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Lode Gold Deposits In Western Canada

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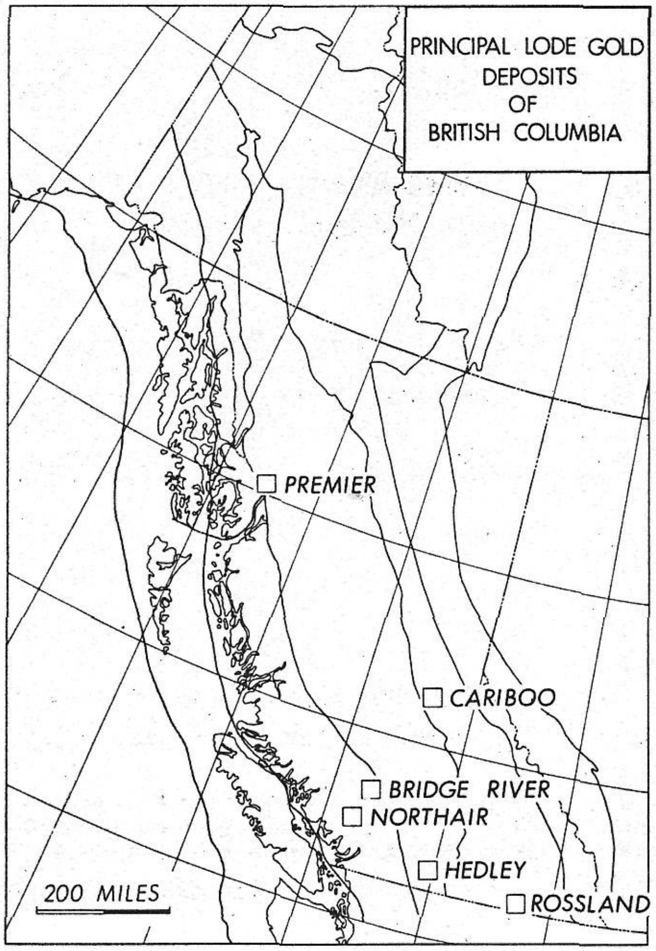

FIGURE 1 — Index Map.

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Keywords: Economic geology, History, Gold deposits, Western Canada, Rossland, Hedley, Premier, Bridge River, Cariboo, Northair Mines Ltd.

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Abstract

The area under consideration is British Columbia and Yukon Territory, both of which were settled during famous placer gold rushes — the Cariboo and the Klondike respectively.

Numerous lode gold mines have operated in B.C. at intervals since the turn of the century, but only five gold camps have produced more than 2,500,000 tons of ore. The Yukon has not had a successful lode gold mine.

The five B.C. camps occur in three of the tectonic belts of the Canadian Cordillera. The geological settings of the camps are markedly different, being similar only in the fact that vein deposits characterize four and that, in all, gold was the principal metal from an economic standpoint.

It is noted that "granite" is closely related spatially to the gold deposits in four of the five camps. Whether there is a genetic relationship or not is debatable, but a common denominator, other than "granite", is not readily discernible.

An entirely new gold producer is described briefly. Northair is a geochemical discovery.

A price of more than $150 per ounce has not produced a gold boom in Western Canada, largely due to offsetting factors such as inflation, taxes, royalties and general government involvement.

Introduction

DURING the past 25 years, an entire generation of geologists has worked in Western Canada, bending its efforts almost entirely to the discovery and development of a variety of base-metal deposits — zinc, lead, tungsten, iron, copper and molybdenum. From time to time, these geologists might venture underground in a gold mine on a field trip, but, for the most part, they were concerned with alteration haloes, open-pit potential and strip ratios. Few knew anything about gold because interest in that most precious metal died overnight in Canada during the summer of 1947.

1972 saw the end of a cycle of vigorous exploration for porphyry copper deposits that started in the mid-1960's. Hardly noticed, the average price per fine ounce of gold increased from $35.34 in 1971 to $57.72 in 1972. This resulted in a small simulus to small-scale placer mining.

The outstanding feature of 1973 was the increase in copper price to 83.2 cents per pound from 44.8 cents in 1972. Gold rose almost $40 per ounce and exploration was initiated with a view to reopening long-established gold mines in the Bridge River and Cariboo areas, but there has been no gold boom — for reasons that will be mentioned later.

The purpose of this paper is to describe very briefly the principal lode gold deposits of Western Canada, past and present. With regard to the past, attention is arbitrarily confined to gold camps from which production has been more than 2,500,000 tons of ore. The five British Columbia camps that qualify have produced about 11,700,000 ounces of gold, or 70 per cent of the lode gold produced (17,000,000 ounces) in British Columbia. Incidentally, this amount (11,700,000 ounces) is approximately equal to the Yukon placer production. The Yukon has had no lode gold production of consequence.

No apology is made for an old-fashioned ring to the geological descriptions, because old-fashioned geologists found the ore.

Past

ROSSLAND

Lode mining in British Columbia got underway during the last decade of the 19th century and Rossland was the first major discovery. Prospectors working along the old Dewdney trail spotted gossans on what became known as Red Mountain and, in 1890, the Centre Star, War Eagle and Le Roi discoveries were made. The first samples sent to Butte from the Le Roi assayed 4 ounces of gold, 3 ounces of silver and 5.25 per cent copper — aggregating $84.40 per ton at the prevailing prices. Ore was actually shipped in 1894, but, in 1895, Augustus Heintze came up from Butte and began building a smelter at Trail, 6 miles east of Rossland — after arranging to treat 75,000 tons of Le Roi ore. In 1897, Heintze's smelter turned out the first gold brick produced in Canada. The following year, the Canadian Pacific Railway acquired Heintze's smelter and the narrow-gauge railway between Rossland and Trail. This was the beginning of the Consolidated Mining and Smelting Company Limited (now multi-national Cominco Ltd.), as a copper producer relying solely on the ores from the Rossland mines.

