,998	432,349	317,939	387,063	70,020	88,571	259,584	226,407	286,126	303,205	3,675,793
Field totals	698,306	647,207	694,273	659,394	518,302	571,382	97,545	147,369	475,641	297,230	413,723	505,824	5,726,196
Gundy Creek field—													
Baldonnel													
Baldonnel-Charlie Lake													
Field totals													
Halfway field—													
Baldonnel	22,686			3,061		2,562	19,641	19,752	20,442	40,430	38,734	38,837	206,145
Halfway	26,767	22,333	17,005	10,279		3,465	1,136	7,398	8,736	20,624	12,080	17,388	147,211
Field totals	49,453	22,333	17,005	13,340		6,027	20,777	27,150	29,178	61,054	50,814	56,225	353,356
Highway field—													
Dunlevy	11,047	11,219	9,594	7,882	10,208	5,028		7,421	4,643	12,687	12,053	10,900	102,682
Baldonnel	8,747	7,601	4,482	7,894	8,780	1,221	7,337	9,827	3,465		1,440	2,244	63,038
Mississippian	36,205	30,497	11,170	30,261	41,815	8,579	32,966	53,470	419		2,646	7,309	255,337
Field totals	55,999	49,317	25,246	46,037	60,803	14,828	40,303	70,718	8,527	12,687	16,139	20,453	421,057
Jedney field—													
Gething												20,768	20,768
Upper Carbonate of Schooler Creek	980,050	887,733	1,105,812	679,944	532,994	598,469	591,647	431,379	333,617	912,161	665,038	873,974	8,592,818
Halfway	739,553	689,229	951,103	778,122	595,164	586,067	554,355	584,443	532,338	881,049	753,833	869,312	8,514,568
Field totals	1,719,603	1,576,962	2,056,915	1,458,066	1,128,158	1,184,536	1,146,002	1,015,822	865,955	1,793,210	1,418,871	1,764,054	17,128,154

Kobes-Townsend field—													
Dunlevy	115,612	97,091	116,014	120,215	73,329	52,241	21,553	106,441	6,403	37,811	96,073	115,970	958,753
Charlie Lake	101,069	121,861	157,876	107,631	52,139	64,792	59,348	160,598	59,095	100,957	149,473	142,066	1,276,905
Halfway	199,589	173,331	189,410	188,902	194,731	157,610	124,346	201,946	168,403	225,820	212,381	205,809	2,242,278
Mississippian	188,404	168,114	175,362	69,632		40,854	180,936	173,964	117,638	150,818	155,767	165,546	1,587,035
Field totals	604,674	560,397	638,662	486,380	320,199	315,497	386,183	642,949	351,539	515,406	613,694	629,391	6,064,971
Laprise Creek field—Upper Carbonate of Schooler Creek	1,255,379	1,121,646	1,324,397	1,094,428	961,643	765,326	544,353	596,122	1,267,097	926,058	976,054	1,256,541	12,089,044
Laprise Creek West field — Upper Carbonate of Schooler Creek	18,128	14,090	8,440	12,621	10,761	7,700	15,889	2,641	26,323	13,788	26,401	18,580	175,362
Montney field—													
Bluesky-Gething													
Charlie Lake													
Halfway	55,356	57,997	55,162	56,319	58,218	47,701	3,477	45,420	55,117	52,979	51,060	48,132	586,938
Field totals	55,356	57,997	55,162	56,319	58,218	47,701	3,477	45,420	55,117	52,979	51,060	48,132	586,938
Nig Creek field—Upper Carbonate of Schooler Creek	1,022,098	822,876	1,031,468	1,197,178	1,145,227	888,050	1,044,818	173,315	625,160	1,044,706	1,318,944	1,098,937	11,412,777
Parkland field—													
Upper Devonian	229,664	201,640	241,432	108,935		178,835	172,318	281,569	212,702	250,914	216,112	225,644	2,319,765
Wabamun								130,926	126,126	1,918	66,340	61,323	386,633
Field totals	229,664	201,640	241,432	108,935		178,835	172,318	412,495	338,828	252,832	282,452	286,967	2,706,398
Red Creek field—													
Charlie Lake	33,174	19,658	36,004	36,971	36,672	28,895	25,528	28,410	14,686		7,915	27,211	295,124
Halfway	26,167	1,590	11,622	28,919	27,203	21,202	25,700	29,874	9,516		21,841	37,712	241,346
Field totals	59,341	21,248	47,626	65,890	63,875	50,097	51,228	58,284	24,202		29,756	64,923	536,470
Rigel field—Gething	808,351	604,606	604,212	676,132	711,960	576,416	412,856	743,184	454,080	715,902	1,239,911	908,207	8,455,817
Snyder Creek field—Dunlevy	44,353	42,054	46,797	18,103	6,252	25,480	27,407	45,893	35,864	17,590	7,991	22,810	340,594
Stoddart field—Belloy	461,950	483,583	491,800	352,918	397,864	339,985	34,066	152,677	379,962	275,251	206,259	345,017	3,921,332
Other areas—													
Schooler Creek			22,765	18,090		29,946	10,128						80,929
Upper Carbonate of Schooler Creek						43,491	38,946	34,128	91,414	59,823	174,070	152,935	594,807
Baldonnel "A"													
Charlie Lake													
Halfway										16,179	10,715		26,894
Belloy								24,318	70,508	20,168	33,432	46,870	195,296
Areas totals			22,765	18,090		73,437	49,074	58,446	161,922	96,170	218,217	199,805	897,926
Totals	12,235,115	10,132,413	11,624,121	10,372,661	9,333,256	8,084,439	6,496,686	6,940,965	8,571,825	10,154,899	10,751,761	11,757,617	116,455,758

TABLE 13.—SUMMARY OF DRILLING AND PRODUCTION STATISTICS, 1963

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Drilling authorities—													
Issued.....	41	36	13	1	14	10	9	3	4	15	9	20	175
Cancelled.....		1				3							4
Wells spudded.....	37	35	23	1	4	17	8	6	3	13	11	16	174
Rigs operated during month.....	42	48	50	19	13	23	20	14	12	18	21	21	1 55
Rigs operating at month's end.....	35	42	18	6	12	15	10	9	6	12	11	13	
Development footage.....	58,752	54,736	48,586	5,367	2,319	40,891	39,098	18,991	13,376	35,548	25,484	33,150	376,298
Exploratory outpost footage.....	23,675	41,789	42,229	3,267	6,503	8,388	13,049	4,432	3,717	9,005	20,086	20,962	197,102
Exploratory wildcat footage.....	85,976	87,833	62,240	7,165	9,777	19,490	10,230	6,255	2,554	10,732	5,561	17,507	325,320
Total footage drilled.....	168,403	184,358	153,055	15,799	18,599	68,769	62,377	29,678	19,647	55,285	51,131	71,619	898,720
Wells abandoned.....	10	14	24	6	1	5	4	1	2	2	6	7	82
Service wells.....	1		1								1		3
Oil wells completed.....	2	8	6	1		3	2	2	1		2	4	31
Producible oil wells.....	358	367	376	377	375	378	381	384	384	384	386	389	389
Producing oil wells.....	336	341	351	347	346	350	302	280	350	352	351	350	
Production in barrels.....	1,065,841	985,797	1,102,609	906,250	1,165,534	1,107,114	851,031	914,838	1,131,451	1,121,626	1,065,414	1,110,976	12,528,681
Average daily production.....	34,382	34,135	35,575	30,208	37,598	36,904	27,453	29,511	37,715	36,182	35,514	35,838	
Gas wells completed.....	7	10	14	5	1	4	6	6	3	7	4	3	70
Producible gas wells.....	403	412	427	432	433	437	442	447	450	457	461	464	464
Producing gas wells.....	202	208	204	209	192	209	182	188	212	212	221	213	
Production in M s.c.f.....	12,235,115	10,132,413	11,624,121	10,372,661	9,333,256	8,084,439	6,496,686	6,940,965	8,571,825	10,154,899	10,751,761	11,757,617	116,455,758
Average daily production.....	394,681	361,872	374,972	345,753	301,073	269,481	209,571	223,902	285,724	327,577	358,392	379,278	

1 Rigs operated during 1963.

Each zone of a multiple completion is counted as one well.

TABLE 14.—MONTHLY CRUDE-OIL¹ DISPOSITION, 1963

(Quantities in barrels.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
<i>Field</i>													
Production	1,065,841	985,797	1,102,809	906,250	1,165,534	1,107,114	851,031	914,838	1,131,451	1,121,626	1,065,414	1,110,976	12,528,681
Opening inventory	38,998	39,413	36,137	41,298	44,958 ²	38,811 ²	46,414	53,125	54,321	43,440	33,849	36,854	38,998
Injection oil recovered	5,667	6,071	6,812	1,791	2,591	3,474	1,903	625	1,005	2,117	711	4,249	37,016
Other oil receipts	4,865	2,890	1,267	—	80	—	—	—	—	—	—	—	9,102
Losses and adjustments	1,353	—104	—55	171	1,917	119	—	—	—116	1	—	71	3,317 ³
Transfers and well-head sales	14,071	13,089	9,898	1,986	3,718	3,744	2,176	690	1,908	2,295	818	6,384	60,777
Closing inventory	39,413	36,137	41,298	45,063	38,665	46,414	53,126	54,321	43,440	33,849	36,854	36,784	36,784
Refinery sales	1,060,534	985,049	1,095,884	902,119	1,168,863	1,099,122	844,046	913,577	1,141,545	1,131,038	1,062,302	1,108,840	12,512,919
Total sales	1,074,605	998,138	1,105,782	904,105	1,172,581	1,102,866	846,222	914,267	1,143,453	1,133,333	1,063,120	1,115,224	12,573,696
Reporting adjustment	537	187	—496	—139	—2,007	—118	115	95	—379	—242	270	471	—1,706
<i>Transporters</i>													
Receipts—													
B.C. crude	1,059,997	984,862	1,096,380	902,258	1,170,870	1,099,240	843,931	913,482	1,141,924	1,131,280	1,062,032	1,108,369	12,514,625
B.C. plant condensate	81,252	54,299	80,805	49,323	52,164	38,558	39,118	39,275	57,838	50,923	53,465	53,285	650,305
Opening inventory	998,484	1,032,050	845,537	951,458	948,831	1,087,900	994,796	1,104,512	1,194,778	1,068,037	1,046,027	1,058,269	998,484
Losses and adjustments	29,079	3,308	—5,020	12,760	2,961	2,139	—3,028	—16,886	28,571	—14,663	9,879	—9,787	39,313
Closing inventory	1,032,050	845,537	951,458	948,831	1,087,900	994,796	1,104,512	1,194,778	1,068,037	1,046,027	1,058,269	1,129,607	1,129,607
Deliveries—													
B.C. refineries	935,226	1,141,563	998,207	753,815	1,003,193	1,192,521	738,595	829,800	1,154,414	1,059,622	1,007,738	1,019,008	11,833,702
Alberta	—	2,120	—	—	—	—	—	—	—	10,131	2,956	—	15,207
Export	143,378	78,683	78,077	187,633	77,811	36,242	37,766	49,577	143,518	149,123	82,682	81,095	1,145,585
Other	—	—	—	—	—	—	—	—	—	—	—	—	—
Total deliveries	1,078,604	1,222,366	1,076,284	941,448	1,081,004	1,228,763	776,361	879,377	1,297,932	1,218,876	1,093,376	1,100,103	12,994,494
Reporting adjustment	—	—2,323	1,407	317	—1,505	—2	101	—	—	—	1	—	—2,004
<i>B.C. Refineries</i>													
Receipts—													
B.C. crude	935,226	1,143,886	996,800	753,498	1,004,698	1,192,523	738,494	829,800	1,154,414	1,059,622	1,007,737	1,019,008	11,835,706
Alberta crude	1,471,228	1,146,272	1,542,710	1,535,327	1,494,001	917,935	689,512	654,095	1,071,077	1,136,394	1,237,683	1,310,561	14,206,795
Opening inventory	608,889	499,487	662,501	598,582	689,277	582,235 ⁴	596,764	559,628	747,744 ²	840,790	726,224	678,654	608,889
Losses and adjustments	668	487	660	—303	2,287	578	—26	—552	449	—307	—328	571	—121,038 ⁴
Closing inventory	499,487	662,501	598,582	689,277	585,811	596,764	559,628	618,946	840,790	726,224	678,654	538,645	538,645
Refinery runs	2,515,188	2,126,657	2,602,769	2,198,433	2,599,878	2,095,351	1,465,168	1,425,129	2,131,996	2,310,889	2,293,318	2,469,007	26,233,783

¹ Includes condensate delivered to transporters. For complete summary of condensate production and disposition see Table 15.² Amended.³ Includes inventory change of 40 by company.⁴ Includes inventory change of 125,222 by company.

TABLE 15.—MONTHLY NATURAL-GAS DISPOSITION, 1963

(Quantities in M s.c.f.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
<i>Field</i>													
B.C. production—													
Wet gas	11,954,557	9,875,983	11,324,352	10,202,005	9,292,338	7,899,522	6,311,339	6,495,990	8,215,865	9,868,721	10,429,809	11,429,905	113,300,386
Dry gas	280,558	256,430	299,769	170,656	40,918	184,917	185,347	444,975	355,960	286,178	321,952	327,712	3,155,372
Associated gas	1,192,791	1,090,633	1,374,808	1,216,591	1,588,030	1,598,022	1,273,633	1,478,592	1,721,971	1,628,801	1,543,614	1,585,478	17,292,964
Totals	13,427,906	11,223,046	12,998,929	11,589,252	10,921,286	9,682,461	7,770,319	8,419,557	10,293,796	11,783,700	12,295,375	13,343,095	133,748,722
Flared	1,111,560	1,007,444	1,286,188	1,099,854	1,442,824	1,497,576	1,143,745	1,326,558	1,510,086	1,469,917	1,377,890	1,416,086	15,689,728
Lease use	77,102	65,301	106,275	94,351	116,035	65,895	180,570	104,356	86,638	106,753	103,522	80,931	1,187,729
Metering difference	—222,244	—258,058	—237,626	—53,185	—83,917	—69,653	—202,834	8,612	—110,112	—154,895	—83,108	—24,538	—1,491,558
Delivered to gas-gathering system	12,461,488	10,408,359	11,844,092	10,448,232	9,446,344	8,188,643	6,648,838	6,980,031	8,807,184	10,361,925	10,897,071	11,870,616	118,362,823
Reporting adjustment	—11,496	3,596	22,270	21,769	9,553	77,379	15,128	—12,338	138,737	87,110	79,816	126,297	557,821
<i>Gas-gathering System</i>													
Received from B.C. producers	12,472,984	10,404,763	11,821,822	10,426,463	9,436,791	8,111,264	6,633,710	6,992,369	8,668,447	10,274,815	10,817,255	11,744,319	117,805,002
Line loss and metering difference													
Delivered to—													
Gas plants	12,205,949	10,151,249	11,525,447	10,259,200	9,397,112	7,927,352	6,449,320	6,550,002	8,314,453	9,990,636	10,495,303	11,419,331	114,685,354
Transporters	267,035	246,373	289,302	162,029	36,244	181,460	179,419	437,417	349,024	278,653	312,858	315,055	3,054,869
Distributors		7,141	7,073	5,234	3,435	2,452	4,971	4,950	4,970	5,526	9,094	9,933	64,779
<i>Gas Plants</i>													
Receipts from gathering system	12,205,949	10,151,249	11,525,447	10,259,200	9,397,112	7,927,352	6,449,320	6,550,002	8,314,453	9,990,636	10,495,303	11,419,331	114,685,354
Plant fuel	241,549	217,918	211,212	190,816	171,643	173,224	153,289	157,318	171,339	190,679	240,090	265,011	2,384,088
Processing shrinkage	562,464	428,648	556,787	496,736	451,365	419,819	353,821	318,805	348,589	517,235	488,859	545,344	5,488,472
Plant waste and metering difference	666,943	673,379	513,715	286,136	283,330	206,409	280,487	225,907	339,841	203,782	402,692	256,816	4,339,437
Marketable residual gas	10,734,993	8,831,304	10,243,733	9,285,512	8,490,774	7,127,900	5,661,723	5,847,972	7,454,684	9,078,940	9,363,662	10,352,160	102,473,357
<i>Transporters</i>													
Receipts—													
Residual gas from plants	10,734,993	8,831,304	10,243,733	9,285,512	8,490,774	7,127,900	5,661,723	5,847,972	7,454,684	9,078,940	9,363,662	10,352,160	102,473,357
Dry gas from gathering system	267,035	246,373	289,302	162,029	36,244	181,460	179,419	437,417	349,049	278,653	309,980	315,055	3,052,016
Alberta dry gas	3,537,571	2,960,630	2,718,605	2,449,293	1,963,239	1,575,508	2,939,134	3,072,451	2,696,941	2,627,671	3,477,404	3,624,850	33,643,297
Totals	14,539,599	12,038,307	13,251,640	11,896,834	10,490,257	8,884,868	8,780,276	9,357,840	10,500,674	11,985,264	13,151,046	14,292,065	139,168,670
Reporting adjustment	288,392	269,574	191,223	247,236	127,606	37,726	—3,713	275,692	362,677	213,964	230,072	334,944	2,575,393
Deliveries to B.C. distributors—													
North-east	300,086	233,342	226,194	151,007	120,826	80,464	70,917	72,632	99,742	149,284	251,308	272,657	2,028,459
Interior	1,284,828	948,563	924,977	748,720	657,977	547,041	558,975	592,162	597,394	821,664	1,046,224	1,207,188	9,935,713
Lower Mainland	3,283,974	2,200,247	2,578,366	2,180,374	1,529,407	1,262,594	1,174,561	1,175,828	1,246,486	2,172,406	2,728,851	3,140,879	24,673,973
Totals	4,868,888	3,382,152	3,729,537	3,080,101	2,308,210	1,890,099	1,804,453	1,840,622	1,943,622	3,143,354	4,026,383	4,620,724	36,638,145

Deliveries to export—														
B.C. gas	7,215,240	6,306,277	7,443,754	6,840,254	6,582,548	5,757,664	4,663,899	4,876,678	6,179,899	6,775,575	6,582,843	7,022,078	76,246,709	
Alberta gas	2,167,079	2,080,304	1,887,126	1,729,243	1,471,893	1,199,379	2,315,637	2,364,848	2,014,476	1,852,371	2,311,748	2,314,319	23,708,423	
Total deliveries	14,251,207	11,768,733	13,060,417	11,649,598	10,362,651	8,847,142	8,783,989	9,082,148	10,137,997	11,771,300	12,920,974	13,957,121	136,593,277	
Reporting adjustment	2,936	—3,865	—12	23	773	—5,193	—5,908	—6,461	—3,476	—8,685	—1,248	—210	—31,326	
<i>B.C. Distributors</i>														
Received from transporters	4,865,952	3,386,017	3,729,549	3,080,078	2,307,437	1,895,292	1,810,361	1,847,083	1,947,098	3,152,039	4,027,631	4,620,934	36,669,471	
Received from gathering system		7,141	7,073	5,234	3,435	2,452	4,971	4,950	4,970	5,526	9,094	9,933	64,779	
Losses and adjustments	306,939	—85,307	57,654	9,390	—64,757	—16,539	42,694	52,046	79,715	249,527	273,813	220,220	1,125,395	
Deliveries to consumers—														
Residential	2,253,868	1,534,814	1,572,795	1,209,978	735,353	489,331	388,554	338,552	389,691	846,001	1,665,654	2,035,772	13,460,363	
Commercial	685,735	561,033	516,531	387,829	271,470	194,128	157,429	148,834	165,055	290,094	493,291	663,212	4,534,641	
Industrial	1,619,410	1,382,618	1,588,740	1,524,295	1,368,806	1,230,824	1,226,655	1,312,601	1,317,607	1,771,943	1,603,967	1,711,663	17,659,129	
Total sales	4,559,013	3,478,465	3,678,066	3,122,102	2,375,629	1,914,283	1,772,638	1,799,987	1,872,353	2,908,038	3,762,912	4,410,647	35,654,133	
Reporting adjustment			902	—46,180									—45,278	

TABLE 16.—MONTHLY NATURAL-GAS LIQUIDS AND SULPHUR DISPOSITION, 1963

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
<i>Condensate/Pentanes Plus</i>													
Production (bbl.)—													
Field	344	931	745	360	1,853	347	418	577	1,399	978	2,044	3,675	13,671
Plant	93,381	73,410	82,773	75,508	68,736	55,122	52,037	46,133	65,695	85,100	69,372	74,473	841,740
Opening inventory	24,931	16,639	20,212	7,936	14,342	27,456	19,320	25,226	10,730	17,096	19,186	18,644	24,931
Receipts													
Losses and adjustments	-2,448	-4,133	-3,242	-1,204	-2,965	-2,737	-2,296	-2,220	-2,780	-3,313	-1,853	-2,431	-31,622
Transfers		350	325	50							100	295	1,120
Closing inventory	16,639	20,212	7,936	14,342	27,456	19,320	25,226	10,730	17,096	19,186	18,644	25,801	25,801
Sales—													
British Columbia—													
North-east B.C. refineries	22,505	17,131	17,753	20,941	8,149	27,757	9,727	24,151	5,493	36,083	20,395	19,196	229,281
Other B.C. refineries	708	376	153	352	127	27			177	255	39	646	2,860
Alberta													
Export	81,252	57,044	80,805	49,323	52,164	38,558	39,118	39,275	57,838	50,963	53,277	53,285	652,902
Total sales	104,465	74,551	98,711	70,616	60,440	66,342	48,845	63,426	63,508	87,301	73,711	73,127	885,043
<i>Butane</i>													
Production (bbl.)—													
Plant	39,149	35,100	33,519	33,063	30,071	28,202	28,872	31,331	32,350	39,934	37,614	39,882	409,087
Refinery	21,494	15,787	16,545	8,096	9,106	8,691	3,446	1,250	12,125	16,514	21,106	19,026	153,186
Opening inventory	7,008	12,229	11,227	13,943	12,597	13,809	13,037	8,868	6,044	5,803	5,459	6,787	7,008
Losses, transfers, consumed	17,755	17,195	22,487	17,078	28,476	29,117	31,646	26,595	20,967	26,560	31,193	31,145	300,214
Closing inventory	12,229	11,227	13,943	12,597	13,809	13,037	8,868	6,044	5,803	5,459	6,787	11,354	11,354
Sales—													
British Columbia	16,820	13,283	15,765	9,863	7,996	8,047	4,348	7,823	10,859	12,396	18,399	12,760	138,359
Alberta	291	442	501	233				987	696	214			3,364
Export	20,556	20,969	8,595	15,331	1,493	501	493		12,194	17,622	7,800	10,436	115,990
Total sales	37,667	34,694	24,861	25,427	9,489	8,548	4,841	8,810	23,749	30,232	26,199	23,196	257,713
<i>Propane</i>													
Production (bbl.)—													
Plant	26,612	24,415	17,582	16,343	12,996	13,079	9,391	9,291	14,740	16,178	20,265	24,270	205,162
Refinery	25,884	21,190	25,205	14,767	20,622	17,305	20,229	24,667	14,214	19,917	25,306	27,301	256,607
Opening inventory	3,923	1,660	2,698	5,645	4,747	2,219	2,873	4,458	3,603	2,475	3,366	2,889	3,923
Losses, transfers, consumed	588	—1	1,465	3,493	552	90	—296	1,167	394	830	951	3,206	12,439
Closing inventory	1,660	2,698	5,645	4,747	2,219	2,873	4,458	3,603	2,475	3,366	2,889	4,978	4,978

Sales—													
British Columbia	45,736	36,468	28,031	24,736	27,723	23,545	23,144	20,424	24,522	30,008	39,177	40,808	373,322
Alberta	4,769	2,704	2,105	828	871	2,046	1,495	492	1,467	1,092	1,490	1,520	20,879
Northwest Territories	396	130	406	227	99	288	520	129	521	266	473	270	3,725
Yukon	1,079	1,102	721	1,217	334	1,223	1,057	698	1,436	559	1,660	776	11,862
Export	2,191	4,164	7,112	1,507	6,567	2,538	2,115	2,903	1,742	2,449	2,297	2,902	38,487
Total sales	54,171	44,568	38,375	28,515	35,594	29,640	28,331	33,646	29,688	34,374	45,097	46,276	448,275
<i>Sulphur</i>													
Production (short tons)	6,396	4,506	6,644	5,952	5,270	5,279	4,015	3,838	3,502	5,510	4,330	5,130	60,372
Opening inventory	111,914	112,675	111,580	112,289	111,148	108,796	108,465	106,092	104,218	101,016	99,958	98,747	111,914
Losses and adjustments													
Closing inventory	112,675	111,580	112,289	111,148	108,796	108,465	106,092	104,218	101,016	99,958	98,747	96,487	96,487
Sales—													
British Columbia	1,383	1,808	2,190	2,072	2,632	1,747	2,291	2,095	1,786	1,997	2,206	1,974	24,181
Export	4,252	3,793	3,745	5,021	4,990	3,863	4,097	3,617	4,918	4,571	3,335	5,416	51,618
Total sales	5,635	5,601	5,935	7,093	7,622	5,610	6,388	5,712	6,704	6,568	5,541	7,390	75,799

TABLE 17.—MONTHLY VALUE OF CRUDE OIL, NATURAL GAS, NATURAL-GAS LIQUIDS, AND SULPHUR TO PRODUCER, 1963

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Crude oil	\$2,034,053	\$1,913,491	\$2,124,932	\$1,722,948	\$2,366,055	\$2,220,527	\$1,694,691	\$1,832,508	\$2,321,954	\$2,293,633	\$2,153,254	\$2,249,540	\$24,927,586
Natural gas	1,114,092	920,784	1,069,101	956,740	868,016	744,663	597,990	638,759	792,046	950,397	982,458	1,084,252	10,719,298
Products—													
Natural-gas liquids ¹	\$79,637	\$66,029	\$73,650	\$62,034	\$61,434	\$46,552	\$47,983	\$45,253	\$62,690	\$72,544	\$54,525	\$60,421	\$732,752
Sulphur	8,884	4,383	10,195	7,239	4,832	3,060	4,795	3,814	3,347	5,134	3,461	4,855	63,999
Totals	\$88,521	\$70,412	\$83,845	\$69,273	\$66,266	\$49,612	\$52,778	\$49,067	\$66,037	\$77,678	\$57,986	\$65,276	\$796,751
Total values	\$3,236,666	\$2,904,687	\$3,277,878	\$2,748,961	\$3,300,337	\$3,014,802	\$2,345,459	\$2,520,334	\$3,180,037	\$3,321,708	\$3,193,698	\$3,399,068	\$36,443,635

¹ Includes condensate/pentanes plus, butane, and propane.

NOTE.—This statement includes amendments received up to March 20, 1964.

