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Great Mining Camps of Canada 3.
The History and Geology of the Cariboo Goldfield, Barkerville and Wells, BC

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Article abstract

The discovery of placer gold deposits in the Cariboo in 1860, and the immediate realization of their importance, were directly responsible for the establishment of the Province of British Columbia, allowing Canada to expand from 'Sea to Shining Sea.' Later, in the early 1930s, the new lode gold mines helped rescue the province from bankruptcy during the Great Depression. The Cariboo Goldfield is one of the longest continuously productive mining camps in Canada (nearly 150 years).

The Cariboo Goldfield, like the California Goldfield, manifests two styles of mineralization: 1) primary lode gold deposits, and 2) secondary placer deposits. In plan, the zone of lode deposits trends linearly about 6 km in a northwest–southeast direction, within an inverted boot-shaped cluster of placer deposits having a surface area of about 250 km^2. Three zones of rich placer creeks also trend northwest– southeast within the goldfield, the most northeasterly of which envelopes the known lode trend.

The Cariboo Goldfield encompasses two dominant rock domains–an upper or hanging-wall domain of late Paleozoic ophiolitic rocks, part of Slide Mountain Terrane, and a more widespread, lower or foot-wall domain of late Proterozoic to Paleozoic continental margin meta-sedimentary rocks, part of the Barkerville Terrane. In cross-section, the lode deposits are located in a sub-horizontal, terrane-bounding fault (suture or high-strain zone), which separates the hanging-wall and footwall domains. The vertical extent of the mineralized zone below this suture is half a kilo-metre or less. Gold occurs in both pyritic quartz veins and pyritic replacement deposits; the mineralogy of the ore is simple: gold-bearing (auriferous) pyrite and minor amounts of other sulfide minerals.

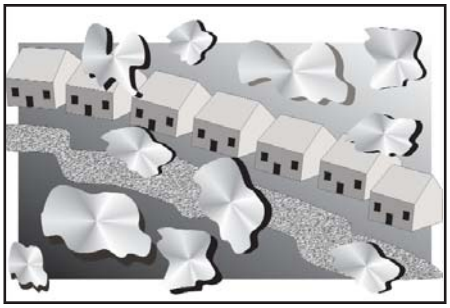
Three lode mines in the goldfield are from southeast to northwest, the Cariboo Gold Quartz, Island Mountain and Mosquito Creek mines. Combined production from these mines between 1933 and 1987 is about 38.3 million grams (g) (1.23 million troy ounces) of gold and 3.16 million g (101 439 troy ounces) of silver, which would be worth more than one billion dollars at current prices (~US$900 gold).

Major placer deposits are located largely along creeks in the Goldfield mostly lying in gutters on bedrock overlain by Late Tertiary gravels but gold is also redistributed within overlying glacial sediments. Gold nuggets exhibit diverse shapes, from irregular and drusy to rounded and hammered, indicative of varied histories of transport. Average fineness ranges from 830 to 950 [gold to gold+silver, pure gold = 1000]. Since 1860, placer mines probably produced more than 118.2 million g (3.8 million troy ounces) worth about 3.4 billion dollars at current prices.

Adventuresome placer miners reached the south end of the Goldfield in the winter of 1860 and the major producing creeks were all discovered during the following year. Initial mining took place in shallow deposits along creeks but within a year some mining was underway in water saturated gravels to depths of 20 m. Production peaked in 1863 but has continued at diminished rates until today. As placer production tailed off, great efforts went into the search for lode deposits. Many mineralized, pyritic quartz veins were found with very fine-grained gold contained within pyrite, but quartz veins containing nugget gold typical of that found in the placers remained elusive. In spite of provincial government assistance by providing milling and roasting facilities to process the lode deposits, the technology of the day was inadequate to make the deposits economic. The lodes were not viable until cyanide treatment became available and the price of gold rose. The Cariboo Gold Quartz mine opened in January 1933 and Island Mountain in November 1934. The Cariboo Gold Quartz purchased the Island Mountain mine in 1959 and both mines continued producing until 1967 when they closed because of unfavourable economics. Higher gold prices resulted in the Mosquito Creek mine coming into production in 1980 and continuing until 1987, after prices had receded. Recent high gold prices have again stimulated significant exploration.

Like all gold rushes, the Cariboo has had a cast of strong and interesting characters. Four of the most memorable include: Billy Barker, an early placer miner; Bill Hong, a later Chinese placer miner; Amos Bowman, the first geologist; and Fred Wells, a prospector and mining entrepreneur during the heyday of lode mining. The village of Barkerville, named after Billy Barker, is now the site of a provincial park and museum dedicated to the gold rush, and the nearby town of Wells, named after Fred Wells, now functions mainly as a base for seasonal tourism, some exploration, and minor placer mining.

SERIES



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SUMMARY
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Atholl Sutherland Brown received a Ph.D. degree from Princeton in 1954 for studies related to regional and mine mapping in the Cariboo District. Later, he conducted bedrock mapping for the BC Geological Survey, followed by studies of copper-iron skarns, porphryry deposits and metallogeny. He was editor of Canadian Institute of Mining and Metallurgy Special Volume 15, Porphyry Deposits of the Canadian Cordillera, in 1976. From 1975 to 1984 he was Chief Geologist of the Survey. He then worked as a consultant, during which he spent three years mapping in central Vancouver Island as part of Phase 1 of Lithoprobe. He was President of the Geological Association of Canada in 1979-1980 and of the Canadian Geoscience Council in 1982. Since retiring, he has written three histories, including one on the BC Geological Survey. Another concerned his experiences as a long-range fighter pilot with the RCAF in Burma during WWII. He was awarded a Distinguished Flying Cross in 1945, Queen Elizabeth's Silver Jubilee medal in 1978, and the Ambrose medal of GAC in 1987.

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Chris Ash, a native of Newfoundland, obtained both his B.Sc. and M.Sc. degrees from Memorial University of Newfoundland. His M.Sc. thesis focused on the crust-mantle transition zone of the Troodos ophiolite in Cyprus. From 1988 to 2002, Chris worked as a Project Geologist with the BC Geological Survey. During this time, he conducted geological mapping and mineral deposit studies on a wide range of deposit types and commodities throughout British Columbia, including gold-quartz veins, Cu-Au and Cu-Mo porphyries, Cu-Ni (PGE) ultramafic deposits, and PGEs in Alaskan ultramafic bodies. From 2002 to 2008 Chris was involved in land use planning and mineral policy with the BC Ministry of Energy and Mines while moonlighting as a geological consultant conducting mineral property evaluations for exploration companies throughout the Yukon. Since leaving the BC Ministry of Energy and Mines in 2008, he has worked as a geological consultant involved primarily in mineral property mapping in both BC and the Yukon.

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RÉSUMÉ

La découverte des gisements aurifères dans la région de Cariboo en 1860, et la prise de conscience immédiate de leur importance, sont les causes directes de la création de la province de Colombie-Britannique, ce qui a permis au Canada de s’étendre « d’un océan à l’autre ». Puis, au début des années 1930, de nouvelles mines d’or filonien ont permis de sauver la province de la faillite durant la Grande crise. Le champ aurifère de Cariboo est l’un des camps miniers ayant été en production continue le plus longtemps au Canada (presque 150 ans).

Le champ aurifère de Cariboo, comme le champ aurifère de Californie, comporte deux styles de minéralisation : 1) des gisements primaires d’or filoniens, et 2) des gisements secondaires placériens. En plan, la zone de gisements filoniens s’étire sur 6 km du nord-ouest vers le sud-est, au sein d’un essain de gisements placériens formant une botte inversée d’une superficie de 250 km2. Trois zones de ruisseaux de riches gisements d’or placériens s’étirent aussi du nord-ouest au sud-est au sein de la région aurifère, la plus au nord-est enveloppant la zone de gisements filoniens.

Le champ aurifère de Cariboo comprend deux domaines principaux de roches – à l’éponte supérieure, un domaine de roches ophiolitiques paléozoïques faisant partie du terrane de Slide Mountain, et à l’éponte inférieure, un domaine plus étendu de roches métasédimentaires de marge continentale de la fin du Protérozoïque et du Paléozoïque faisant partie du terrane de Barkerville. En coupe, on peut voir que les gisements filoniens sont situés dans la zone d’une faille subhorizontale (de suture ou de déformation intense) séparant les domaines des deux épontes. Verticalement, l’épaisseur de la zone minéralisée sous cette suture ne dépasse pas un demi kilomètre. L’or se présente tantôt dans des veines de quartz pyritiques et tantôt dans des gisements de remplacement pyritique; la minéralogie du minerai est simple : il s’agit de pyrite aurifère et de quantités mineures d’autres minéraux sulfurés.

Dans le champ minier, du sud-est vers le nord-ouest on trouve trois mines d’or filonien, soit les mines Cariboo Gold Quartz, Island Mountain et Mosquito Creek. La production combinée de ces trois mines entre 1933 et 1987 totalise environ 38,3 millions de grammes (1,23 onces troy) d’or et 3,16 millions de grammes (101 439 onces troy) d’argent, ce qui vaudrait plus d’un milliard de dollars au prix actuels (~900 $ US l’once d’or).

Les gisements placériens les plus importants sont situés surtout le long de ruisseaux du champ minier formant gouttière sur le substratum recouverts de graviers de la fin du Tertiaire, mais on trouve aussi de l’or remobilisé au sein des dépôts glaciaires sus-jacents. Les pépites d’or se présentent sous des formes diverses, allant d’irrégulières et drusiques à arrondies et martelées, selon l’historique de leur transport. En moyenne la pureté (titre) varie de 830 à 950 (or à or + argent, or pure=1000). Depuis 1860, les mines placériennes ont donné plus de 118,2 millions de grammes (3,8 millions d’onces troy), ce qui vaut environ 3,4 milliards de dollars aux prix actuels.

Les chercheurs d’or les plus aventureux ont atteint la limite sud du champ minier à l’hiver de 1860, et les principaux ruisseaux producteurs ont tous été découverts durant l’année

suivante. Au début, l'extraction s'est faite à partir des gisements peu profonds le long des ruisseaux, mais en moins d'une année on a travaillé à partir de gisements de graviers saturés d'eau à des profondeurs de 20 m. La meilleur année de production a été 1863, mais la production s'est poursuivie jusqu'à maintenant à des rythmes moindres. Au fur et à mesure que la production placérienne baissait, on a investit de plus en plus d'efforts d'exploration en quête de gisements filoniens. On a trouvé de nombreux gisements filoniens de quarts minéralisés de pyrite renfermant des grains d'or très fins, sans que l'on puisse trouver des gisements filoniens de quartz renfermant des pépites d'or comme celles des gisements d'or placériens. En dépit de l'aide gouvernemental provinciale qui a fourni des installations de concassage et de grillage du minerai filonien, la technologie d'alors n'en permettait pas une exploitation profitable. L'exploitation des gisements filoniens sont demeurés non rentables jusqu'à l'avènement du traitement par cyanure et la hausse du prix. La mine Cariboo Gold Quartz a été inaugurée en janvier 1933 et la mine Island Mountain en novembre 1934. La mine Cariboo Gold Quartz a acheté la mine Island Mountain en 1959 et les deux exploitations ont continué leurs opérations jusqu'à leur fermeture en 1967 à cause d'un contexte économique défavorable. De meilleurs prix pour l'or ont permis l'ouverture de la mine Mosquito Creek en 1980, opérations qui ont continuées jusqu'en 1987, jusqu'à une baisse insoutenable du prix de l'or. La remontée récente des prix a encore une fois stimulé des investissements significatifs en exploration.

Comme toutes les ruées vers l'or, celle de la région de Cariboo a eu ses personnages intéressants. En voici quatre parmi les plus illustres : Billy Parker, un des premiers mineurs; Bill Hong, un mineur placérien arrivé plus tard; Amos Bowman, le premier géologue; et Fred Wells, un prospecteur et entrepreneur minier de l'âge d'or de l'exploitation minière filonienne. Le village de Bakerville, du nom de Billy Barker, est maintenant le site d'un parc provincial et d'un musée dédié à la ruée vers l'or, et non loin de là, la petite ville de Wells, du nom de Fred Wells, doit son existence surtout au tourisme saisonnier, à l'exploration minérale et à quelques activités mineures d'extraction de placers.

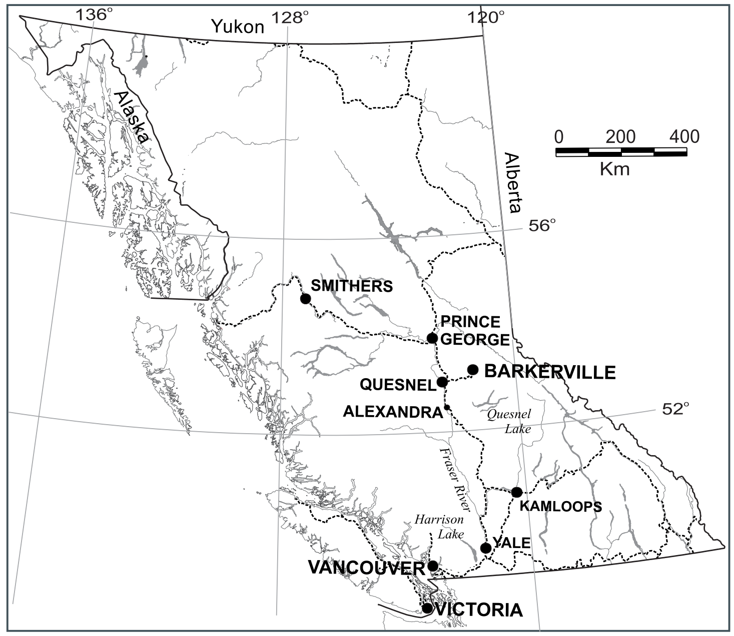

Figure 1. Index map showing the location of Barkerville in east-central British Columbia.