Ninety-eight per cent of the Rossland production came from four inter-connected mines in a central area of 2000 by 4000 feet. It amounted to 6,200,000 tons with a recoverable grade of 0.47 oz gold and 1 per cent copper per ton. Practically all of this was smelted directly. The mines operated continuously from 1894 to 1928, but production dropped sharply from 1917 on. Profitable leasing for gold was carried on in the 30's and much of the ore thus won was smelted in one of the lead furnaces at Trail.

Geologically, Rossland was a centre of igneous activity, particularly during the Tertiary. Several intrusive masses and a considerable variety of dykes are present. The invaded rocks are Late Paleozoic and Lower Jurassic volcanics and sediments that have been dated on the basis of a limited number of fossils.

The compact central block mentioned above is rectangular in form, with its long axis about east-west. It is bounded on the north by the contact of the Trail granodiorite and on the west by the contact of the latites of the Rossland Group. The block itself consists partly of the west end of the oldest local pluton, the Rossland monzonite stock. It forms an irregular body measuring about 5 miles east to west and 2 miles north to south, which is exposed in the City of Rossland and eastward toward Trail. The remainder of the block consists of volcanics and sediments immediately north and west of the monzonite. In general terms, the irregular horseshoe formed by the western part of the monzonite contact was the locus of mineralization. The mineralization extended outward into the enclosing rocks, occurring chiefly in ore-grade veins in the augite porphyrite and the volcanics. Veins also occurred in the monzonite, but were generally low grade, except near the contact. Weak disseminations of sulphides are present in the sediments.

The augite porphyrite in the mines area forms the Rossland sill. It is as much as 2500 feet thick and dips westward at low angles. It lies beneath hornfelsic siltstones and above volcanic breccias, sandstones and conglomerates. The augite porphyrite is intruded by the Rossland monzonite and extends to the lowest levels of the principal mines.

A rock mapped as diorite porphyry, which appears rather similar to both porphyrite and monzonite in places, occurs in irregular tongues in the mines area. It merits mention because ore shoots were found along its margins.

All the dykes in the immediate area that have been subjected to K-Ar dating are of Tertiary age. The lamprophyre dykes were referred to as "mica dykes" by the early miners. They trend northward and dip steeply; they range from a few inches in thickness to more than 50 feet in the case of the Josie and Nickel Plate dykes.

The lamprophyre dykes are now generally accepted as pre-ore, which makes the ore Tertiary (about 48 m.y.)

The ore occurred in well-defined veins that have two principal trends, N60-70°E (e.g. Le Roi - Centre Star) and N60°W (e.g. War Eagle). They dip steeply (60-80 degrees) northward.

The orebodies were replacements along fissures and were "composed of pyrrhotite, chalcopyrite, some pyrite, and minor amounts of other sulphides, in a gangue of altered wall rock with variable amounts of quartz and calcite"[1]. In places, the veins were composed of essentially massive sulphides, but good values in both gold and copper were obtained in some shoots that contained relatively little pyrrhotite. The copper-gold (lb/oz) ratio ranged from 19:1 to 72:1 and averaged 40:1, with the total copper production having a dollar value of approximately ⅓ the gold.

More than 80 per cent of the ore shipped was mined between the Josie and the Nickel Plate dykes — which were half a mile apart.

The main (Le Roi - Centre Star) vein was mined continuously for a length of several thousand feet. In general, however, the fissures contained a series of ore shoots of modest size, with the greatest dimension being down the dip. The shoots raked steeply, eastward and westward.

Along strike and dip, minor offsetting was a common feature. Along strike, ore shoots would terminate against a lamprophyre dyke — where the ore shoot would thicken.

An ore shoot terminated down dip because of weakening structure or weakening values or both. Vein widths varied greatly, from a few feet to 130 feet. The deepest workings were 2400 feet below the surface.

HEDLEY

The Hedley camp is on Nickel Plate Mountain on the north side of the Similkameen River. Placer gold was discovered on Hedley (Twenty Mile) Creek in 1859, but the history of Nickel Plate Mountain really began in August, 1898 when an outcrop containing abundant gold-bearing arsenopyrite was discovered by two prospectors, Francis H. Wollaston and Constantine H. Arundel. M. K. Rodgers, then working for Marcus Daly of Butte, Montana, saw samples from this outcrop at the Provincial Fair in New Westminster, B.C., and that was the beginning. It was noted in local papers that the prospectors were paid $60,000-$80,000 for their find and development started under the direction of Rodgers as general manager. Milling commenced in 1904 and continued until 1931.

In 1932, the holdings of the original Hedley Gold Company were purchased by the South American Development Company on the recommendation of Paul Billingsley. Operations resumed in 1934 and proceeded without interruption until the shutdown in 1955.