TABLE 18.—NATURAL-GAS PIPE-LINES, 1963

Company	Source of Natural Gas	Transmission-lines		Compressor Stations		Present Daily Capacity (M S.C.F.)	Gathering and Distribution Lines		Areas Served by Distributors
		Size (In.)	Mileage	Number	Horse-power		Size (In.)	Mileage	
British Columbia Hydro and Power Authority	Westcoast Transmission Co. Ltd.	30	18.0	—	—	188,000	—	2,625.9	Lower Mainland of British Columbia.
		24	12.0	—	—	—	—	—	
		20	13.6	—	—	—	—	—	
		18	36.0	—	—	—	—	—	
		12	25.0	—	—	—	—	—	
Columbia Natural Gas Ltd.	Alberta Natural Gas Co. Ltd.	6	37.7	—	—	17,130	8	1.7	Cranbrook, Fernie, Kimberely, Chapman Camp, Creston, Marysville.
		4	11.2	—	—	—	6	2.4	
		3	27.7	—	—	—	4	5.4	
		2	0.5	—	—	—	3	9.2	
		—	—	—	—	—	2	20.2	
Gas Trunk Line of British Columbia Ltd.	Beg field	—	—	—	—	—	1½	25.2	To Westcoast Transmission Co. Ltd.
		—	—	—	—	—	16	27.4	
		—	—	—	—	—	6½	5.9	
		—	—	—	—	—	16	31.4	
		—	—	—	—	—	12¾	31.5	
Inland Natural Gas Co. Ltd.	Westcoast Transmission Co. Ltd.	—	—	—	—	—	10¾	7.0	Okanagan and West Kootenay areas.
		—	—	—	—	—	12¾	23.8	
		12	152.8	—	—	50,000	16	28.3	
		10	116.0	—	—	—	8	12.2	
		8	15.6	—	—	—	6	18.3	
Northland Utilities (B.C.) Ltd.	Peace River Transmission	6	33.4	—	—	—	4	54.4	Dawson Creek, Pouce Coupe, and Rolla.
		4	70.2	—	—	—	3	31.6	
		2	5.2	—	—	—	2	280.0	
		—	—	—	—	—	1½	20.7	
		—	—	—	—	—	1¼	14.6	
Plains Western Gas & Electric Co. Ltd.	Westcoast Transmission Co. Ltd.	—	9.4	—	—	9,400	—	48.8	Fort St. John, Annesfield, and Taylor.
		6	0.3	—	—	—	4	6.9	
		4	10.8	—	—	—	3	1.3	
		3	5.7	—	—	—	2	21.6	
		2	0.3	—	—	—	1½	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	
		—	—	—	—	—	10¾	2.7	
Sun Oil Co. Ltd. (low-pressure system)	Blueberry field	—	—	2	1,495	15,000	8¾	4.9	To Westcoast Transmission Co. Ltd.
		—	—	—	—	—	6¾	2.8	
		—	—	—	—	—	4½	0.6	
		—	—	—	—	—	3½	1.6	
		—	—	—	—	—	—	—	

TABLE 18.—NATURAL-GAS PIPE-LINES, 1963—Continued

Company	Source of Natural Gas	Transmission-lines		Compressor Stations		Present Daily Capacity (M S.C.F.)	Gathering and Distribution Lines		Areas Served by Distributors
		Size (In.)	Mileage	Number	Horse-power		Size (In.)	Mileage	
Sun Oil Co. Ltd.	Buick Creek field	—	—	1	495	15,000	8 6 4	1.5 1.0 1.2	To Westcoast Transmission Co. Ltd.
Westcoast Transmission Co. Ltd.	McMahon Plant and 26-inch line from Alberta	30	646.6	5	64,600	450,000 ¹	—	—	To Plains Western Gas & Electric Co. Ltd., Inland Natural Gas Co. Ltd., British Columbia Hydro and Power Authority, and export to the United States.
	Alberta	26	32.5	—	—	215,000	—	—	
	Alaska Highway system	—	—	—	—	—	26 20 18	37.5 19.3 17.9	
	Blueberry West field	—	—	—	—	—	12¾	9.9	
	Boundary Lake field	—	—	—	—	—	8¾	6.7	
	Buick Creek field	—	—	—	—	—	16	0.5	
	Buick Creek East field	—	—	—	—	—	10¾	5.6	
	Buick Creek West field	—	—	—	—	—	8	6.6	
	Dawson Creek field	—	—	1	1,980	—	20	16.2	
	Fort St. John field	—	—	1	2,640	—	8½	5.4	
	Fort St. John Southeast field	—	—	—	—	—	18	7.8	
	Gundy Creek field	—	—	—	—	—	10¾	0.9	
	Kobes-Townsend field	—	—	1	6,000	—	8¾	0.7	
	Montney field	—	—	—	—	—	12¾	4.0	
	Parkland field	—	—	—	—	—	10¾	6.1	
	Red Creek field	—	—	—	—	—	12¾	18.9	
	Rigel field	—	—	—	—	—	8¾	5.5	
	Stoddart field	—	—	—	—	—	4½	7.4	
		—	—	—	—	—	8¾	6.6	
		—	—	—	—	—	4½	2.9	
		—	—	—	—	—	{ 12¾ }	19.9	
		—	—	—	—	—	{ 10¾ }	—	
		—	—	—	—	—	8¾	6.3	

¹ Minimum.

TABLE 19.—GAS-PROCESSING PLANTS, 1963

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		
Pacific Petroleum Ltd.	Taylor	All B.C. producing gas-fields except Parkland, 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.
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. treating absorption, condensate stabilization.	1962	10	9.5	Condensate	Westcoast Transmission Co. Ltd.

TABLE 20.—SULPHUR PLANTS, 1963

Name	Location	Raw Material	Principal Product	Capacity (Long Tons per Day)	Remarks
Jefferson Lake Petrochemical Co. of Canada Ltd.	Taylor	Hydrogen sulphide	Sulphur	300	Began operation in November, 1957.

TABLE 21.—CRUDE-OIL PIPE-LINES, 1963

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.....	8½	62.8	}	1	12,000	12,000	26.59	74,800
		12¾	2.2						
Trans-Prairie Pipelines (B.C.) Ltd..	Beaton River, Beaton River West, Boundary Lake,	4½	15.0	}	1	36,000	{ 52,000 ¹ 24,000 ² }	42.8	150,000
	Milligan Creek, Peejay,	6½	24.3						
	Peejay West, Wildmint.	8½	103.0						
Western Pacific Products and Crude Oil Pipelines Ltd.		12	505		6	45,000	45,000	33,575	340,000

¹ Boundary Lake.² Terminal to Western Pacific Products and Crude Oil line.

TABLE 22.—CRUDE-OIL REFINERIES, 1963

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.	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.
Royalite Oil Co. Ltd. ¹	Kamloops	Comp.	1954	B.C.	5,000	460,000	Catalytic-fluid	1,400	Catalytic polymerization, catalytic reformer, naphtha hydrogen treater, distillate hydrogen treater, merox.
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.
Standard Oil Co. of British Columbia Ltd.	North Burnaby	Comp.	1936	B.C. and Alberta	18,000	1,441,500	Thermal visbreaking	3,000	Catalytic polymerization, catalytic reformer, lube-oil blending plant, asphalt.
Pacific Petroleum Ltd.	Taylor	Comp.	1957, 1961	B.C.	3,500	400,000	Catalytic-fluid	1,700	Alkylation, asphalt, pentane splitter, platformer, unifiner.

¹ Figures for Royalite 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

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FATAL ACCIDENTS

During 1963 there were 10 fatal accidents connected with lode mines, placer mines, and quarries. This compares with the average for the past 10 years of 9.9.

The following table shows the mines at which fatal accidents occurred during 1963, with comparative figures for 1962:—

Mine or Place	Mining Division	Number of Fatal Accidents	
		1963	1962
Bralorne.....	Lillooet.....	1	—
Britannia.....	Vancouver.....	1	—
Capilano Crushing Co.....	Vancouver.....	—	1
Cassiar.....	Liard.....	2	1
Clayburn.....	New Westminster.....	—	1
Craigmont.....	Nicola.....	—	1
Estella.....	Fort Steele.....	1	—
Glacier Gulch.....	Omineca.....	—	1
Granduc.....	Skeena.....	—	1
Jedway.....	Skeena.....	1	—
Sullivan.....	Fort Steele.....	1	2
Texada.....	Nanaimo.....	3	—
Zeballos Iron.....	Alberni.....	—	1
Totals.....		10	9

The following table classifies fatal accidents as to cause and location:—

Cause	Number	Location
Falls of person	2	Underground.
Falls of rock	1	Underground.
Explosives	3	(¹)
Run of muck	2	Underground.
Snowslide	1	Surface.
Vehicles	1	Surface.
Total	10	

¹ Two surface, one underground.

A description of all fatal accidents follows.

Allan Smith, aged 32, married, and employed as a tractor operator at the Cassiar open-pit asbestos mine of Cassiar Asbestos Corporation Limited, suffocated some time between 6.45 and 10.45 p.m. on January 6, 1963, when buried in a snowslide while operating a bulldozer to plough snow on one of the mountainside roads which service the mine installations.

There were no witnesses. Smith was last seen at 5.30 p.m., when the area was visited by the shiftboss. At 6.45 p.m. the mine foreman checked the area and noticed that a fresh snowslide had come down to block the road for 120 feet. Visibility was poor as it was snowing and the wind was blowing. A check was made to determine if Smith had moved the bulldozer elsewhere, and when it was not found the slide area was searched. At 8 p.m. a piece of steel pipe was found sticking out of the snow in the slide area about 60 feet below the road. This was part of the tractor canopy which had separated from the tractor. A rescue party was then organized, which found the tractor upside down under 3 feet of snow. Further probing found the body of the tractor operator 37 feet down the slope from the tractor in a head-down position and covered by 3 to 4 feet of snow. The time was 10.45 p.m. Mouth-to-mouth respiration was attempted, but when the doctor arrived a short time later, death was pronounced. There were no broken bones or internal injuries, and death was determined as due to asphyxia.

The inquest jury returned a verdict of accidental death and recommended that when such road work is being done, another workman, driving a vehicle equipped with two-way radio, should be on site.

Joseph Berths, aged 29, single, and employed as a miner at the Bralorne mine of Bralorne Pioneer Mines Limited, was killed by a fall of ground in a stope about 2 p.m. on February 22nd.

The stope in question was of the cut-and-fill type, averaging about 6 feet in width and inclined at 65 to 70 degrees. On the day of the accident the deceased, together with a lead miner and a helper, was engaged in backfilling the stope. Waste was dropped down the fill raise from the level 30 feet above the stope and scraped to one side of the raise. When this side of the stope was filled, the slusher was moved to a new position in preparation to fill the other side of the stope. Berths was in the act of moving the slusher block from the brow of the raise when a fall of ground occurred at this brow. The other two men were on the level above and were able to shout a warning, but Berths was unable to avoid a further fall and was partially buried. He was freed quickly but rapidly lost consciousness, and although mouth-to-mouth artificial respiration was applied, it seemed likely he was dead within five minutes of the accident. Death was confirmed by the doctor at 3.15 p.m. A subsequent autopsy disclosed the cause of death as being due to internal hæmorrhage and asphyxia. A heavy blow on the back had fractured a number of ribs and

ruptured the deceased's diaphragm, causing the stomach and internal organs to move up into the chest cavity. An important vein was ruptured, causing severe internal bleeding.

The fall of ground amounted to about 10 tons. The ground in the vicinity of the raise had not been considered good. The stope generally was well supported with plenty of stulls and posts. The vein itself was rock bolted up to a few feet of the brow of the raise. The brow where the fall occurred would be the weakest part of the stope, but it had been checked by the lead miner at the start of the shift and it had sounded solid then. The shiftboss visited the stope about three hours previous to the accident, and no signs of fractures or loose rock were observed in his examination of the brow of the raise at that time.

The jury of the inquest rendered a verdict of accidental death with no blame attached to anyone, but recommended that "posts or square-sets be set at the brow of this raise and all other similar raises where workmen must pass" and, further, "that all new underground employees be thoroughly familiarized with all working conditions in the mine before being assigned to any working place."

The second recommendation of the jury refers to the fact that it was the first shift of the deceased at this mine. Berths did have about five years' underground experience and had previously worked as a miner in an Ontario mine.

Eric Egon Blatt, aged 50, married, and employed as a scraperman at the Britannia mine of The Anaconda Company (Canada) Ltd., was fatally injured about 7.30 p.m. on March 13th when he fell into an ore-pass.

On the day of the accident Blatt was bringing down ore from a draw point in a scraper drift and passing it through a grizzly directly in front of the draw point. He was accompanied by another scraperman, who was working another draw point about 30 feet away. Both draw points became blocked, and blasting became necessary. After lighting the fuses, Blatt went to one end of the scraper drift and his partner went to the sublevel below to guard the blasting operation. The partner heard the shots detonate and the blasting whistle shut off shortly after, presumably by Blatt. He started to eat his lunch, and while doing so heard a run of muck in the ore-pass below the grizzly which serves the scraper drift. On returning to the scraper drift he could not locate Blatt but presumed he had left the area. About an hour later he checked Blatt's lunch bucket, and when he found it intact he contacted the shiftboss. A search located the deceased 450 feet down the ore-pass below the grizzly. There was no sign of life. Death was attributed to extensive brain damage and multiple body bone and skull fractures.

Blatt had apparently fallen through an opening in the grizzly. These openings, if clear of rock, are 18 inches wide by 7 feet long. However, when Blatt's partner returned to the scene after the blast there was only an opening 18 inches wide by 2 feet long, the remainder of the grizzly being covered by a plank and large boulders of ore.

The deceased had been employed at Britannia for five years and for at least two years as a scraperman. He was considered to be competent. Safety belts were available at the nearby slusher hoist. The jury of the inquest returned a verdict of accidental death and recommended "a tightening up on safety in scraper drifts."

William Leonard Roach, aged 50, miner, and *Maurice George Gaudet*, aged 26, mechanic, were killed on March 14th by a premature blast on one of the waste dumps of Texada Mines Ltd.

Roach, Gaudet, and another workman were attempting to drive out, by means of explosives, the shaft of a front idler sprocket of a model 80-D Northwest shovel. Half-stick charges of explosives, using No. 0 S.P. caps, were being fired by a Shot

King blasting-machine set up about 200 feet away. The charges were placed on the shaft end with a mud pack, which was built up on the sprocket and shaft end and over the charge. The shaft and sprocket assembly were placed on a stand to permit the release of the shaft on its being driven through. Four half-stick charges were fired separately, commencing about 10.30 p.m. while the foreman was present. After the foreman had left for other duties, Roach and Gaudet were placing a fifth charge when a blast occurred, instantly killing Gaudet and fatally wounding Roach, who died within half an hour of the blast. The other workman was injured but was able to make his way to a nearby machine-shop to give warning of the accident. The time was about 11.20 p.m.

An examination of the blasting-site immediately following the accident revealed that the blasting lead wires were connected to the blasting-machine, and that a portion of a red plastic-covered leg wire was on the idler sprocket. Subsequently it was found that a yellow leg wire was attached to one of the lead wires. The survivor of the accident had difficulty remembering details, but there is some evidence that Roach and Gaudet were immediately over the shaft and in the process of wiring up the cap wires to the lead wires when the explosion occurred.

Premature detonation could have been caused by an electrical storm, stray currents from cap lamps or a nearby power-line, mishandling of cap or powder, or an overheated shaft due to previous blasting. All these possibilities were investigated and found to be highly improbable. The most likely source of ignition was the blasting-box, especially as it was connected to the lead wires. Tests made with this box found that the firing button could remain in the firing position and, if so, another shot could still be fired through the lead wires 13 minutes after one shot had been fired. This condition was found to be the result of a defective resistor within the box that failed to drain off any residual voltage as it had been designed to do.

Blasting procedure was at fault in that the firing-cables were not disconnected from the blasting-box and short circuited while men were in the area of the blast. A defective blasting-box added to the possibility of accident. Permission for the use of this blasting-machine was withdrawn, but was later reinstituted when suitable modifications to the machine were made.

The inquest jury brought in a verdict of accidental death and recommended "that unconventional blasting operations be done under the supervision of a proper authority who will not participate in the actual work."

Murray B. McLeod, aged 47, married, and employed as a miner at the Sullivan mine of The Consolidated Mining and Smelting Company of Canada, Limited, was injured by burns on May 15th and died in hospital on June 8th.

McLeod and another miner were working in a scraper drift which had several draw points to a stope above. The ore in the stope had been broken by 45 tons of explosives in February, 1962, and some heating of the ore had taken place due to spontaneous combustion of the sulphide in the ore. On May 15, 1963, the ore being drawn into the scraper drift was reported as being hot but not excessively so. The men were required to wear respirators to protect against any hot dusty conditions and were wearing these on May 15th while they were endeavouring to bar down muck which had hung up in a draw-hole. Suddenly there was an outburst of hot air and dust from the draw-hole that completely enveloped the two workmen as they attempted to run to safety. McLeod's mask was momentarily dislodged when he stumbled, but he reported holding his breath while readjusting the apparatus. Both men were burned about the lower part of the body from the knees to the waist and also received severe burns to the hands and face. Both were taken to hospital. Both responded to treatment and skin grafting. McLeod's partner was discharged in about two weeks after the accident, but McLeod, who was burned up to 40 per

cent of his body area, required further treatment. On the morning of June 8th he suffered a setback in recovery. It was diagnosed he was hæmorrhaging from an acute ulcer in the stomach. Blood transfusions were given, but he became progressively worse and died in the evening at 9 p.m. It was the medical opinion that death was due to blood loss from a bleeding duodenal ulcer, and that such ulcer had been recently formed as a result of the burns. The possibility of inhaling fumes did not have a bearing on the formation of the ulcer.

Hot muck conditions have occurred for the past several years in certain areas of the Sullivan mine and are usually observed several months after a large quantity of explosives has been used to break a large tonnage of ore. The ore is then drawn as quickly as possible to slow down the heating and to prevent any cementing of the broken ore. Products of heating are traces of sulphur dioxide and fine oxide dust. No sudden release of hot air and dust had been experienced prior to the present incident. It is presumed there was a further hang-up above the muck the men were barring, and that this had suddenly been released to force out hot air and dust which had accumulated between the two hang-ups.

The jury of the inquest ruled the event an unforeseen accident and attached no blame to anyone. The jury recommended "that miners in slusher drifts consult their immediate supervisors when any doubt exists in the procedure of bringing down draw-holes that are hung up." And, further, "(a) the procedure being followed at present of leaving excessively hot draw-holes to cool off be carried on; (b) an immediate follow-up in regard to suitable protective clothing and equipment in conjunction with the B.C. Department of Mines and Petroleum Resources as indicated at this inquest."

Marvin E. Ulmer, aged 28, married, and employed by Temiskaming-Inspiration, was killed in an underground blasting accident on July 6th at the Texada mine of Texada Mines Ltd.

Ulmer and his partner had drilled a 37-hole round and had loaded 33 holes for blasting, with double priming in one lifter because of water issuing from that hole. Ten-foot tape fuses with ignitor-cord connectors were used to prime the 8-foot holes. The four holes not loaded were part of the burn cut. Thermalite ignitor cord, Type B, which has a burning speed of approximately 16 seconds per foot, was used and was connected to the ignitor-cord connectors.

Ulmer commenced lighting the ignitor cord, but according to his partner was experiencing difficulties in keeping it lit. As Ulmer's lighter burned out, he asked his partner for his matches and lighter. Apparently his partner was standing by the locomotive about 50 feet from the face and was smoking a cigarette when Ulmer called to him to bring the cigarette to help him light the cord. They lit the remainder of the cord and started to run away from the face, Ulmer being on the east or cut side of the drift and his partner on the west. While Ulmer was passing the locomotive, the cut holes exploded. The force of the blast was directly onto Ulmer's back and propelled him farther down the drift. The partner was struck by flying rock and suffered a fractured right ankle but was able to crawl out and give warning of the accident. A rescue team brought Ulmer out, but he died in the stretcher while being transported to the surface, approximately 15 minutes after the accident took place. He had received massive injuries to his lower back, and his right arm was almost severed at the elbow. Cause of death was attributed to loss of blood and shock.

In the investigation of the accident, the broken muck was hand-mucked in an effort to find all fuse, ignitor-cord connectors, etc., that might have been involved in the accident. Partly burned lengths of ignitor cord were found, which would indicate

that the function of the cord had failed, either by a manufacturing defect or by abusive use. A number of tests were made on cord having the same serial number as that used at the time of the blasting accident, and, short of kinking the cord, pulling the kink out, and then leaving the cord in water, no other means of abuse produced a failure in the cord's function. The kinks were produced by pulling the cord rapidly sideways from the box. In one box the outer end of the cord was in front of the box window, and when drawn out it kinked immediately.

An inquest jury found that death was due to a misjudgment on the part of the deceased in returning to the face to relight the ignitor cord or thermalite. It recommended "more care should be used when using thermalite cord and all cord should be checked for kinks, that mining operations should have safety meetings and make sure all blasters are familiar with safety regulations" and, further, "that shiftbosses should check on all blasters and make sure they are following all safety regulations."

James Fraser, aged 53, single, and employed as a miner at the Estella mine of Copper Soo Mining Company Limited, was injured about 10 p.m. on August 5th by a fall into an ore-pass and died in the Cranbrook hospital at 1.45 a.m. on August 6th.

The accident occurred in a two-compartment raise known as the Rover raise and took place while Fraser and his partner were moving a quantity of material from a sublevel off the raise to another sublevel 25 feet above. The partner was on the upper sublevel hoisting the material by means of a hemp rope, and Fraser was at the lower sublevel attaching the material. After making four hauls (two stopers and two long planks) the partner heard what sounded to be a number of drill steels sliding down the raise. He shouted to Fraser, and on receiving no response he investigated and found his partner had fallen down the chute compartment of the Rover raise, about 100 feet, coming to rest on broken ore. Help was obtained and Fraser was transported to the Cranbrook hospital, arriving about one-half hour later at 10.30 p.m. He was conscious but not in a fit state to make a statement as he was suffering from severe and extensive chest injuries. He died at 1.45 a.m. on August 6th, with death determined as due to multiple chest injuries with hæmorrhage into both pleural cavities and into the mediastenum.

The deceased's partner was positive nothing fell from above which would have struck the deceased. Four drill steels were found at the bottom of the chute, and thus it could be assumed Fraser slipped or stumbled when he was attaching the steel rods to the hemp rope. The opening through which he fell had previously been protected by two planks, a ladder, and a stull, but after the accident only the ladder and stull were in place. Apparently the deceased had removed the two planks to send up to his partner, possibly intending to replace these by other planks nearby in the sublevel.

The inquest jury brought in a verdict of accidental death with no blame attached to anyone.

Raymond Giroux, aged 23, single, and employed as a mucking-machine operator at the Harriet Harbour mine of Jedway Iron Ore Limited, was fatally injured when buried on December 1st at about 1.45 p.m. by a large run of ore from the main ore-pass on the 150 level.

The 150 level is the haulage adit. A 70-degree ore-pass raise, 730 feet in length, extends from this adit to a point on the surface near the primary ore crusher. On the 150 level there is a stub drift 40 feet in length driven to the footwall side of the raise. At the end of this drift a raise, 40 feet in length, had been driven to tap the ore-pass for drainage purposes. It was in this stub drift that the accident occurred.

About a month previous to the accident a ditch on surface broke its channel and water drained into the ore-pass. No more ore was allowed to be dumped into

the ore-pass, and a safety procedure was instituted to draw the wet muck out of the ore-pass. This consisted of spragging the chute on the 150 level closed, and allowing the ore to spill into the stub drift from the drainage raise. A slusher was then set up and the muck removed to a point where it could be safely handled by a mucking-machine. This was the procedure until November 29th, when it was observed that markers thrown into the top of the ore-pass the day previous had appeared in the scraper muck below. The volume of the ore removed also indicated that the ore-pass should be empty. It was then decided to clean up the stub drift with the mucking-machine, and this is what the deceased and his helper were doing on December 1st. They had reached a point about 15 feet from the drainage raise when there was a sudden rush of wet muck from the drainage raise. Both men ran for safety but became separated at the junction of the stub drift with the main drift. The flowing muck pushed the mucking-machine, mine cars, and locomotive out toward the portal. The last car became derailed at the junction switch and apparently trapped and crushed Giroux against the side of the drift. He was then buried by the muck, which flowed another 120 feet toward the portal. His partner escaped with minor injuries, but it was not until December 3rd that Giroux's body was recovered. The multiple injuries he had received to his head, neck, and chest indicated death was instantaneous.

The inquest jury brought in a verdict of accidental death with no blame attached to any individual. A recommendation was added that the drift be cleaned up by the method of slushing and mucking until the chute is empty.

The jury's recommendation is in line with the safety procedure which was in force before it was presumed the ore-pass was empty. The spill which occurred was estimated at 1,500 tons, and it is difficult to understand how such a large volume could remain undetected in the ore-pass after a marker had passed through. The ore-pass was driven 7 by 7 feet in cross-section and had only been in use about a year. Investigation after the accident indicated some caving had taken place, which would have allowed considerable muck to build up on the footwall of the raise. This would have permitted the markers to pass through and yet leave an unsuspected volume of ore still in the raise.

Dante Gambaro, aged 34, married, and employed as a driller by Cassiar Asbestos Corporation, was instantly killed at 9.40 a.m. on December 27th when his head was crushed between the rear-mounted winch on a tractor and the radiator of a portable compressor.

The accident occurred at a new drill-site on the road leading to a new crusher building. A portable 600 c.f.m. compressor had just been towed to the site by a crawler tractor. A foreman arrived at this stage and took charge. The compressor was parked at a point where the grade was minus 8 per cent in the direction of travel. The wheels were blocked by rocks, and Gambaro unhooked the compressor from the tractor. The tractor operator moved his machine ahead about 2 feet to allow the drawbar to fall to the ground. Shortly after, the compressor started to move slowly toward the tractor, possibly pushing rocks downgrade on the hard-packed snow. Gambaro, for some reason, stooped forward in front of the compressor and his head was caught between the radiator of the compressor and the winch at the rear of the tractor. The tractor was immediately moved ahead, but then Gambaro fell down to be pinned by the compressor. He was released by the tractor operator turning his machine around and pushing the compressor back with the bulldozer blade. The doctor was summoned and pronounced death at about 10.15 a.m. His evidence indicated Gambaro died instantly from multiple skull fractures.

The accident was caused by the fact that the portable compressor was improperly blocked. There was no reason for Gambaro to expose himself to danger,

but possibly he wished to lift the drawbar of the compressor to jam it against the tractor and thus prevent the radiator of the compressor from being damaged. The jury of the inquest did not place any blame but recommended that "safety equipment of some type, such as wheel chocks, preferably with rough base, be carried on all movable equipment."

FATAL ACCIDENTS AND ACCIDENTS INVOLVING LOSS OF TIME

Ten fatal accidents and 172 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 the lode mines over a 10-year period and relates these accidents to the number of persons employed and tons of ore mined.