INTRODUCTION

Location and Overview

The Cariboo Goldfield is located in the Quesnel Highlands (QH) of east central British Columbia (BC), 220 km north of Vancouver, centred at approximately 53°N and 121°30'W. It is situated 60 km, by Highway 26, east of Quesnel, which connects to Highway 97, the main route north through central BC (Fig. 1). The landscape is characterized by mountains that display rounded summits to just above 2000 m (Figs. 2, 3). The local base level (Jack of Clubs Lake) is at approximately 1200 m elevation. The mountains are covered to near the peaks with subalpine forest of Engelmann Spruce (*Picea engelmann*), Subalpine Fir (*Abies lasiocarpa*), Lodgepole Pine (*Pinus contorta* var. latifolia), and the shrub, *Rhododendron albiflorum*, but near Barkerville, the forest has been clear-cut and burned several times. It is being harvested again because of the current pine beetle infestation.

The area is subject to a semi-alpine continental climate and moderately heavy winter snowfall and summer rainfall. The mean daily temperature at Barkerville (elevation 1265 m) in January is -9.2°C and in July is 12.3°C. The mean monthly precipitation of all sorts in January is 99.6 mm and in July is 89.8 mm. Water for placer mining, especially hydraulic mining, depended on natural and artificial storage of snow melt run-off and was a critical factor in placer gold production.

Camp is a term normally used to describe a cluster of mineral deposits or occurrences that have a similar mineralogy and geological setting. Cariboo Goldfield is an alternative term to camp and is preferred because it is succinct and because the area contains both lode (primary) and placer (secondary) gold deposits. The placer and lode deposits have a common geographic distribution suggestive of a common origin, although the distribution of placer deposits extends beyond that of the lode deposits. This relationship is clearly demonstrated at Antler, Lightning, Slough and Williams Creeks (Table 1), where the richest placer sites are in close proximity to the lode sites (Fig. 2). The assumption of most miners and geologists since the earliest days has been that the placer deposits originated from the lodes, although the distribution of the two types is not

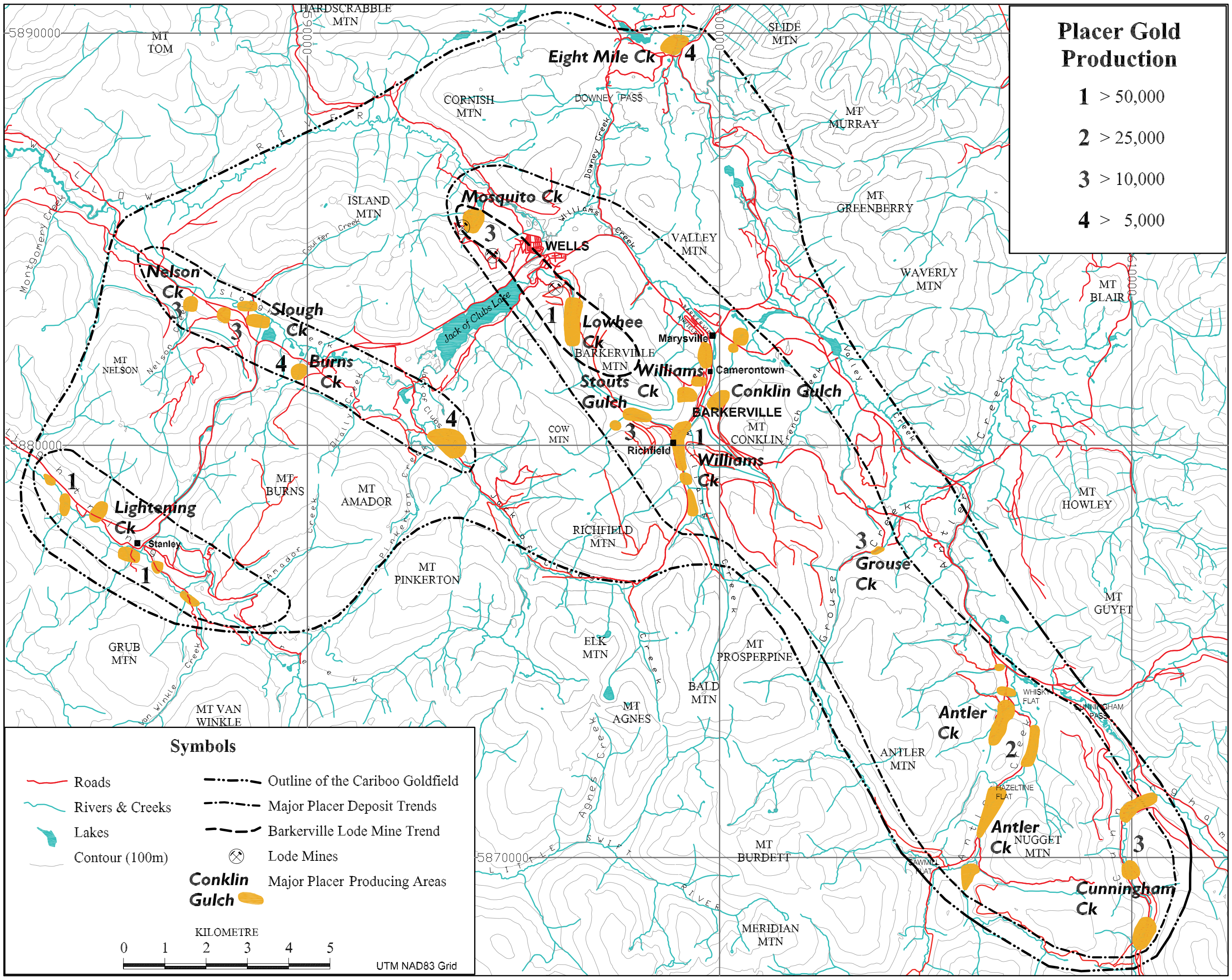

Figure 2. Topographic map showing the distribution of major placer deposits (see Table 1) delineated by Bowman (1895), and lode mines and trends in the Cariboo Goldfield. Placer gold production figures are from Holland (1950).

identical and the habit of the gold in the respective deposits is not the same.

Significant placer mining took place on about a hundred streams, fifteen of which produced in excess of 5000 ounces of gold (Table 1, Fig. 2). Unfortunately, production before 1874, which included the most productive years, was not accurately recorded, so estimates are approximate. The gold produced between 1874 and 1945, which was well recorded by banks and government, is tabulated by Holland (1950) and can be taken to fairly represent the relative wealth of the ground. The estimated minimum placer gold production in the province from 1858 to 1949 (Holland 1950) is stated to be 5 102 521 ounces. Bowman's (1886) graph indicates that between 1860 and 1886, ninety percent of the gold produced in BC came from the Cariboo District. Including post-1886 production, probably 75 percent of BC production was recovered from Cariboo placers, or about 118.2 million g (3 800 000 troy ounces) worth about 3.4 billion dollars at current prices (~ US$900). Placer mining continues in a minor way, as the idea that gold can simply be washed from gravel is transfixing, hope is hard to dampen, and the current high price of gold is stimulating. However, contemporary environmental regulations and high fuel prices make current placer mining particularly challenging.

The search for bedrock sources of the placer deposits quickly followed the initial discoveries, but success was elusive. In the late 1920s, lodes that were developed underground on both sides of Jack of Clubs Lake (Wells) were later proved to be mineable. Two mines came on stream, the Cariboo Gold Quartz on Cow Mountain southeast of the lake, in 1933, and Island Mountain northeast of the lake, in 1934. Much later, in the 1980s, the Mosquito Creek mine opened farther northwest on Island Mountain (Fig. 2). All mines are on the same northwesterly trend and the workings are more or less contiguous.

Between 1933 and 1987, the three lode mines produced 38.3 million g (1 23 million troy ounces) gold and 3.16 million g (101 439 troy ounces) of silver, worth more than 1.3 billion dollars at current prices (MINFILE).

The high price of gold has recently stimulated lode and placer exploration. Several occurrences of low-grade, bulk-tonnage style gold have been identified by International Wayside Gold Mines at the southern end of the existing lode mine trend. These are currently undergoing feasibility studies and the permitting process. Also, all the placer creeks within and beyond the goldfield are leased and many are again being actively explored.

Figure 3. Aerial view of the town of Wells looking east; Mount Murray (left) and Mt. Waverly (right) are the highest peaks in the distance, with Cariboo Mountains beyond. Island Mountain forms the foreground with Valley Mountain (left) and Barkerville Mountain (right) in the middle distance (see Fig. 2 for locations). The southeastern part of Wells is built on a fan of placer tailings that issued from Lowhee Creek, right, into Jack of Clubs Lake (bottom right). Chris Ash photo.

Table 1. Recorded gold production between 1869 and 1945 from placer deposits of the Cariboo Goldfield (from Holland 1950)

Drainage	Gold Production (ounces)	
Lightning Creek	98 602	
Williams Creek	85 530	**>50 000**
Lowhee Creek	74 022	
Antler Creek	33 652	**>25 000**
Point Benches	23 953	
Mosquito Creek.	18 295	
Stouts Gulch	15 610	**>10 000**
Grouse Creek	14 435	
Nelson Creek	13 620	
Cunningham Creek	12 852	
Conklin Gulch.	7 342	
Eight Mile Creek	6 982	
Jack of Clubs Creek	6 916	**>5 000**
Slough / Ketch Creek	6 384	
Burns Creek.	5 655	

Purpose

The Cariboo Goldfield has been vitally important to the province and the nation, economically and geopolitically, even though its total production is modest compared to that of some other Canadian gold camps. This article briefly summarizes the industrial and cultural history of the goldfield as well as the evolution in understanding of its geology. However, it also attempts, with new interpretation and data, to emphasize aspects not previously highlighted. First, the relationship between major placer deposits and existing lode deposits is explicitly revealed. Second, the importance of ground preparation (i.e. the spatial association with a major terrane-bounding fault zone containing interleaved ophiolitic rocks) in constraining the distribution of gold mineralization is highlighted. Third, the relationship between coarse-grained nugget gold of the placers and fine-grained gold of the lodes is re-examined and an explanation for this is proposed.

Information Sources

Information on the history, geology and productivity of the goldfield is derived chiefly from the Annual Reports of the British Columbia Minister of Mines (AR-BCMM), the publications of the British Columbia Geological Survey (BCGS) and its predecessors, and the reports and maps of the Geological Survey of Canada (GSC). The history of the Gold Rush comes principally from the early authoritative publications of Bancroft (1887), Begg (1894) and Howay (1914), and later scholarly compilations such as those from Rickard (1947), Akrigg and Akrigg (1977), Griffin (1992), and Forsythe and Dickson (2007). Hong (1978) is a principal source for the extensive but poorly recognized contributions of Chinese placer miners to the Cariboo community in the twentieth century.

For 120 years a platoon of

geologists has wrestled with the problems of stratigraphy, structure and age of the rocks in the area in an effort to understand the origin and distribution of the gold deposits. First, Amos Bowman in 1885 and 1886 studied the geology and placer deposits but had to spend much of his effort constructing topographic maps. He was followed by Johnston and Uglow (1926) and then Hanson (1935) for the GSC; Holland (1950, 1954) and Sutherland Brown (1957, 1963) for the BCGS; Campbell et al. (1973) and Struik (1988) for the GSC; and Ferri and O'Brien (2002) and Schiarizza and Ferri (2003) for the BCGS. Detailed geology was studied in the vicinity of mines by Skerl (1948) at the Cariboo Gold Quartz mine, by Benedict (1945) at Island Mountain mine (each for their respective private companies), and later by Sutherland Brown (1957), Andrew et al. (1983), Alldrick (1983), Robert and Taylor (1989), Levson and Giles (1993), Ash (2001), and Ray et al. (2001).