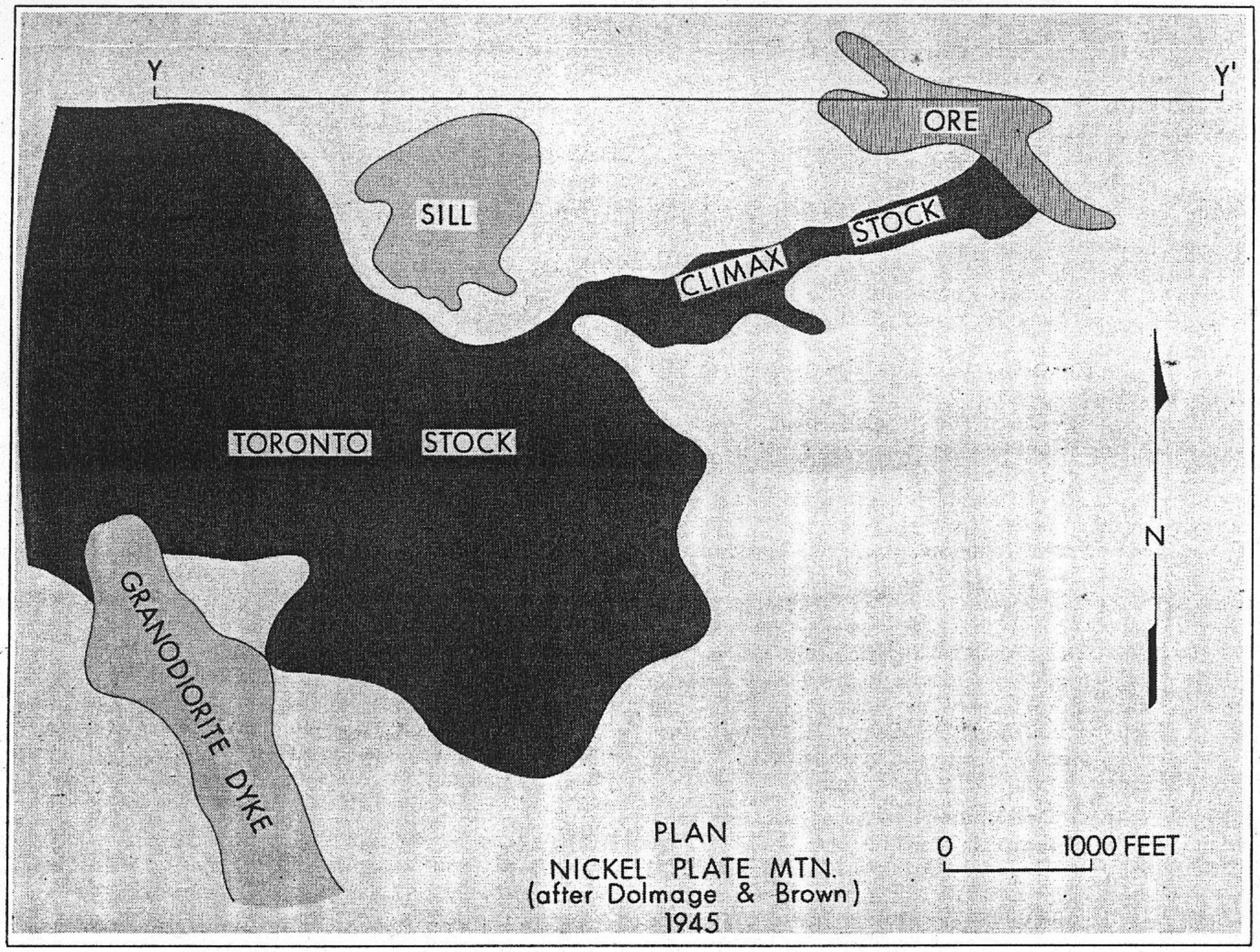

FIGURE 2 — Hedley (plan).

The famous Mascot Fraction is part of the history of Nickel Plate Mountain. The owner of this 7.8-acre fraction, Dunc Wood, sold to an opposing group, Hedley Mascot Gold Mines Ltd., and in 14 years (1936-50) this small fraction yielded 680,000 tons of ore averaging ⅓ oz gold per ton.

Nickel Plate Mountain, a steep bare mountain, is composed of Triassic sediments and minor volcanics intersected by a differentiated granitic stock and innumerable sills and dykes that exhibit a porphyritic texture in the mine area.

On the basis of seven widely spaced and carefully chosen, informational drill holes, the Nickel Plate formation (the prospective formation) was divided into three members as follows:

Upper Member	— Quartzite and breccia	300 ft
Middle Member	— Thinly bedded pure and impure limestones, and quartzites, intercalated with massive limestone beds up to 80 feet thick	600-700 ft
Sunnyside Member	— Massive limestone beds, minor thinly bedded quartzites	150-200 ft

The principal stock, the Toronto stock, is largely quartz diorite, but its highermost parts are augite diorite, quartz-gabbro and gabbro.

The numerous sills and dykes, apophyses of the Toronto stock, and commonly referred to as 'porphyry', are rather basic in composition — dioritic or gabbroic. The sills are generally irregular, are not precisely parallel to the bedding and frequently step up or down stratigraphically at an acute angle. Connecting dykes from one sill to another are common. Three groups of sills are recognized in the Nickel Plate Formation, the middle group being the Mine Sills. The most famous of these is the Hot Sill (for obvious reasons), and a particularly large dyke that spans the Nickel Plate Formation is called the Central Dyke.

In the mine area, the sill-dyke complex constitutes 30-40 per cent of the total thickness of the Nickel Plate formation.

The limy beds of the Nickel Plate formation have been folded, faulted and converted in part to a hard green skarn composed of pyroxene and garnet. The skarn is most extensively developed on the east and north margins of the Toronto stock, i.e. in the mines area. The ore minerals — mainly arsenopyrite (the gold carrier), pyrrhotite and chalcopyrite — replace the skarn and were locally deposited in fractures in the sills and dykes.

Localization of the ore is dependent on folds and faults in the appropriate sediments as well as on geometric configurations of the sills and dykes and, particularly, their intersections. The major ore control, however, is the famous 'Marble Line', a term coined by Billingsley. The 'Marble Line' is a well-defined boundary that marks the limit of metamorphism in the sediments. No mineralization of consequence occurs in the unaltered limestone and none of economic significance has been found in the skarn at a distance of more than 250 feet from the 'Marble Line'.