ACCIDENTS CAUSING DEATH OR INJURY CLASSIFIED AS TO CAUSE

Cause	Number of Accidents	Percentage of Total
Bin, chutes	2	1.1
Explosives	3	1.6
Falls of ground	22	12.1
Falls of persons	36	19.8
Lifting and handling material	35	19.2
Machinery and tools	51	28.0
Transportation	23	12.7
Miscellaneous	10	5.5
Totals	182	100.0

ACCIDENTS CAUSING DEATH OR INJURY CLASSIFIED AS TO THE OCCUPATION OF THOSE INJURED

Occupation	Number of Accidents	Percentage of Total
Underground—		
Chutemen	4	2.2
Haulagemen	5	2.7
Miners	70	38.5
Helpers	9	5.0
Timbermen	6	3.3
Mechanics, electricians, etc.	18	9.9
Miscellaneous	10	5.5
Surface—		
Shops	5	2.7
Mills	9	4.9
Quarries	14	7.7
Surface, general	32	17.6
Totals	182	100.0

ACCIDENTS CAUSING DEATH OR INJURY CLASSIFIED AS TO PARTS
OF THE BODY INJURED

Location	Number of Accidents	Percentage of Total
Head and neck	10	5.5
Eyes	9	4.9
Trunk	56	30.7
Upper extremities	41	22.6
Lower extremities	48	26.4
General	18	9.9
Totals	182	100.0

COMPENSABLE AND FATAL ACCIDENTS RELATED TO TONS MINED
AND MEN EMPLOYED

Year	Number of Accidents	Number of Persons Employed	Frequency per 1,000 Persons	Tons Mined	Tons Mined per Accident
1954	718	6,293	114	8,513,865	11,850
1955	679	6,208	109	9,126,902	13,450
1956	615	6,507	94	8,827,037	14,350
1957	535	5,678	94	7,282,436	13,600
1958	396	4,353	91	6,402,198	16,200
1959	310	4,316	72	6,990,985	22,550
1960	395	4,389	90	8,242,703	20,920
1961	338	3,993	85	8,392,161	24,830
1962	429	4,872	88	11,212,106	26,135
1963	521	5,025	104	11,898,408	22,838

DANGEROUS OCCURRENCES

Thirteen 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 23 reported for 1962.

Of these occurrences, four were connected with explosives and one each with fire, hoisting, gas poisoning, air-line rupture, subsidence, emission of gas, lightning, haulage, inrush of water.

On February 23, 1963, at the Granduc mine, two men received numerous lacerations when struck by flying rock from the blast of a raise round they had just finished lighting. The men delayed two long at the face by using more than one hot wire lighter to light the round.

On April 6, 1963, at the Craigmont mine, a small fire occurred underground when acetylene gas was ignited at the storage bottle while an oxy-acetylene cutting torch was being used.

On April 1, 1963, at the Sullivan mine, the safety dogs on a cage in No. 1 shaft gripped the guides as the cage was being lowered. The cage-tender was uninjured, but there was some damage to the shaft guides and the hoisting-rope.

On May 22, 1963, at the Cassiar open-pit mine, a tram-line station, a conveyor gallery, and a bull-wheel were damaged and put out of commission for about one week due to miscalculation of the effect of a nearby blasting operation.

During May, 1963, at the Bralorne mill, 14 men became hospitalized due to arsine poisoning. The source of arsine was traced to the end of the mill circuit where the gold is precipitated out of the gold cyanide solution by the addition of

zinc dust and then recovered by a filter press. Arsenopyrite in the ore was believed to be the most likely source of arsenic, which could have combined with nascent hydrogen if same was released when the zinc dust was added.

On May 30, 1963, at the Giant Mascot mine, one man was injured due to the rupture of the mine's main 8-inch-diameter air-line when struck by a locomotive. The air-line had apparently been dislodged by nearby blasting into the path of the locomotive.

On June 4, 1963, at the quarry of Scott Bros. Gravel Co. Ltd., a workman fell into the feed hopper of the crushing plant and was being drawn into the feed opening when fortunately he was discovered. No injuries were suffered.

On August 25, 1963, at the Phoenix Copper open-pit mine, a vehicle was allowed to enter a blast area and reached within 30 feet of the blast when the first holes detonated. No one was injured.

On September 7, 1963, at the Cassiar open-pit mine, a grader left the mine road when the brakes failed and rolled down the hillside, coming to rest 130 feet below. The operator jumped clear and was not injured.

On December 5, 1963, at the Sunro mine of Cowichan Copper Co. Ltd., a stope caved through to surface in the bed of Jordan River. All men were safely evacuated from the mine, but little could be done to prevent flooding of the lower adit and a washout of surface installations at the portal. The possibility of such a stope cave-in had been recognized several months previously, and 24,792 feet of rock bolts, tensed to 6 tons, had been grouted into the roof pillar of the stope. The original break-through to the river bed was a hole 10 by 20 feet, but by December 9, 1963, it had increased to roughly 70 by 80 feet. Attempts to seal off the stope and fill with gravel were unsuccessful.

On December 12, 1963, at the Giant Mascot mine, a mine foreman was injured when he walked into a blast which had not been effectively guarded. (See Prosecutions.)

PROSECUTIONS

Two prosecutions were instituted under the *Metalliferous Mines Regulation Act*, as follows:—

The owner of W.K. Crushing Co. Ltd., and operator of the McNabb Creek slate quarry, was charged with two violations, one under section 21, General Rule 21, for not storing explosives in a suitable magazine and the other under section 21, General Rule 55 (a), for conducting blasting operations without being the holder of a provisional or permanent blasting certificate. The hearing was held in North Vancouver on May 27, 1963, and the defendant pleaded guilty. He was fined \$100 on each count.

A blaster at the Giant Mascot Mines Limited was charged under section 21, Rule 70 (a), for failing to effectively guard a place where he was conducting blasting operations. The offence took place on December 12, 1963, and the hearing was held in Hope on January 10, 1964. A conviction was obtained, and a fine of \$25 and costs was imposed.

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 a total of seven offenders were suspended for periods ranging from three weeks to three months. The offences were failing to guard a blast properly, storing detonators with explosives, using too short a fuse, and drilling in the vicinity of a hole that had been blasted.

EXPLOSIVES USED IN MINES

The table below shows the quantities of explosives and ammonium nitrate used in mines and quarries (other than coal) in British Columbia in 1959, 1960, 1961, 1962, and 1963:—

	1959	1960	1961	1962	1963
High explosives (lb.).....	6,319,000	7,188,000	7,280,000	4,522,619	4,072,000
Hydromex.....	325,000	862,000	2,116,000	2,013,850	1,770,000
Amex II.....	30,000		169,000	2,429,550	2,639,000
Ammonium nitrate.....	872,000	1,641,000	2,647,000	5,921,690	8,900,860

The quantity of high explosives used in 1963 decreased 10 per cent from that used in 1962. However, this decrease was more than offset by the increased use of ammonium nitrate explosives. The use of the slurry type of explosive, Hydromex (ammonium nitrate, T.N.T., and water), decreased 12 per cent from the previous year, but the do-it-yourself explosive of ammonium nitrate and fuel oil (AN/FO) continued its spectacular rise in annual consumption. In 1961 the commercial form of AN/FO (Amex II) was allowed to be used underground and rapidly replaced the standard explosives. In 1962 a factory licence was issued to The Consolidated Mining and Smelting Company of Canada, Limited, to blend ammonium nitrate and fuel oil, and permission was given for the use of this explosive underground at the Sullivan, Bluebell, and H.B. mines. A further innovation at this latter plant was the manufacture of a more sensitive explosive for use in secondary blasting, accomplished by the use of compressed air to drive the AN/FO prills against a steel plate. The AN/FO explosives have good safety features, but there is a danger that their fume characteristics will change under certain conditions. Thus their use 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

Problems in dust control and ventilation have continued to receive the attention of mine operators and the Department. In 1962 the Department undertook the responsibility of directly carrying out dust and ventilation surveys in mines, quarries, and concentrators. Previous to this these surveys had been conducted by officials of the Workmen's Compensation Board, and their reports were made available to the Inspectors of Mines. A summary of the work of the Department, as prepared by R. J. Craig, Senior Inspector, Silicosis Control, follows.

1. Seventy-five surveys of dust concentrations were made at 48 mining operations during 1963.
2. The main object of this work is to lower as much as possible the amount of dust breathed by the workman. The figure of 300 particles per cubic centimetre as determined with a konimeter is known to represent a working atmosphere that can be obtained under good conditions of ventilation and dust control.
3. Stopper drilling operations continue to produce higher dust concentrations than desired. Sixty-two per cent of the surveys made in 1963 gave less than 1,000 particles per cubic centimetre. Auxiliary ventilation has been found to be the best method of reducing the dust from these operations.

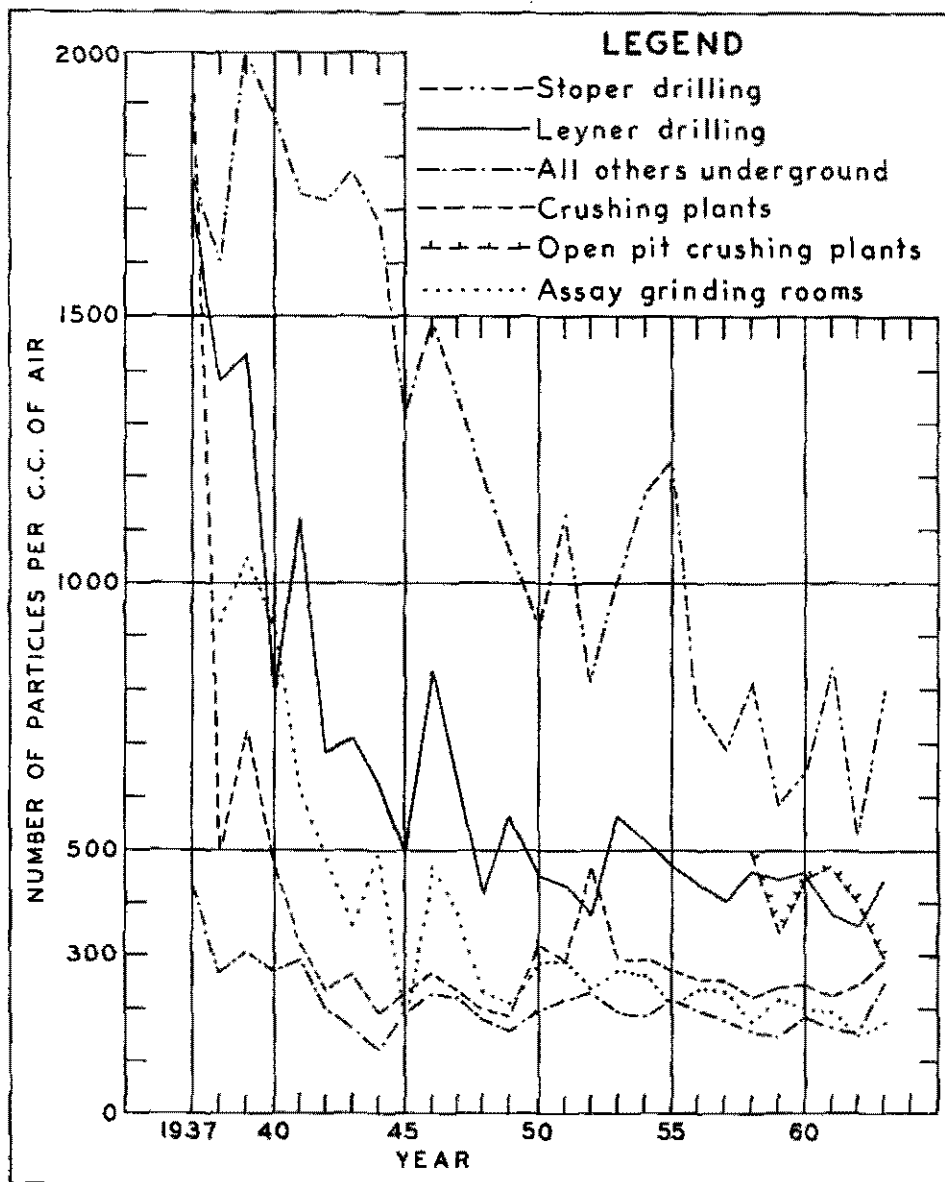


Figure 16. Average dust counts obtained each year since 1937.

4. At leyner, jackleg, and plugger drilling operations 57 per cent of the surveys gave averages of less than 500 particles per cubic centimetre of air.

5. The averages for all other underground locations increased in 1963. The percentage of surveys which showed less than 300 particles per cubic centimetre has decreased from 77 to 69 per cent.

6. Fifty-four per cent of the crushing plants at underground operations showed an average of less than 300 particles per cubic centimetre.

7. The use of detergent to wet down the dust during drilling operations with tractor-mounted machines is practically universal. It has given good results in

reducing the dust at drilling operations. Seventy-one per cent of the surveys gave averages of less than 500 particles per cubic centimetre.

8. The dust concentration found in the crushing plants at the open-pit mines showed a big improvement this year. The percentage of surveys showing averages of less than 300 particles per cubic centimetre increased from 20 to 55 per cent.

9. Eighty-four per cent of the surveys made in assay grinding-rooms gave averages of less than 300 particles per cubic centimetre. All assay grinding-rooms are equipped with exhaust systems.

10. The percentage of certificates of fitness in good standing held by the employers for their workmen who require medical examination was more than 96 per cent.

11. Aluminum-powder prophylaxis treatments for the prevention of silicosis were given in the dry-house at one of the mines during the year and were made available at a second mine to those who desired it.

12. Figure 16 is a graph showing the median of all the averages in various operations in the metalliferous 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 1963, 113 provisional certificates were issued, each good for two years from the date of issue. Examinations for permanent certificates were held in Bralorne, Merritt, Jordan River, Kimberley, Nelson, Cranbrook, Hope, and Britannia Beach. Thirty-one men received certificates, as follows:—

Cert. No.	Name	Date	Cert. No.	Name	Date
208	Donald B. Cameron.....	2-1-63	224	Archibald F. Buie.....	14-6-63
209	Howard Graham.....	27-2-63	225	Eric Walter Holdsworth.....	14-6-63
210	Stanley G. Hill.....	27-2-63	226	Eric Olaf Hallstrom.....	14-6-63
211	Clifford C. Rennie.....	27-2-63	227	James Elliot Crookshanks.....	26-6-63
212	Hans Felderhof.....	16-4-63	228	Alastair Hamilton Summers.....	12-7-63
213	Paul Dase.....	18-4-63	229	Cecil R. Morton.....	19-7-63
214	Albert Tindate Richardson.....	14-6-63	230	Howard J. Rayner.....	30-7-63
215	J. David Kelland.....	14-6-63	231	George Delbert Moore.....	31-7-63
216	William Robert Johnston.....	14-6-63	232	Peter Angelo Marconato.....	1-10-63
217	Jack Jenkins.....	14-6-63	233	Marvin Reeves Arkinstall.....	1-10-63
218	Donald Cliburn Jackson.....	14-6-63	234	John Brown MacDonald.....	1-10-63
219	Robert M. Giegerich.....	14-6-63	235	Ronald Thomas Baverstock.....	1-10-63
220	Tony Eeglon.....	14-6-63	236	Rene Dupasquier.....	3-10-63
221	Donald Scott Boyle.....	14-6-63	237	Alvin H. Crittenden.....	11-10-63
222	John Soden.....	14-6-63	238	Carl Maurice Shelrud.....	6-11-63
223	John J. Sutherland.....	14-6-63			

MINE RESCUE, SAFETY, AND FIRST AID

The promotion of mine rescue and first aid continued at a high level throughout 1963. 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 1963 Department-owned equipment totalled 51 McCaa two-hour apparatus and 44 Chemox $\frac{3}{4}$ -hour apparatus, while that owned by mining companies totalled 51 McCaa's and 52 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 Cumberland was maintained throughout most of 1963 to serve the Tsable River coal mine with an instructor hired on a part-time basis. In October W. H. Childress was transferred from Nelson to establish a station on a full-time basis with headquarters in Nanaimo. The Cumberland station was closed, but equipment for emergency purposes was stored at the Tsable River mine. The Cumberland station has been in continuous use since it was built in 1912 by Canadian Collieries (Dunsmuir) Limited. From 1917 to 1963 the operation of the station was by the Department on a lease arrangement, and when the station was closed the building was returned to its present owners, Canadian Collieries Resources Ltd. In 1963 the instructor for the new Nanaimo office held a mine-rescue class at Britannia and a first-aid class at Sooke. A mine-rescue exhibit was shown at the Kinsmen Fall Fair at Victoria and won second prize. A new mobile unit was purchased.

The Kamloops station was moved from Princeton in 1961. A mobile unit is in use in this district, but in addition public transportation was used to give service over a wide area which included northern British Columbia and the Lower Mainland as well as the central part of the Province. Mine-rescue and (or) first-aid training was given at the Giant Mascot, Craigmont, Bethlehem, Cassiar, Cariboo Gold Quartz, Bralorne, Texada, and Highland Bell mines. The first-aid classes held in communities near mines were open to the general public. The number receiving first-aid certificates totalled 104. There were no emergency calls for apparatus during 1963.

The east and west Kootenay areas have been serviced since 1950 by a mobile mine-rescue unit stationed at Nelson. Mine-rescue classes were held at the Bluebell, Canadian Exploration, H.B., and Mineral King mines. First-aid classes were held at Nelson, Salmo, Grand Forks, Riondel, and Toby Creek. A short course in artificial respiration was given at Procter and Balfour. Instruction was also given in the use and care of breathing apparatus to the Nelson, Grand Forks, Salmo, and New Denver fire departments. In September, G. J. Lee was appointed as Instructor at Nelson to replace W. H. Childress on his transfer to Nanaimo.

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 attendance of 81 persons. There was one emergency call from the Michel Colliery for apparatus to aid in the sealing of an underground fire.

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. During 1963, in addition to the regular teams in training, 95 men took the course and were granted certificates, as follows:—

Certificate No.	Name	Where Trained	Certificate No.	Name	Where Trained
3458	Anthony R. C. James	Vancouver.	3506	Barre W. Goldie	Merritt.
3459	Thomas R. Buckham	Vancouver.	3507	James Mackintosh Gibbs	Merritt.
3460	Robert Henry Seraphim	Vancouver.	3508	Allan G. Stevenson	Merritt.
3461	J. Cameron Stephen	Vancouver.	3509	Ronald F. Emery	Merritt.
3462	Erik Andre Ostensoe	Vancouver.	3510	Ronald George Ianson	Merritt.
3463	James A. Robertson	Vancouver.	3511	Don Duncan	Merritt.
3464	Earl David Dodson	Vancouver.	3512	George F. Kirby	Merritt.
3465	Joseph Sullivan	Vancouver.	3513	William J. Canning	Merritt.
3466	James Wm. MacLeod	Vancouver.	3514	Fergus Patrick Kerr	Merritt.
3467	Patrick Landy	Salmo.	3515	John E. Dodge	Merritt.
3468	Bradford Pearson	Salmo.	3516	Januse Sztyler	Salmo.
3469	Ross Dion	Salmo.	3517	Walter Joseph Golla	Riondel.
3470	Michael Poznikoff	Salmo.	3518	Steve Fedun	Riondel.
3471	Lloyd Andrews	Salmo.	3519	Derrel Keith Dixon	Riondel.
3472	Carl M. Shelrud	Salmo.	3520	Alexander Vivian Scott	Riondel.
3473	Brian Backler	Salmo.	3521	Leroy William Ward	Riondel.
3474	Jack Walton	Salmo.	3522	David Gold	Riondel.
3475	Ralph Leipert	Salmo.	3523	Henry T. Smith	Jordan River.
3476	Wesley Engen	Salmo.	3524	William M. Schubert	Merritt.
3477	Irvin Engen	Salmo.	3525	Donald C. Stephens	Ashcroft.
3478	Edward Hupple	Salmo.	3526	Ben Mieran	Ashcroft.
3479	Kjill Sandberg	Kimberley.	3527	Lawrence Albert Stout	Ashcroft.
3480	Donald C. Jackson	Kimberley.	3528	Roy Gordon Robins	Ashcroft.
3481	William Alexander Howe	Kimberley.	3529	Ernest Borsato	Michel.
3482	Cornelius Robert Unrah	Kimberley.	3530	James Harold Hall Cham-berlin	Fernie.
3483	Donald S. Boyle	Kimberley.	3531	Arvid Lundeberg	Salmo.
3484	John Alexander McDonald	Kimberley.	3532	George Walter Gilbert	Wells.
3485	Raynald D. Gunthier	Kimberley.	3533	Thomas Keogh	Grand Forks.
3486	Robert M. Giegerich	Kimberley.	3534	David Crellin	Grand Forks.
3487	John Alexander Glennie	Kimberley.	3535	Paul Koetinoff	Grand Forks.
3488	George Edward Casavant	Kimberley.	3536	Dale Schultz	Grand Forks.
3489	Carl Lindberg Helland	Kimberley.	3537	Lloyd Iverson	Grand Forks.
3490	William Robert Johnston	Kimberley.	3538	Frank Trach	Grand Forks.
3491	John Daniel Kelland	Kimberley.	3539	Evan Murphy	Grand Forks.
3492	Tony Eeglon	Kimberley.	3540	Harvey S. Rielly	Britannia Beach.
3493	George E. Thomas	Hope.	3541	William I. Harrison	Britannia Beach.
3494	Fred A. Chwojk	Hope.	3542	Harry Yaky	Britannia Beach.
3495	Mervin John Schmidt	Hope.	3543	Steven Rakoezy	Britannia Beach.
3496	Richard Addison	Hope.	3544	Lloyd Edward Johnston	Britannia Beach.
3497	Emilio Pellegrino	Hope.	3545	Robert Leftbrook	Britannia Beach.
3498	Andrew J. Grubisic	Hope.	3546	Larry J. Marion	Britannia Beach.
3499	Robert J. Pittman	Merritt.	3547	Ed Barich	Britannia Beach.
3500	William George Knutsen	Merritt.	3548	Pierre Bouchard	Britannia Beach.
3501	K. A. Ray Smith	Merritt.	3549	Ian Patterson	Britannia Beach.
3502	Peter H. Atkinson	Merritt.	3550	Peter A. Marconato	Britannia Beach.
3503	Robert R. Brooks	Merritt.	3551	Nedo A. Gizzi	Britannia Beach.
3504	Scott Wallace Weeks	Merritt.	3552	Stefan Mista	Britannia Beach.
3505	James F. Bristow	Merritt.			

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 21st annual competition at Bralorne on April 27, 1963. This was a first-aid meet with events for juniors and seniors. As in former years the senior event was designed for good spectator appeal in that it demonstrated what could happen if the casualties from a shooting affray were then complicated by a bus accident. The event was won by a team captained by W. Thiessen.

The Vancouver Island Mine Safety Association held its 49th annual competition in Cumberland on May 25, 1963. Three teams competed in the mine-rescue event—two from the Tsable River mine and a visiting team from Britannia. The winning team was from the Tsable River mine and was captained by W. High.

The Central British Columbia Mine Safety Association held its 15th annual competition at Merritt on June 1, 1963. Five teams took part in the mine-rescue competition—one each from Craigmont, Bethlehem, Britannia, Cariboo Gold Quartz, and Bralorne mines. The Craigmont team, captained by A. M. Laird, took first place.

The West Kootenay Mine Safety Association held its 17th annual competition at Nelson on June 8, 1963. Four teams took part in the mine-rescue event—two from the Bluebell mine and one each from the Canadian Exploration and H.B. mines. A Bluebell team captained by P. E. Rowan took first place.

The East Kootenay Mine Safety Association held its 42nd annual competition at Fernie on June 15, 1963. Five teams took part in the mine-rescue event—two from the Sullivan mine and one each from Fernie, Michel, and Toby Creek. First place was won by the Mineral King team from Toby Creek, captained by B. A. McConachie.

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 eighth Provincial mine-rescue competition was held at Victoria on June 22, 1963. The winning teams from the Cumberland, Fernie, Nelson, and Merritt events competed for a trophy and silver trays. The event was won by the Bluebell team of The Consolidated Mining and Smelting Company of Canada, Limited, captained by P. E. Rowan. 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 seventh Provincial men's first-aid competition, and teams competed which had won local events at Victoria, Cumberland, Terrace, Merritt, Nelson, and Fernie. The winning team was the Naval Fire Service team from Victoria, captained by C. Williamson.

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 the first major changes in the competition rules were made in that it was required of metalliferous mines that sufficient calendar years be submitted by each entering mine to complete 1,000,000 man-hours. In 1963 the Regional Trophy for metalliferous mines was won by the H.B. mine of The Consolidated Mining and Smelting Company of Canada, Limited, with an accident frequency of 2.5. This fine showing placed the mine second among the mines in Canada in the competition for the Dominion Trophy.

In 1963 the Michel Colliery of The Crow's Nest Pass Coal Company Limited won the Regional Trophy for coal mines. This is a repeat for the year 1962 with also a lowered accident frequency.

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

not eligible for the John T. Ryan awards. 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 1963 the award was won by The Cariboo Gold Quartz Mining Company Limited with an accident frequency of zero. This is an excellent record when it is noted the total of working shifts for the year was close to the maximum allowed for the competition.

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. The trophy is awarded to the operation having worked a minimum of 75,000 man-hours in the year and having the lowest number of compensable injuries per million man-hours of exposure. 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 1963 the trophy was won by the Texada Island limestone quarry of Domtar Chemicals Ltd. A zero accident frequency was obtained, the first such zero frequency in the three years of competition. Nine quarries received certificates of achievement, as follows: British Columbia Cement Company Limited, at Cobble Hill; Clayburn-Harbison Ltd.; Domtar Chemicals Ltd., on Texada Island; Hillside Sand & Gravel of Ocean Cement Limited; Jack Cewe Ltd.; Langley Gravel Pit of Deeks-McBride Ltd.; Linton's Construction Co. Ltd.; Pooley Bros. Ltd. (Craigmont open pit); Western Gypsum Products Limited, of Windermere.

Coal

By Robert B. Bonar, Deputy Chief Inspector of Mines

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PRODUCTION

The gross output in short tons of the coal mines of the Province for 1963 was 965,809 tons, an increase of 52,972 tons or 5.8 per cent over 1962. A total of 99,328 tons came from strip mines at Michel Colliery and Coleman Collieries.

The Vancouver Island District production was 75,695 tons, a decrease of 5,891 tons or 7.2 per cent from 1962.

The Nicola-Princeton District production was 60 tons, a decrease of 65 tons or 52.0 per cent from 1962.

The Northern District production was 6,751 tons, a decrease of 590 tons or 8.0 per cent from 1962.

The East Kootenay District production was 883,303 tons, an increase of 59,518 tons or 7.2 per cent over 1962.