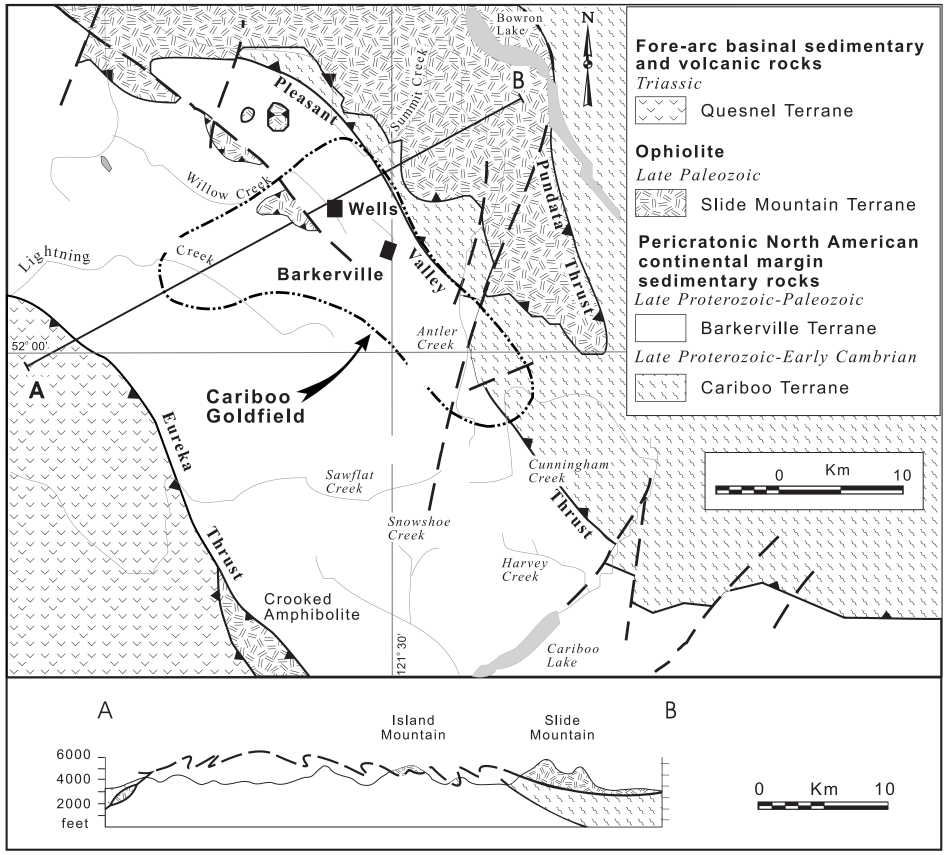

Figure 4. Simplified plan and cross section (A – B) showing the known geologic terranes relative to the Goldfield (inverted boot-shaped area); modified after Struik (1988) and Ash (2001).

GEOLOGICAL SETTING

Glacial History

The QH were completely covered by the Cordilleran ice sheet during the Wisconsin (Fraser) Glaciation (30–10K BP), as demonstrated by the occurrence of fresh erratic boulders and till on the summits of the mountains (Sutherland Brown 1957). Valleys incised into the highlands show clear evidence of Tertiary iron- and manganese-cemented gravels overlain by pre-Wisconsin and Wisconsin till and interglacial sediments (Lay 1941; Levson and Giles 1993). In the Barkerville Terrane, the richest placer deposits lie on bedrock covered by cemented gravels. However, paying gravels are also found above these basal gravels, in till and interglacial sediments (Levson and Giles 1993). Johnston and Uglow (1926) originally dated the cemented gravels as Tertiary on the basis of a collection of elephant genera teeth. More recent studies of volcanic tephra and palynology have confirmed that these gravels are pre-late Miocene (Levson and Giles 1993, p. 21).

The mountains of the QH have rounded tops (Fig. 3) featuring only a few minor cirques fretted from the northeast faces; these were probably developed in post-Wisconsin time. Valleys show little catenary (U-shaped) sculpturing and mountain spurs are not facetted; however, many of the valley bottoms are filled with till and outwash. Bedrock in the valleys shows local glacial grooves and polish, so gold placer deposits are likely to have been dispersed in places by glacier movement and re-deposited by outwash.

Although glaciers covered the QH, movement and erosion were relatively minor. Ice flowed generally outward and westward, fanning from southwest in the south to northwest in the north, as demonstrated by erratics of Kaza Group quartzite on Mount Murray and Mount Greenberry, as well as a large boulder of conglomerate derived from the Guyet Formation found near Williams Creek (Sutherland Brown 1957, p. 14). Ice was channelled in various directions by transverse valleys, but regionally it flowed outward to join a northward flow, then eastward around the Cariboo Mountains toward the Rocky Mountains northeast of Prince George (Tipper 1971).

In contrast, in the adjacent Cariboo Mountains, alpine peaks and ridges display a fretted form indicating that they extended above the Cordilleran ice sheet. The valleys show intense catenary sculpturing, demonstrating that erosive flow was guided topographically down transverse valleys to join trunk glaciers flowing northwestward.

Regional Geology

Terranes

The regional geology of the Cariboo Goldfield is shown in simplified form in figures 4 and 5. Figure 4 depicts the major tectonostratigraphic terranes of the area, including the Cariboo, Barkerville, Slide Mountain, and Quesnel terranes. A terrane is generally considered to be a discrete belt or block of transported (fault-bound) oceanic or continental crust that has been added to a craton at an active continental

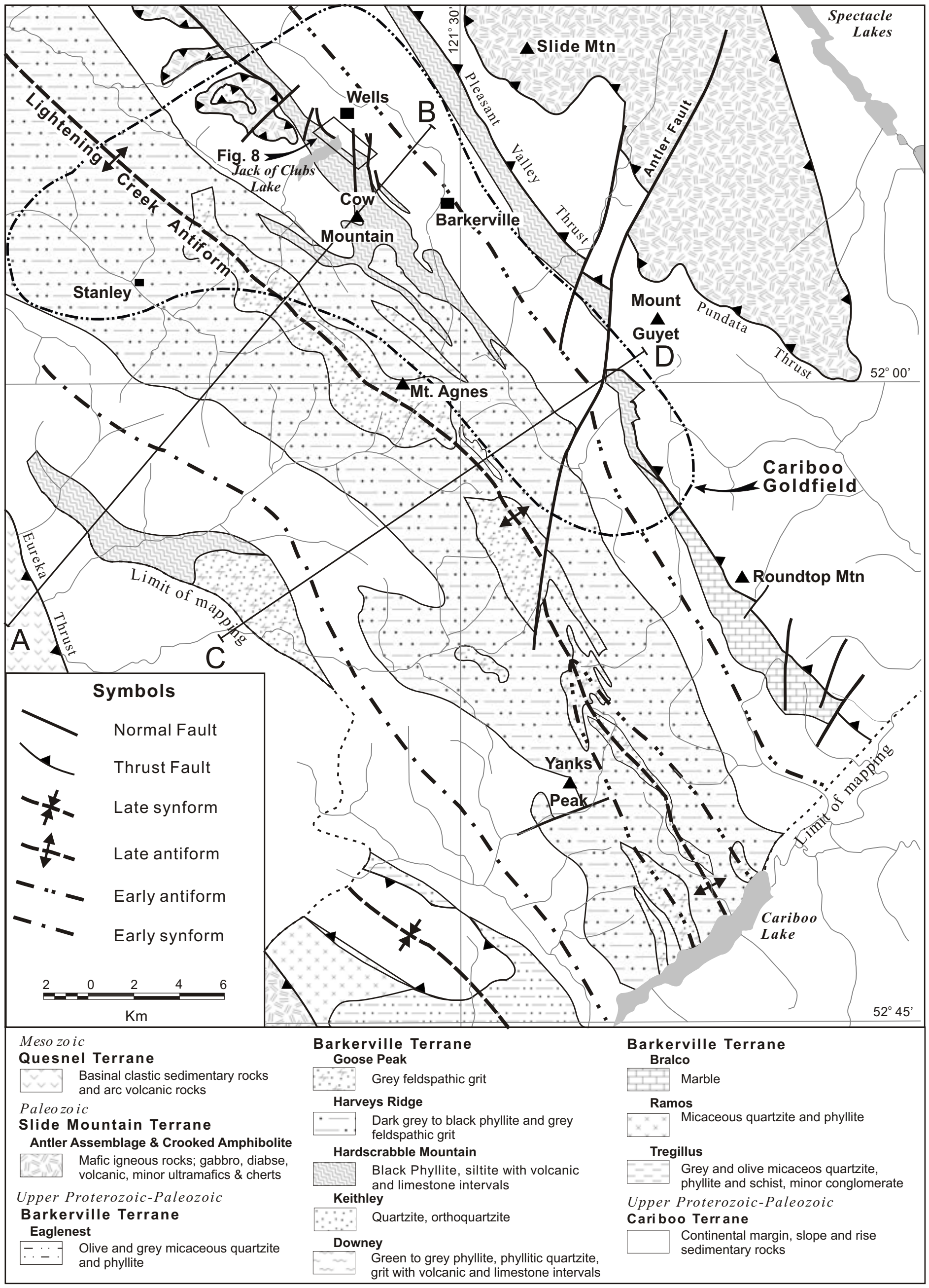

Figure 5. Simplified geological map of the Cariboo Goldfield and surrounding area showing the approximate locations of cross sections A-B and C-D (sections e) and d), respectively, in Figure 7) and the location of Figure 8; modified after Struik (1988) and Schiarizza and Ferri (2003).

margin by accretion (plate-tectonic processes). Cross section A-B (Fig. 4) shows that the goldfield lies at, or near, the fault boundary (or suture) between the Slide Mountain Terrane (hanging wall) and the underlying Barkerville (and minor Cariboo) Terrane (footwall). The hanging wall comprises ophiolitic rocks, consisting primarily of gabbro, diabase and basalt, and subordinate ultramafic rocks and chert. These rocks are remnants of predominantly late Paleozoic oceanic crust and upper mantle, which initially formed at, or adjacent to, an oceanic spreading centre and were later tectonically transported and emplaced (or obducted) onto the continental foreland (Monger 1977, 1984). The footwall consists of variably metamorphosed and deformed Proterozoic to late Paleozoic, predominantly clastic sedimentary rocks and subordinate limestone, that were originally deposited along the ancient North American continental margin (Struik 1988).

The contact between the hanging-wall and footwall rocks is a regional fault, called the Eureka Thrust in the west and the Pundata Thrust in the east, that represents a terrane-bounding suture (Fig. 4). The structural transport of the hanging wall, from west to east, onto the continental margin, resulted in the development of a zone of intense tectonic disruption at the contact between footwall meta-sedimentary and hanging-wall ophiolitic rocks. This zone is characterized by compressed drag-folds in shuffled packets of sheared and schistose rocks, in which any semblance of stratigraphic continuity has been largely obliterated; as a result, the deformed contact is possibly best characterized as a zone of 'broken formation'. Importantly, all lode deposits of the Cariboo Goldfield identified to date are contained within this tectonized contact zone.

Rock Units

Figure 5 shows the distribution of many of the informal rock units that make up the Barkerville Terrane in the vicinity of the goldfield, i.e. Eaglenest, Goose Peak, Harveys Ridge, Hardscrabble Mountain, Keithley, Downey, Bralco, Ramos, and Tregillus, which are all part of the formally defined Snowshoe Group (Struik 1988; Schiarizza and Ferri 2003). However, only four of them crop out within the limits of the goldfield, namely Downey, Hardscrabble Mountain, Harveys Ridge, and Goose Peak, and of these, only the first two crop out in the vicinity of the lode deposits. A fifth unit, the Early Permian Sugar limestone, which occurs just west of Island Mountain but covers too small an area to show on the map, constitutes the top of the Snowshoe Group (Struik 1986). The stratigraphic order of the other four units in the Barkerville Terrane is not agreed upon, as shown by the three columns in Figure 6. Notably, the Downey is now considered to be one of the oldest units in the Group (Fig. 6c), rather than being one of the youngest (Fig. 6a).

The Barkerville Terrane (footwall) or Snowshoe Group is predomi-

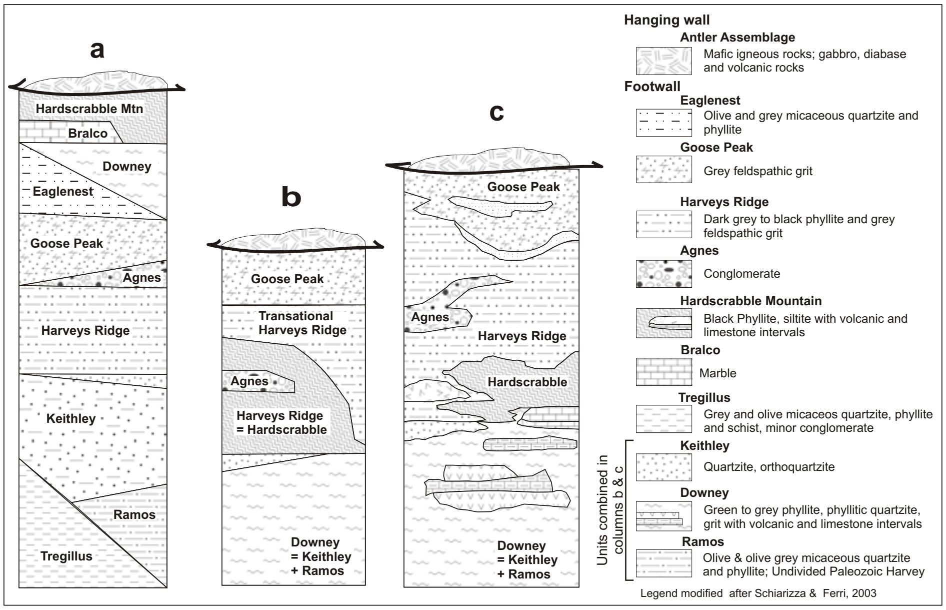

Figure 6. Recently proposed geological columns of eastern Cariboo area. Column "a" is after Struik (1988); "b" is after Ferri and O'Brien (2002), and "c" is after Schiarizza and Ferri (2003).

nately of detrital sedimentary origin. The rocks were originally mature, quartz-rich sandstones, siltstones and shales with subordinate conglomerate and limestone intervals. The whole succession most likely was deposited in a deltaic and upper-shelf setting on the ancient margin of the North American craton (Struik 1988). These rocks have all been metamorphosed to greenschist facies and most are intensely foliated. The sandstones, when deposited, were sub-greywackes (Sutherland Brown 1957) but have been metamorphosed into micaceous quartzites. The finer grained rocks, originally siltstones and shales, are phyllites, siltites or schists. Struik (1988; pers. comm. 2007) considers that the lower part of the Group is Late Proterozoic but the upper part, except for the Sugar limestone, is probably early Paleozoic.