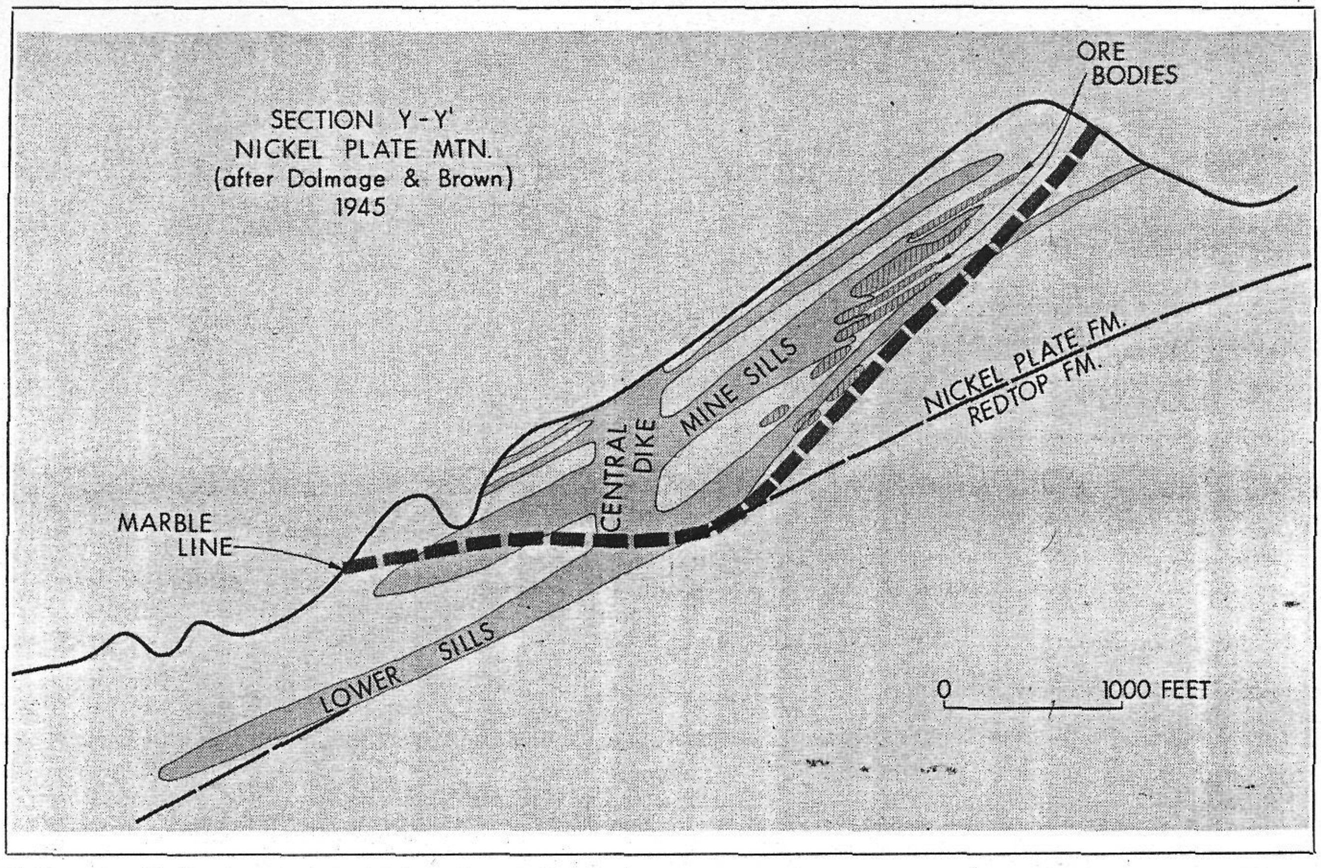

FIGURE 3 — Hedley (section) — ore deposits are dark grey.

The 'Marble Line' is not conformable — it is definitely a cross-cutting feature. If it has the ring of empiricism to it, it has nevertheless served its purpose in the search for ore.

Much of the above has been stated with the Nickel Plate orebodies in mind, because they were by far the most important at Hedley. They were a series of tabular, overlapping bodies separated by low-grade or barren skarn, or by porphyry sills. Viewed collectively as a single pipelike deposit, the Nickel Plate extends from surface outcrop, plunging in a N50°W direction at an angle of –28 degrees for a slope distance of 3000 feet.

This mineralized skarn was hard and competent and large stope areas required little or no support. In contrast to this, below and just beyond (west) the Nickel Plate deposit was a steeper, less competent deposit that was characterized by mud seams and the presence of chloropal — the Morning orebody. Much of this orebody had to be square set.

During its nearly 50 years of operation, the Nickel Plate Mine produced 3,315,800 tons of ore with a recoverable grade of 0.41 oz gold per ton. (A minor amount of copper was recovered). In the early days, gold bricks were produced at the mine; in the Kelowna Exploration years, concentrates were shipped to Tacoma and a precipitate to New Jersey.

PREMIER

The Premier Mine is in the Portland Canal district, adjacent to the southern tip of the Alaska Panhandle. Claims were recorded in 1911 in the name of the Salmon Bear River Mining Company. Development work was carried out, but no ore was shipped until 1918 after high-grade silver ore was found in the No. 1 tunnel. An 11-mile tramline was built to connect the mine with tidewater. The dock was barely in Canada, whereas the eventual 13 miles of road to the mine was mainly in Alaska.

In 1919, a majority interest in the property was acquired for $1,000,000 cash by the American Smelting and Refining Company. The Premier Gold Mining Company was formed with a capitalization of $5,000,000 and the show was on the road. During the first 10 years of operation, well over $11,000,000 in dividents was distributed, a figure that was eventually doubled. In 1936, Premier merged with two adjacent companies to form Silbak Premier Mines Limited.

(In passing, it is worth noting that the early spectacular success of the Premier brought a rush of prospectors to the head of Portland Canal and a great number and variety of mineral showings were found and diligently explored — but none was sufficient to sustain an operation for more than a brief period).

The Premier is on the eastern margin of the Coast Crystalline Belt, represented here by the Texas Creek granodiorite batholith. The country rock in the mine area consists partly of Hazelton volcanics (?) and volcanic sediments (for which a cataclastic origin has recently been proposed)[8] of Lower Jurassic age. Whatever the precise origin of these rocks, they are now altered to greenstones and green schists. The remaining country rock is 'porphyry'. A stock-like mass of feldspar porphyry outcrops in Cascade Creek immediately west of the mine and swarms of porphyry dykes and sills traverse the mine property, mainly parallel to the northwesterly regional structure.