OUTPUT AND PER CAPITA PRODUCTION, 1963

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	73,893	234	104	3.04	710	80	3.94	923
Midan mine	527	140	2	1.88	264	2	1.88	264
Loudon No. 6 mine	70	34	2	1.03	35	2	1.03	35
Lewis mine (Timberlands)	482	115	3	1.39	161	3	1.39	161
Carruthers and Wakelem No. 3 mine	211	128	1	1.65	211	1	1.65	211
Undun No. 3 mine	512	81	2	3.16	256	2	3.16	256
Coldwater mine	60	28	2	1.07	30	2	1.07	30
Bulkley Valley Collieries	5,605	177	16	1.98	350	12	2.64	467
Gething No. 3 mine	1,146	157	5	1.46	229	4	1.82	286
Michel Colliery (underground)	783,975	240	592	5.51	1,324	393	8.31	1,995
Michel Colliery (strip)	98,828	240	14	29.41	7,059	—	—	—
Coleman Collieries (strip)	500	—	5	—	—	—	—	—

DISTRICT OUTPUT AND PER CAPITA PRODUCTION, UNDERGROUND MINES, 1963

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	75,695	114	664	90	841
Nicola-Princeton	60	2	30	2	30
Northern	6,751	21	338	16	422
East Kootenay	783,975	592	1,324	393	1,995
Whole Province	866,481	729	1,190	501	1,730

OUTPUT PER MAN-SHIFT, UNDERGROUND MINES, 1954-63

Year	Man-shifts ¹	Tonnage	Average per Man-shift (Tons)
1954	280,353	1,064,023	3.79
1955	304,139	1,157,813	3.86
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

¹ Includes both surface and underground workers.

COLLIERIES OF BRITISH COLUMBIA, 1963—PRODUCTION AND DISTRIBUTION, BY COLLIERIES AND BY DISTRICTS (SHORT TONS)

Mine	Gross Output	Washery Refuse	Net Output	Used under Companies' Boilers, etc.	Used in Making Coke	Stocks				Sales				Total Coal Sold and Used ¹	
						On Hand First of Year	On Hand Last of Year	Added To	Taken From	In Canada	In U.S.A.	Elsewhere	Total Sales		
Vancouver Island District															
Comox Mining Company Ltd.—Tsable River Colliery.....	73,893	1,830	72,063	.....	.....	9,450	6,587	.....	2,863	74,926	.....	.....	74,926	74,926	
Midan mine (Chambers No. 5)	527	.....	527	.....	.....	.....	.....	.....	.....	527	.....	.....	527	527	
Loudon No. 6 mine	70	.....	70	.....	.....	.....	.....	.....	.....	70	.....	.....	70	70	
Lewis mine (Timberlands).....	482	.....	482	.....	.....	.....	.....	.....	.....	482	.....	.....	482	482	
Carruthers and Wakelem No. 3 mine	211	.....	211	.....	.....	.....	.....	.....	.....	211	.....	.....	211	211	
Undun No. 3 mine	512	.....	512	.....	.....	.....	.....	.....	.....	512	.....	.....	512	512	
Totals, Vancouver Island District.....	75,695	1,830	73,865	.....	.....	.....	.....	.....	2,863	76,728	.....	.....	76,728	76,728	
Nicola-Princeton District															
Coldwater mine	60	.....	60	.....	.....	.....	.....	.....	.....	60	.....	.....	60	60	
Totals, Nicola-Princeton District.....	60	.....	60	.....	.....	.....	.....	.....	.....	60	.....	.....	60	60	
Northern District															
Bulkley Valley Collieries.....	5,605	.....	5,605	.....	.....	220	125	.....	95	5,700	.....	.....	5,700	5,700	
Gething No. 3 mine	1,146	.....	1,146	.....	.....	.....	.....	.....	.....	1,146	.....	.....	1,146	1,146	
Totals, Northern District.....	6,751	.....	6,751	.....	.....	220	125	.....	95	6,846	.....	.....	6,846	6,846	
East Kootenay District															
The Crow's Nest Pass Coal Co. Ltd.—Michel Colliery (underground and strip).....	882,803	126,519	756,284	17,089	191,879	13,662	3,474	.....	10,188	188,374	1,799	367,331	557,504	766,472	
Coleman Collieries—Tent Mountain mine (strip).....	500	65	435	.....	.....	.....	.....	.....	.....	435	.....	.....	435	435	
Totals, East Kootenay District.....	883,303	126,584	756,719	17,089	191,879	13,662	3,474	.....	10,188	188,809	1,799	367,331	557,939	766,907	
Coal															
Grand totals for Province.....	965,809	128,414	837,395	17,089	191,879	23,332	10,186	.....	13,146	272,443	1,799	367,331	641,573	850,541	
Coke															
The Crow's Nest Pass Coal Co. Ltd.—Michel Colliery.....	145,764	.....	145,764	.....	.....	23,950	14,871	.....	9,079	76,770	78,073	.....	.....	154,843	

¹ Includes coal used in making coke and coal used under company stationary and locomotive boilers, etc.

COAL

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COLLIERIES OF BRITISH COLUMBIA, 1963—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	7	4	11	68	—	68	—	—	—	—	17	17	5	3	8	80	24	104
Midan mine (Chambers No. 5)	1	—	1	1	—	1	—	—	—	—	—	—	—	—	—	2	—	2
Loudon No. 6 mine	1	—	1	1	—	1	—	—	—	—	—	—	—	—	—	2	—	2
Lewis mine (Timberlands)	1	—	1	2	—	2	—	—	—	—	—	—	—	—	—	3	—	3
Carruthers and Wakelem No. 3 mine	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	1	—	1
Undun No. 3 mine	1	—	1	1	—	1	—	—	—	—	—	—	—	—	—	2	—	2
Totals, Vancouver Island District	11	4	15	74	—	74	—	—	—	—	17	17	5	3	8	90	24	114
Nicola-Princeton District																		
Coldwater mine	1	—	1	1	—	1	—	—	—	—	—	—	—	—	—	2	—	2
Totals, Nicola-Princeton District	1	—	1	1	—	1	—	—	—	—	—	—	—	—	—	2	—	2
Northern District																		
Bulkley Valley Collieries	1	1	2	4	—	4	6	—	6	1	1	2	—	2	2	12	4	16
Gething No. 3 mine	1	—	1	2	—	2	1	—	1	—	1	1	—	—	—	4	1	5
Totals, Northern District	2	1	3	6	—	6	7	—	7	1	2	3	—	2	2	16	5	21
East Kootenay District																		
The Crow's Nest Pass Coal Co. Ltd.—																		
Michel Colliery (underground)	33	25	58	172	—	172	83	—	83	52	125	177	53	49	102	393	199	592
Michel Colliery (strip)	—	1	1	—	—	—	—	—	—	—	13	13	—	—	—	—	14	14
Coleman Collieries Ltd.—Tent Mountain (strip)	—	1	1	—	—	—	—	—	—	—	3	3	—	1	1	—	5	5
Totals, East Kootenay District	33	27	60	172	—	172	83	—	83	52	141	193	53	50	103	393	218	611
Grand totals for Province	47	32	79	253	—	253	90	—	90	53	160	213	58	55	113	501	247	748

NOTE.—U.=Underground; A.=above ground; T.=total.

COAL-PREPARATION PLANTS

There were no changes or additions to the existing coal-preparation plants at the various collieries in 1963. For full details of plants *see* 1954 and 1962 Annual Reports.

COKE-MAKING

Coke is made at only one plant in the Province, that of the Michel Colliery, The Crow's Nest Pass Coal Company Limited, Fernie.

LABOUR AND EMPLOYMENT

In 1963, 748 persons were employed in and about the coal mines of the Province, a decrease of 28 from 1962. Because of the five-day week in force throughout the Province at the larger mines and the legal holidays, the maximum number of working-days was 242. In the Vancouver Island District, the one large mine, the Tsable River mine, worked 234 days. In the East Kootenay District, the Michel Colliery worked 240 days.

COMPETITION FROM COAL PRODUCED OUTSIDE OF
BRITISH COLUMBIA

In 1963 the shipment of Alberta coal, briquettes, and char to British Columbia totalled 262,433, 5,492, and 350 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
1954.....	891,194	1959.....	437,118
1955.....	932,764	1960.....	379,668
1956.....	860,329	1961.....	321,909
1957.....	672,527	1962.....	283,651
1958.....	532,911	1963.....	262,433

Of the 641,573 tons of British Columbia coal marketed, 165,014 tons was sold for domestic and industrial use in Alberta, Saskatchewan, Manitoba, and Ontario; 1,799 tons was exported to the United States; and 367,331 tons was exported to Japan.

The amount sold for domestic and industrial use in the Province was 107,429 tons.

ACCIDENTS IN AND AROUND COAL MINES

In 1963 there was one fatal accident, as compared with none in 1962. The number of fatal accidents per 1,000 persons (underground and strip-mine personnel) employed was 1.33, compared with 0.00 in 1962, 6.37 in 1961, 0.00 in 1960, 1.89 in 1959, 0.00 in 1958, 1.45 in 1957, 4.39 in 1956, 3.38 in 1955, and 0.69 in 1954.

The number of fatal accidents per 1,000,000 gross tons of coal (underground and strip-mine coal) produced was 1.03, compared with 0.00 in 1962.

The following table shows comparative figures for 1962 and 1963:—

Company	Colliery	1963	1962
The Crow's Nest Pass Coal Co. Ltd.	Michel	1	—

The following table classifies the fatal accidents in coal mines as to cause:—

FATAL ACCIDENTS CLASSIFIED AS TO CAUSE

Cause	1963		1962	
	Number	Per Cent	Number	Per Cent
Crushed between mine car and rotary dump	1	100.00	—	—
Total	1	100.00	—	—

The following tables classify the accidents in coal mines in 1963:—

ACCIDENTS CLASSIFIED AS TO OCCUPATION

Occupation	Number of Accidents	Percentage of Accidents
Underground—		
Miners	55	40.75
Drillers and facemen	13	9.63
Haulage and conveyor men	25	18.52
Trackmen and mechanics	9	6.67
Supervisors	8	5.93
Timbermen	5	3.70
Coal-cutters	—	—
Miscellaneous	4	2.96
Surface—		
Shops	2	1.48
Surface	4	2.96
Preparation and coke-ovens	10	7.40
Miscellaneous	—	—
Totals	135	100.00

ACCIDENTS CLASSIFIED AS TO CAUSE

Cause	Number of Accidents	Percentage of Accidents
Fall of ground	28	20.74
Fall of material and flying material	8	5.93
Lifting and handling equipment and material	28	20.74
Machinery and tools	37	27.41
Slipped and tripped	25	18.52
Falling off staging and platforms	5	3.70
Miscellaneous	4	2.96
Totals	135	100.00

ACCIDENTS CLASSIFIED AS TO INJURY

Injury	Number of Accidents	Percentage of Accidents
Head and neck	15	11.11
Eyes	3	2.22
Trunk	30	22.22
Back	7	5.19
Arms	10	7.40
Hands and fingers	25	18.52
Legs	30	22.22
Feet	10	7.40
Toes	5	3.70
Totals	135	100.00

COMPENSABLE¹ 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
1954	360	1,434	251	1,447,608	4,021
1955	372	1,478	252	1,484,066	3,989
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

¹ Compensable accident means an injury causing a loss of more than four days' work.

EXPLOSIVES

The following table shows the quantity of explosives used in underground coal mines in 1963, 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)	40,000	73,893	50,000	1.84	0.80
Midan mine (Chambers No. 5)	150	527	300	3.51	0.50
Loudon No. 6 mine	80	70	100	0.88	0.80
Lewis mine (Timberlands)	300	482	350	1.61	0.86
Carruthers and Wakelem No. 3 mine	250	211	300	0.84	0.83
Undun No. 3 mine	200	512	180	2.56	1.11
Totals for district	40,980	75,695	51,230	1.84	0.80

NICOLA-PRINCETON 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
Coldwater mine.....	30	60	60	2.0	0.50

NORTHERN DISTRICT

Bulkley Valley Collieries.....	7,000	5,605	8,400	0.80	0.82
Gething No. 3 mine.....	600	1,146	1,200	1.91	0.50
Totals for district.....	7,600	6,751	9,600	0.88	0.79

EAST KOOTENAY DISTRICT

Michel Colliery (underground).....	85,557	783,975	87,019	9.16	0.98

PROVINCE

Totals for Province.....	134,167	866,481	147,909	6.46	0.90

QUANTITY OF DIFFERENT EXPLOSIVES USED

	Lb.
Monobel of different grades	132,641
Permissible rock powder	1,526
Total	134,167

MACHINE-MINED COAL

In 1963, mining machines produced approximately 483,727 tons or 55.82 per cent of the total output from underground mining. A total of 99,328 tons of strip-mined coal was removed by mechanical means.

SAFETY LAMPS

There were 810 safety lamps in use in the mines of the Province. Of this number, 735 were approved electric lamps, mostly of the Edison 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 P, carrying the Approval Certificate No. 26 of the United States Bureau of Mines, Model R-4, Approval No. 29.

The Wheat electric lamp and having Approval No. 20, 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 17,676 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 the permission of the Chief Inspector of Mines, 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 January 18, 1963, a fireboss removed a cover from the main contactor panel in the No. 764 continuous-miner place, "A" North mine, Michel Colliery, and inserted his "flame-safety" lamp into the panel to see if any methane gas was present. The lamp came in contact with the control-circuit fuses, which were live, causing an arc. Fortunately no damage occurred and no one was injured.

On January 24, 1963, a flash fire occurred in the combustion chamber of a gas drier in the fine-coal cleaning plant, Michel Colliery. The fire ignited a small wooden structure that had been erected a few days earlier to protect valves and

electrical controls near the open end of the drier during sub-zero weather. The structure was completely destroyed and a number of the controls were damaged before the fire was extinguished. No one was injured.

On May 17, 1963, a miner was overcome and became unconscious due to methane gas at the face of a working-place in the No. 1 slope section, "A" North mine, Michel Colliery, while wedging the collar of a set of timber. Artificial respiration was performed immediately and the man recovered. Subsequent investigation disclosed that a "pocket" of gas had accumulated near the roof where the workman was standing.

On July 31, 1963, an ignition of firedamp occurred at the face of the No. 4 room, No. 1 slope section at "A" North mine, Michel Colliery, which burned for a short period of time before it was put out by the use of a fire-extinguisher. It was suspected that the picks of a continuous miner operating at the face had caused a spark through coming in contact with a rock intrusion, and that this in turn ignited a small feeder of gas escaping near the floor.

On May 26, 1963, definite traces of carbon monoxide gas were found issuing from an area of old workings at the inner end of No. 1 left belt-road section, "A" West mine, Michel Colliery. Gob heating was suspected and the area was sealed off.

On August 5, 1963, a shuttle car servicing a continuous miner in a pillar extraction area in the No. 1 incline section, "A" West mine, Michel Colliery, ran over the trailing cable of the continuous miner as the latter machine was cutting and advancing at the face. The connecting end of the cable was torn from its socket, thus causing an electrical short circuit which ignited the rubber hose conduit. No one was injured.

On September 25, 1963, dense smoke was discovered in the return airway of the bottom working-place off the diagonal slope, Tsable River mine, at about 7.30 p.m. All the men were immediately removed from the mine.

Just prior to the discovery of the smoke a heavy "bump" was felt underground, and it is believed that a large cave had occurred in the sealed-off fire area to the right of the diagonal slope, and the cave had apparently broken some of the fire seals.

Due to the impracticability of resealing the fire at or near the point of discovery, it was decided to seal off the fire just below the junction of the diagonal and main slopes where conditions were more suitable for the erection of air-tight seals. This meant that new working-places to accommodate the crews would have to be established quite a few hundred feet above the present workings. After salvaging much of the mining equipment from the affected area, conditions appeared to deteriorate, so all men were moved above the junction and work on erecting the two seals to isolate the fire was started. These seals were erected by the mine-rescue crew wearing McCaa apparatus.

By October 2, 1963, most of the mine personnel were again engaged in producing coal and repairing old roadways for production.

On October 30, 1963, a small fire was found burning in a wood stopping which formed a ventilation seal on the abandoned No. 3 left belt road at "A" West mine, Michel Colliery. The presence of heat, smoke, and traces of carbon monoxide gas also indicated that there was a fire of greater intensity behind the stopping. The fire in the stopping was extinguished, and further seals were erected at the outer end of the belt road. Mine-rescue equipment was worn by the men combating the fire.

BUMPS AND OUTBURSTS

There were no bumps or outbursts reported from any of the coal mines in the Province during 1963.

PROSECUTIONS

On February 15, 1963, Roger Girou, fireboss, The Crow's Nest Pass Coal Company Limited, was prosecuted for removing an inspection cover on the electrical controls of a continuous miner in a working-place at "A" North mine, Michel Colliery, on January 18, 1963, without isolating the current in a proper manner. He was fined \$10 and costs (\$4) for exposing live electrical conductors to the atmosphere.

On February 15, 1963, John Whittaker, overman, The Crow's Nest Pass Coal Company Limited, was prosecuted at the Natal Police Court for failing to isolate the electric current from the cables and controls of a continuous miner at the face of a working-place in "A" North mine, Michel Colliery, on January 18, 1963, in the presence of more than 1¼ per cent of inflammable gas. He was fined \$10 and costs (\$4).

SUPERVISION OF COAL MINES

During 1963, 10 companies operated mines, employing 501 men underground. In the supervision of underground employees there were 2 managers, 7 overmen, and 38 firebosses, or approximately 1 official for every 10 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 once a year and more often if necessary. An examination was held at the Fernie centre in 1963 on May 2nd, 3rd, 4th, 22nd, 23rd, and 24th.

The total number of candidates at these examinations were as follows: Mine surveyor's certificate, three (one passed, two failed).

The following was the successful candidate: Mine surveyor, James T. McVeigh.

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 has failed to satisfy the Board as to his fitness, experience in a coal mine, and a general working knowledge of the English language.

During 1963, 25 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.

REGISTERED LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY AS COAL-MINE OFFICIALS

FIRST-CLASS CERTIFICATES OF COMPETENCY

Name	Date	No.	Name	Date	No.
Aschacher, Martin	Apr. 16, 1964	A 216	Lawrence, Stanley J.	Jan. 4, 1943	-----
Baxter, Andrew	June 10, 1911	-----	Leighton, Henry	May 9, 1912	-----
Bennett, John	Dec. 30, 1926	-----	Mackinnon, Hugh G.	May 19, 1922	-----
Bonar, Robert B.	Dec. 15, 1932	-----	Macauley, D. A.	June 10, 1911	-----
Brace, Tom	May 13, 1915	-----	Marshall, Thomas	July 18, 1946	A 194
Bridge, Edward	July 22, 1908	-----	Mazey, William John	Oct. 31, 1912	-----
Brown, Robert Joyce	May 13, 1915	-----	McCulloch, James	Sept. 10, 1910	-----
Chamberlin, James H. H.	Mar. 18, 1963	A 214	McDonald, Edward A.	Nov. 28, 1949	A 206
Chapman, William	Dec. 20, 1938	-----	McDonald, John	Oct. 3, 1919	-----
Church, James A. H.	June 10, 1911	-----	McDonald, Leslie M.	Jan. 8, 1949	A 203
Clark, Henry Wilton	Oct. 9, 1943	-----	McKay, Walter	Jan. 20, 1944	-----
Cochrane, James	July 9, 1945	A 193	McVicar, Samuel	May 1, 1909	-----
Cox, Richard	May 13, 1915	-----	Millar, John K.	Nov. 22, 1906	-----
Crawford, John	Sept. 28, 1946	A 195	Miller, Andrew Anderson	Oct. 31, 1912	-----
Cumberford, James	Oct. 7, 1938	-----	Miller, Henry	July 17, 1948	A 200
Cunningham, John Howard	May 9, 1912	-----	Montgomery, John W.	May 1, 1909	-----
D'Amico, Zupito	June 14, 1955	A 210	Morgan, Dewi R.	May 30, 1949	A 205
Davidson, John M.	Sept. 20, 1948	A 202	Morgan, Evan Henry	June 26, 1944	A 191
Davies, David	June 10, 1911	-----	Morris, James Eugene	Nov. 18, 1952	A 208
Davies, Stephen	Nov. 15, 1917	-----	Murray, George	June 21, 1921	-----
Davies, Thos. Owen	May 21, 1914	-----	Ovington, John	May 27, 1913	-----
Devlin, E. H.	Dec. 30, 1926	-----	Parry, Glyn R. D.	Jan. 20, 1956	A 212
Dickson, James	Oct. 31, 1912	-----	Peacock, Frank David	Oct. 28, 1911	-----
Dinsdale, William	July 16, 1948	A 198	Penman, Hugh	May 21, 1914	-----
Dutton, Joseph A.	Aug. 17, 1948	A 201	Phelan, Arthur	May 27, 1913	-----
Elliott, John B.	June 30, 1928	-----	Powell, J. W.	June 10, 1911	-----
Emmerson, Joseph	Nov. 9, 1907	-----	Quinn, John Graham	July 8, 1916	-----
France, Thos.	Nov. 22, 1906	-----	Ramsay, Peter Millar	May 16, 1918	-----
Fraser, Norman	Mar. 4, 1905	-----	Reger, Frederick W. ¹	Mar. 18, 1949	A 204
Freeman, H. N.	May 1, 1909	-----	Rolfe, Emrys	Dec. 15, 1932	-----
Frew, Wm. M.	July 6, 1932	-----	Roper, William	May 13, 1915	-----
Galloway, C. F. J.	July 22, 1908	-----	Russell, John	May 21, 1914	-----
Gardner, Harold H.	Feb. 10, 1947	A 196	Simpson, Edward O. T.	July 16, 1948	A 199
Garroway, Alfred J.	May 6, 1954	A 209	Smith, A. E.	Oct. 28, 1911	-----
Gascoyne, Rowland B.	May 21, 1914	-----	Smith, David	Nov. 13, 1957	A 213
Gee, Archibald R.	Jan. 20, 1944	A 192	Smith, Joseph	July 22, 1908	-----
Gilham, John	Jan. 5, 1925	-----	Smith, Thos. Edwin	Dec. 19, 1918	-----
Glover, Francis	Oct. 31, 1912	-----	Spicer, J. E.	Oct. 28, 1911	-----
Goodwin, William	Dec. 30, 1963	A 215	Stevens, L. C.	Nov. 27, 1909	-----
Hanson, Wm. B.	Dec. 9, 1930	-----	Stewart, R. T.	Sept. 10, 1910	-----
Hewlett, Howe	May 27, 1913	-----	Strang, James	June 10, 1911	-----
Higgins, Alexander	Dec. 19, 1918	-----	Stubbs, Clement	July 21, 1929	-----
Hodge, William K.	June 16, 1925	-----	Touhey, James	May 21, 1914	-----
Howells, Nathaniel	Oct. 28, 1911	-----	Vincent, Thomas C.	June 24, 1924	-----
Hughes, Edward R.	Dec. 29, 1936	-----	Walker, William	May 16, 1918	-----
Hughes, John C.	May 17, 1917	-----	Wallbank, J.	Sept. 10, 1910	-----
Hulbert, Vans H.	Sept. 13, 1955	A 211	Whittaker, John	Dec. 19, 1918	-----
Humphries, Clifford	June 10, 1911	-----	Whittaker, William C.	Apr. 6, 1938	-----
Hunter, Alex. B.	July 8, 1916	-----	Williams, John Samuel	Dec. 19, 1918	-----
Huntrods, Eustace S. F.	May 19, 1922	-----	Williams, Thos. B.	May 17, 1917	-----
Jackson, Thos. R.	Nov. 9, 1907	-----	Williams, Thos. H.	Nov. 22, 1906	-----
James, Anthony R. C.	Apr. 11, 1950	A 207	Wylie, John	July 20, 1908	-----
Johnston, John	June 30, 1928	-----	Yates, Frank	Dec. 31, 1925	-----
Johnstone, William W.	July 10, 1947	A 197	Young, David B.	Dec. 6, 1943	-----

¹ Issued in lieu of certificate dated July 6, 1932, destroyed by fire.