The Barkerville Terrane also includes some volcanic rocks, specifically in the Downey and Hardscrabble Mountain units. The Downey consists of green to grey micaceous quartzite, grit, and phyllite, and minor mafic volcanic rocks and limestone. The Hardscrabble Mountain consists of black phyllite and siltite with volcanic and limestone intervals. These volcanic rocks are altered and schistose and should be re-assigned to the Slide Mountain Terrane based on geochemical data (Ray et al. 2001), which shows that they have a geochemical affinity with ophiolitic rocks (Ash 2001). Ash (2001) also recognized that this re-assignment provided a lithotectonic framework for understanding the setting and possible regional controls on lode gold mineralization.

The Slide Mountain Terrane (hanging wall) comprises the Crooked Amphibolite in the southwest and the Antler assemblage in the northeast (Figs. 4, 5). The Crooked Amphibolite (Struik 1986) occurs as relatively thin, discontinuous tectonic slivers of mafic and lesser ultramafic igneous rocks along the Eureka Thrust fault (Fig. 4). The thrust dips west and separates Quesnel arc volcanic and sedimentary rocks in the hanging wall to the west, from footwall rocks of the Barkerville Terrane to the east (Struik 1986). The Antler assemblage comprises a series of internally imbricated Early Mississippian to Early Permian mafic igneous rocks (oceanic crust) and overlying pelagic sedimentary rocks (Struik and Orchard 1985; Struik 1988). Mafic igneous rocks (gabbro and diabase), referred to as the Mount Murray intrusions, also appear to be part of the Slide Mountain Terrane; U–Pb zircon isotopic dates from three samples of metagabbro all yielded an Early Permian age (~ 280 Ma; Ferri and Friedman 1992, 2002). This age is well within the known range of ophiolitic crustal rocks in BC (Ash 2001) and suggests that these igneous rocks are either part of, or comagmatic with, the ophiolitic suite. Correlation of the Crooked Amphibolite with the Antler assemblage implies that the Pundata and Eureka thrust faults are part of a once continuous structure that has been separated by erosion (Struik 1988; Ash 2001).

Intrusive Rocks

Relatively undeformed felsic dikes and sills, called Proserpine dikes by Johnston and Uglow (1926), crosscut rocks of the Barkerville Terrane and the goldfield. These bodies are up to 6 m wide, and generally weather to buff or reddish brown because of fairly intense ankeritic (ferroan dolomite) alteration. These bodies normally follow the foliation but locally crosscut it. Their age is poorly constrained but they were emplaced following the last major folding event, presumably in the Early Jurassic (Andrew et al. 1983).

Dikes with ankeritic alteration are commonly associated with gold-quartz vein deposits in other camps, e.g. the Atlin, Bralorne and Mother Lode belt (Ash 2001), where they mostly post-date deformation and display high-level porphyritic textures, carbonate–sericite–pyrite alteration, and locally elevated gold values. A genetic association between the dikes and gold veins of the goldfield was suggested by Johnston and Uglow (1926). Although this is a possibility, modern isotopic dating of both the dike rocks (Ar–Ar on micas, U–Pb on zircons) and the gold mineralization (e.g. Re–Os on pyrite) is needed to establish a temporal relationship between the two.

Structure

The evolution of the structural interpretation of the Barkerville Terrane and of the goldfield is illustrated by the increasing complexity of the cross sections and changes in stratigraphic nomenclature, from top to bottom in Figure 7. The sections were drawn transverse to strike but they do not represent the same line of section (locations shown in Fig. 5). They show a progressive increase in stratigraphic and deformational complexity, more

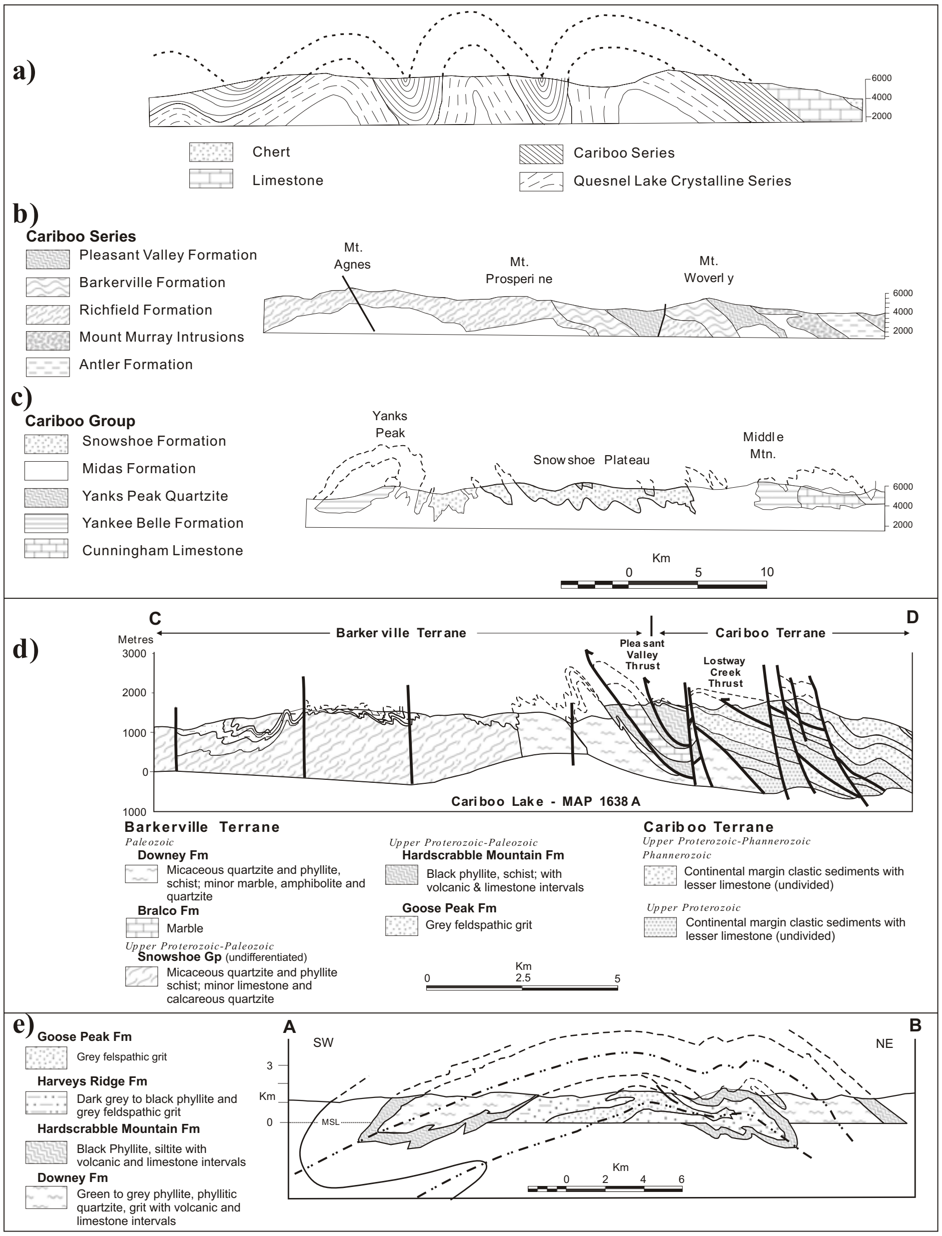

Figure 7. Evolution in interpretation of structural cross-sections for Cariboo Goldfield area. Section a) is after Bowman (1888), b) is after Johnston and Uglow (1926), c) is after Holland (1954), d) is after Struik (1988, and e) is after Schiarizza and Ferri (2003). The approximate locations of cross-sections d) and e) (C-D and A-B, respectively) are shown on Figure 5. Sections a), b) and c) are schematic only; because they are historical sections, they do not match the geology shown in Figure 5.

significant faults, and bolder interpretations. Early investigators (Bowman 1888) working at reconnaissance scale pictured the rocks as a simple folded stratigraphic sequence (Fig. 7a). Later workers (Figs. 7c to e) recognized more complex folding of rock units and intercalation of tectonic slices; hence, a simple stratigraphic sequence became difficult to define. Consequently, a variety of stratigraphic names were used, not all of which can be identified on the sections. However, Struik (1988, Table 2) summarized the evolution of this nomenclature and attempted to correlate the various rock units. Sutherland Brown (1957) recognized that the juxtaposition of older, deformed and variably metamorphosed rocks (Snowshoe Group) against younger oceanic rocks (Slide Mountain Terrane) presented a problem, but Struik (1988) was the first to propose that this juxtaposition was caused by accretion of separate terranes. Ash (2001) was the first to call attention to the potential significance of ophiolitic rocks in controlling ore distribution at the camp scale by comparing the goldfield to similar gold camps elsewhere in the Cordillera. Schiarizza and Ferri (2003) and Ferri and O'Brien (2002) pictured a significantly different gross structure involving a large recumbent F_2 fold or nappe (Fig. 7e) refolded by the upright F_3 Lightening Creek antiform (Fig. 5). Deformation in the goldfield is interpreted to be Mesozoic (Jurassic?) based upon K/Ar and Pb isotope ages (Andrew et al. 1983), and to be post Early Jurrasic and pre-Middle Cretaceous based on structural relationships (Struik 1988).

The whole Barkerville Terrane, including the goldfield, has been interpreted by Struik (1988), Ash (2001), Schiarizza and Ferri (2003) and others to be bounded at the top by the regionally extensive Pundata Thrust, which correlates with the Eureka Thrust to the west (see cross section A-B in Fig. 4). The Pundata emplaces the Slide Mountain Terrane over the Barkerville and Cariboo terranes (Figs. 4, 5). The Slide Mountain Terrane is represented by mafic igneous rocks that cap Island Mountain and by the Crooked Amphibolite southwest of the Eureka Thrust. Another thrust, the Pleasant Valley thrust, brings the Cariboo Terrane into contact with the Barkerville Terrane.

Northerly-striking, steeply east-dipping faults and less numerous easterly-striking, south-dipping faults segment the map area. The Antler Fault shows the greatest apparent displacement of all the northerly striking faults and is the only one shown in Figure 5. However, other faults of this orientation occur approximately every three kilometres along strike, and are associated with a suite of 'ac' joints normal to fold axes. The northerly trending faults displace the thrusts and are therefore younger. All workers since Johnston and Uglow (1926) have recognized that these structures were the conduits of ore-forming fluids because they host the auriferous quartz veins of the goldfield.

Table 2. Chronology of events related to the Cariboo Goldfield

Year	Event(s)
1853	Governor Douglas declared that gold belonged to the Crown.
1858	Gold Rush started on the lower Fraser river bars.
1860	Placer gold discovered at Quesnel Forks and Keithley Creek.
	In the late Fall John Rose and Ranald McDonald crossed the Snowshoe Plateau and discovered rich deposits on Cunningham and Antler Creeks.
1861	In early winter Rose and McDonald returned and were tracked by a band of prospectors who staked claims and start mining.
	Scores of prospectors quickly covered the whole Goldfield.
	The rich ground on Lowhee, Antler, Grouse, Stouts, Williams and Lightning Creeks are all discovered.
	Thousands of miners flood into the Goldfield and built villages on Antler, Williams and Lightning Creeks.
1862	Royal Engineers start surveying and construction of Cariboo road north from Yale.
	The Barnard Express (BX) is formed and starts freight service from Yale to the Goldfield.
	Pack trail completed from Quesnel to Richfield.
1863	Goldfield produces nearly $4,000,000 worth of gold at contemporary prices which proves to be the maximum.
	A Gold Commissioner appointed resident in Barkerville.
1867	Flood on Williams Creek damaged many shaft mines.
1868	Fire destroyed town of Barkerville.
1874	Department of Mines created and the first annual Report of the Minister of Mines published.
1875	John Bowron appointed Gold Commissioner for Cariboo Mining District, continues for 31 years.
1885	Amos Bowman started his survey of the Goldfield.
1886	BC Department of Mines built the stamp mill and reduction works (roaster) at Barkerville.
1895	Bowman's placer maps issued the year after he died.
1922	Uglow's analysis of structure of quartz veins (Johnston and Uglow) stimulates lode prospecting.
1924	Kafue bucket-line dredge constructed at Cunningham Pass.
1927	Cariboo Gold Quartz Mining Company incorporated.
1933	Cariboo Gold Quartz mine started production, the first successful lode mine.
1934	Island Mountain mine started production.
1954	Island Mountain mine sold to Cariboo Gold Quartz.
1955	Kumilla dragline dredge constructed at Williams Creek.
1967	Cariboo Gold Quartz mine closes.
1977	Cariboo Gold Quartz mill burned to the ground.
1980	Mosquito Creek mine started production.
1987	Mosquito Creek mine closes.
1995	International Wayside Gold Mines start extensive exploration along the historic lode mine trend.