The term 'porphyry' is applied to a variety of rocks in the mine area. In places, large orthoclase phenocrysts are common and in other places the porphyry is non-porphyritic. Three varieties were mapped in the mine, green, red and 'Premier', which was appropriately the principal host rock. To a lesser extent, ore occurred in the green-

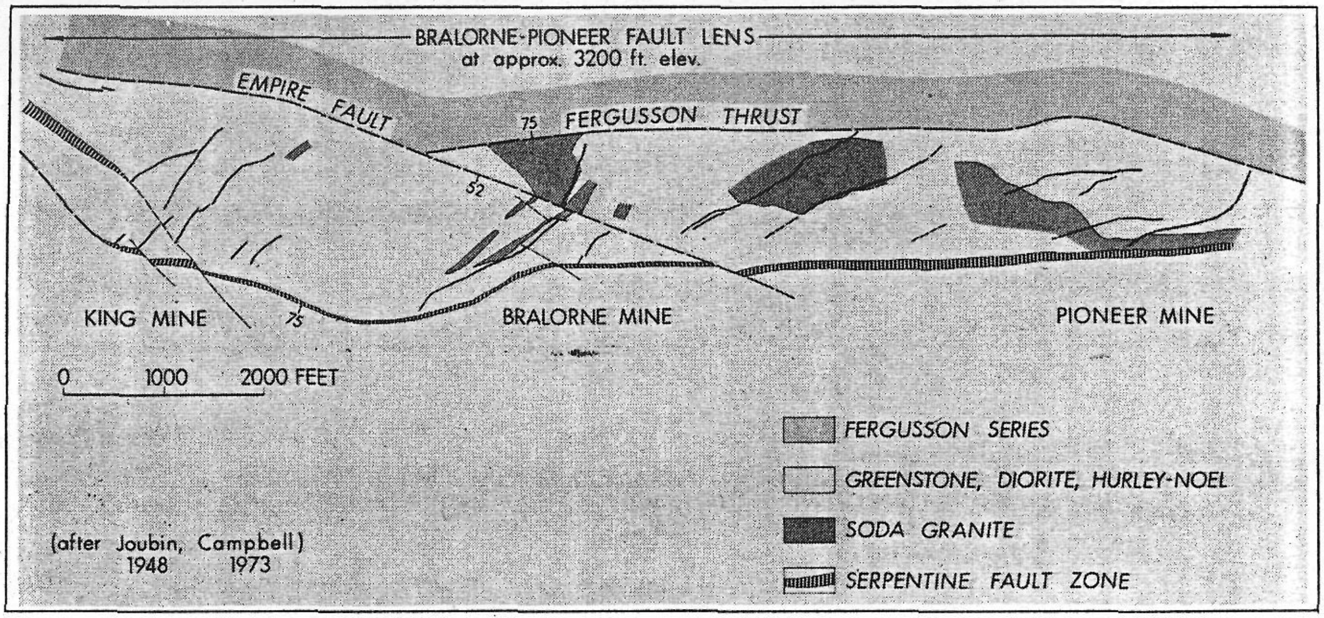

FIGURE 4 — Bridge River—veins are shown as single strands.

stone, particularly near contacts with the favourable Premier porphyry.

The porphyry was sheared along NW and NE directions and most of the ore was found along a wide zone with a NE trend. Along this trend, ore was mined for approximately one mile.

The mine rocks were fractured, sheared, silicified and chloritized — and enclosed a massive quartz-pyrite fissure-replacement system. Ore-grade mineralization was stoped over considerable widths — in places more than 50 feet.

Most mines have certain features of particular interest to the structural geologist, and the Premier is no exception. It is a good deal more interesting, however, from a mineralogical standpoint. The ore consisted principally of pyrite, sphalerite, galena, chalcopyrite and pyrite, but the near-surface ore — to a depth of 300 feet and, locally, 600 feet — was a true bonanza in which gold, electrum, argentite, pyrargyrite, polybasite and, locally, native silver occurred.

The native gold occurred as minute inclusions in the quartz and also within crystals of pyrite. The electrum occurred in fractures in pyrite and was closely associated with the galena. The native silver occurred in quartz and pyrite associated with argentite, the most abundant of the silver minerals. It also occurred with the polybasite, galena and sphalerite. Calcite was typical in this association.

The bonanza minerals were largely mined out during the first few years of operation. Nevertheless, the quantity of bonanza minerals, more typical of Nevada, is unique in British Columbia deposits. Some research has been done on the origin of the silver minerals and the general consensus is that they are primary.

Production was continuous until 1953 and aggregated about 4,700,000 tons which yielded the following:

1,820,000 oz Au
41,000,000 oz Ag
4,300,000 lb Cu
60,000,000 lb Pb
16,200,000 lb Zn

In 1953, mining stopped at a depth of 1500 feet because of low base metal prices.

In 1922, the first full year of operation, the recoverable grade was 1.2 oz gold and 40 oz silver per ton. Ten years later, in 1932, the grade was 0.34 oz gold and 7 oz silver per ton.

There is one fascinating, probably final footnote to the Premier story. In 1959, leasers obtained a one-year lease from the company and proceeded to mine high-grade ore from the old glory hole — where a wall of waste had fallen in. The leasers and, subsequently, the Silbak company mined 2,736 tons here which contained:

18,595 oz Au	(6.8 oz Au/T.)
394,933 oz Ag	(144 oz Ag/T.)
16,258 lb Cu	
216,000 lb Pb	
322,118 lb Zn	

BRIDGE RIVER AREA

The Bridge River area is on the eastern margin of the Coast Crystalline Belt, 70 miles by mountainous road from the railway town of Lillooet. Placer gold was found in 1863, many of the known veins were discovered in 1897, and the construction of a railway (the Pacific Great Eastern) from Vancouver to Lillooet in 1915 helped encourage development work on the lode claims. In 1928, the Pioneer Mine went into production with a 100-tpd cyanide plant which subsequently was increased to 400 tons per day. Next-door neighbour Bralorne Mines Ltd. went into production in 1932 and by 1935 the capacity of the mill was increased to 475 tons per day.