SECOND-CLASS CERTIFICATES OF COMPETENCY

Adams, Wm. Henry	June 24, 1935	B 286	Bell, John	May 17, 1917	B 212
Almond, Walter	Nov. 15, 1917	B 213	Beveridge, William	June 21, 1920	B 233
Alstead, Robert	June 24, 1924	B 257	Bonar, Robert B.	June 30, 1928	B 270
Anderson, James J. E.	July 12, 1946	B 306	Brace, Tom	Nov. 27, 1909	B 96
Archibald, William	Nov. 22, 1922	B 250	Brett, Leonard	June 29, 1954	B 324
Barlow, Benjamin Robt.	Dec. 19, 1918	B 229	Bridge, Edward	Oct. 23, 1906	B 33
Bastion, Albert	Nov. 21, 1923	B 256	Brown, George	Dec. 19, 1918	B 225
Baudoux, Stirling A.	Mar. 24, 1952	B 319	Brown, James L.	Oct. 28, 1911	B 136

SECOND-CLASS CERTIFICATES OF COMPETENCY—Continued

Name	Date	No.	Name	Date	No.
Brown, James W.	Dec. 15, 1951	B 318	Hynds, John	May 18, 1922	B 247
Brown, John C.	Oct. 23, 1906	B 39	Hynds, William	Dec. 14, 1920	B 240
Brown, John Todd	May 9, 1912	B 150	Jackson, Thos. R.	Mar. 4, 1905	B 5
Brown, R. J.	Oct. 28, 1911	B 134	James, David	Nov. 2, 1907	B 58
Brown, Robert	May 21, 1914	B 183	Jarrett, Fred	May 1, 1909	B 84
Brown, Robert Sneddon	May 13, 1915	B 196	John, Francis	July 8, 1916	B 200
Brown, William Gold	Dec. 19, 1918	B 228	Johnston, John	June 10, 1927	B 267
Brownrigg, John H.	May 17, 1917	B 124	Johnstone, William W.	July 9, 1945	B 304
Caulfield, John	July 8, 1916	B 199	Jones, William T.	July 22, 1908	B 66
Cawthorne, L.	May 1, 1909	B 93	Jordan, Thos.	Nov. 27, 1909	B 104
Challinor, Jno. Thomas	May 27, 1913	B 169	Kirkwood, John R.	Oct. 31, 1912	B 160
Challoner, Jno. Arthur	May 21, 1914	B 178	Knowles, James E.	Oct. 28, 1911	B 137
Chapman, Wm.	June 10, 1927	B 268	Lancaster, Peter	Dec. 20, 1938	B 292
Chester, Daniel	July 24, 1943	B 299	Lander, Frank	May 13, 1915	B 195
Churchill, James	July 22, 1908	B 65	Larbalestier, P. D.	July 28, 1952	B 322
Clark, Robert	June 21, 1921	B 242	Lawrence, Stanley J.	Dec. 9, 1940	B 295
Clarkstone, Wm. W.	May 21, 1914	B 180	Lazaruk, Stephen	July 20, 1944	B 302
Cochrane, James	July 22, 1942	B 298	Lee, Robert John	Sept. 10, 1910	B 110
Cochrane, Thomas	Jan. 16, 1941	B 297	Littler, Albert	July 28, 1955	B 327
Corbett, Garnett S.	June 30, 1928	B 272	Luck, George	June 10, 1911	B 128
Corrigan, Harry	July 19, 1947	B 309	Mason, Joseph	May 13, 1915	B 193
Coupland, George	May 16, 1918	B 217	Massey, H.	Nov. 27, 1909	B 99
Crawford, David	May 1, 1909	B 88	Mather, Thomas	June 10, 1911	B 127
Cunliffe, Thomas	May 1, 1909	B 78	Matusky, A.	May 1, 1909	B 91
Cunliffe, Thomas H.	July 20, 1949	B 312	Mayer, Ralph Waldo	May 9, 1912	B 144
Davey, William H.	July 5, 1950	B 314	Mazay, W. J.	Nov. 27, 1909	B 101
Davies, J. C. H.	June 15, 1934	B 285	McDonald, J. A.	Oct. 28, 1911	B 133
Davies, Stephen	Sept. 10, 1910	B 113	McDonald, John	May 27, 1913	B 172
Dennis, Fred W.	May 21, 1914	B 174	McFegan, W.	Nov. 31, 1909	B 106
Devlin, Ernest H.	May 21, 1914	B 179	McGarry, Martin	Oct. 31, 1912	B 156
Dewar, Alexander	Oct. 31, 1912	B 162	McKay, Walter	June 30, 1926	B 262
Dickenson, Clifford	May 13, 1915	B 189	MacKinnon, Hugh G.	Dec. 22, 1921	B 243
Dinsdale, William	June 26, 1944	B 301	McLean, Michael D.	June 21, 1920	B 234
Dockrill, Arthur H.	Jan. 16, 1941	B 296	McMillan, D.	June 10, 1911	B 125
Dunn, Jas. W.	July 5, 1932	B 282	McNeil, William George	Mar. 13, 1962	B 331
Dunsmuir, John	Nov. 14, 1905	B 26	McPherson, James E.	July 22, 1908	B 73
Dykes, J. W.	May 1, 1909	B 77	Middleton, Robert	July 22, 1908	B 72
Eberts, Henry R.	July 19, 1961	B 329	Mitchell, Henry	July 8, 1916	B 201
Eccleston, Wm.	May 1, 1909	B 87	Morgan, Daniel	Nov. 21, 1923	B 254
Fairfoul, James	May 21, 1914	B 186	Morgan, Irvine	July 18, 1938	B 291
Fairley, James	July 5, 1950	B 313	Morgan, John	Nov. 2, 1907	B 43
Finlayson, James	July 29, 1905	B 21	Morgan, William	Dec. 19, 1918	B 224
Fisher, John Mackie	May 5, 1954	B 323	Morris, James E.	Jan. 9, 1951	B 315
Frame, Muir A.	July 23, 1946	B 308	Morton, Robert W.	July 22, 1908	B 59
France, Thos.	May 14, 1905	B 27	Murray, George	Oct. 3, 1919	B 232
Francis, Enoch	May 1, 1909	B 86	Musgrave, J.	May 1, 1909	B 90
Francis, James	July 22, 1908	B 63	Myers, Peter	May 9, 1912	B 149
Frater, George	July 8, 1916	B 204	Nicholl, Joseph O.	Dec. 31, 1925	B 261
Freeman, Henry N.	Nov. 2, 1907	B 45	Osborne, Hugh	Dec. 14, 1920	B 239
Frew, Wm. M.	June 10, 1927	B 269	Ovington, John	Nov. 2, 1907	B 52
Garbett, Richard	Oct. 31, 1912	B 161	Park, William	June 21, 1920	B 238
Garraway, Alfred J.	July 30, 1951	B 316	Parkinson, T.	May 1, 1909	B 80
Gething, Lloyd M.	Aug. 23, 1948	B 311	Parnham, Charles	Nov. 2, 1907	B 49
Gilham, John	June 21, 1920	B 237	Parry, Glynn R. D.	June 24, 1952	B 320
Gourlay, Robert	Dec. 19, 1918	B 227	Quinn, John	May 9, 1912	B 146
Gray, David	May 1, 1909	B 76	Ramsay, Peter Millar	May 17, 1917	B 209
Gray, George	July 8, 1916	B 207	Rankin, George	Nov. 27, 1909	B 103
Greenwell, Archibald	May 16, 1918	B 220	Raynes, M. T.	Oct. 28, 1911	B 139
Gregory, Wm.	June 16, 1931	B 278	Rear, Albert E.	June 15, 1934	B 283
Hastings, Andrew P.	Dec. 19, 1918	B 223	Reid, Wm.	Oct. 28, 1911	B 132
Hayes, Thomas O.	July 24, 1943	B 300	Renny, James	Oct. 28, 1911	B 140
Hodge, William K.	Jan. 5, 1925	B 259	Richards, Samuel	May 9, 1912	B 152
Holliday, William	Dec. 19, 1918	B 230	Rigby, John	July 29, 1905	B 29
Hopkins, Harry	June 16, 1930	B 276	Roberts, Ebenezer	Sept. 10, 1910	B 117
Horrocks, Abner G.	June 10, 1911	B 130	Robinson, William	July 22, 1908	B 69
Howells, Nathaniel	Nov. 27, 1909	B 97	Rogers, George	May 1, 1909	B 79
Hughes, Edward R. ¹	Sept. 28, 1931	B 280	Roper, William	May 9, 1912	B 141
Hughes, John C.	Sept. 10, 1910	B 109	Rowbottom, Thomas	May 16, 1918	B 222
Hulbert, Vans H.	June 24, 1952	B 321	Russell, John	Nov. 2, 1907	B 47
Hutton, Isaac	May 21, 1914	B 185	Scarpino, Francis	Dec. 19, 1918	B 226
Hutton, John	May 9, 1912	B 154	Senycz, John J.	Aug. 28, 1961	B 330

¹ Substituted for No. B 279, June 16, 1931.

SECOND-CLASS CERTIFICATES OF COMPETENCY—*Continued*

Name	Date	No.	Name	Date	No.
Shanks, David	Oct. 31, 1912	B 159	Touhey, William	July 8, 1916	B 205
Shaw, Thomas John	May 27, 1913	B 166	Vaughan, John Henry	July 12, 1939	B 293
Smillie, John	Dec. 8, 1955	B 328	Virgo, John	May 1, 1909	B 89
Smith, John	Oct. 3, 1919	B 231	Waddington, Daniel M.	June 16, 1931	B 277
Smart, Robert K.	Nov. 22, 1922	B 248	Walker, William	May 13, 1915	B 192
Stafford, Matthew	June 10, 1911	B 131	Webster, Arnold	Aug. 23, 1951	B 317
Stewart, J. M.	May 1, 1909	B 95	Webster, James S.	June 24, 1924	B 258
Stockwell, William	Nov. 2, 1907	B 56	Weir, James	July 31, 1945	B 305
Strang, Thomas	Oct. 31, 1912	B 158	Whittaker, John	July 2, 1954	B 325
Stubbs, Clement	May 18, 1922	B 245	Williams, John Samuel	Nov. 15, 1917	B 215
Taylor, Robert	Dec. 30, 1926	B 265	Wilson, Richard B.	Jan. 16, 1945	B 303
Thomas, Daniel W.	Nov. 22, 1922	B 249	Wilson, Robinson	May 21, 1914	B 177
Thompson, Joseph	Sept. 10, 1910	B 114	Wilson, Thomas	July 22, 1908	B 74
Tonge, Thomas	July 22, 1908	B 71	Woods, Robert W.	Oct. 15, 1954	B 326
Touhey, James	May 9, 1912	B 147	Yates, Frank	Nov. 22, 1922	B 251

THIRD-CLASS CERTIFICATES OF COMPETENCY

Adams, Wm. H.	Dec. 9, 1930	C 845	Boyce, James A.	July 29, 1949	C 988
Adamson, Wm.	Dec. 22, 1921	C 721	Bradley, Wilfred	May 17, 1922	C 733
Allan, Archie M.	Jan. 7, 1947	C 969	Bradley, William	July 22, 1908	C 291
Almond, Walter	July 22, 1908	C 286	Brett, Leonard	July 10, 1947	C 975
Alstead, Robert	June 21, 1921	C 719	Bridge, Edward	July 29, 1905	C 223
Ambrosi, Antonio	June 16, 1930	C 843	Brisco, F.	July 22, 1908	C 309
Anderson, James J. E.	Dec. 17, 1945	C 958	Broscoe, Fred S.	July 7, 1937	C 878
Anderson, John	Oct. 28, 1911	C 437	Broderick, Harold D.	July 9, 1945	C 955
Anderson, Robert	Oct. 14, 1914	C 599	Brown, Arthur A.	Oct. 14, 1914	C 596
Angell, William	May 21, 1914	C 591	Brown, David G.	July 12, 1946	C 965
Apponen, Fred	June 29, 1946	C 963	Brown, George	July 8, 1916	C 626
Arbuckle, John	May 13, 1915	C 622	Brown, George A.	Dec. 14, 1920	C 706
Archibald, George	May 21, 1914	C 569	Brown, James	Sept. 10, 1910	C 364
Archibald, Thomas	Oct. 28, 1911	C 454	Brown, James	June 10, 1911	C 412
Bann, Thomas	Oct. 31, 1912	C 494	Brown, James	July 8, 1916	C 625
Baggaley, J.	July 22, 1908	C 300	Brown, James M.	Jan. 4, 1943	C 930
Baguley, James	Dec. 2, 1929	C 829	Brown, Jas. Miller	May 13, 1915	C 615
Bain, James	May 27, 1913	C 546	Brown, James Weir	July 16, 1948	C 979
Bainbridge, James	Nov. 21, 1922	C 744	Brown, John	Sept. 10, 1910	C 392
Baker, Ralph	July 16, 1948	C 980	Brown, Matthew	July 5, 1932	C 854
Bankhead, Hugh	July 9, 1945	C 954	Brown, Robert	Oct. 28, 1911	C 451
Barber, Walter H.	Jan. 20, 1944	C 943	Brown, Robert D.	June 10, 1911	C 423
Barker, Robert	June 10, 1911	C 415	Brown, Robert S.	June 10, 1911	C 408
Barlow, B. R.	May 1, 1909	C 337	Brown, William Gold	July 8, 1916	C 629
Barr, Samuel	June 10, 1927	C 809	Bryant, Richard J.	July 8, 1955	C 1022
Barrass, Robt.	June 30, 1926	C 795	Bryden, Thomas	June 16, 1930	C 842
Bastion, Albert	May 30, 1923	C 750	Bullen, Thomas	Sept. 10, 1910	C 379
Batchelor, Harry	Jan. 20, 1944	C 945	Cairns, Andrew	June 10, 1911	C 420
Bate, Horace	Dec. 30, 1926	C 802	Cairns, Robert	May 27, 1913	C 539
Bateman, Joseph William	Oct. 28, 1913	C 551	Caldwell, Peter	June 21, 1921	C 715
Beard, Henry C.	May 30, 1923	C 751	Calverly, Joseph	Sept. 10, 1910	C 375
Beard, Henry G.	July 17, 1961	C 1032	Camamile, Hollis	Oct. 28, 1911	C 443
Beeton, D. H.	May 1, 1909	C 338	Campbell, Samuel	Nov. 15, 1917	C 662
Bell, John	May 9, 1912	C 477	Carroll, George	Nov. 21, 1922	C 746
Bennett, Andrew M.	Nov. 15, 1917	C 661	Carruthers, Robert	Dec. 22, 1933	C 859
Bennett, John	Oct. 14, 1914	C 597	Carson, George	Mar. 17, 1917	C 663
Bennie, William W.	July 18, 1938	C 895	Catchpole, Charles	July 29, 1905	C 227
Beveridge, Wm.	June 10, 1911	C 396	Caulfield, John	May 1, 1909	C 321
Biggs, James	June 1, 1933	C 858	Challoner, Arthur	Oct. 28, 1911	C 433
Biggs, Thomas	Oct. 28, 1911	C 449	Chambers, Ralph H.	Dec. 14, 1920	C 709
Birchell, Richard	Oct. 1, 1907	C 266	Chapman, John	May 30, 1923	C 753
Blakemore, Roydon B.	Dec. 27, 1934	C 869	Chapman, Wm.	Dec. 22, 1921	C 720
Bias, Emil	June 24, 1924	C 774	Chapple, Allison D.	Aug. 19, 1947	C 978
Blewett, Ernest	July 22, 1908	C 298	Cheetham, Ben	July 22, 1908	C 311
Blunkhorn, Thomas	Dec. 19, 1918	C 681	Chester, Daniel	Dec. 20, 1939	C 912
Bobchak, Daniel	Jan. 26, 1944	C 946	Chester, John	Oct. 28, 1911	C 440
Bond, Frank	June 30, 1926	C 797	Cimolini, Primo	June 24, 1940	C 915
Bowie, James I.	May 6, 1936	C 873	Cimolini, Romeo	Jan. 4, 1943	C 929

1 Substituted for No. C 309, July 20, 1908.

THIRD-CLASS CERTIFICATES OF COMPETENCY—Continued

Name	Date	No.	Name	Date	No.
Cimolini, Sero J.	Jan. 4, 1943	C 928	Ewing, Robert	May 13, 1915	C 608
Clark, John William	July 20, 1949	C 986	Fairfoull, James	Oct. 28, 1911	C 453
Clark, Walter Pattison	May 9, 1912	C 480	Fairley, James	Jan. 24, 1940	C 916
Clarkson, Hugh G.	May 17, 1922	C 736	Farrow, John William	Dec. 19, 1918	C 683
Clarkson, James M.	July 10, 1947	C 973	Ferryman, Henry	June 21, 1920	C 697
Clarkson, Robert	June 21, 1920	C 696	Fitzpatrick, T. J.	Oct. 2, 1911	C 452
Clarkstone, Wm. W.	Oct. 28, 1911	C 431	Flockart, David	Jan. 21, 1913	C 531
Cleaves, Walter	May 9, 1912	C 475	Fortunato, Joseph A.	Oct. 4, 1934	C 1016
Clifford, William	July 22, 1908	C 313	Forsyth, William	June 16, 1930	C 836
Cloke, Chas. E.	June 16, 1925	C 782	Fowler, Robert	Oct. 31, 1912	C 495
Contes, Frank	June 16, 1925	C 789	Frame, Muir	July 12, 1939	C 906
Cochrane, James	June 24, 1940	C 914	France, Henry A.	May 28, 1956	C 1023
Coldgrove, Charles Henry	Dec. 19, 1918	C 679	Francis, James	Oct. 1, 1907	C 250
Coldwell, Daniel	May 17, 1917	C 639	Frater, George	May 13, 1915	C 616
Cooper, John Andrew	Dec. 19, 1918	C 689	Frater, Joseph	July 21, 1929	C 828
Cooper, Leonard	Dec. 16, 1937	C 887	Freeman, H. N.	Nov. 14, 1903	C 230
Cope, Frank	Oct. 28, 1913	C 549	Frew, Joseph	June 26, 1944	C 947
Corbett, Garnett S.	Dec. 23, 1927	C 812	Frew, William M.	May 30, 1923	C 752
Corrigan, Harry	July 18, 1938	C 901	Frobisher, Martin	Jan. 16, 1945	C 950
Coulthard, James	June 10, 1911	C 407	Frodsham, Vincent	July 22, 1908	C 282
Coupland, David	June 21, 1921	C 713	Gabriel, Ernest P.	May 17, 1922	C 739
Craig, Robert T. S.	Aug. 2, 1946	C 967	Gail, Louis	Jan. 20, 1944	C 942
Crawford, David	Mar. 4, 1905	C 208	Garbett, Richard	Sept. 10, 1910	C 377
Cullen, Alex.	July 21, 1929	C 824	Garraway, Alfred J.	July 5, 1950	C 993
Cunliffe, Thos.	Oct. 1, 1907	C 265	Gascoyne, Rowland B.	Jan. 21, 1913	C 513
Cunliffe, Thos. H.	Dec. 20, 1938	C 903	Gauthier, Phillias J.	July 26, 1961	C 1033
Cunningham, G. F.	Nov. 11, 1905	C 229	Geater, Jas. Gordon	May 21, 1914	C 573
Cuthell, George W.	Dec. 2, 1929	C 832	Gee, Archibald R.	Jan. 10, 1944	C 939
Cyto, William	July 5, 1955	C 1019	Gething, Lawrence C. ²	June 25, 1962	C 1035
Dabb, Owen	May 21, 1914	C 578	Gething, Quentin F.	June 29, 1946	C 959
Davey, Andrew	June 17, 1953	C 1012	Gibson, Munro M.	Dec. 27, 1931	C 850
Davey, George	June 21, 1921	C 718	Gigliotti, Frank	July 20, 1949	C 985
Davey, William H.	June 29, 1946	C 962	Gilham, John	May 13, 1915	C 623
Davies, Evan Thomas	May 9, 1912	C 463	Gillies, William	May 16, 1918	C 668
Davies, John H. C.	May 17, 1922	C 729	Gilmour, Hugh M.	July 18, 1938	C 896
Davis, William	May 1, 1909	C 339	Girou, Roger	Jan. 27, 1947	C 972
Dean, Alexander	June 10, 1944	C 931	Glen, James	Oct. 28, 1911	C 435
Dean, Joseph	May 13, 1915	C 611	Gordon, Davis John	May 9, 1912	C 474
Delprato, Joseph	June 16, 1930	C 837	Graham, James D.	Aug. 17, 1949	C 989
Derbyshire, A.	June 10, 1911	C 401	Grant, Ferguson	Oct. 29, 1951	C 1005
Dewar, Alex.	Sept. 10, 1910	C 369	Gray, George	May 9, 1912	C 467
Devlin, Edward	Oct. 23, 1906	C 241	Greenhorn, John	May 21, 1914	C 575
Devlin, Ernest Henry	May 27, 1913	C 538	Gregory, William	May 30, 1923	C 756
Devlin, John	Oct. 3, 1919	C 693	Gregson, John B.	Dec. 31, 1925	C 790
Devoy, William	May 17, 1917	C 638	Griffiths, Edward	Oct. 31, 1914	C 568
Dickenson, Clifford	May 27, 1917	C 532	Groat, Ed. Murray	Nov. 20, 1923	C 764
Dickie, Leslie	Nov. 20, 1923	C 762	Gunnell, James	Oct. 31, 1912	C 505
Dingsdale, George	Oct. 28, 1911	C 459	Gunniss, Matthew	May 9, 1912	C 460
Dinsdale, William	Dec. 27, 1934	C 868	Guy, George	June 16, 1931	C 848
Dockrill, Arthur H.	Dec. 20, 1938	C 904	Haile, Joseph G.	May 17, 1922	C 731
Doherty, J. S.	May 1, 1909	C 340	Hall, James	May 17, 1922	C 742
Donelan, Lawrence	June 29, 1946	C 960	Halsall, J.	July 22, 1908	C 307
Doney, John	Mar. 4, 1905	C 211	Hamer, Joseph	Dec. 9, 1930	C 846
Donnachie, John	June 10, 1911	C 425	Hamilton, Charles	July 31, 1962	C 1037
Dorrance, Orlin William	Jan. 21, 1913	C 517	Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550
Doratty, Robert O.	July 5, 1950	C 992	Hancock, Arthur	Nov. 15, 1917	C 656
Douglas, D. B.	Oct. 23, 1906	C 235	Hannah, Archibald	Dec. 2, 1929	C 834
Dow, And. Y.	May 21, 1914	C 587	Hanson, T. H.	July 8, 1908	C 280
Drybrough, Robert	June 21, 1920	C 701	Hardy, Edward	June 21, 1920	C 694
Dunlop, Thomas S.	June 26, 1944	C 948	Hart, Daniel M.	May 17, 1922	C 730
Dunn, Andrew	Jan. 7, 1936	C 871	Harvey, Thomas	May 9, 1912	C 466
Dunnigan, Richard	June 21, 1921	C 716	Harwood, Fred	Sept. 10, 1910	C 384
Dunsmore, Alexander	Dec. 9, 1930	C 847	Hayes, Ernest	Dec. 2, 1929	C 830
Easton, Andrew B.	July 18, 1938	C 893	Heaps, Robert	Sept. 10, 1910	C 373
Ebert, Henry R.	Jan. 16, 1941	C 926	Hemer, Herbert	Oct. 14, 1914	C 595
Eccleston, John J.	May 30, 1923	C 757	Hendry, James	May 9, 1912	C 471
Eckersley, John	June 15, 1934	C 866	Hetherington, Geo.	July 21, 1929	C 825
Edwards, John	May 27, 1913	C 542	Heycock, James E.	July 5, 1932	C 852
Elliott, John	May 27, 1913	C 541	Heycock, William J.	Dec. 29, 1936	C 876
Elliott, John B.	Dec. 23, 1927	C 811	Heyes, Edward	May 1, 1909	C 320
Elmes, Levi	July 5, 1932	C 856	Heyes, Thos. O.	Jan. 7, 1936	C 870
Evans, D.	July 22, 1908	C 284	High, William	July 11, 1951	C 997

² Substitute certificate issued in lieu of No. C 982.

THIRD-CLASS CERTIFICATES OF COMPETENCY—Continued

Name	Date	No.	Name	Date	No.
Hilton, Mathias	Dec. 19, 1918	C 825	Loxton, George	June 10, 1911	C 428
Hilton, R. G.	Sept. 10, 1910	C 376	Loxton, John	June 10, 1911	C 416
Hindmarsh, John G.	June 30, 1926	C 799	Luck, George	May 1, 1909	C 318
Hindmarsh, Peter	May 30, 1923	C 755	Lynch, Stewart	Oct. 28, 1911	C 432
Hinskens, Joseph T.	Jan. 2, 1952	C 1007	Mack, George	Sept. 10, 1951	C 1004
Hodge, William K.	Nov. 20, 1923	C 761	Mackie, John	June 10, 1911	C 421
Hodson, R. H.	Mar. 4, 1905	C 216	Magielka, John	June 24, 1940	C 918
Holdsworth, William	May 16, 1918	C 671	Maio, Silvio	June 19, 1956	C 1026
Holley, Thomas W.	July 2, 1943	C 932	Maki, Hannes	July 7, 1941	C 922
Holliday, William	July 8, 1916	C 634	Makin, J. Wm.	Sept. 10, 1910	C 385
Hopkins, Harry	Dec. 31, 1925	C 791	Matone, John	May 21, 1914	C 585
Horbury, Joseph W.	June 10, 1911	C 406	Manifold, A.	May 1, 1909	C 336
Horrocks, A. G.	May 1, 1909	C 324	Martin, James	June 10, 1911	C 398
Howells, Nathaniel	May 1, 1909	C 316	Mason, Joseph	July 22, 1908	C 297
Hughes, Edward R.	Dec. 9, 1930	C 844	Massey, Henry	May 1, 1909	C 317
Hughes, Isaac R.	June 18, 1936	C 874	Mather, Thomas	July 22, 1908	C 293
Hughes, Sydney S.	July 2, 1943	C 938	Matusky, Andrew	Oct. 1, 1907	C 259
Huibert, Vans H.	July 13, 1951	C 1000	Maxwell, Alfred W.	July 7, 1937	C 881
Hunchuk, William	July 12, 1939	C 907	Maxwell, Geo.	May 21, 1914	C 571
Hunt, Sydney, Jr.	July 24, 1940	C 913	McArthur, John Malcolm	May 17, 1917	C 648
Hunter, Peter M.	June 30, 1926	C 798	McArthur, Robert	Dec. 22, 1921	C 723
Hunter, Thomas	June 16, 1925	C 786	McCann, Thomas	July 12, 1939	C 910
Hutchinson, Lawrence	July 2, 1943	C 937	McCourt, John	Oct. 14, 1914	C 605
Hutchison, Ben	Nov. 14, 1905	C 232	McCourt, Thos.	Dec. 30, 1926	C 805
Hynd, John	Dec. 14, 1920	C 707	McCulloch, James	May 1, 1909	C 315
Hynds, William	July 8, 1916	C 632	McDonald, Allen	June 30, 1928	C 817
Ireson, John	Oct. 31, 1912	C 507	McDonald, John	Oct. 28, 1911	C 448
Irvine, David	June 10, 1911	C 413	McFagen, Alexander	May 9, 1912	C 490
Jack, John	May 21, 1914	C 582	McGarry, Martin	May 1, 1909	C 326
Jardine, Geo. Edward	Jan. 21, 1913	C 521	McGrath, James	July 8, 1916	C 630
Jarrett, Fred J.	Oct. 1, 1907	C 256	McGregor, Gregor	Jan. 20, 1944	C 941
Jenkins, John	Sept. 10, 1910	C 390	McGuire, Thomas	Oct. 28, 1913	C 553
John, Howell	July 22, 1908	C 305	McInnis, John C.	July 7, 1937	C 885
Johnston, Fred	Dec. 30, 1926	C 803	McIntyre, Neil	May 21, 1914	C 574
Johnston, Robert	May 9, 1912	C 479	McKay, Walter	Nov. 20, 1923	C 763
Johnstone, William W.	July 18, 1938	C 894	McKenzie, Peter	June 10, 1911	C 427
Jones, Douglas M.	June 15, 1934	C 861	McKibben, Matthew	May 21, 1914	C 580
Jones, Samuel	Mar. 4, 1905	C 544	McKinley, John	Oct. 28, 1914	C 442
Jones, William E.	Jan. 21, 1913	C 556	McLachlan, Alex.	June 10, 1912	C 419
Jones, William T.	Oct. 28, 1913	C 221	McLaren, John	May 30, 1923	C 754
Joyce, Walter	Nov. 27, 1909	C 361	McLaughlin, James	May 9, 1912	C 485
Judge, Peter	Sept. 10, 1910	C 391	McLean, M. D.	Sept. 10, 1910	C 389
Keenan, Wm. James	June 10, 1911	C 426	McLellan, William	Mar. 4, 1905	C 219
Kelly, Ernest	May 17, 1917	C 646	McLeod, James	July 22, 1908	C 296
Kelly, Francis	June 16, 1930	C 839	McLeod, John	May 13, 1915	C 609
Kemp, Wm.	Oct. 14, 1914	C 594	McMeakin, James	May 13, 1915	C 612
Kinakin, Peter E.	July 5, 1955	C 1021	McMillan, D.	Sept. 10, 1910	C 363
Kirkeberg, H. S.	Nov. 27, 1909	C 350	McMillan, Edward	Oct. 31, 1912	C 493
Kirkham, Alfred	Oct. 28, 1913	C 559	McMillan, Neil	Nov. 15, 1917	C 654
Kirkpatrick, Hugh	June 26, 1944	C 944	McNeill, Adam L.	July 22, 1908	C 281
Klejko, Steve	Dec. 14, 1920	C 703	McVeigh, Francis	July 5, 1932	C 855
Kniert, Kenneth F.	Sept. 28, 1946	C 968	McWhirter, Archibald	June 30, 1926	C 794
Knowles, Joseph	July 10, 1947	C 974	Meek, Matthew	May 9, 1912	C 484
Krall, John	July 29, 1949	C 987	Menduk, Stanley	June 29, 1946	C 964
Krall, Thomas F.	July 2, 1943	C 936	Merrifield, George	Oct. 23, 1906	C 239
Kusnir, Paul	July 5, 1950	C 994	Mihalynuk, Michael	July 17, 1961	C 1031
Lancaster, Peter	Dec. 16, 1937	C 888	Miles, John	June 10, 1911	C 414
Larner, Ralph	July 7, 1941	C 924	Miller, Frederick	July 21, 1929	C 823
Lazaruk, Steve	June 30, 1928	C 815	Miller, Harry	Aug. 29, 1951	C 1003
Leeman, T.	May 1, 1909	C 345	Mitchell, Charles	May 1, 1909	C 322
Leonard, Leon D.	Jan. 16, 1941	C 925	Mitchell, Henry	Sept. 10, 1910	C 366
Lester, Frank	May 17, 1922	C 734	Moore, George	Oct. 23, 1906	C 242
Lewis, Benj. J.	Sept. 10, 1910	C 386	Moore, John	May 1, 1909	C 335
Lewis, Clyde	Jan. 2, 1952	C 1006	Moreland, Thomas	July 22, 1908	C 299
Lewis, Glyn	July 12, 1939	C 909	Morgan, Cornelius	Dec. 22, 1921	C 725
Leyward, Paul	May 17, 1917	C 637	Morgan, Irving	July 7, 1937	C 885
Lindsay, William	May 17, 1917	C 642	Morgan, John	June 24, 1924	C 773
Linn, George Y.	May 17, 1922	C 737	Morgan, Spencer, Jr.	July 11, 1961	C 1030
Litherland, David	June 30, 1928	C 816	Morgan, William	May 17, 1917	C 636
Littler, Albert	July 2, 1943	C 933	Morris, David	May 9, 1912	C 472
Littler, Robert, Jr.	July 18, 1938	C 898	Morris, Thomas B.	July 12, 1946	C 966
Livingstone, Alex.	Oct. 28, 1911	C 436	Murdoch, Gordon	July 5, 1955	C 1018
Louden, William D.	July 7, 1941	C 923			