GEOLOGY OF THE CARIBOO LODES

Rock Units

The general geology of the area in the vicinity of the Cariboo Gold Quartz (CGQ), Island Mountain (IM), and Mosquito Creek (MC) mines is shown in longitudinal section (top) and plan (bottom) in Figure 8 (see Fig. 5 for location). The distribution of northerly trending faults and the inferred position of the Pundata Thrust are also shown. Most of the workings are in the Downey succession, which constitutes the Baker and Rainbow members of Hanson (1935), but some extend into the Hardscrabble Mountain succession, which is equivalent to the BC member of Hanson (1935). Both successions are part of the Snowshoe Group of Struik (1988), formerly the Snowshoe formation of Holland (1954). Sutherland Brown (1957) called the Downey and Hardscrabble Mountain units in the vicinity of the mines, the Snowshoe and the Midas formations, respectively.

Hanson (1935) described northwest-striking, steeply east-dipping, schistose rocks in the mine trend, which he named the BC, Rainbow and Baker members in assumed stratigraphic order, and assigned them to his Richfield formation. The BC member is composed almost entirely of black quartzose argillite, siltite and phyllite, and includes very minor limy argillites and a few dark grey quartzites. Microscopically, its composition generally varies from 90 to 20% quartz, 2 to 65% muscovite, 5% opaque carbonaceous matter and up to 5% ankerite (Sutherland Brown 1957). The Rainbow member comprises roughly equal proportions of micaceous quartzite with minor phyllite, and phyllite with minor quartzite beds or dismembered lenses. The average composition of twenty micaceous quartzites from the mines is 74% quartz, 17% muscovite, 5% ankerite and 4% feldspar (Sutherland Brown 1957). The Baker member comprises varicoloured phyllite, micaceous quartzite and limestone in decreasing order of abundance. Most rocks are somewhat calcareous. Rhys and Ross (2001) provide more detailed description of these units.

What is not shown in Figure 8 is that the workings are spatially associated with disrupted ophiolitic rocks, which occur along the core of the gold belt (Downey succession) south of Jack of Clubs Lake. These rocks, ranging from massive gabbro/diabase to intensely sheared chlorite–sericite schist, were previously unrecognized as being ophiolitic prior to recent mapping by one of the authors (CA). The schistose rocks show considerable variability in relative content of chlorite and sericite, reflecting the original proportions of feldspar to mafic minerals in the protolith. Subsequent hydrothermal carbonate alteration imparts additional variability and creates a range of sericitic schistose rocks containing varying abundances of carbonate, chlorite and pyrite, and producing a wide

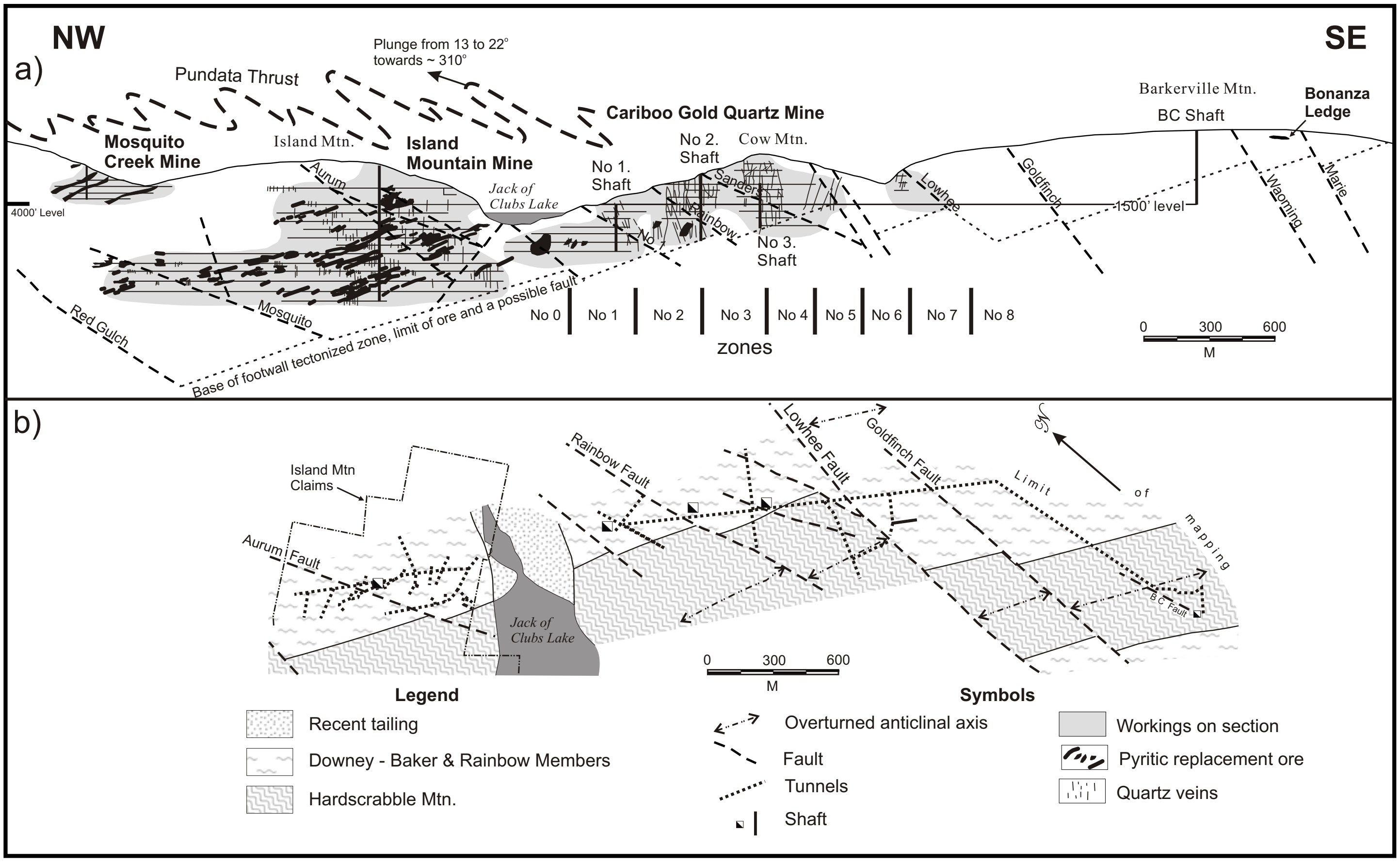

Figure 8. a) Longitudinal section and b) geological plan showing the mine workings and ore bodies of the Cariboo Gold Quartz, Island Mountain and Mosquito Creek lode mines; the Bonanza Ledge deposit (top right) is also shown (modified after Hanson, 1935 and later workers). See Figure 5 for location of mine area.

array of weathering colours.

From just south of Jack of Clubs Lake to the limit of mapping, just beyond the Bonanza Ledge deposit, these ophiolitic rocks form a 300 to 350 m-wide continuous belt. North of Jack of Clubs Lake, the ophiolitic rocks are well represented by the Island Mountain amphibolite, which caps Island Mountain. East of Island Mountain, in the area of both the MC and IM mines, the ophiolitic rocks are mainly talc-carbonate-altered ultramafic cumulates that form discontinuous and isolated synclinal tongues within the underlying footwall sedimentary rocks. The inferred contact (Fig. 4, section A-B) has been modified from Ash (2001) to reflect inclusion of ophiolitic rocks beyond Island Mountain toward the lode belt to the east.

The presence and significance of hanging-wall ophiolitic rocks has largely gone unrecognized at the scale of the lode camp. Most workers have considered mafic igneous rocks such as those capping Island Mountain to be part of the Barkerville Terrane (Struik 1988; Ray et al. 2001; Schiarizza and Ferri 2003), or else they have not been reported (Skerl 1948; Rhys and Ross 2001). As a result, the true tectonostratigraphic setting of the lode deposits, i.e. their position within the tectonized footwall zone of a terrane-bounding suture, has not been elucidated.

Structure

At least two phases of folding are present in the rocks hosting the lode deposits, as was first documented by Benedict (1945, 1948) at the IM Mine. Subsequently, Sutherland Brown (1957) demonstrated that many of the rocks in the area have two cleavages (see his Fig. 11); this has been more recently confirmed by Schiarizza and Ferri (2003), who recognized three phases of folding. Benedict (1948) noted that the older folds *"are tight with axial planes that dip a few degrees less steeply than the predominant bedding"*, whereas the younger folds *"are gentle and open, with axial planes approaching vertical"* (see his Figs. 3, 4). Overall, fold axes consistently plunge at shallow angles (5 to 15°) to the northwest and axial planes consistently verge at steep to moderate angles to the southwest.

Numerous normal faults are present (Fig. 8); most show apparent displacements of 6 m or less, and can be divided into northerly striking and easterly striking types (Benedict 1948; Richards 1948). The northerly striking faults dip 50–70° eastward and are dextral, whereas the easterly striking faults dip 30–60° northward and are sinistral. Faults with apparent displacement greater than 6 m are classed as major faults and most are the northerly type (Richards 1948). At the CGQ Mine, four of these faults are referred to as the No. 1, Rainbow, Lowhee, and Goldfinch faults, from northwest to southeast (Fig. 8); of these, the Lowhee Fault is most important. In the

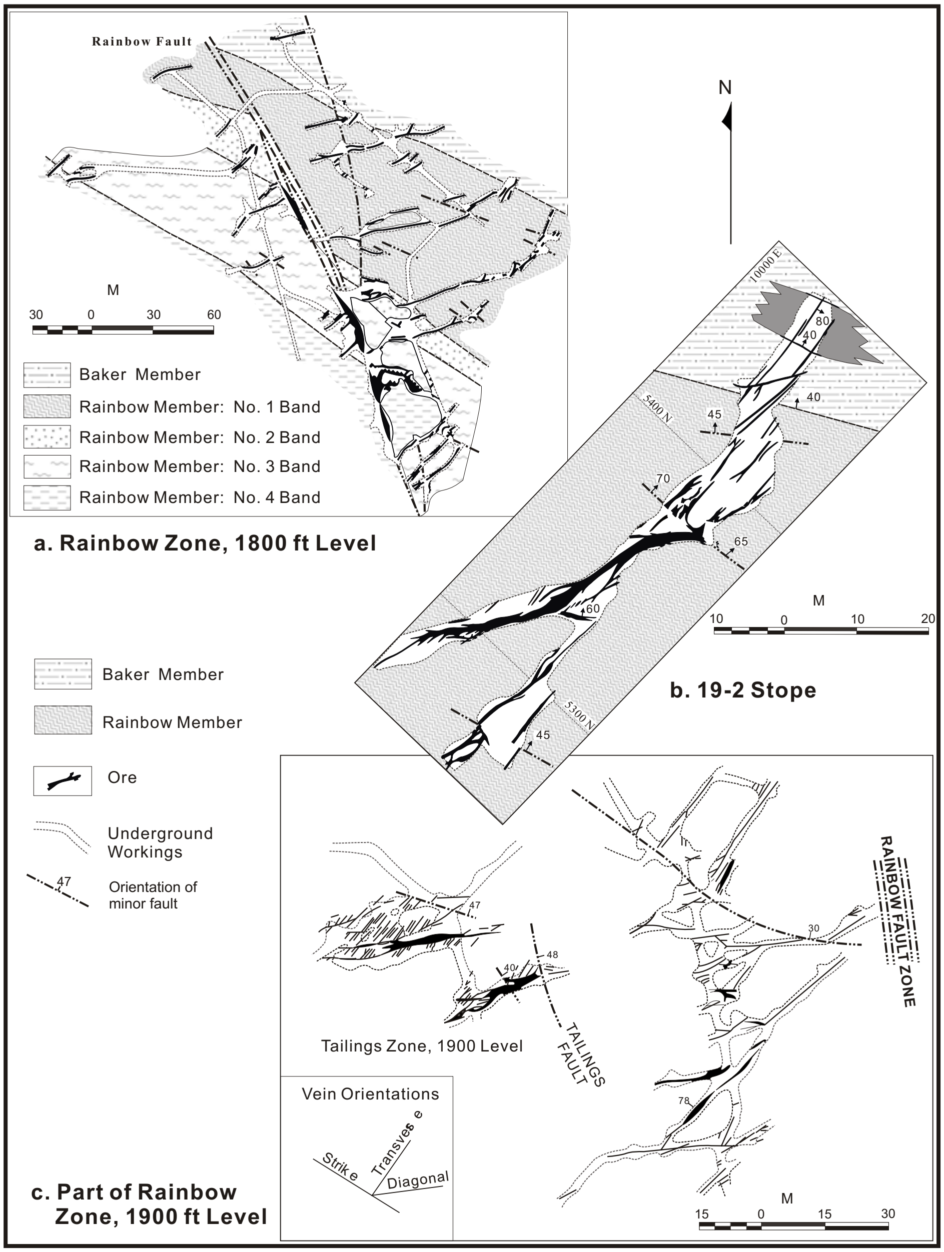

Figure 9. Level plans from the Rainbow Zone at Cariboo Gold Quartz mine; "a" is after Richards (1948), "b" is after Skerl (1948), and "c" is after Sutherland Brown (1957).