Production ceased at the Pioneer in 1962 and at Bralorne in 1971. Statistics are as follows:

		Production (oz)	
	Tonnage	*Au*	*Ag*
Pioneer................	2,476,693	1,333,083	244,648
Bralorne..............	5,474,238	2,821,036	705,862
Total..................	7,950,931	4,154,119	950,510
Grade (recoverable).....		0.5225 oz/t	0.1195 oz/t

The early production, indeed a great deal of the production, came from quartz veins 3-5 feet wide. Of the 30-odd veins in the two properties and the ore environment, 6 produced the bulk of the gold. Bralorne's '77' vein produced 2,100,000 tons of ore over a vertical range of 4650 feet and on the bottom 'level' (actually a decline) 6150 feet below the collar of the Empire Shaft, there has just

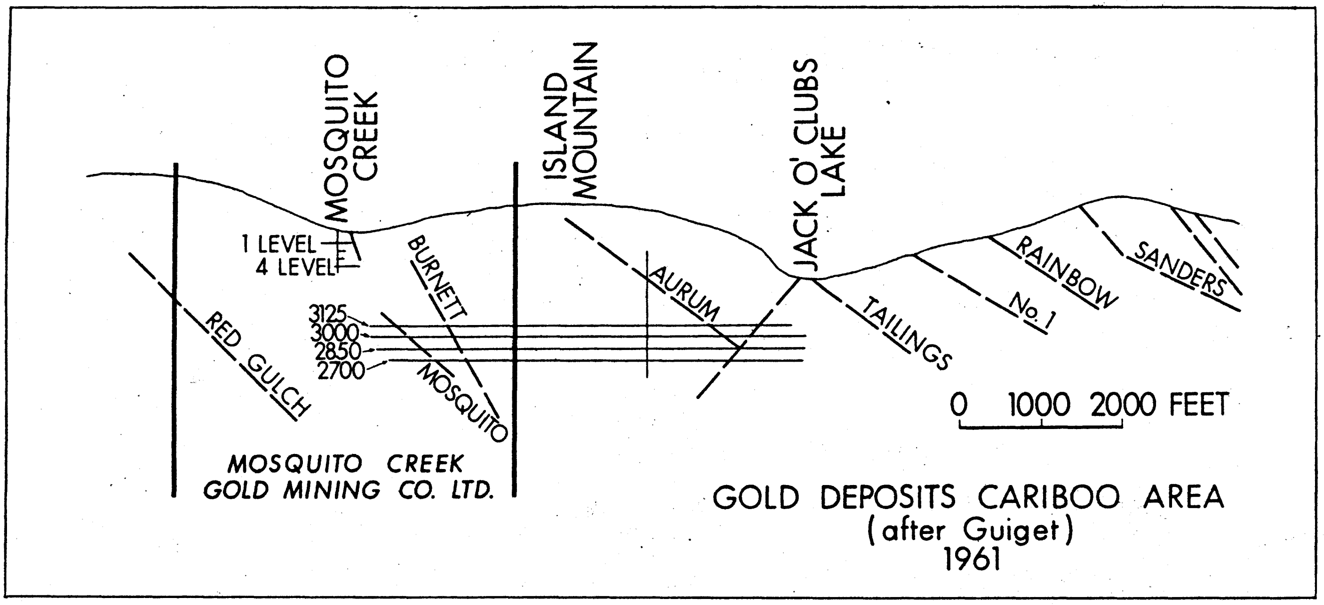

FIGURE 5 — Cariboo — longitudinal section showing principal faults.

been sufficient work to indicate a 530-foot length of vein, 6.8 ft wide and averaging better than 1 oz Au per ton. It is also worth noting that at this depth the temperature (unrelieved) was 135°F (57°C).

The Bridge River camp occurs near the northern (recognizable) end of the Fraser Fault System — a profound crustal rent that is a complex, multiple feature persisting southward into the U.S.A. In many places, this Fault System is marked by the occurrence of ultrabasic intrusives and the development of serpentine. (In the Hope area, 30-odd miles north of the U.S.A. border, a successful nickel-copper producer operated for years on the west bank of the Fraser River, and old gold showings on the east bank of the river are now being vigorously explored.)

In the Bridge River area, the segment of the Fraser Fault System that is relevant to the gold deposits is the Cadwallader Fault Zone or "Break" — ranging from 50 feet to several hundred feet in width. It, too, is characterized by a marked development of serpentine.

Very briefly, the country rock of the camp consists of sediments and volcanics of Late Paleozoic and Triassic-Jurassic age.

The Paleozoic rocks (Fergusson series), consisting of cherts and argillites, are intensely deformed. They border the productive area on the northeast and are separated from it by the Ferguson Thrust.

The Triassic-Jurassic rocks, Hurley-Noel sediments (argillites, tuffs, minor chert) and Pioneer greenstones occur within the productive area as well as to the southwest of it, beyond the Cadwallader "Break". The Pioneer greenstone was the principal host rock at that mine and the non-argillaceous sediments of the Hurley-Noel formations were moderately favourable.

The Bralorne diorite occurs in irregular stocklike masses along the Cadwallader "Break" and is the principal host rock at the Bralorne Mine. The rock is fine to coarse grained and appears to grade into the Pioneer greenstone as well as intrude it. Inevitably, workers have suggested a close genetic relationship between the two principal host rocks.

The environment of the productive Bridge River veins is lenticular in shape and northwest trending. It is approximately 3 miles in length by as little as ¼ mile wide at the surface. The northeast boundary is the Fergusson Thrust, which dips steeply northeast (±75 degrees). The southwest boundary is the Cadwallader Fault Zone, which dips steeply southwest. We have, therefore, an ore environment that actually widens with depth.

Within the ore environment is a large, vertical lens or dyke-like mass of soda granite — which is unique to the environment. This distinctive rock type is intrusive into the Bralorne diorite and into the Pioneer greenstone. The soda granite is not a good host rock.

Thus, the Bridge River ore environment can be closely defined — a lens in plan bounded by two profound fault features. From this area, for all practical purposes, the area of soda granite can be subtracted and the resultant area is the potential area or net ore environment.

A genetic relationship between soda granite and ore-bearing quartz veins is considered reasonable and it is noteworthy that the veins are generally richer in close proximity to the soda granite. Joubin[3] believes the sequence to be: (1) soda granite, (2) albitite dykes with arsenopyrite and (3) gold-bearing quartz veins.

In passing, it is also worth noting that Bralorne miners early observed that the veins were often abnormally rich adjacent to the serpentine.

Campbell[2] noted that the ore-bearing veins "all occupy tension fractures" that traverse the lens obliquely. They dip steeply northward and rake vertically to steeply northwestward.