THIRD-CLASS CERTIFICATES OF COMPETENCY—Continued

Name	Date	No.	Name	Date	No.
Murdoch, Jno. Y.	May 21, 1914	C 564	Russell, Robert	Nov. 27, 1909	C 351
Murray, Robt.	June 30, 1926	C 796	Salvador, Cirino	July 7, 1950	C 995
Myers, Peter	Oct. 28, 1911	C 446	Sanders, Henry	June 15, 1934	C 863
Nee, Wm. R.	Dec. 22, 1921	C 724	Saunders, Eustace L.	Jan. 21, 1913	C 520
Neen, John R.	Dec. 16, 1937	C 889	Scales, Joseph	May 17, 1922	C 738
Neilson, William	May 9, 1912	C 481	Scarpino, Francis	May 17, 1917	C 649
Nelson, Horatio	Oct. 1, 1907	C 263	Sclippa, Louis A.	June 26, 1953	C 1015
Nicholas, George H.	June 24, 1952	C 1008	Scott, Henry	July 22, 1908	C 294
Nicholson, James	May 9, 1912	C 469	Seddon, James	Oct. 3, 1919	C 824
Norris, Joshua	Oct. 28, 1913	C 557	Serek, Joseph John	July 5, 1955	C 1020
Nowotny, Gerhard F.	July 11, 1961	C 1029	Shanks, David	Sept. 10, 1910	C 372
Nuttall, Wm.	June 16, 1925	C 780	Sharp, James	May 1, 1909	C 325
Oakes, Robert	Oct. 31, 1912	C 498	Sharpe, Henry	June 16, 1925	C 783
O'Brien, Reginald	June 26, 1940	C 917	Shaw, Robert	June 1, 1933	C 857
Odgers, Eli	Jan. 21, 1913	C 523	Shea, Thomas J.	Dec. 22, 1921	C 722
O'Neill, Henry J.	Oct. 25, 1948	C 983	Shields, Thomas	May 16, 1918	C 667
Osborne, Hugh	Oct. 28, 1913	C 555	Shipley, John W.	Oct. 28, 1911	C 456
Oswald, Geo. L.	Sept. 10, 1910	C 370	Shooter, Joseph	Oct. 1, 1907	C 261
Park, William	Dec. 19, 1918	C 684	Shortman, J.	May 1, 1909	C 331
Parker, John H.	June 15, 1934	C 864	Sim, James	Dec. 14, 1920	C 711
Parker, L.	May 1, 1909	C 341	Simister, J. H.	Nov. 27, 1909	C 353
Parkinson, James Wm.	Nov. 15, 1917	C 655	Simister, W.	May 1, 1909	C 334
Parkinson, T.	July 22, 1908	C 289	Simms, Hubert Allan	Jan. 21, 1913	C 526
Parkinson, Thomas	June 24, 1924	C 769	Sinclair, William	Jan. 21, 1913	C 527
Parks, Alexander	Jan. 21, 1913	C 519	Singleton, Eric	June 24, 1952	C 1009
Parrott, Jas. E.	May 21, 1914	C 590	Slee, Thomas	June 30, 1926	C 793
Parson, Herbert	May 13, 1915	C 621	Smellie, John	May 29, 1923	C 758
Parsons, Albert	June 10, 1927	C 808	Smith, A. E.	Sept. 10, 1910	C 367
Parsons, Herbert H.	July 8, 1952	C 1011	Smith, John Watterson	May 16, 1918	C 665
Pasiand, Roger A.	July 18, 1938	C 897	Smith, Joseph	Mar. 4, 1905	C 207
Patrick, Andrew	June 16, 1931	C 849	Smith, Richard Beveridge	Oct. 28, 1913	C 561
Penman, Hugh	Oct. 28, 1913	C 552	Smith, Thos. J.	Oct. 1, 1907	C 271
Perry, Lorne B.	July 12, 1939	C 911	Smith, Thomas	May 9, 1912	C 486
Pettoello, Mario J.	Jan. 7, 1947	C 970	Smith, Thomas	Dec. 14, 1920	C 705
Phillips, James	Nov. 21, 1922	C 749	Socket, James C.	Jan. 16, 1945	C 951
Phillips, Richard S.	May 17, 1917	C 620	Somerville, Alexander	July 7, 1937	C 884
Pickup, A.	July 22, 1908	C 310	Sopwith, Reginald Scott	Jan. 21, 1913	C 512
Plant, Samuel	Nov. 14, 1905	C 233	Southern, John C.	July 9, 1945	C 956
Plonka, Czeslaw Jan	June 22, 1953	C 1013	Sparks, Edward ³	Oct. 1, 1907	C 314
Pollock, John	May 30, 1923	C 760	Spencer, G.	May 1, 1909	C 329
Poole, Samuel	May 27, 1913	C 536	Stafford, M.	Sept. 10, 1910	C 382
Price, Walter	Sept. 10, 1910	C 371	Starr, Wallace	May 9, 1912	C 488
Protti, Samuel	Mar. 17, 1950	C 991	Staton, Edward	May 21, 1914	C 581
Quarin, Nillo	July 26, 1961	C 1034	Steele, Walter	Oct. 28, 1911	C 439
Quayle, Alex. B.	Jan. 5, 1925	C 778	Stewart, George	May 27, 1913	C 534
Queen, John	July 12, 1939	C 908	Stewart, James B.	June 16, 1925	C 785
Queen, Peter	Jan. 16, 1941	C 927	Stewart, James M.	Oct. 23, 1906	C 240
Quinn, John	Oct. 28, 1911	C 429	Stewart, John	Dec. 30, 1926	C 801
Quintillio, Hugh	June 11, 1956	C 1024	Stockwell, William	Oct. 23, 1906	C 238
Rallison, R.	July 22, 1908	C 279	Stone, Wm. C.	June 21, 1921	C 714
Rankin, George	July 22, 1908	C 275	Strang, James	May 13, 1915	C 614
Rankin, Wm. Shaw	May 9, 1912	C 489	Surtees, Edward	June 16, 1930	C 835
Raynor, Fred	Oct. 1, 1907	C 257	Sutton, Charles E.	July 30, 1951	C 1002
Rear, Albert E.	June 10, 1927	C 807	Sweeney, John	May 17, 1922	C 735
Reid, Thos.	May 21, 1914	C 592	Taylor, Charles M.	Mar. 4, 1905	C 213
Reid, Wm.	June 10, 1911	C 403	Taylor, Henry	Dec. 20, 1928	C 818
Reilly, Thomas	July 22, 1908	C 303	Taylor, Hugh	Jan. 21, 1913	C 530
Renney, Jas.	Nov. 27, 1909	C 354	Taylor, Jonathan	Dec. 19, 1918	C 680
Richards, James	Nov. 1, 1907	C 249	Taylor, J. T.	Oct. 28, 1911	C 447
Richards, Samuel	Oct. 23, 1906	C 244	Taylor, Leroy	Sept. 10, 1910	C 381
Richardson, J. H.	Oct. 28, 1911	C 458	Taylor, Reginald T.	June 18, 1936	C 875
Rigby, John	July 29, 1905	C 225	Taylor, Robert	June 21, 1920	C 695
Roberts, Arthur	June 24, 1924	C 772	Taylor, Robert K.	July 10, 1947	C 976
Roberts, Ebenezer	May 1, 1909	C 327	Taylor, Thomas	May 21, 1914	C 577
Robertson, Thomas H.	July 7, 1937	C 883	Taylor, Thomas	July 7, 1937	C 882
Robinson, Asa	June 16, 1925	C 787	Tellier, Lucien	July 13, 1951	C 999
Robinson, Michael	May 1, 1909	C 332	Tennant, Joseph	June 24, 1924	C 770
Robson, James	June 16, 1925	C 788	Thacker, Geo.	May 27, 1913	C 537
Roper, William	July 22, 1908	C 274	Thewlis, David	July 2, 1943	C 935
Rowbottom, Thomas	Oct. 31, 1914	C 492	Thewlis, David, Jr.	July 11, 1951	C 998
Royle, Edward	Oct. 31, 1912	C 506	Thomas, Edward J.	Jan. 16, 1950	C 990
			Thomas, John B.	Nov. 14, 1905	C 231

³ Issued in lieu of No. C 255, destroyed by fire.

THIRD-CLASS CERTIFICATES OF COMPETENCY—Continued

Name	Date	No.	Name	Date	No.
Thomas, Thomas	Sept. 10, 1910	C 365	Watson, George M.	July 16, 1957	C 1027
Thomason, Charles	Nov. 15, 1917	C 657	Watson, John	May 17, 1922	C 743
Thompson, Joseph	Oct. 1, 1907	C 269	Watson, Joseph	Jan. 21, 1913	C 515
Thompson, Thomas	Oct. 1, 1917	C 267	Watson, Reginald V.	July 20, 1949	C 984
Thomson, Charles	June 24, 1924	C 765	Watson, William	Oct. 22, 1906	C 246
Thomson, John A.	July 14, 1951	C 1001	Watson, William	May 17, 1917	C 645
Touhey, William	May 27, 1913	C 547	Webb, Herbert	Oct. 28, 1911	C 457
Travis, Harvey R.	July 15, 1960	C 1028	Webster, Arnold	Apr. 12, 1951	C 996
Tully, Thomas	May 9, 1912	C 468	Webster, James Stewart	Dec. 19, 1918	C 685
Tune, Elijah	May 9, 1912	C 476	Weir, James	July 7, 1937	C 880
Tymchuk, Michael	July 4, 1952	C 1010	West, James Gloag	May 16, 1918	C 676
Unsworth, John	June 16, 1925	C 784	Whalley, William	Dec. 19, 1918	C 686
Uphill, Vernon R.	June 15, 1934	C 862	White, Ronald	July 5, 1955	C 1017
Valentine, Wilfrid	July 21, 1929	C 826	Whittaker, John, Jr.	July 18, 1938	C 891
Vanderjagt, Simon	June 19, 1956	C 1025	Wilkinson, Edward	Oct. 28, 1911	C 438
Vardy, Robt.	May 21, 1914	C 570	Williams, Arthur	Dec. 20, 1938	C 905
Vaton, Harry	July 5, 1932	C 853	Williams, John Sam	June 10, 1911	C 404
Vaughan, John Henry	Oct. 28, 1913	C 560	Wilson, John M.	Dec. 16, 1937	C 890
Verkirk, William	Jan. 7, 1947	C 971	Wilson, Joseph	June 30, 1928	C 814
Vincent, Thomas C.	Nov. 21, 1922	C 745	Wilson, Joseph R.	July 18, 1938	C 902
Volpatti, Benjamin A.	June 29, 1946	C 961	Wilson, Robinson	June 10, 1911	C 397
Waddington, D. M.	June 10, 1927	C 806	Wilson, William	Oct. 1, 1907	C 262
Wakulchik, Michael S.	July 20, 1945	C 957	Wilson, William	May 17, 1917	C 647
Walker, George	July 8, 1916	C 633	Winstanley, H.	July 22, 1908	C 283
Walker, Jas. Alexander	Oct. 31, 1912	C 496	Wintho, Thomas A.	July 29, 1905	C 222
Walker, Robert C.	May 17, 1922	C 728	Witherington, George	Oct. 28, 1913	C 554
Walker, Wm.	May 21, 1914	C 586	Wood, Francis E.	Dec. 16, 1937	C 886
Wallace, Fred	Oct. 1, 1907	C 260	Wright, John	May 21, 1914	C 593
Waller, Wm. E.	July 5, 1932	C 851	Wright, Robert	May 21, 1914	C 589
Walls, John	Dec. 14, 1920	C 710	Wright, William	Jan. 21, 1913	C 522
Walsh, James, Jr.	July 19, 1947	C 977	Yates, Frank	May 17, 1922	C 732
Wardrop, James	Oct. 31, 1912	C 504	Yates, John	June 16, 1930	C 840
Wasiewicz, Stanley A.	July 23, 1962	C 1036	Yeowart, Hudson	June 24, 1924	C 771
Watson, George	July 22, 1908	C 288	Young, Alexander	May 16, 1918	C 666

MINE SURVEYORS' CERTIFICATES

Andersen, Thormod	Jan. 10, 1944	85	Holland, Alwin	Oct. 12, 1949	96
Anderson, Harry C.	May 19, 1922	59	Holmes, Terence C.	June 16, 1930	74
Baile, Wynne Jeffreys	Oct. 3, 1919	16	Hornquist, Eric F.	Feb. 10, 1947	88
Bapty, Harry	Dec. 16, 1942	83	Hughes, Edward	Dec. 14, 1920	38
Bonar, Robert B.	Dec. 30, 1926	64	Hughes, Edward R.	Aug. 12, 1949	95
Bowerman, Everard S.	Dec. 14, 1920	39	Hunter, George	Oct. 3, 1919	30
Britton, Allan	Dec. 16, 1957	105	Jackson, Thos. R.	May 19, 1922	43
Buckham, Alexander F.	June 26, 1944	86	King, Alfred Geo.	Oct. 3, 1919	27
Caufield, Bernard	May 19, 1922	54	Kneen, Percy	Dec. 20, 1928	67
Clark, Harry W. Wilton	Feb. 14, 1948	89	Lancaster, George H.	July 16, 1948	90
Corbett, Garnett S.	May 19, 1922	49	Lancaster, Peter	Oct. 3, 1919	23
Cox, Richard	May 19, 1922	57	Larbalestier, Philip D.	July 30, 1951	104
Crosscombe, James S.	May 31, 1923	60	Lawrence, Stanley J.	Dec. 20, 1939	82
Daniell, Geo. W. B.	Oct. 3, 1919	29	Leroy, Alfred J.	Jan. 26, 1950	97
Davis, Gerald D.	Oct. 3, 1919	28	Lindoe, Luke	June 21, 1921	41
Delaney, James	Oct. 3, 1919	21	MacDonald, John	May 19, 1922	46
DePaoli, Celiste	July 29, 1949	94	McKenzie, Frank	June 10, 1927	66
Diamond, Rene J.	July 5, 1950	99	McVeigh, James T.	Sept. 16, 1963	107
Dickson, James	Oct. 3, 1919	3	Montgomery, Brockwell	Dec. 17, 1946	87
Drewry, Wm. Stewart	May 19, 1922	56	Munro, David L.	Dec. 16, 1939	79
Dwarkin, Lucien M.	July 5, 1950	100	Parry, Glyn R. D.	July 30, 1951	103
Edwards, Jas.	June 10, 1927	65	Rafter, Wm.	May 19, 1922	51
Freeman, Harry N.	May 19, 1922	47	Reger, Frederick Wm. ¹	Mar. 18, 1949	93
Gardner, Harold H.	June 16, 1930	72	Richards, Chas. Clifton	Oct. 3, 1919	19
George, Frank J.	May 19, 1922	48	Richards, James A.	Oct. 3, 1919	15
Graham, James D.	Sept. 1, 1948	91	Richmond, Alexander M.	Jan. 25, 1943	84
Graham, Morton H.	Dec. 20, 1938	81	Ridley, James	Oct. 3, 1919	18
Gregory, Richard J.	July 5, 1950	98	Roaf, Jos. R.	Oct. 3, 1919	14
Heaney, Chas. J.	June 16, 1930	73	Rutherford, John A.	Dec. 2, 1929	70
Hepburn, James T.	Dec. 14, 1920	37	Sandland, Joseph	May 31, 1923	61
Holdsworth, William	Oct. 3, 1919	9	Schjelderup, Vilhelm	July 21, 1929	69

¹ Issued in lieu of certificate dated October 3, 1919, destroyed by fire.

MINE SURVEYORS' CERTIFICATES—*Continued*

Name	Date	No.	Name	Date	No.
Scobbie, Roland G.	May 11, 1962	106	Williams, John S.	Dec. 15, 1932	78
Scott, Samuel A.	Aug. 29, 1950	101	Williams, Paul E. R.	Dec. 2, 1929	71
Stewart, R. T.	Nov. 17, 1923	62	Williams, Robert	July 14, 1951	102
Stropkay, John	June 16, 1931	76	Wilson, Arthur Rupert	Oct. 3, 1919	13
Townsend, Neville F.	Nov. 17, 1919	31	Wilson, Chas. James	Oct. 3, 1919	22
Vallance, Wm. Dixon	Oct. 3, 1919	8	Wilson, R. Robinson	Oct. 3, 1919	12
Verkirk, Lucas	June 21, 1921	42	Wilton, Douglas D.	May 19, 1922	59
Waddington, Geo. W.	June 21, 1920	35	Wright, Austin	Dec. 14, 1920	40
Williams, Arthur E.	Nov. 8, 1948	92			

NOTES ON COAL MINES

VANCOUVER ISLAND INSPECTION DISTRICT

By R. B. Bonar

The gross output of coal from the Vancouver Island Inspection District was 75,695 tons, a decrease of 5,891 tons or 7.2 per cent from the 1962 output. Only one large coal mine, the Tsable River mine, is now in production on the Island. Operations in the once important Nanaimo coalfield are now restricted to five very small mines, providing employment for no more than 10 men. These mines operate in outcrop, 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 coalfield.

The annual mine-rescue and first-aid meet organized by the Vancouver Island Mine Safety Association was held at Cumberland on Saturday, May 25th. Two teams from the Tsable River mine and a visiting team from Britannia mine participated in the mine-rescue competition, and a very high standard of performance was maintained. The winning team was the Tsable River team No. 2, captained by W. High.

NANAIMO (49° 123° S.W.)

Midan Mine This mine, formerly known as the Chambers No. 5 mine, is in Section 14, Range 7, in the Douglas district, near Extension. It is now operated by the Midan brothers; A. Midan, fireboss. The present workings consist of a 600-foot slope driven in a section of the Wellington seam in the vicinity of the old Vancouver slope workings. The slope pillars and the pillars between the rooms driven to the right off the slope are being mined on the retreat.

The coal is mined by picking out the middle band of carbonaceous shale with hand-picks. It is then blasted and hand-loaded into cars which are hauled to the tippie by a gasoline-driven hoist. A small shaker screen sorts the coal into 2-inch, 1- to 2-inch, and under 1-inch sizes.

The above working area was depleted of reserves early in the year, and a new slope was started to the left of the old slope. A considerable-sized pillar of 8 feet high coal was encountered and was skipped on the low side to form a haulage road.

Total production in 1963 was 527 tons over a working period of 140 days with a crew of two men. 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 formed 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 1963 was 582 tons over a working period of 115 days with a crew of three men. Working conditions were found to be satisfactory, and no accidents were reported.

Undun No. 3 Mine J. Unsworth and A. Dunn, operators; A. Dunn, fireboss. This mine was brought into production in September, 1960, and is located near the No. 3 slope, old Extension Colliery. A long outcrop pillar of fairly thick coal was encountered, which was skipped on the inside for several hundred feet to form a level haulage road. This pillar is now being mined on the retreat.

Production was 512 tons over a period of 81 days with a crew of two men.

Conditions found during inspections were satisfactory, and no accidents were reported.

NORTH WELLINGTON (49° 124° S.E.)

Loudon No. 6 Mine William Loudon, 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 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 1963 amounted to 70 tons over a working period of 34 days with a crew of two men. Working conditions were found to be satisfactory during the course of inspections, and no accidents were reported.

Carruthers and Wakelem No. 3 Mine R. B. Carruthers, operator and fireboss. This mine, near the Loudon mine, is also in the No. 2 or Upper Wellington seam adjacent to the abandoned workings of the old No. 9 mine. Production in 1963 amounted to 211 tons over a working period of 128 days with a crew of one man. Working conditions were found to be satisfactory in 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 4, Union Bay, B.C.

Tsable River Mine.—S. J. Lawrence, manager; James Cochrane, overman; A. Somerville, M. Frobisher, A. Cullen, L. Cooper, G. Nicholas, and W. High, firebosses.

Early in the year the recovery of equipment was completed in the northeast section, where production ceased at the end of 1962 due to the depletion of reserves. Work was concentrated on No. 10 right level, the diagonal slope pillars, and on the left side of the diagonal slope until September 25th, when dense smoke was discovered in the return airway at about 7.30 p.m. This incident is fully reported under "Dangerous Occurrences."

Owing to this fire it was found necessary to retreat to above the junction of the main and diagonal slopes. New roadways were started and old ones repaired to accommodate the working crews. This took time, and production was curtailed. However, production was about normal at the end of October.

Production in 1963 amounted to 73,893 tons over a working period of 234 days with a crew averaging 104 men.

While Joy loaders are still being used to advantage, most of the output is hand-loaded onto shaker-conveyors. Electrical multiple blasting with millisecond delay detonators is used throughout the mine.

First-aid arrangements were maintained at a satisfactory standard. A suitably equipped first-aid room was provided on the surface, and an ambulance was held in readiness for emergencies. Two mine-rescue teams of six men each were maintained, and these attended periodic practices at the Cumberland mine-rescue station. The mine-rescue station was closed on December 31st. A new station was opened in the Nanaimo Courthouse, where equipment and a mobile mine-rescue truck will be stationed to service all of Vancouver Island. W. H. Childress, instructor, was moved from the Nelson area to take charge of this station. Sufficient mine-rescue equipment was stationed at the Tsable River mine to meet any emergency there.

Conditions at the mine were usually found to be satisfactory in the course of inspections.

EAST KOOTENAY INSPECTION DISTRICT

By D. R. Morgan

The production of coal from the East Kootenay Inspection District during 1963 was 883,303 tons, an increase of 59,518 tons over that produced in 1962. There were two companies in operation, but most of the activities were restricted to the operation of Michel Colliery. The colliery, owned and operated by The Crow's Nest Pass Coal Company Limited, produced 882,803 tons. The remainder of the production, 500 tons, was produced from the Tent Mountain Strip Mine, near Corbin, by the Coleman Collieries Limited. The workings are on both sides of the interprovincial boundary, and are operated from the Alberta side. The strip mine was inactive in 1962 and returned to operation in December, 1963.

The accident record at Michel Colliery during 1963 showed an increase in severity and reduction in frequency rates. One workman was fatally injured, and three other serious accidents were reported and investigated. The fatal accident occurred on the surface and was caused by a haulage mishap. The other three accidents were underground, two being caused by machinery and the other by a fall of coal. This was a reduction of five in the total number of serious accidents reported in 1962 and an increase of one in the fatality rate. Minor accidents resulting in the loss of one or more working-days totalled 106, of which 85 occurred underground and 21 on the surface, a reduction of 10 in the total number of accidents. Five dangerous occurrences were investigated at 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 Tent Mountain strip mine.

The East Kootenay Mine Safety Association held its 42nd annual mine-rescue and first-aid competitions at Fernie on June 15th, and the various contests were well attended. Five teams from Fernie, Michel, Kimberley, and the Mineral King mine at Toby Creek entered the mine-rescue competition. The Department of Mines and Petroleum Resources shield was won by the Mineral King mine, captained by Bert-ram McConachie. The men's open competition in the first-aid event was won by the Sullivan mine team, captained by Ralph Chatterson. Both teams won their respective competitions for the second year in succession. The two teams represented the East Kootenay District at the Provincial competitions held at Victoria on June 22nd.

The Crow's Nest Pass Coal Company Limited T. G. Ewart, president, 670 Elveden House, 717 Seventh Avenue Southwest, Calgary, Alta.; Thomas F. Gleed, vice-president, Seattle, Wash.; W. R. Prentice, secretary, Fernie; J. F. Cleeve, treasurer, Fernie; J. E. Morris, resident manager, Fernie. This company has conducted large-scale coal-

mining operations in the Crowsnest Pass area since 1897. The present activities are confined to the Michel Colliery, and they include both underground and open-cast operations. The production is mainly sold on the industrial market, and a large amount is exported to the Japanese market. A large quantity of fines is used for making coke, and the coke is sold in 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 supervisor; Harry Corrigan, afternoon-shift overman.

The colliery is operated at Michel, 24 miles east of Fernie, and is situated on the Crowsnest Pass branch of the Canadian Pacific Railway. It is a large colliery, and has been in operation since 1899. The present workings include five underground mines, two stripping operations, and a modern by-product plant. A number of prospect tunnels were also started in 1963 as part of the current exploration programme. The mines are operated on both sides of the Michel Valley and, with the exception of one, are named according to the seam that is worked and the direction of development. Three of the mines have been developed from a pair of long rock tunnels which have been driven across the synclinal structure of the coal measures on the south side of the valley. The other two, Balmer and "A" North, are being developed from the outcrops of the respective seams on each side of the valley. The mines are worked by a modified room-and-pillar system, and the pillars are extracted on the retreat. All the mines are fully mechanized, and a large percentage of the coal is mined by continuous miners, of which there were six in operation at the end of the year. Most of the equipment is operated by electricity. The equipment is of the flame-proof type and has been approved for use in coal mines. Transportation on most of the main levels is by means of compressed-air, diesel, or battery locomotives. The production from all the mines is cleaned and treated at a modern preparation plant located near to the entrances to the rock tunnels. A description of the plant has been given in past Annual Reports.