IM Mine, the Aurum Fault is the only major fault (Benedict 1948).

Lode Mineralization

Two distinct but genetically and spatially associated styles of lode mineralization exist: 1) gold-bearing pyritic quartz veins, and 2) gold-bearing pyritic replacement bodies.

Gold-bearing pyritic quartz veins are generally hosted by micaceous quartzites and occur in clusters adjacent to northerly trending faults. Richards (1948) reported three kinds:

- 'transverse veins', striking 020° - 050° and dipping subvertically;
- 'diagonal veins', striking 060° - 080° and dipping 50° north to 70° south; and
- 'strike veins', striking 110° - 130° and dipping 45° to 70° northeast.

Examples of all three kinds are portrayed in Figure 9a, but of the three, the diagonal veins (Fig. 9b) are the most important because they are numerous, tend to be longer and wider than the transverse veins (up to 75 m versus 30 m long and average 1 m versus 0.3 m wide, respectively), and typically have higher gold grades than the strike veins. Transverse veinlets or 'horsetails' (Fig. 9c) commonly extend from the larger diagonal veins, generally parallel to 'ac' joints or fractures, and they significantly increase mining widths.

During production, ore shoots averaged 40 m long, 5 m wide and 30 m down-dip. Stopes were 15 to 60 m long and normally contained one or two principal veins together with many splays having different orientations. Veins of economic grade normally contained 15 to 20 percent pyrite that assayed 35 to 70 g/t (~1 to 2 ounces per ton) or more of gold before dilution (Skerl 1948; Sutherland Brown 1957). Pyrite in veins occurs as discrete crystals, masses of crystals, or as ribboned bands. A few much larger veins parallel to foliation, such as the Bonanza lode on Stouts Gulch (Fig. 2), occur within the lode trend and beyond, but these normally are barren of sulfide mineralization except in pockets.

Gold-bearing pyritic replacement bodies are found adjacent to faults or quartz-pyrite veins. Traditionally, these bodies have all been interpreted as having a sedimentary limestone and/or dolomite precursor. However, it is now recognized that at least some of them did not form by replacement of limestone, but by replacement of mafic igneous rocks (e.g. gabbro, diabase and basalt) that had undergone pervasive CO_2, K and S hydrothermal metasomatism (Ash 2001). Thus, there are two types of replacement mineralization, depending upon the original host rock: replacement bodies in limestone, and replacement bodies in mafic igneous rocks.

Limestone occurs only in the upper part of the Downey succession (Baker member of Hanson 1935), and is more common in the northern part of the lode belt than to the south of Jack of Clubs Lake, where limestone abundance is comparatively low. Benedict (1948) noted that over 95% of the replacement ore in the Island Mountain Mine came "*from the most basal (nearest to the Rainbow) relatively pure Baker limestone.*" However, he added: "*This limestone is so variable in its characteristics, and is lacking for such considerable distances, that it cannot be stated with assurance* *that it represents a single stratigraphic horizon.*" Sutherland Brown (1952) indicated that replaced limestone beds in the Island Mountain Mine normally contain un-mineralized, intercalated phyllite laminae that evidently pass laterally into unmineralized beds outside of the mineralized zone.

Replacement bodies in limestone have been described as being typically pipe-like in form and consisting of massive to semi-massive pyrite and minor arsenopyrite (Benedict 1948). They were up to 10 m^2 in cross-sectional area and persisted down plunge for up to 300 m or more, commonly following the hinge lines of tight folds. They also occurred as discontinuous or stacked tabular lenses along the plunge of these folds. No diagonal veins were ever found extending into the replacement bodies but transverse horsetail veins were commonly noted.

This style of replacement mineralization is seen at the Mosquito Creek Mine (Fig. 10). The change from limestone that is replaced to that which is not is relatively sharp, although a thin transitional zone with several percent pyrite is locally present. Weathered surfaces of this type of replacement mineralization are highly gossanous and typically coated with a combination of white (calcareous?) and rusty brown (ferrous) sulfate minerals. Locally, late quartz veinlets containing 1 to 2% galena are proximal to this type of mineralization. The grain size of pyrite is variable but generally it is fine-grained; rare, coarse-grained sulfide masses are present but contain less gold. Free gold has not been recognized. Pyritic ore assays up to ~170 g/t (5 ounces per ton) and even after dilution ranges from ~16 to 28 g/t (0.46 to 0.83 ounces per ton, Benedict 1945).

Replacement bodies in mafic igneous rocks consist of semi-massive to massive pyrite in a gangue of ankerite and sericite, transected by veins of quartz and dolomite. Possibly the best example of a mafic igneous replacement is the Bonanza Ledge gold deposit, discovered in 2000 by International Wayside Goldmines Ltd. (International Wayside Mines 2006) and subsequently accessed via inclined adit for bulk sampling. The replacement body occurs in carbonate–pyrite-altered, chlorite–sericite schist that forms the sheared and recystallized contact zone of a massive gabbro. The adit, which was driven northeast to obtain the bulk sample, cuts through this massive gabbro body on approach to the ore zone; therefore, the transition from non-mineralized to mineralized rock can be observed. At the periphery of this replacement body, thin lenses of relatively massive pyrite are parallel to schistosity in the gabbro. Moving into the gabbro, these lenses thicken and coalesce to form larger bodies of massive pyrite. In some instances, the thicker, massive pyritic zones are preferentially developed along fold axes. Zones of massive sulfide are typically surrounded by haloes of disseminated pyrite consisting of medium- to coarse-grained (1 to 4 mm) subhedral to euhedral pyrite grains that make up 5 to 20% of the rock. Unlike the limestone replacement bodies, no sulfates have formed on weathered exposures.

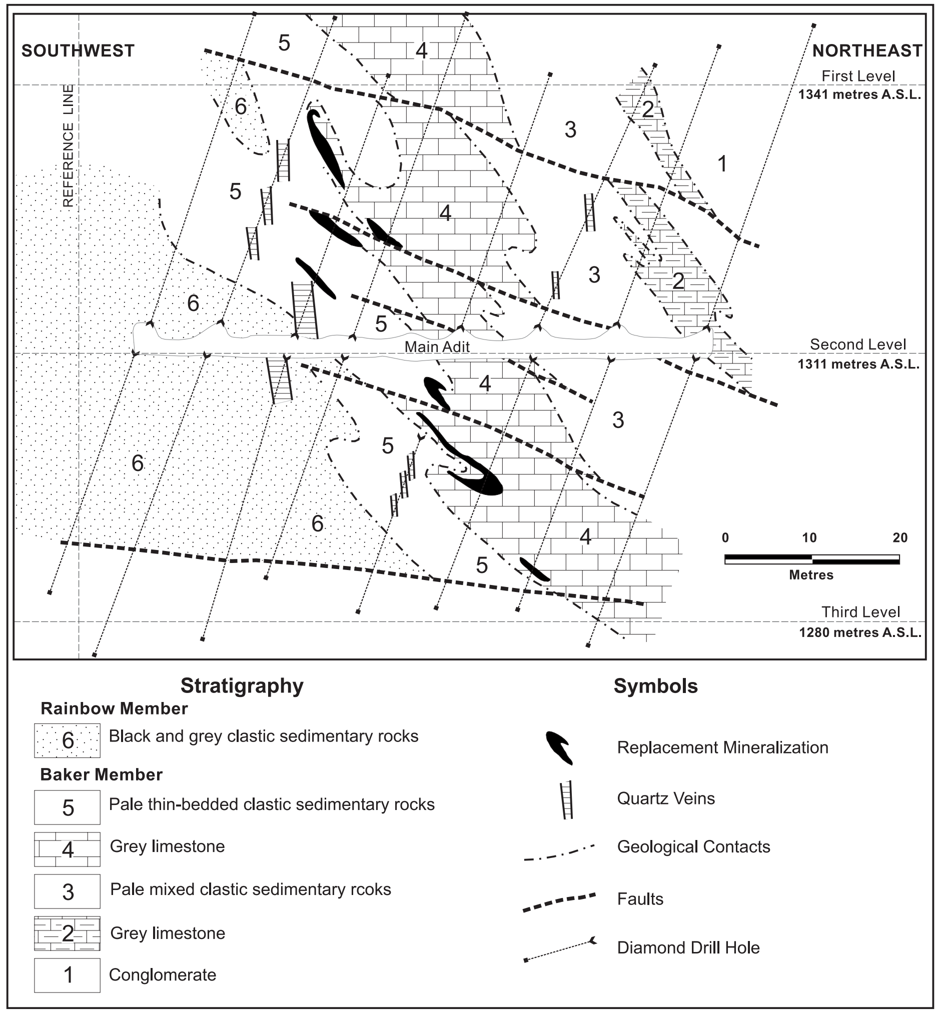

Figure 10. Northeast – southwest cross section through the Mosquito Creek mine, looking northwest, showing replacement bodies in limestone of the Baker member (after Alldrick 1983).

Mineralogy of Lode Deposits

The ore mineralogy is simple. Fine-grained (~ 1 mm) to coarse-grained (1 cm) pyrite is the principal metallic mineral within both the veins and replacement bodies. The replacement pyrite is normally richer in gold than the vein pyrite. Sulfide minerals in the quartz veins are much more varied than in replacement ores; pyrite masses in the former contain up to 2% arsenopyrite and trace to minor amounts of galena, sphalerite, scheelite, pyrrhotite, chalcopyrite, cosalite and bismuthinite. The latter two minerals are important because they occur with fine visible gold and quartz crystals in drusy vugs.

Gold manifests chiefly as microscopic grains within the crys-

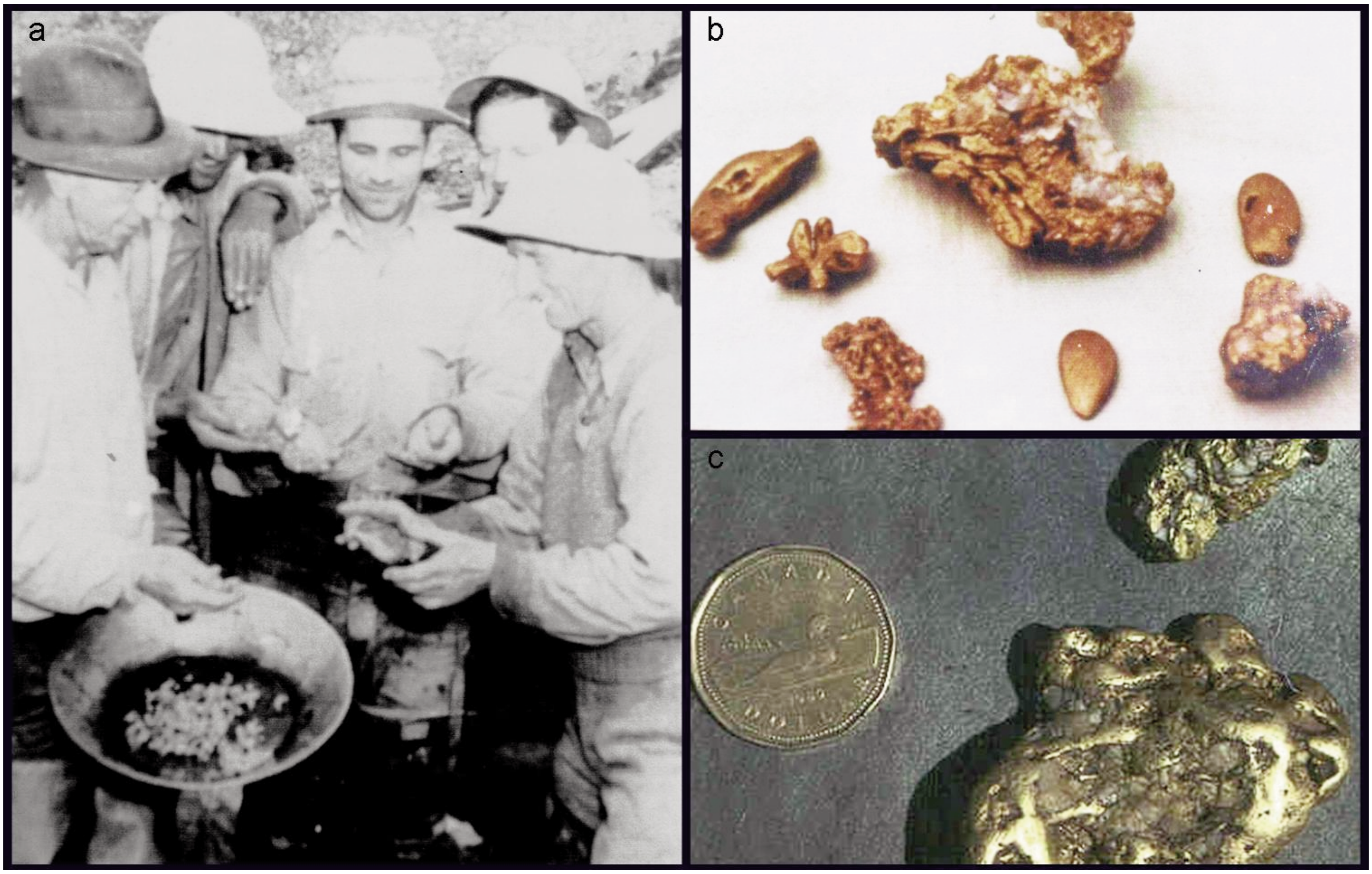

Figure 11. Nuggets from the Goldfield. a) Clean-up at the Lowhee hydraulic mine in 1947; the large nugget held by Oliver Nelson (right) weighed 583 g (18.75 ounces) (Stuart Holland photo); b) Nuggets of diverse shape with seemingly different histories, all from one cleanup at Bill Gunn's hydraulic mine on Mosquito Creek circa 1947; field of view is approximately 10 cm (Stuart Holland photo); c) Placer nuggets from Harold Hedrick's Antler Creek lease (Chris Ash photo).