It was noted above that much of the production came from vein widths of 3 to 5 feet. In places, however, particularly in the '77' vein, stoping widths of 10 to 20 feet occurred. Ore shoots varied greatly in length, but few exceeded 800 feet.

The mineralogy of the veins is rather simple, consisting mainly of quartz and carbonate, pyrite and arsenopyrite, free gold, and very minor amounts of sphalerite, scheelite and mariposite. Joubin[3] noted that the latter two minerals generally signified the extremity of an ore shoot, whereas the presence of sphalerite was often accompanied by a rise in gold content.

Over a vertical range of more than 6000 feet, there is no change in mineralogy. The sulphides constitute 1% to 3%

of the vein material at most. Where the vein quartz is ribboned or banded (due to the smearing and shearing of sulphides along fractures) parallel to the walls of a vein, economic grade can be anticipated.

It might be expected that a mine which had prospered for years at a base price of $35 gold, and had only closed down in September 1971, would reopen automatically as the price of gold surged up to $150 and beyond. In addition to rather serious mechanical rehabilitation problems, however, there is a caving problem, and the fact that the best of the known ore is at the bottom of an unusually warm mine. Moreover, at shut-down, the known reserves were scattered in relatively small blocks.

An exploration program was initiated in 1973 in which work was concentrated in the lower levels (2000-2600) of the 'Upper' mine — on the '51' and '52' veins.

Concerning the situation at present, the president of Bralorne Resources Limited stated in the annual report of operations for 1974 that the company had ceased all exploration of the property and that "internal engineering studies identified currently accessible reserves above the 3900 level of 233,000 tons grading 0.33 oz gold per ton. . ."

CARIBOO

The Fraser River gold rush of 1858 was quickly succeeded by the greater Cariboo gold rush in 1860, when spectacular finds were made on half a dozen creeks, including Antler Creek. Although the peak placer year in the Cariboo was 1863 and gold-bearing quartz veins were found in the early 1870's, it was 70 years later (1933) before lode mining made a successful beginning in the Antler Creek area. Nowhere in B.C., however, has the relationship between placer and lode deposits been more clearly and closely demonstrated than in the Cariboo.

From a real-estate standpoint, the Cariboo was a two-property camp. The Island Mountain property, operated for 21 years (1934-54) by Newmont Mining Corporation, was surrounded on three sides by the Cariboo Gold Quartz Mining Company Limited, which property also included the townsite of Wells. The 1,019 acres of Island Mountain ground was purchased by Cariboo Gold Quartz for $300,000 in August, 1954. Cariboo Gold Quartz operated its own mine for 27 years (1933-59) and the Island Mountain for 13½ years (1954-67).

The present concept of the complex geological environment is the work of A. Sutherland Brown[1]. The information set forth in this paper is largely derived from Marcel Guiget[2,3], who went to Wells on September 2, 1946, on a 3-month mapping assignment and stayed 21 years (until shutdown in 1967), the last 10 years as general manager.

The rocks in the mine area are of Lower Cambrian age — limestone, limy phyllites, quartzites, argillites and gradational types. In the present interpretation, the Cariboo Group is a relatively thin sequence thickened by tight overturned folding and faulting. The formations plunge northwestward at 22 degrees and dip northeastward at 30-45 degrees.

The main feature of each ore zone is a strong fault striking northerly and dipping eastward — with the exception of the Jack O'Clubs fault, which dips westward.

The prospective members of the Cariboo Group are the Baker and the Rainbow. The ore occurs in quartz veins and as replacements of limestone beds. The quartz veins consist of two main types:

1. Transverse. S = N30°-55°E. D = 70°SE to 70°NW
2. Diagonal. S = N70°-90°E. D = SE (steep)

There was nothing outstanding about these veins. They contained 10-40 per cent pyrite and small amounts of free gold. On average, shoots were not over 125-150 feet long and widths were generally less than 5 feet. The veins that were mined carried 0.32-0.45 ounce gold per ton. Most of the quartz veins are in the Rainbow member.

The replacement ore was richer, averaging 0.70 ounce gold per ton. It occurs adjacent to the Rainbow-Baker contact, most often in the 'first' limestone bed of the Baker member. It consists of fine-grained pyrite that has entirely or partially replaced the limestone.

Both types of ore, vein and replacement, occur in the vicinity of the northerly faults as noted above.

The form and attitude of the replacement bodies relate to the fold structure. Pencil replacement structures are most common and they plunge sympathetically with the major structure (22° NW). In cross section, these bodies range from 4 ft by 4 ft to 5 ft by 15 ft, but in length a series of stopes extended for 2000 feet.

In addition to the pencil replacement orebody, tabular deposits formed on the limbs of folds and these were much larger than the former.

With the purchase of the Island Mountain mine in 1954, Cariboo Gold Quartz operated its new acquisition for 13½ years, but, in addition, the purchase gave them ready underground access to the Mosquito group of claims on the northwest side of the Island Mountain holdings. Island Mountain had already drilled three long drill holes out toward Mosquito Creek and established the existence of a strong fault 20 feet wide.

To make a long story short, between 1958 and 1961, long drives were put out northwesterly on the 2,850-, 3,000- and 3,125-foot levels. An unanticipated fault was encountered before the Mosquito fault was reached and replacement ore was found in both the hanging wall and footwall of this structure, called the Burnett fault (after the long-time president of the Cariboo company). Some 40,000 tons grading 0.70 oz gold per ton remain in the five levels (3125 to 2550) in the Burnett fault - Mosquito fault area, with access the main operational problem.

With the recent rise in the price of gold, consideration was given to investigation of the Mosquito Fault. Indica-

TABLE 1 — Production from the Cariboo Area

Mine	Operator	Years	Tons Milled	Recovered Au (oz)	Recovered Ag (oz)
No. 1 Mine (Cow Mtn.)	Cariboo Gold Quartz	1933-59	1,681,950	626,755	56,092
Island Mountain	Newmont Mining Corp.	1934-54	771,109	332,465	47,225
Island Mountain	Cariboo Gold Quartz	1954-67	474,186	237,063	34,433
			2,927,245	1,196,283	137,750

tions of replacement ore had been found some years before in the placer workings of Mosquito Creek and a search for lodes in this relatively unexplored area was logical. A new company, Mosquito Creek Gold Mining Co. Ltd., was formed and a drilling program undertaken in 1973. Some replacement ore was found at the 4400-foot elevation and a shaft was collared at the 4573-foot elevation. In preparing the shaft site, some replacement ore was found and a modest band was also encountered in the shaft at a depth of 161 feet.