The underground operations are under the direct supervision of 5 overmen and 23 firebosses. A brief synopsis of the operations follows.

"A" West Mine.—Henry Eberts, overman; Thomas Krall, Albert Littler, Stanley Menduk, and John McInnes, firebosses.

This mine has been developed in the "A" seam, and the workings are on the eastern and western limbs of the Michel syncline. The mine is entered on the right side of the rock tunnels, and all the workings are toward the outcrop. The seam is

12 to 28 feet thick, dips at an angle of 20 to 35 degrees, and is overlain by a moderately strong shale roof. The mine is operated by the room-and-pillar system. It is partitioned into panels, and the roadways are arranged so that most of the pillars can be extracted on the strike of the seam. The mine has been in operation since 1937, and the coal reserves are rapidly nearing depletion. A description of the workings has been given in past Annual Reports.

The mine averaged a daily production of 520 tons during 1963 with a crew of 65 men. Most of the production was obtained from the extraction of pillars, and the operations were confined to the No. 1 Incline and No. 1 Left belt-road sections, which are the last two panels intended to be worked. The pillars in the No. 1 Incline section were extracted by continuous miners, of which two were in operation for several months. A rapid extraction was achieved, and the work was completed at the end of the year, and the section abandoned. The pillars in the No. 1 Left belt-road section, where the coal is 28 feet thick, are extracted by the caving system. The roadways are driven on the footwall of the seam, and the top coal is supported by timber sets. The rooms are driven at 45-foot centres, and the coal is mined with pneumatic picks or is blasted from the solid with the use of millisecond delay action detonators. During extraction of pillars the timber supports are withdrawn, and the top coal is allowed to fall or is blasted into the roadways. The coal is loaded by duckbill conveyors, which extend beyond the timber supports to prevent the workmen being exposed to the caved areas. The coal is later transferred to a central loading point on the main west level by a series of belt conveyors. The production from all the mine is brought to this point and loaded into long trips of cars and taken from the mine by compressed-air locomotives.

The mine is ventilated by an electrically driven axivane fan which delivers 85,000 cubic feet of air per minute to the workings at a 2.5-inch water-gauge. The conditions in general were found to be satisfactory during the course of inspections, with the exception of one instance where a small fire was found to be burning in a ventilation seal on the abandoned No. 2 Left belt road. This incident is reported more fully under "Dangerous Occurrences."

Upper "A" South Mine.—James E. Anderson, overman; William Verkerk, Robert Doratty, John Krall, Joseph Serek, Arnold Webster, Michael Tymchuk, Benjamin Volpatti, Roger Pasiaud, and Herbert Parsons, firebosses.

This mine is in the "A" seam and is being worked to develop a large area of virgin coal left between the abandoned "A" South mine and the outcrop of the seam. The workings are on the western limb of the Michel syncline and are entered by two inclines which have been driven in the underlying seam and later connected to the "A" seam by two rock tunnels. The seam was entered in 1958, and since that time three inclines have been driven on the full pitch of the seam to the outcrop, and development levels worked on each side of the inclines. The coal is 26 feet thick, is of good quality, and pitches at an angle of 35 degrees in a westerly direction. The mine is operated by the room-and-pillar system and the pillars are extracted by the caving system. A description of the workings has been given in past Annual Reports.

The mine averaged a daily production of 800 tons during 1963 with a crew of 120 men. Most of the activities were directed to the development of the No. 2 North level section, which is in the upper part of the mine, and to the extraction of pillars in the No. 1 South level section. The extraction of pillars in the No. 1 South level section was completed in July, 1963. In the No. 2 North level section the two main levels were driven by continuous miners, and one of the levels was driven to the outcrop of the seam in an adjacent valley. Two pairs of raises were driven from the

levels, and a number of rooms are being developed for future pillar extraction. The coal is mined by pneumatic picks or is blasted from the solid. Pillar extraction in the No. 1 South level district is made by the caving system, and is similar to the method used at the "A" West mine. The coal from all the working-places is loaded onto conveyors or chutes and is transferred to various loading points on the main levels, where it is loaded into 10-ton capacity bottom-dumping cars. It is later dumped into large coal-bins on the main raises at the various levels and transferred by retarding conveyors to a central loading point on the main rock tunnel. Compressed-air locomotives are used for hauling the cars. Total development work in 1963 was 10,500 feet.

The mine is ventilated by an electrically driven aerodyne fan which delivers 75,000 cubic feet of air per minute to the mine workings at a 2-inch water-gauge. This quantity was found to be sufficient to meet the normal requirements of the mine. Some difficulty was experienced for a short period due to leakages of carbon monoxide issuing from a number of fire seals in the adjacent "A" mine, but the condition was later rectified. Other conditions were found to be satisfactory during the course of inspections.

"A" East Mine.—Harry Corrigan, overman. This mine, in the "A" seam, was abandoned in February, 1963, following the depletion of the coal reserves. The supplies and equipment were later withdrawn and the workings allowed to flood. The mine had been in operation since 1940 and was one of the major producers at the colliery. It is estimated that over 3,250,000 tons of coal was produced during its operation. The mine is located on the left side of the rock tunnels, and the workings are on the western limb of the Michel syncline. A description of the workings has been given in past Annual Reports.

"A" North Mine.—John Whittaker, overman; Thomas Taylor, Sidney Hughes, Frank McVeigh, Robert Taylor, Kenneth Kniert, and Roger Girou, firebosses.

This mine, in "A" seam, is on the north side of the Michel Valley, and is approximately half a mile east of the colliery preparation plant. The mine was opened in 1951, and is entered by means of two pairs of main levels which have been driven from various elevations on the outcrop and follow the strike of the seam. The seam is very irregular and faulty. It is 12 feet thick where normal, dips at an angle of 15 to 20 degrees in a southerly direction, and is overlain by a moderately strong shale roof. The mine is operated by the room-and-pillar system. The workings are panelled, and most of the operations are conducted by the use of continuous miners. A description of the workings has been given in past Annual Reports.

The mine averaged a daily production of 1,250 tons during 1963 with a crew of 97 men. The activities were mainly directed to the operation of a section of workings known as the No. 1 Slope district, and most of the production was obtained by the extraction of pillars. This district is in the lower part of the mine and is developed from a long pair of slopes which were driven in 1962. The slopes are over 1,000 feet in length, and it was originally intended to extend the slopes to develop an area of coal on the south side of the valley. Further advancement was stopped in the early part of 1963 owing to geological difficulties, and since that time the work has been concentrated on the development and extraction of pillars on each side of the slopes. The whole cycle of operations was carried out by two Joy continuous miners, and a rapid rate of extraction was obtained. The development rooms were driven on level course and the pillars extracted by angling extraction roadways from a number of raises or "splits" between the rooms during retreat. Systematic timbering was rigidly enforced on all roadways, and large auxiliary fans were used with each of the "miners" for ventilation purposes. The coal was loaded onto shuttle

cars and fast-moving belt conveyors. It was transferred to a central loading point on the No. 1 level, and loaded into 10-ton-capacity bottom-dumping cars. The cars were taken from the mine by diesel and battery locomotives and dumped into a large storage bin on the surface near the lower portal of the mine. The coal is later trucked to the preparation plant. The two continuous miners were removed from the No. 1 Slope district during the latter part of 1963. One was transferred to the No. 1 level to develop an area of workings above the level, and the other was transferred to another mine. Total development during 1963 was 34,000 feet.

The mine is ventilated by an electrically driven axivane fan which delivers 82,000 cubic feet of air per minute to the mine workings at a 2-inch water-gauge. The fan is new and was installed in September, 1963, because of difficulty in ventilating a section of workings in the lower part of the mine by the previous fan. It is located near to the entrance to No. 2 level, and the upper and lower workings are presently ventilated as two separate splits. The performance of the fan to date has been satisfactory, and has resulted in a greater quantity of air circulating the lower workings. Other conditions were found to be satisfactory during the course of inspections, with the exception of one instance where a small ignition of gas occurred at the face of a working-place during the operation of a continuous miner. This is reported more fully under the heading of "Dangerous Occurrences." Two officials at the mine were also prosecuted by the Department for an infraction of the *Coal Mines Regulation Act*, as reported under "Prosecutions."

No. 1 Mine.—William Davey, overman; Henry Sanders, James Walsh, Michael Mihalnuk, and Harvey Travis, firebosses. This mine is in No. 1 seam, and is on the eastern limb of the Michel syncline. It is an old mine that was abandoned in 1938, but was reopened in 1963 to recover a large number of pillars that were left from the former working. The coal is 12 to 15 feet thick, pitches at an angle of 15 to 20 degrees, and is overlain by a moderately hard shale roof. Entry was made from the right side of the rock tunnels, and most of the proposed workings will be to the dip. The size of the operation will be considerably restricted owing to the presence of flooded workings in an overlying seam, but it is estimated there is sufficient area available to recover over 1,000,000 tons of coal from the pillars without endangering the workings. The mine went into production in June, and since that time has averaged a daily output of 375 tons with a crew of 45 men. Most of the activities were directed to the development of roadways. Two slopes have been driven on the full dip of the seam, and two roadways known as the No. 101 and 102 Entries driven to the east of the slopes for the extraction of the pillars. Long sections of the roadways are supported by roof bolts, and bolts are also used for supporting the coal ribs where necessary. The slopes were driven by the conventional hand method, and the entries by a Joy continuous miner. The coal is loaded via shuttle car and fast-moving belt, and is transported to a large bin near the entrance to the mine by a series of belt conveyors. From the bin it is loaded into large trips of cars on the main rock tunnel and taken from the mine by compressed-air locomotives. Total development work at the mine during 1963 was 4,845 feet.

The mine is ventilated by an electrically driven axivane fan which delivers 50,000 cubic feet of air per minute to the mine working at a 2.8-inch water-gauge. This quantity was found to be sufficient for the present requirements of the mine. Other conditions were found to be satisfactory during the course of inspections.

Balmer (No. 10) Mine.—William Davey, overman. This mine is in No. 10 seam, and is being worked to develop a large area of virgin coal on the south side of the Michel Valley. The workings are 1 mile west of the preparation plant, and are being developed from three levels which have been driven from the outcrop of

the seam, near creek elevation. The coal is 40 feet thick, of good quality, and is overlain by a moderately hard shale roof. The seam pitches at an angle of 30 degrees in an easterly direction, and the three levels are driven in close contact with the roof.

The mine averaged a daily output of 100 tons during 1963 with a crew of 29 men, but was inactive during the last five months owing to the state of the coal market. Most of the activities were directed to the development of a pair of inclines from the No. 2 level, and others were directed to the completion of by-pass roadways at the bottom of the inclines and construction of various loading points on the level. The roadways were driven by conventional methods using pneumatic picks, and when necessary blasting the coal from the solid. The coal is loaded onto belt and chain conveyors, transferred to various loading points, and loaded into 10-ton-capacity bottom-dumping cars and taken from the mine by battery locomotives. The coal is dumped into a large bin on the surface and later trucked to the preparation plant. Total development during 1963 was 1,400 feet. This included both inclines and pass-byes.

The mine is ventilated by an electrically driven centrifugal fan which delivers 35,000 cubic feet of air per minute to the mine workings at a 2-inch water-gauge. It is a temporary installation and will be replaced by a larger fan at a later date when one of the inclines has been driven to the surface outcrop. The conditions in general were found to be satisfactory during the course of inspections.

Prospect Tunnels.—Spencer Morgan, fireboss. These tunnels are at an elevation of 5,000 feet on Natal Ridge on the north side of Michel Valley, and approximately 1½ miles west of the preparation plant. They are being driven to explore the possibility of developing a number of workings in a large area of virgin coal in the "A," "C," and "D" seams. The progress in 1963 included the driving of four adit tunnels in "A" seam totalling 352 feet, two in the "C" seam totalling 293 feet, and one in the "D" seam totalling 63 feet. Several bulk samples of coal amounting to over 1,000 tons were mined and shipped for testing. The work was under the direction of J. J. Crabb, chief geologist.

During 1963, 84,031 pounds of Monobel No. 4, 1,526 pounds of CXL-ite, and 87,019 electric detonators were used at the colliery for coal and rock blasting. No misfired shots were reported.

One hundred and seventy-six tons of limestone dust was used for the application of inert dust on the roadways at the various mines to minimize the coal-dust hazard and for tamping shots. Monthly mine-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 the 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 accordance with the requirements of the *Coal Mines Regulation Act* were examined periodically and found to be in order.

Baldy Mountain Strip Mine.—Vans H. Hulbert, manager; George Lancaster, foreman. This operation is on Baldy Mountain, 4 miles northwest of Michel, and is near the entrance to the Upper Elk Valley. It is at an elevation of 5,000 feet, and can be reached by means of a private roadway leading from the preparation plant. The coal is 40 to 60 feet thick, of fairly 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 conducted several large-scale stripping operations along the outcrop since 1948. The present activities

are directed to what is known as the No. 4B pit. It was opened in 1960, and is being worked on a contract basis by Emil Anderson Construction Company. A description of the property has been given in past Annual Reports.

The operation produced 30,836 tons during 1963 with a crew of one shovel operator for loading and three truck-drivers for transporting the coal to the preparation plant. The operations were considerably restricted owing to the present state of the coal market, and activities were confined to loading coal on a single-shift basis. Removal of overburden from the No. 4B pit was completed in 1961. It is estimated there was approximately 100,000 tons of coal left exposed in the pit at the end of 1963.

"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 is being worked to mine a large area of outcrop coal above the underground workings of the Upper "A" South mine. The coal is 30 feet thick, of good quality, and dips at an angle of 35 degrees in a westerly direction. The mine was opened in 1961, a large quantity of overburden was removed, and present activities are confined to the loading of coal. The work is carried out on a contract basis by Emil Anderson Construction Company.

The operation produced 67,992 tons of coal during 1963 with a crew of three men. The coal is removed in 15-foot lifts along the strike of the seam. It is loaded by power-shovel, trucked to a large bin at the entrance to one of the raises which has been driven to the surface outcrop from the Upper "A" South mine, and is transported to the preparation plant via the underground workings. The operation was suspended in October and will remain idle for the winter months.

By-product Plant.—George Lancaster, superintendent. This plant is on the colliery-site, and 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 mainly confined to the Curran Knowle ovens during 1963, and the plant produced 132,927 tons of coke, 11,395 tons of breeze (coke fines), and 950,472 gallons of tar. A further 1,442 tons of coke was produced while testing various blends of coal in the Mitchell testing-ovens, which were installed in 1962.

A major modification to the coal-handling facilities at the plant was started during the latter part of 1963, and the project is expected to be completed in the early part of 1964. The project will include the division of the 1,800-ton surge bin into four sections, and blending-conveyors will be installed at the bottom of the bin. Other modifications will include the installation of a 60-tons-per-hour coal-pulverizer and a 60-tons-per-hour mixer.

(49° 114° N.W.) C. Blanchflower, general superintendent,
Coleman Collieries Coleman, Alta.; William Goodwin, manager. This company
Limited operates a large stripping operation on the interprovincial
 boundary on Tent Mountain, near Corbin. Most of the op-
 eration is on the Alberta side, but large quantities of coal have been produced from
 the British Columbia side during the past 12 years. The property is at an elevation
 of 7,000 feet. It can be reached by means of a 10-mile private road leading from
 the No. 3 highway at Crowsnest Lake. The road is on the Alberta side, and all the
 production is trucked to the company's preparation plant at Coleman, Alta. A de-
 tailed description of the property has been given in past Annual Reports.

The operation was considerably restricted during 1963 owing to the present state of the coal market, and the mine was inactive during the first 10 months. Following resumption of operations the company loaded 500 tons from the British Columbia side in December. The coal was loaded from the No. 4 pit.

NICOLA-PRINCETON INSPECTION DISTRICT

By David Smith

Coal production in 1963 in the Nicola-Princeton District was 60 tons. Production was obtained from one small mine for domestic purposes. Further exploration was carried out by Imperial Metals and Power Ltd. on the Coldwater leases and on coal leases in the Coalmont area.

No accidents were reported in 1963, nor were there any prosecutions under the *Coal Mines Regulation Act*.

MERRITT (50° 120° S.W.)

Coldwater Mine This property, 1 mile south of Merritt, is operated by the owner, S. Gerrard. Mining of coal has been confined to the recovery of pillars in the abandoned workings of the old Middlesboro No. 5 mine. Production in 1963 was 60 tons, used for household purposes. A crew of two men was employed. Working conditions were satisfactory, and no methane was detected in the course of inspections.

NORTHERN INSPECTION DISTRICT

By David Smith, except as noted.

The coal mines of the Northern District produced a total of 6,751 tons of coal in 1963. The output is sold entirely on the domestic market, which limits all operations to seasonal work.

No accidents and no dangerous occurrences were reported from the mines of this district in 1963.

PEACE RIVER (56° 122° S.E.)

King Gething Mines This property is on Lot 1039, 12 miles by road west of Hudson Hope, and is owned and operated by Q. F. (King) Gething. A. Rapp is fireboss. Total production for 1963 was 1,146 tons. A crew of five men was employed. Conditions in the mine were found to be satisfactory in the course of inspections, and no methane was detected. No accidents were reported.

Peace River Coal Mines Ltd. This property is on Larry Creek, on the west slope of Portage Mountain, at the upper end of the Peace River canyon, about 18 miles by road from Hudson Hope. In 1962, because of its proximity to the Portage Mountain dam-site, an investigation of conditions in the underground workings was made. The main travelways and slopes were retimbered. Subsequent work planned for 1963 was not carried out, and the mine remained idle.

TELKWA (54° 127° N.E.)

Bulkley Valley Collieries Limited Company office, Telkwa. J. D. Carnahan, general manager; L. Gething, manager; P. Baker and A. B. Caswell, firebosses. This property is on Goat Creek, a tributary of Telkwa River, about 7 miles southeast of Telkwa. Total production in 1963 was 5,605 tons. The mine was closed at the end of March, a skeleton crew was maintained to carry out routine work, and the mine resumed operations in September. An average crew of 14 men was employed.

Conditions in the mine were found to be satisfactory in the course of inspections, and no methane was detected. No accidents were reported.

BOWRON RIVER (53° 121° N.W.)*

**Northern Coal
Mines Ltd.**

Registered office, 716 Hall Building, 789 West Pender Street, Vancouver 1. H. V. Ross, president; A. J. Garraway, manager. This company, together with two associated companies, holds 155 mineral claims in the vicinity of Bowron River, about 30 miles due east of Prince George. Two of the principals in the company also hold Coal Licence No. 148 covering Lot 9592. The company was formed to work coal and mineral deposits in the Bowron River coalfield, which consists of Tertiary coal-bearing sediments underlying the Bowron River valley in a belt 1½ to 2 miles wide and about 7 miles long. The valley bottom is covered by heavy overburden, so that outcrops are largely restricted to the river banks. The coal measures in general strike about north 40 degrees west and dip northeast at 20 to 60 degrees. The surrounding rocks are mainly volcanic. Intermittent exploration work has been done in past years, mainly on seams outcropping on the west bank of the river on Lot 9593; the Bowron Coal Company did some work from 1946 to 1950, and this was continued by Central Industries Ltd. from 1952 to 1954. In 1960 Tanar Gold Mines Ltd. made an option agreement with A. J. Garraway and associates and sank a 125-foot shaft, which was later abandoned. Descriptions of the work done are given in the Annual Reports for 1948, 1954, 1955, 1960, and 1962.

The present company began work in 1962. A new site for a slope was selected on Lot 9591 about 4,000 feet southwest of the old portal and 1,000 feet west of Bowron River. The overburden at this point was found to be only 10 feet thick. A 9- by 12-foot slope was driven south 72 degrees east for 250 feet on a gradient of 20 degrees and then levelled off for a landing for a distance of 90 feet. From this landing two crosscuts were turned off northeast and southwest respectively. The northeast crosscut was driven 216 feet in 1962, the objective being to cut the major coal seams.

In 1963 the northeast crosscut was driven to a point 380 feet from the slope landing. This crosscut did not cut the major coal seams; according to projections made by the company, these seams are believed to be about 50 feet ahead of the present face. At the latter end of the year the southwest crosscut was driven for a total distance of 180 feet. In December the crosscut entered a faulted zone at 140 feet from the slope landing. The face of the crosscut is still in faulted ground, indicating that the fault is quite extensive.

The fault is approximately vertical and strikes about north 39 degrees west. Patches of coal were evident throughout the faulted area.

A crew of five men was employed from April 5th until December 20th. Permitted explosives and short-period delay detonators were used for blasting rock and coal, and an Eimco 12B mucking-machine was used for loading the cars. A 315-cubic-foot portable compressor supplied air for drilling and pumping. General working conditions were found satisfactory in the course of inspections, and no methane was found.

* By A. R. C. James.

Inspection of Electrical Equipment and Installations at Mines, Quarries, and Well Drilling Rigs

By L. Wardman, Senior Electrical Inspector

ELECTRIC POWER

In 1963 electric power was used by 34 mining companies in operations at 38 lode mines, one placer mine, and three collieries. Twenty-nine metallurgical mills were operated during the year. Electric power was also used at 25 structural-material and industrial-mineral mines and quarries. Fifty-five drilling rigs operated in the Province during the year.

LODE-METAL MINES

Two small mills were built and put into service. Five other surface and one underground electrical installations were made. A power plant that was installed underground in 1962 was moved to a new building on the surface.

The kilovolt-ampere capacity of mining-company-owned plants that operated in 1963 is given below:—

Prime Mover	Generator Kva. Capacity
Diesel engines	19,924
Hydro	13,610
Steam	3,600
Total	37,134

The electric power generated by these plants amounted to 69,455,445 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 275,840,555 kilowatt-hours. The total amount of power consumed at lode mines was 345,296,000 kilowatt-hours.

A general breakdown of the connected load follows:—

Equipment	Horsepower
Hoists (incline and shaft)	6,697
Hoists (scraper)	7,285
Fans (mine ventilating)	5,219
Pumps (mine unwatering)	6,409
Rectifiers and M.G. sets	8,046
Air compressors	19,836
Crushing	13,823
Sink float	1,900
Grinding	24,865
Concentrating	14,081
Conveyors	3,286
Pumps (mill)	11,499
Shovels and rotary drills	1,825
Workshops	2,494
Miscellaneous	5,588
Total	132,853

In addition to electrically powered equipment, there was in use approximately 13,753 horsepower of prime movers driving direct-connected or belt-connected equipment as tabulated below:—

Prime Mover	Horsepower
Diesel engines	12,353
Hydro	1,400
Total	13,753

On the haulage systems there were in use 106 battery locomotives, 96 trolley locomotives, 19 diesel locomotives, and 1 air locomotive.

STRUCTURAL-MATERIAL AND INDUSTRIAL-MINERAL MINES AND QUARRIES

Electric power was used at 22 structural-material and industrial-mineral mines and quarries. At two of these properties, power is produced by a privately owned plant. For the remainder, power is purchased from public utilities. The capacity of the company-owned plants is 3,451 kilovolt-amperes.

Approximately 15,026,200 kilowatt-hours of power was generated and 8,295,-675 kilowatt-hours was purchased, making a total of 23,321,875 kilowatt-hours of power consumed.

The distribution of the connected load was approximately as follows:—

Equipment	Horsepower
Hoists and overhead tram	252
Hoists (scraper)	205
Fans (ventilating and dust-collecting)	103
Pumps	954
Rectifiers and M.G. sets	37
Air compressors	786
Electric drills and shovels	210
Crushing, rock reject and drying	5,365
Conveyors	3,889
Screens	622
Milling	2,891
Workshops	302
Miscellaneous	1,758
Total	17,374

At these properties there was also direct-driven equipment totalling 1,028 horsepower.

One battery locomotive was in use for underground haulage.

COAL MINES

There was no change in the number of collieries using electric power. The distribution of the connected load was as follows:—

Surface—	Horsepower
Compressors	3,940
Ventilation	1,035
Hoisting	908
Haulage	20
Coal-crushing	25

Surface— <i>Continued</i>	Horsepower
Coal washing and screening	2,041
Pumping	65
Coke production	1,190
Miscellaneous	835
Total	10,059
Underground—	
Ventilation	465
Hoisting	310
Haulage	999
Coal-loaders	400
Conveying	1,935
Pumping	480
Compressors	500
Borecuts	450
Continuous miners	2,010
Coal-cutters	50
Miscellaneous	18
Total	7,617
Total for surface and underground	17,676

Four battery locomotives and two diesel locomotives were in use for haulage above and below ground.

A total of 28,392,407 kilowatt-hours of electric power was used for mining and coal-processing.

ELECTRICAL INSTALLATIONS

LODE MINES

UNUK RIVER (56° 130° S.E.)

Granduc Mines Limited.—A new temporary power-house was built near the Leduc portal of the drainage adit. The equipment from the underground power-house was moved into this new building but was not put into service.

SALMON RIVER (56° 130° S.E.)

Silbak Premier Mines Limited At the new 6 level site a temporary office, warehouse, new dry, and a machine-shop were wired for lighting and power. A 100-kva. diesel-driven electric power-plant supplies electricity for lighting and power. A crusher and mill site was prepared, and the French mill from Hedley was dismantled and moved to the property but will not be erected until the spring of 1964.

ALICE ARM (55° 129° N.W.)

Dolly Varden Mines Limited An air compressor driven by a 200-horsepower synchronous motor and a slusher driven by a 30-horsepower motor were installed at the Wolf mine for development work. Three 50-kva. 13,200–440-volt transformers were installed to supply power from the 13,200-volt line.

HARRIET HARBOUR (52° 131° S.E.)

Jedway Iron Ore Limited A 225-kva. diesel-driven electric power unit was installed adjacent to the power plant as a stand-by unit. An air compressor driven by a 125-horsepower motor was installed for the mine. A small stream not far from the mine was dammed, and a pump driven by a 20-horsepower motor was installed to supply water during periods of shortage at the main pumping-site.

SMITHERS (54° 126° N.W.)

New Cronin Babine Mines Limited.—New wiring was installed to replace the old wiring between the main generator and the main gutter box. Also part of the lighting system was replaced.

BRIDGE RIVER (50° 122° N.W.)

Bralorne Pioneer Mines Limited A transformer station consisting of six 25-kva. 4,600–460-volt transformers was installed on the 3700 level of the Queen shaft to supply the lower levels of this shaft while the 3100 level transformer station will supply the 3300, 3400, 3600, and 3800 levels.

Two new power cables were installed in the Crown shaft, and the old cable was taken out of service.

The ventilation-fan cables were extended to supply fans on the 1400, 2000, 2600, 3200, 3800, and 4100 levels.

HIGHLAND VALLEY (50° 120° N.W.)