talline pyrite, as fine disseminations, and as fracture fillings. Free gold has not been observed in pyritic replacement deposits, and is rare and erratically distributed as small grains in veins. Silver is amalgamated with the gold in proportions of 1 to 10 weight percent.

The cosalite-containing vugs were the objects sought by high-graders. It was said that miners who sat in the Wells Hotel or Jack of Clubs beer parlours after shift with their lunch buckets between their feet were likely high-graders, especially if they were known to buy sulfuric acid at the drug store. It was also rumoured that the mines bought the finished product back because it was cheaper than mining the gold themselves.

Age of Lode Deposits

Conventional K/Ar isotopic dating of hydrothermal vein mica indicates an age of approximately 140 Ma (latest Jurassic) for hydrothermal activity (Ash 2001); however, more advanced techniques (e.g. Ar/Ar sericite, Re/Os pyrite) are needed to further constrain the age of mineralization. Andrew et al. (1983) reported an isotopic age of 185 Ma for vein lead but the possible error (50 Ma) is large. Additionally, the age of associated felsic intrusive rocks (Proserpine dikes) must be determined to establish whether or not there is a genetic relationship between magmatic and hydrothermal activity.

PLACER DEPOSITS

The richest placer deposits are distributed in three northwesterly trending zones that generally define the Cariboo Goldfield (see Introduction and Fig. 2). The most extensive zone is the northeastern one, which encompasses the main lode deposits from Mosquito Creek in the north to the Bonanza Ledge in the south. The absence of significant lode deposits in the southeastern part of this trend, i.e. southeast of Barkerville Mountain, has been an enigma.

Large nuggets from the goldfield show great diversity in size and shape. A large nugget from the Lowhee hydraulic mine clean-up in 1942 weighed ~ 583.5 grams (18.75 ounces; Fig. 11a). Nuggets from Jack Gunn's pit on Mosquito Creek (~1950 clean-up) are variable in morphology. One is composed of a large druse with embedded quartz crystals and needle-like voids, probably representing dissolved cosalite; another appears crystalline; several others have smooth, flattened and rounded shapes (Fig. 11b). Early reports of nuggets from Stouts Gulch and Lowhee Creek similarly describe jagged and rounded nuggets (Howay 1914). Selected coarse nuggets from Antler Creek, mined at

Harold Hedrick's claim in 1992, demonstrate examples of the more rounded, polished type of nugget gold, in this case containing significant gangue quartz (Fig. 11c).

Such a variety of nugget shapes has been thought to result from different depositional processes. Clearly, the drusy and crystalline nuggets could not have travelled far unless they were encased in quartz during transport. The variability in shape is probably indicative of different travel trajectories; some nuggets were relatively far-travelled and became rounded, whereas others essentially remained in place as chemical weathering and erosion proceeded. Possibly the farther-travelled gold ended up in transverse valleys such as Williams or Antler creeks, whereas a higher proportion of irregular large nuggets became resident closer to source in the longitudinal valleys (see Fig. 2). The fact that the richest placer deposits lie to the southeast of the known lode deposits, but still on the mine trend, indicates that they most likely originated from erosion of lode deposits that once projected above the present surface (see Figs. 2, 4, 8).

In fact, most miners and geologists thought that the placer gold was derived from the sulfide lodes. To account for the marked discrepancy between the coarse-grained free gold found in the placers (e.g. including nuggets) compared to the fine-grained gold in the lodes, many geologists maintained that the nuggets resulted from solution and re-precipitation processes. McTaggart and Knight (1993) have confirmed, by trace-element studies, the genetic relationship between the lode and placer gold but they maintain that significant re-precipitation of gold did not occur. However, chemical weathering completely removed the host pyrite from the lodes at surface, thereby liberating microscopic gold from blebs and micro-fractures to the placer environment.

Holland (1950) showed that raw placer gold from all over the goldfield had fineness ranging between 830 and 950 (gold to gold+silver, pure gold = 1000). Complete solution and re-precipitation of microscopic gold would have produced pure gold nuggets (Boyle 1979; McTaggart and Knight 1993). However, only partial solution and re-precipitation would have been necessary to allow supergene cementation of microscopic gold particles that were liberated from pyrite. Therefore, the fineness numbers quoted above are not inconsistent with limited re-precipitation of gold as claimed by McTaggart and Knight (1993).

Conversely, coarse-grained gold may have been directly liberated from lodes in pre-existing, overlying ophiolitic rocks. Such a source is supported by the following relationships:

- remnants of ophiolitic rocks occur immediately above and, in part, within the belt of known gold mineralization and would have originally overlain the entire Cariboo Goldfield;
- all other significant placer gold camps in the Canadian Cordillera (e.g. Klondike, Atlin, Barkerville, Cassiar) display a lithotectonic setting similar to that of the Cariboo Goldfield, i.e. detrital gold is found in erosional troughs dissecting flat-lying fault zones that feature hanging-wall ophiolitic rocks (Ash 2001, 2006);
- coarse-grained free gold occurs in the hanging-wall ophiolitic rocks of the Cassiar camp; and
- in all the significant gold-quartz vein camps in the North American Cordillera, gold-quartz lodes with coarse-grained gold are either hosted by, or occur immediately adjacent to ophiolitic mafic igneous rocks affected by intense and pervasive carbonate–sericite–pyrite (listwanite) alteration, and the richest veins are commonly proximal to ultramafic rocks (e.g. Bralorne, Cassiar, Alleghany, and Grass Valley).

HISTORY OF EXPLORATION AND DEVELOPMENT

Exploration of the Cariboo Goldfield occurred in three periods. The first started in 1860 and was dominated by the search for, and mining of, placer deposits. The second, which followed on the heels of the first and continued to 1889, focused on large through-going bull-quartz veins that were believed to be the lode source of the coarse-grained placer gold. The third began around 1927 and was dominated by exploration for and development of cross-cutting gold-bearing, pyrite-rich quartz veins and replacement lodes. The search for lode deposits and mining of placer deposits continues today, but on a small scale.

Placer Mining History

Earliest exploration for placer gold involved simply panning or shovelling into a rocker or grizzly, but soon graduated to mining by sluice box (Fig. 12a), and then to underground hand mining followed by hoisting the gravel from bedrock to the surface, and sluicing (Fig. 12b). Water was channelled from creeks via wooden flumes to wash the gravel and to power the Cornish pumps that lifted water out of the workings (Fig. 12c). Starting late in the 19th century most mining was done by hydraulic monitor (Fig. 13a) and, still later, a few large operations used a bucket or dragline dredge (Fig. 13b). Major investment was required for both; hydraulic mining needed water storage by dams and delivery by contoured ditches, in some cases over many kilometres; dredging needed assurance of grade and volume, which involved much costly drilling, equipment and engineering. A more comprehensive account of the placer mining methods employed in BC is provided by Holland (1942a, b).

Many small placer properties proceeded to mining without extensive exploration, but based on intuition, hope, or even dowsing. Somewhat larger properties were commonly first tested by trial operations in advance of setting up extensive mining infrastructure. Some were fully developed into mining operations on instinct alone and resulted in many failed ventures. Large operations in latter days were normally explored extensively by systematic Keystone or churn drilling that may have been preceded by hammer seismic or electro-resistivity studies prior to the necessary major investment.

Present environmental regulations in BC limit placer mining and prevent hydraulic mining. Although buried leads can be pursued by other methods, no mining is permitted within 10 m of an existing creek. Current mining (Fig. 13c) mostly involves backhoe digging, sluicing and extensive set-

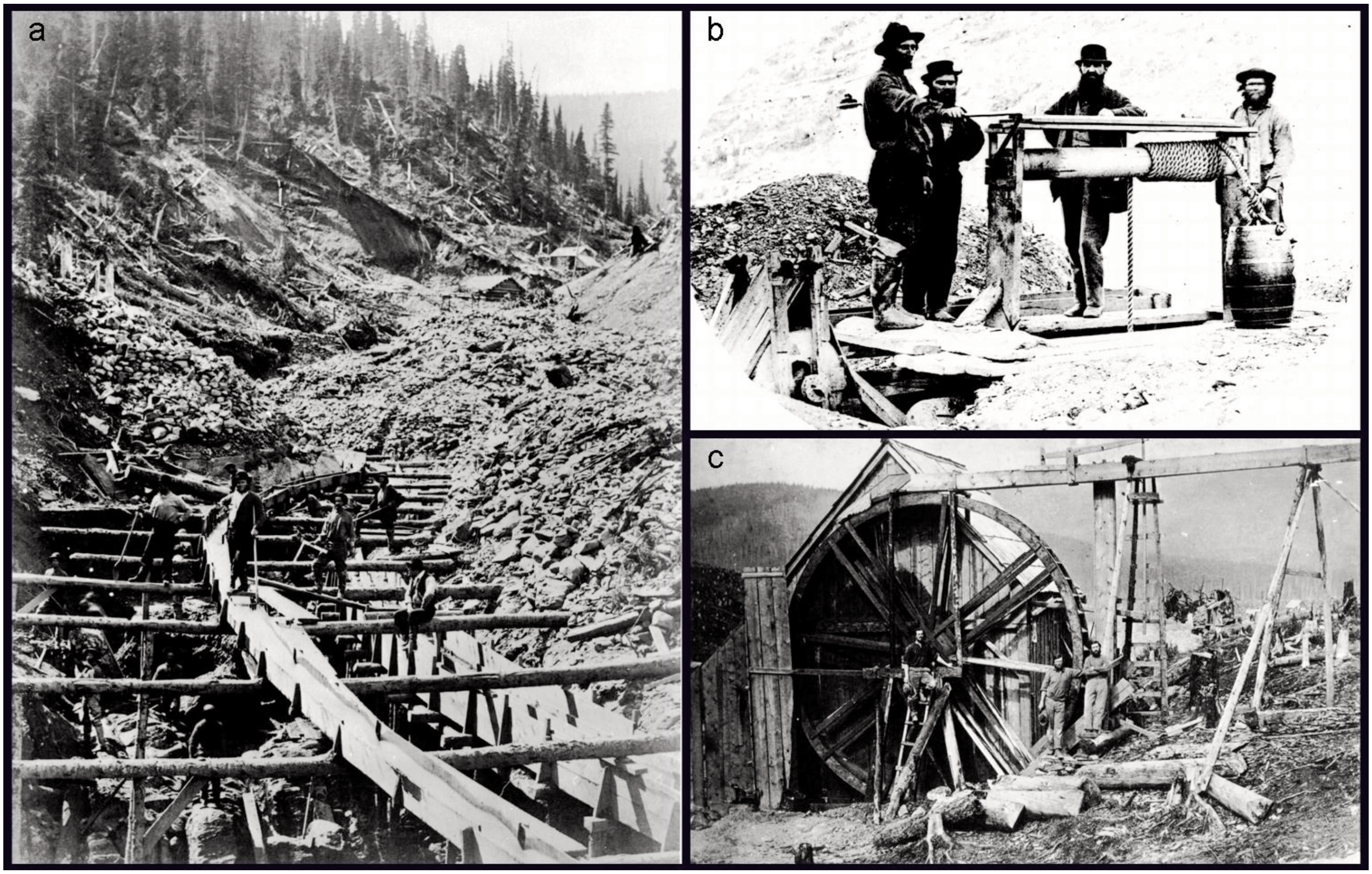

Figure 12. Early placer operations. a) A surface sluice mine on Williams Creek near Richfield in 1867; note new central flume, men cleaning up bedrock and the piled boulders. (Frederick Dally collection, BCARS photo HP-94703). b) Billy Barker, second from left at his company's windlass and shaft (Richard Maynard collection, BCARS photo A-03858). c) Aurora Claim, on Conklin Gulch at Williams Creek, showing partners, plant and the waterwheel of the Cornish pump in 1868. The wheel is now displayed at the bridge over the Fraser River at Quesnel. (Frederick Dally collection, BCARS photo A-00558).

tling ponds. Regardless of the increase in restrictive regulations needed to protect water courses, the present high price of gold has caused a resurgence in applications for placer claims.