Actually, 'modest' is an apt word to describe just about everything associated with the Cariboo lode operations. In mining the quartz veins, hand shovels and wheelbarrows were employed in the original Cariboo Gold Quartz workings until closure in 1959, but the men were men and they made a go of it.

Production figures for the Cariboo mines are shown in Table 1.

Present

NORTHAIR

The Northair property is 70 miles north of Vancouver, in one of the numerous pendants or septa that characterize the Coast Crystalline Belt. A paved highway passes 5 miles east of the property and logging roads provide access the remainder of the way.

The discovery was a geochemical find made in 1969 by a dentist who had attended night courses at the B.C. and Yukon Chamber of Mines and the B.C. Institute of Technology. The dentist, Dr. M. Warshowski, became an energetic weekend prospector. He armed himself with a field kit that was used for testing stream silts for total heavy metal content and, before long, he was on to a stream where the silts gave anomalous results. Subsequently, he contacted veteran geologist A. H. Manifold, who had instructed him at the Institute. Together they carried out further silt sampling and found float mineralized with chalcopyrite and galena — which prompted them to stake 13 mineral claims. From then on, systematic detailed prospecting and hand-trenching revealed two rather widely separated mineralized outcrops — the Discovery Zone and, 3700 feet to the southeast, the Manifold Zone.

After a major Canadian company optioned and turned back the property, Don McLeod, president of Northair Mines Ltd., a junior company on the Vancouver Stock Exchange, optioned the claims and a vigorous program of exploration ensued. Between the Discovery and Manifold zones, the Warman Zone was found and it does not take too much imagination to think in terms of a NW-SE structure extending a minimum of 4000 feet.

The rock is a light to moderately sheared, chloritic andesite (greenstone) and contains quartz-carbonate-filled fissure(s) with highly variable amounts of pyrite, sphalerite, galena, chalcopyrite and native gold. Argentite has also been reported.

Underground work has been carried out on the Manifold Zone at the 3700-foot level (200 feet beneath surface showings) and two shoots indicate a grade of 0.37 oz Au/ton and 21.2 Ag/ton, over a true width of 6 feet and a combined length for the shoots of 437 feet. Underground work on the Warman Zone (3450-ft level) has disclosed a shoot 710 feet long by 7.5 feet true width averaging 0.70 oz Au/ton, 1.0 oz Ag/ton, 0.23% copper, 1.54% lead and 2.39% zinc. The Discovery Zone has been drilled from surface; it contains gold and silver, but apparently runs more to base-metal content.

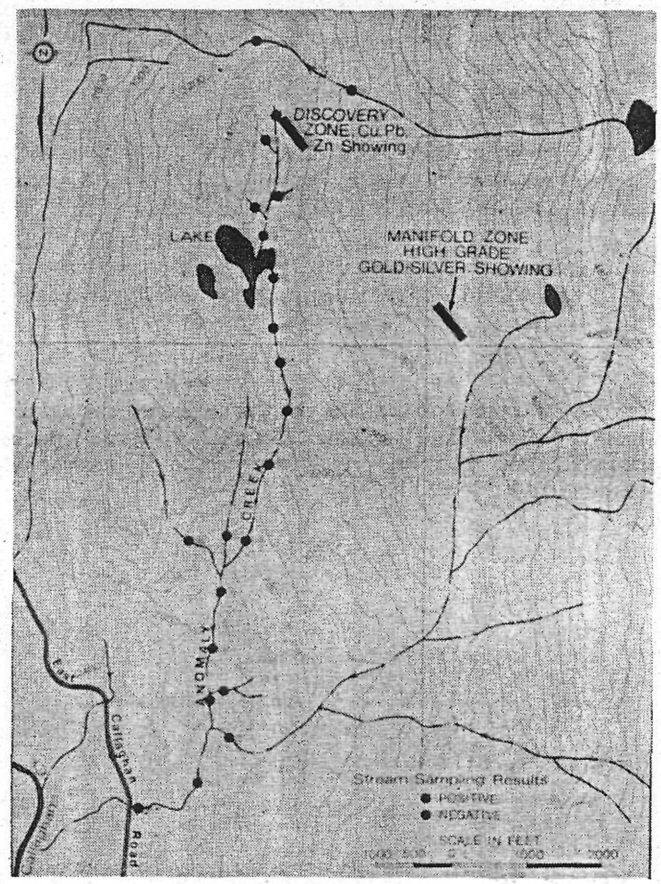

FIGURE 6 — Northair — showing stream sampling results (after Dickson and McLeod).

Plans are to drive a haulage adit at the 3250-foot elevation, beneath the Warman Zone, and commence mining there — where the gold values are highest.

The Northair mine is to be brought in at a production rate of 340 tons of ore per day.

The discovery of the Northair mine indicates that gold properties of merit remain to be found in British Columbia. It further indicates that a simple geochemical sampling technique may be an eminently satisfactory procedure to use under certain mineralogical and other circumstances. A sound geological approach, regional as well as local, will continue to be useful in prospecting for gold in British Columbia.

Nothing has been said with regard to the Yukon Territory, because no economic lode gold deposits have ever been developed there. Obviously, if they are present, they are not going to be found easily at this date.

In spite of the fact that Canadian-produced gold was sold at an average price of $157 per ounce in 1974, there has been little indication of anything approaching a gold boom in Western Canada. There are a number of reasons for this fact, including a frightening escalation in wages and the price of equipment. The main reason, however, is ever-increasing government involvement in the resource industries with no clear statement as to ultimate objectives. This situation, of course, is by no means peculiar to Western Canada.

Conclusions

The mining camps described above are shown on a simplified tectonic diagram of the Canadian Cordillera (Fig. 1).