Trojan (South Seas Mining Limited).—A 37.5-kva. Caterpillar diesel-electric generating unit was installed to supply power for lighting and for an underground pump. This unit replaces the small lighting plant which was formerly in use.

Bethlehem Copper Corporation Ltd. A low-pressure blower driven by a 200-horsepower 550-volt motor was added to the mill grinding circuit. The motor is controlled by a size 5 combination starter with H.R.C. fuses in the mill motor-control centre. A 7.5-horsepower motor was installed on the deep air cell pump.

A temporary crushing plant for recrushing oversize ore at the fine-ore pile was installed. It consists of a 4-foot cone crusher driven by a 100-horsepower motor; a screen driven by a 10-horsepower motor; a conveyor, and a fan each driven by 7.5-horsepower motors, and a pump driven by a 1-horsepower motor.

MERRITT (50° 120° S.W.)

Craigmont Mines Limited A new Bucyrus-Erie rotary electric drill and an electric shovel were installed in the open pit. The connected load of the drill is 150 horsepower and that of the shovel is 350 horsepower. Substation No. 13 was moved to a permanent location in the 24-871 diamond-drill cutout, and substation No. 20 was increased to 225 kva. Forty kva. in capacitors was installed in this station to improve the power factor. A new cutout was made off the 30-915 crosscut to house substation No. 33, consisting of a 112½-kva. 4,160–550-volt 3-phase transformer unit. This unit will supply power mainly for slushers. Two slushers driven by 25-horsepower

motors and one driven by a 50-horsepower motor were installed. A General Electric semi-automatic friction hoist driven by a 100-horsepower, 250-volt d.c. motor was installed underground. Direct-current power is supplied by an M.G. set driven by a 125-horsepower 550-volt motor. The hoist is normally operated from the cage. For backfilling the stopes a centrifugal pump station was installed in the mill and a reciprocating pump was installed in the mine, all controlled from the stope being filled.

The equipment used in this system is as follows:—

	Horsepower
Primary cyclone pump	40
Secondary cyclone pump	30
Gland water pump	25
Five series pumps	150
Underground reciprocating pump	250

A 4,200,000 B.T.U. heat-exchanger was installed at the 2400 level portal to heat the mine ventilation air. Five new 4-ton Atlas battery locomotives were put into service on the mine haulage.

A water pump driven by a 50-horsepower motor was installed in the 24-901 diamond-drill cutout for mine water supply and a submersible pump driven by a 7.5-horsepower motor was installed in the service-shaft sump. In the mill a third reclaim-water pump driven by a 60-horsepower motor was installed. An automatic tailings-density gauge was installed in the underflow of No. 2 thickener and an automatic system for P.H. control was also installed.

On August 18th, at about 5 p.m., during an electric storm, two lightning discharges caused damage to electrical equipment. The ground was struck in the 2400 level area, part of the discharge passing through the trolley wire and a.c. locomotive, causing damage to the variable voltage regulator on the locomotive. The second stroke started a small fire in the tailing-pond area and damaged the switch hook contacts and the lightning-arresters on the telephone-line.

BEAVERDELL (49° 119° S.E.)

Highland-Bell (Mastodon-Highland Bell Mines Limited).—New electrical work during the year consisted of the installation of five electric motors complete with electrical control gear and the extension of the lighting system at several locations.

PHOENIX (49° 118° S.W.)

Phoenix (The Granby Mining Company Limited) An underground 2,300-volt cable was installed to the Victoria shaft to supply the water pumps, and an overhead power-line was built to Marshall Lake. Four new Denver cells driven by two 25-horsepower motors and three cyclone pumps each driven by a 15-horsepower motor were installed in the mill. The motor push-button control centre in the mill was moved to a new location so that all motors could be seen when starting them.

IRON MOUNTAIN (49° 117° S.E.)

Jersey (Canadian Exploration Limited).—Electrical work done consisted mainly of moving substation electrical equipment to accommodate the changing mining programme. A portable 75-kva. substation was put into service in the A zone to supply equipment for pillar removal.

RIONDEL (49° 116° N.W.)

Bluebell (The Consolidated Mining and Smelting Company of Canada, Limited).—The pumping-stations on No. 2A and No. 3 levels of the Bluebell shaft were dismantled and the feeder cables were removed from the shaft. No. 9A level in the Kootenay Chief zone was abandoned and all electrical equipment was removed. The Kootenay Chief transformers on the surface that supplied the ventilation fans were taken out of service, and the fans are now supplied by a 550-volt power-line.

SANDON (49° 117° N.E.)

Silmonac Syndicate A blower driven by a 15-horsepower motor was installed on the surface for mine ventilation. Compressed air and electric power is supplied from the Carnegie power plant. Two stand-by air compressors, diesel driven, were installed at the Carnegie power-house.

SLOCAN LAKE (49° 117° N.E.)

Johnsby Mines Limited A 2,300-volt transmission-line 600 feet long was built from the existing Standard-Mammoth line to a new adit-site. Three 50-kva. 2,300–440-volt transformers were installed to provide 440-volt power for an air compressor driven by a 75-horsepower motor, a mine ventilating-fan driven by a 15-horsepower motor, one 6-horsepower M.G. set, and a rectifier. Two battery locomotives are in use on the underground haulage.

SPRINGER CREEK (49° 117° N.E.)

Ottawa Silver Mines Limited The mill equipment and power plant was moved from the Can Amer property and installed at the Ottawa mill-site late in 1963. This mill has a capacity of 75 tons per day. Electric power is produced by two 440-volt 3-phase 60-cycle generators of 75 and 45 kva. respectively. The diesel that drives the 45-kva. generator also drives the ball mill.

The crushing-plant equipment consists of a jaw crusher driven by a 25-horsepower motor, a Kuckan crusher driven by a 15-horsepower motor, a screen driven by a 1-horsepower motor, and a conveyor driven by a 1.5-horsepower motor.

The concentrating equipment consists of a classifier driven by a 5-horsepower motor; a feeder driven by a 1-horsepower motor; a conveyor driven by a 1.5-horsepower motor; a jig driven by a 1-horsepower motor; two tables driven by two 2-horsepower motors; flotation cells driven by three 5-, one 3-, and one 10-horsepower motors; two concentrate pumps each driven by 2-horsepower motors; a thickener; diaphragm pump, sump pump, and a filter each driven by 1-horsepower motors; a vacuum pump driven by a 3-horsepower motor; and a blower driven by a 2-horsepower motor.

WASA (49° 115° N.W.)

Estella (Copper Soo Mining Company Limited).—A 37.5-kva. diesel-driven electrical generating unit was installed to supply power for a 7.5-horsepower M.G. locomotive-battery charging unit and for two 7.5-horsepower Flygt pumps that were used to dewater the winze.

KIMBERLEY (49° 115° N.W.)**Sullivan (The Consolidated Mining and Smelting Company of Canada, Limited)**

A new ventilation fan driven by a 200-horsepower motor was installed on the No. 39 shaft to replace two fans driven by 25-horsepower motors. In the power-house new switch-gear was installed to control the No. 3 and No. 5 compressor motors, two M.G. set motors, and a water-pump motor. New installations in the mill consist of four pumps driven by two 25-, one 75-, and one 100-horsepower motors respectively; one zinc drier fan driven by a 40-horsepower motor; one zinc drier ribbon feeder driven by a 15-horsepower motor; and two oil pumps driven by ¾-horsepower motors. Two 50- and one 75-horsepower pump motors were replaced with 100-horsepower motors. A 75-horsepower zinc drier motor was replaced with a 100-horsepower motor. A 40-horsepower fan motor was replaced with a 75-horsepower motor. New 550-volt switchboards were installed in the zinc drier and zinc drier oil-house. The 550-volt switchboards in the carpenter-shop, X-ray analyser room, on the filter floor, and the retreatment floor were rebuilt. The old lighting systems in the loading-shed, boiler-shop, carpenter-shop, reagent control room, mill carpenter-shop, mill assay laboratory, and that over the 581–582 conveyors were replaced with mercury-fluorescent lighting. Several fused lighting panels were replaced with circuit-breaker load centres. The oil-switch starters for four pump motors were replaced with combination magnetic starters. Protective relay systems were installed on the rod-mill motor and drive and on the crushers in the 3800 crushing chamber.

HOWE SOUND (49° 123° N.E.)

Britannia (The Anaconda Company (Canada) Ltd.).—A 225-kva. 6,600–440-volt transformer was installed at the 5100 level in the No. 8 mine, and the transformer station on the 4500 level was dismantled. Two 250 M.C.M. 7,500-volt cables were installed between the power-house and the British Columbia Hydro and Power Authority substation.

TEXADA ISLAND (49° 124° N.W.)

Texada Mines Ltd. Three 450-kva. 2,300–480-volt transformer stations were installed underground. Each of these stations contains three 150-kva. single-phase transformers. The wiring for the skip and cage hoists was completed for automatic operation. The capacity of the 12-kv. power-line was increased by replacing the conductors with 266,800-C.M., A.C.S.R. cable.

On March 14, 1963, two men were fatally injured while endeavouring to drive a shaft out of an idler hub by blasting. The men were using a Shot-King exploder and electric blasting-caps to fire small charges of powder placed on the end of the shaft. While hooking up the fifth charge it exploded, fatally injuring the two men laying the charge and causing some injury to a man who was standing nearby. Examination of the exploder showed that the resistor installed in the machine to bleed off any residual charge after firing a shot was open circuited and, therefore, the machine would retain a charge for several minutes.

BENSON RIVER (50° 127° S.E.)

Empire Development Company Limited.—The power plant at the beach loading-dock was dismantled when power from British Columbia Hydro and Power Authority became available at Port McNeill in May, 1963.

Old Sport (Coast Copper Company Limited).—Temporary pumps were installed in the mine to unwater the No. 40 winze and a temporary 100-horsepower hoist was installed. Two new locomotive-battery charging stations were installed. Several electrical installation centres were moved to new locations.

BUTTLE LAKE (49° 125° N.W.)

Lynx (Western Mines Limited) The following equipment was installed during the last quarter of the year: A power plant consisting of three 250-kva. 2,300-volt diesel-driven generators, a hoist driven by a 250-horsepower 2,300-volt motor, an air compressor driven by a 150-horsepower synchronous motor, a ventilation fan driven by a 15-horsepower 550-volt motor, and a pump driven by a 30-horsepower 550-volt motor. A 2,300-volt line was built to the mine adit and a 5,000-volt 3-conductor 1/0 A.W.G. armoured cable was strung in the adit. A 5,000-volt 3-conductor No. 2 A.W.G. cable was hung in the shaft manway to feed the 550-volt pump motor on the 925 level. When a transformer substation is installed on the 925 level, the voltage on the cable will be raised to 2,300 volts.

TRANQUIL INLET (49° 125° S.W.)

Fandora (New Hamil Silver-Lead Mines Limited) A power-house and mill was built on the property. The power unit is a 125-kva. 440-volt 60-cycle 3-phase a.c. generator driven by a Caterpillar diesel engine. The crusher is driven by a 10-horsepower motor, and the crusher feed conveyor is driven by a 2-horsepower motor. The ball mill is driven by a 25-horsepower motor, and the mill feed conveyor is driven by a 2-horsepower motor. The classifier is driven by a 2-horsepower motor. Other equipment consists of two sand pumps, two flotation cells, a diaphragm pump and a filter, each one driven by a 2-horsepower motor. Other equipment consists of a jig driven by a 1-horsepower motor and a vacuum pump driven by a 3-horsepower motor. All equipment operates at 440 volts potential.

KENNEDY LAKE (49° 125° S.E.)

Brynnor Mines Limited.—A 53- by 36-inch single-drum hoist driven by a 250-horsepower motor was installed to sink the proposed shaft.

JORDAN RIVER (48° 120° S.E.)

Sunloch (Cowichan Copper Co. Ltd.).—A new friction hoist driven by a 125-horsepower 440-volt motor was installed. It was operated during sinking as a drum hoist and then converted to a friction hoist when the shaft was completed.

PLACER MINES

LIGHTNING CREEK (53° 121° S.W.)

Wingdam & Lightning Creek Mining Co. Ltd.—A new Caterpillar 353c diesel driving a 250-kva. generator was installed to replace an older diesel unit. A ¾-horsepower bit grinder was installed underground.

STRUCTURAL-MATERIAL AND INDUSTRIAL-MINERAL MINES AND QUARRIES

MCDAME (50° 120° S.W.)

Cassiar Asbestos Corporation Limited

A new crushing plant was built at the mine just above the upper tram terminal. The equipment consists of a four-speed pan feeder driven by a 20-horsepower motor; a crusher driven by a 150-horsepower 2,300-volt motor; two conveyors driven by two motors, one of 15 and the other of 25 horsepower; and a dust-collector driven by a 10-horsepower motor.

Three hundred and fifty-four horsepower was added to the mill connected load, while six and a fraction was removed. A bagging system having a connected load of 256 horsepower made up the greater part of this additional load.

Twenty-four and a half horsepower was added to the primary crusher load, and 36 horsepower was removed from the drying and conveying load. Sixty-nine horsepower was removed from the mine load.

WINDERMERE (50° 115° S.W.)

Western Gypsum Products Limited

A workshop was built and the following equipment was installed: A shaper driven by a 1-horsepower motor, a lathe driven by a ¾-horsepower motor, a hacksaw driven by a ½-horsepower motor, a grinding-wheel driven by a ½-horsepower motor, and an air compressor driven by a 1-horsepower motor. A car-mover was installed on the fines railway spur, and the fines conveyor was extended.

MATSQUI (49° 122° S.E.)

Valley Rite-Mix Ltd.—A new batching plant and a crusher were installed. The crusher is driven by a 75-horsepower motor, and the batching plant is driven by three motors of 20, 5, and 3 horsepower respectively.

VANANDA (49° 124° N.W.)

Ideal Cement Company Ltd.—The following additions were made to the plant:—

	Horsepower
New conveyor line and alterations	70
Crushing-plant equipment	30
Sampling equipment	7
New winch	3
Miscellaneous	3
Total	113

COAL MINES

TELKWA (54° 127° N.E.)

Bulkley Valley Collieries Limited

Surface installations consisted of a new crusher driven by a 20-horsepower motor, replacement of the belt conveyor from the portal to the bunker with two belts driven by a 5- and a 15-horsepower motor respectively, and a new 400-ampere distribution service and supply-line. Underground three Goodman conveyors driven by 15-horsepower motors were installed.

EAST KOOTENAY (49° 114° S.W.)

**Michel Colliery
(The Crow's Nest
Pass Coal Company
Limited)**

No. 1 seam mine was electrified by the installation of the following equipment: Two underground auxiliary fans with a load of 35 horsepower, haulage equipment with a connected load of 105 horsepower, coal-loading equipment with a connected load of 80 horsepower, conveyors with a connected load of 135 horsepower, pumps with a connected load of 55 horsepower, and two continuous miners with a connected load of 260 horsepower. On the surface a main ventilation fan driven by a 100-horsepower motor was installed.

A continuous miner was installed in No. 2 raise, No. 2 level of "A" South mine. The 6,900-volt cable was extended and a two-unit substation was installed to handle the load consisting of the miner, a shuttle car, a hoist, and two conveyors. This equipment was moved from "A" West mine, where it had been in use from July to October, 1963.

A Goodman loader was installed in No. 3 room of "A" North mine to work with the Joy continuous miner.

The following occurrences took place:—

In January trouble was experienced with the shuttle-car cable in "A" North mine. The shielding, because of continuous flexing, had broken in several places and had penetrated the conductor insulation, causing the ground fault leakage trip to operate.

On January 18th, in "A" North mine, a fireboss removed a cover from a main contactor panel of a continuous miner and inserted his lamp to test for gas. The lamp contacted the control-circuit fuses, which were live, causing an arc. Fortunately there was no gas present to cause an explosion.

In "A" West mine, February 14th, the winding of the right side conveyor motor grounded to the end shield.

In "A" North mine, February 21st, the winding of a 75-horsepower belt motor failed.

In "A" South mine, February 24th, a ground fault occurred in the H.V. bushings of a 200-kva. 6,600–550-volt transformer.

In "A" West mine, on August 5th, a shuttle car ran onto the trailing cable of a continuous miner, as the miner was moving forward, causing the cable to be pulled out of the restraining clamp and gland of the miner. The arc created ignited the rubber-hose conduit.

Lode-metal Deposits Referred to in the 1963 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 1963:—

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	Uranium	Chromium	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Cobalt	Antimony	Page
<i>Northern British Columbia</i>																						
Ann	Liard	57° 131° S.W.														3						8
Copco, Liz, Cote	Liard	59° 129° S.W.	3																			6
Decker Creek	Liard	57° 131° S.W.														3						8
FAE	Atlin	58° 131° S.W.			3											3						7
Galore Creek	Liard	57° 131° S.E.			3																	8
Goat	Liard	57° 131° S.E.			3																	8
Joy	Liard	58° 129° S.E.			3																	6
McDame Belle, Bar	Liard	59° 129° S.E.		3		3																6
Mary	Liard	57° 130° S.E.														3						9
Poke	Liard	57° 132° N.E.			3																	7
Sam	Liard	57° 132° N.E.														3						7
Thorn	Liard	58° 132° N.W.				3																6
TNA	Liard	58° 128° S.W.			3																	7
<i>Central British Columbia</i>																						
Aurum	Cariboo	53° 121° S.W.	1	2																		38, A46
Bell	Omineca	54° 125° S.E.														3						35
Bob	Omineca	54° 125° S.E.														3						32
Boss Mountain	Cariboo	52° 120° S.W.														3						39
Berg	Omineca	53° 127° N.E.			3																	28
CAFB	Omineca	53° 127° S.E.														3						29
C.M. and R.W.	Omineca	54° 125° S.E.														3						34
CO	Omineca	54° 125° S.E.														3						34
Canadian Citizen, American Citizen, May, J.W.B.	Omineca	54° 127° N.E.			3																	25
Cob	Omineca	53° 127° S.E.														3						28
Cronin	Omineca	54° 126° N.W.	2	1		1	1	2														26, A46
Croydon	Omineca	55° 125° S.W.	3		3																	38
Duthie, Mamie	Omineca	54° 127° N.E.		3		3	3															25
Elk	Omineca	54° 125° S.E.														3						32
Enco	Omineca	53° 124° N.W.														3						36
Endako	Omineca	54° 125° S.E.														3						32
Glacier Gulch	Omineca	54° 127° N.E.														3						26
Jen, Beaver	Omineca	53° 124° N.W.														3						37
KO	Omineca	54° 124° S.W.														3						36
Len	Omineca	53° 127° N.E.			3											3						28
Leo, Mo	Omineca	54° 125° S.E.														3						35
		and 54° 124° S.W.																				

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 1963 is listed in Table XIV.

Non-shipment Mines.—(3) Metal present, indicated by assay or mineralogical determination.

LODE-METAL DEPOSITS REFERRED TO IN THE 1963 ANNUAL
REPORT—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Uranium	Chromium	Ti	Nickel	Molybdenum	Silica	Sulphur	Mercury	Cobalt	Antimony	Page
Central British Columbia—Cont'd																						
Lucky Ship	Omineca	54° 127° S.E.														3						28
McDonald Island	Omineca	54° 126° N.E.			3																	27
Molly, Molly, Red Canyon, Tom, Len	Omineca	55° 127° N.E.														3						24
Molly, Pogo, Sandy	Omineca	53° 124° N.W.														3						36
Moly	Omineca	54° 125° S.E.														3						32
Nithi	Omineca	53° 124° N.W.														3						37
Rob	Omineca	54° 125° S.E.														3						32
Silver Creek, Silver Lake, Trade Dollar	Omineca	54° 127° N.E.		3		3	3															26
Silver Standard	Omineca	55° 127° S.W.	2	1		2	1															A46
Snowbird	Omineca	54° 124° N.W.	3																	3		38
TIT	Omineca	53° 126° S.W.														3						29
Tor	Omineca	54° 125° S.W.														3						30
Coast and Islands																						
A.M.	N. West'r	49° 121° S.E.			3																	89
Ace, Galena	Skeena	55° 129° N.W.		3		3																12
Alice	Skeena	55° 129° N.W.														3						12
Alpha, Beta	Victoria	48° 124° N.E.	2	2	1																	122, A47
Anomaly	Victoria	48° 124° N.E.			3																	123
Anyox	Skeena	55° 129° S.W.			3																	13
Apex, Morning	Alberni	49° 125° S.E.	3																			121
Azure	Vancouver	50° 122° S.W.			3																	95
Bank, Banker, Isle, Omi, Waller	Skeena	53° 130° S.E.	3																			21
Bayview, United Empire	Skeena	55° 129° N.W.		3		3	3															A11
Britannia	Vancouver	49° 123° N.E.	2	2	1	2	1		2													92, A47
Brynnor	Alberni	49° 125° S.E.								1												117, A46
Buttle Lake Mining	Alberni	49° 125° N.W.	3	3	3	3	3															109
Cambrian Chieftain	Vancouver	49° 123° N.W.		2	1																	A47
Catface	Alberni	49° 125° S.W.			3																	102
Copper Road	Nanaimo	50° 125° S.E.			3																	98
Dolly Varden	Skeena	55° 129° N.W.		3		3	3															12
Domineer	Nanaimo	49° 125° N.E.		3	3																	103
East Gold and East Gold Extension	Skeena	56° 130° S.E.	3	3																		11
Empire Development (Merry Widow and Kingfisher)	Nanaimo	50° 127° S.E.								1												100, A47
Eureka Victoria	N. West'r	49° 121° S.W.		3																		90
F.L., Ridge, Cordova	Nanaimo	50° 126° S.W.								3												101
Fandora and Gold Flake	Alberni	49° 125° S.W.	1	2																		109, A46
Fitzsimmons	Vancouver	50° 122° S.W.			3																	96
Gem	N. West'r	49° 121° N.W.														3						91
Granduc	Skeena	56° 130° S.E.			3					3												9
H. and C.	Skeena	52° 128° N.E.			3																	21
Harriet Harbour	Skeena	52° 131° S.E.								1												16, A47
High Hopes	Vancouver	49° 123° N.E.			3																	93
Indian Chief, Prince	Alberni	49° 126° S.E.	3	3	3																	101
Iron Mike	Nanaimo	50° 125° S.W.								3												99
Jib	Skeena	52° 131° S.E.								3												18
Johnson Nickel	Skeena	52° 131° S.E.													3							18
Kay	Skeena	56° 130° N.E.	3	3		3	3															10
Keeler	Skeena	54° 128° S.E.			3																	24
Little Joe	Nanaimo	50° 127° N.W.			3																	99
London	Vancouver	50° 122° S.W.			3																	94
Lynx, Paramount, Price	Alberni	49° 125° N.W.	3	3	3	3	3															105
Mac	Skeena	52° 131° S.E.								3												18
Mal	Victoria	48° 124° N.W.			3																	123
Musketeer	Alberni	49° 125° S.W.	1	2	2	2	2															102, A46

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REPORT—*Continued*

Property	Mining Division	Latitude and Longitude	Gold	Silver	Copper	Lead	Zinc	Tungsten	Cadmium	Iron	Manganese	Uranium	Chromium	Tin	Nickel	Molybdenum	Silica	Sulphur	Mercury	Cobalt	Antimony	Page
<i>South Central British Columbia—Continued</i>																						
Pay	Nicola	49° 120° N.W.			3																	55
Phoenix	Greenw'd	49° 118° S.W.	1	2	1																	68, A47
Porcupine	Nicola	50° 120° S.W.			3																	54
Primer	Similk'n	49° 120° N.E.			3																	57
Quilchena	Nicola	50° 120° S.W.	3	3																		54
Ray	Similk'n	49° 120° S.W.			3																	62
Rich	Nicola	50° 120° S.W.			3																	49
Robin	Nicola	49° 120° N.W.			3																	55
Rocky, Tom, Nav	Nicola	50° 121° S.E.			3																	42
Rye, Jesse, Jack	Nicola	50° 120° S.W.			3																	52
Shamrock	Nicola	49° 120° N.W.			3																	57
Sheba, Highmont, Minex, B.X.	Nicola	50° 120° S.W.			3																	47
Skomac	Greenw'd	49° 118° S.W.	2	1		1	2															A48
Smuggler	Osoyoos	49° 119° S.W.	1	2		2	2															65, A48
Spatsum	Kamloops	50° 121° N.E.			3					3												44
Susie	Osoyoos	49° 119° S.W.	1	1		2	2															A48
Tom	Nicola	50° 120° S.W.			3																	51
Trojan	Kamloops	50° 120° N.W.			3																	44
WDR	Kamloops	50° 120° N.W.			3																	48
Wade, Sarg, Major	Nicola	50° 120° S.W.			3																	52
<i>Southeastern British Columbia</i>																						
Anna	Slocan	49° 117° N.E.		1		2	2															78, A49
Antoine	Slocan	50° 117° S.E.		1		1	1															74, A49
Arlington	Nelson	49° 117° N.E.		1		1	1															79, A50
Bayonne	Nelson	49° 116° S.E.	3																			72
Black Diamond	Slocan	49° 116° N.W.		1		1	1															A50
Bluebell	Slocan	49° 116° N.W.		2	2	1	1		2													72, A50
Bonanza	Nelson	49° 117° S.E.	1	1		2																A49
Calumet	Slocan	49° 117° N.E.		3		3	3															79
Carnegie Mining Corporation (Silver-smith, Richmond-Eureka etc.)	Slocan	49° 117° N.E.	2	1		1	1															77, A50
Crown and Anchor	Fort Steele	49° 116° N.W.		3		3	3															73
Delphine	Golden	50° 116° S.E.		3		3																85
Estella	Fort Steele	49° 115° N.W.		2		1	1															82, A48
Freddy	Slocan	49° 116° N.W.	2	1		2	2															A50
Gold Belt	Nelson	49° 117° S.E.	1	2		2	2															A49
Golden Age	Nelson	49° 117° S.E.	1	1		2	2															A49
H.B.	Nelson	49° 117° S.E.		2		1	1		1													70, A49
Hecla	Slocan	49° 117° S.E.		3		3	3															77
Humbolt	Fort Steele	49° 116° S.W.		1		1	1															A49
I.X.L.	Trail Cr'k	49° 117° S.W.	1	2		2	2															A50
Idaho	Slocan	50° 117° S.E.		1		1	2															A50
It, In, and To	Revelstoke	51° 118° N.W.			3	3																86
Jersey	Nelson	49° 117° S.E.		2		1	1		2													71, A49
King Fissure, S.B., C.R., and Deby	Revelstoke	51° 118° S.E.				3	3															86
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Lucky Strike	Nelson	49° 117° S.E.	1	1		2	2															A49
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New Arlington	Nelson	49° 117° S.E.	1	2		2	2															70, A49
Ottawa	Slocan	49° 117° N.E.	2	1		2	2															79, A50
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Reeves-MacDonald	Nelson	49° 117° S.E.		2		1	1		2													71, A49
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