The Early Gold Rush

The discovery of the Cariboo Goldfield followed peak production from California's gold fields, but the pattern of discovery was similar to California's (Rickard 1947). A number of *bona fide* discoveries by aboriginals or others took place without creating much excitement. At the Hudson Bay Company (HBC) post in Kamloops, natives had traded placer gold for goods for a number of years. Then in 1858, news of these trades reached San Francisco, which triggered the rush north to the scarcely known regions of central BC. Adventurers came by land in large armed parties through Oregon (driving cattle), overland by prairie schooner, canoe and raft from 'Canada', and principally in great numbers by steam and sailing ships from San Francisco. The initial destination of the ships was commonly Fort Victoria. From there, would-be prospectors went by boat via Fraser River, Harrison River and Lake, and then by way of Anderson and Seaton lakes to join the Fraser above its deep canyon (Fig. 1). Alternatively, they travelled by boat to Yale, the head of navigation on the Fraser, and then moved up the canyon, sampling and mining the bars as they went. In autumn of 1860 some reached Quesnel Forks and Keithley Creek, where encouraging amounts of gold were found.

John Rose and Ranald McDonald were the first prospectors to discover substantial placer deposits within the Cariboo Goldfield. Late in the fall of 1860, they traversed up Keithley Creek and across the Snowshoe Plateau (Bald Mountain) to Cunningham and Antler Creek, where they found some rich placer deposits at shallow depths (Bancroft 1887). Immediately after their discovery a heavy snowfall forced them to retreat to Keithley Creek for supplies. In the early winter of 1861 they set off again by snowshoe and they were tracked by a number of other prospectors who suspected their success. As a result, many claims were staked and many settled in to mine. In a short time a village of ten, then twenty log cabins grew, including a tavern. However, the rich diggings were ephemeral, so within three years Antler village was abandoned.

Nevertheless, other prospectors pushed beyond Antler in the spring of 1861 to other parts of the

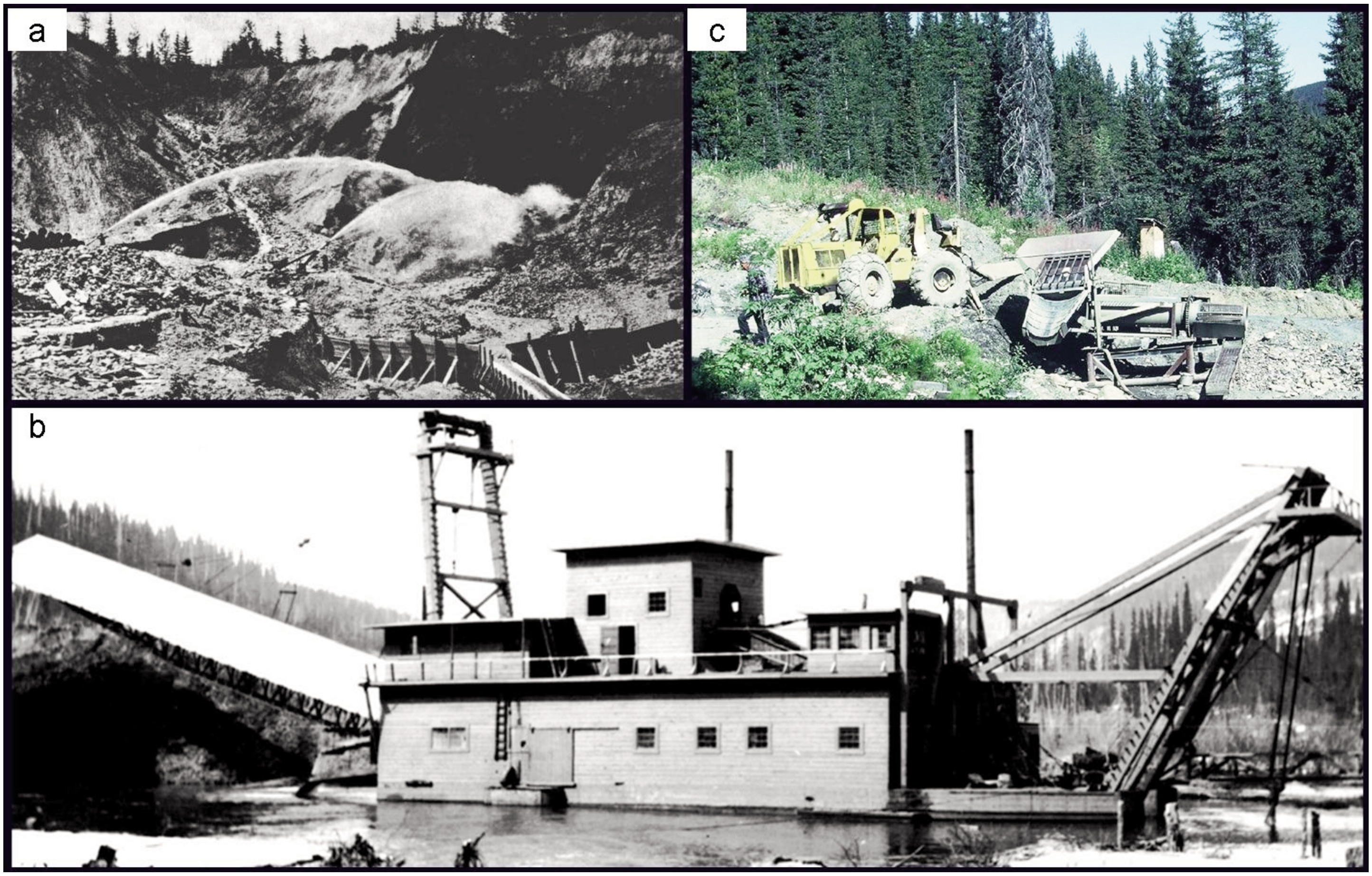

Figure 13. Late placer operations. a) Forest Rose hydraulic mine on Williams Creek circa 1907 (BC Department of Mines, BCARS photo I-55568). b) Kafue Copper Company bucket line dredge on Antler Creek in 1924; the start of Placer Development Ltd. (BCARS photo E-05528). c) Modern day placer mining with back hoe and track-mounted small powered trommel (Chris Ash photo).

Goldfield. Included in this group were Edward Stout, Michael Burns and William Dietz, all of whom had creeks named after them. Discoveries were made that year on all the important creeks and many lesser ones. By March, William 'Dutch Bill' Dietz had discovered rich ground above the Richfield Canyon at shallow depth on the creek that bears his name. Soon a village, then four, appeared along Williams Creek, where paying ground was found along 5 km (3 miles) of creek bed. The village of Barkerville developed in the centre and survived, whereas the nearby villages of Richfield (the government centre up-creek), Camerontown (down-creek), and Marysville, were soon overshadowed and eventually disappeared (Fig. 2).

In the same year, 1861, major discoveries were made on Lightning, Lowhee, Grouse, and Mosquito creeks as well as on Stouts Gulch. The whole extent of the Goldfield was thus revealed; excitement and optimism were endemic. Naturally, first discoveries were shallow, but mining at depths up to 20 m was soon accomplished as prospectors followed leads into deep gravel. Mining at depth had many difficulties. Water caused two of those difficulties: not enough to sluice in summer and too much flowing through the deep gravels, even in winter. Pumps were driven by water wheels until late in the century, when steam engines and eventually diesels became available. Boulders were a problem for sluice mines in narrow gullies and had to be piled expertly so they would not collapse onto the sluices or flumes. Most mines were unworkable during winter freeze-up.

Little comprehensive information and few statistical data exist to document production during the early years, but during the first decade after discovery fortunes were made from a score of creeks. Abundant anecdotal tales of the windfalls recovered by miners in the early period are repeated by Ludditt (1958). For example, Steele and company made $105 000 in two months from claims along Richfield Canyon on Williams Creek. Billy Barker and company made $300 000 in 1863 below the canyon. In 1861, Richard Willoughby recovered 2.6 kg (84 ounces) in one day on Lowhee Creek just above the meadows. The Aurora company is said to have made $1 500 000 up to 1864 by drift mining on Conklin Gulch. The Wattie brothers made $130 000 in 1863. John (Cariboo) Cameron made $150 000 as his share in 1863. His wife died and he took her body, preserved in alcohol, across the western Cariboo to Bella Coola and on to Ontario for burial. He then returned and made another fortune. Fairly authoritative production data, based on

Table 3. Estimated placer-gold production, numbers of claims and numbers of miners involved for various creeks in the Goldfield between 1875 and 1877 (after Bancroft 1887).

Year			**1875**				**1876**				**1877**	
Creeks	**Claims**	**Whites**	**Chinese**	**$ Yield**	**Claims**	**Whites**	**Chinese**	**$ Yield**	**Claims**	**Whites**	**Chinese**	**$ Yield**
Lightning	14			513 527	16				18			
Burns	6			10 990	5				6			
Nelson	4			9 750	6				5			
Cottonwood *	5			5 000	6				8			
Swift River *	3	145	177	3 300	0	202	172	137 306	0	134	208	222 071
William	27			68 760	27				33			
Conklin Gulch	5			41 200	4				6			
Stouts Creek	3			4 200	4				3			
Grous Creek	4			4 414	6				9			
Various Creeks: Lowhee, Jack of Clubs, Mosquito, McArthur, Antler	20	192	117	26 400	17	188	225	224 071	25	176	215	162 385
N & S Forks, Quesnel *	14		55	40 040								
Keithley Creek*	17	25	65	25 515								
Harvey, Snowshoe, etc.	14	11	24	13 162				82 460	38	28	177	20 370
Totals				**766 258**				**443 837**				**404 772**

* Not within the Cariboo Goldfields as defined here.

estimates, exist after the first decade or so (Table 3).

On lower Lightning Creek the deep shaft mines, Vulcan, Vancouver, Victoria and Last Chance, were initial successes but suffered from severe water problems. The adjacent villages of Stanley and Van Winkle grew near these rich placer workings. Stanley survived into the mid 20th century although it slowly lost place to Barkerville, and later to Wells. Van Winkle disappeared earlier although it remained the post office address for both Stanley and Van Winkle until after World War II (WWII) (Fig. 2).

Naturally there were disputes regarding validity of the location and ownership of claims. The government in Victoria acted quickly to regulate mining and resolve disputes. Regulations created earlier for mining the Fraser River bars, restricted each placer claim to 30.5 m (100 feet) of creek front. Lode claims and real estate were located separately and sized differently, but could overlap. Confusion resulted. In 1862, Gold Commissioner Nixon, resident in the village of Williams Lake in the southern Cariboo, set a moratorium on locating claims until he sorted out the problems. The next year a Gold Commissioner, Ball, became resident in Barkerville and was an important and powerful man in the community. It is remarkable that there were few serious disputes and the rulings of the Commissioner were readily accepted. The principal exception was what was grandly called the Grouse Creek War in 1867. This dispute arose between two companies that both thought the Gold Commissioner had granted them rights to mine on the creek. The dispute quickly escalated and a score of men on both sides were ready to take violent action. It was settled in the courts, and Commissioner Ball was replaced because of his unwise decisions. The most famous Commissioner, John Bowron, was appointed in 1875 and remained until 1906.

The Cariboo was not California in terms of the quantity of placer gold recovered; production peaked in 1863 (Fig. 14) and then tailed off all over the goldfield to the alarm of both the Colonial Government and the miners. Nevertheless, developments continued; the Barnard Express (BX) established efficient services to Quesnel by 1862 using horse-drawn freight wagons and stages, then on to Barkerville by pack horse. A wagon road was completed up Lightning Creek to Barkerville in 1865 and the BX Stage line became the longest in the world. Gold that was transported down this road by the BX Express was initially accompanied by armed escort (Fig. 15a), which proved unnecessary because the roads were safe. Large pack trains were still the way to move freight and equipment to the outposts (Fig. 15b).

Several disasters occurred at Barkerville in the early years. Spring floods in 1867 broke the banks and low gravel levees along Williams Creek and flooded all the deep mines. It was a year before some of them could produce again. Worse still, in 1868 Barkerville burnt to the ground. Fredrick Dally, the famous British photographer of early BC scenes, was in Barkerville and described the night of the fire. It was a clear cold September evening with a spectacular Aurora Borealis. According to his information, a miner in the upstairs of the Barry and Adler saloon was trying to kiss a 'dancing girl' but fell against the stove pipe, displacing it and causing an immediate outbreak of fire in the canvas roof. A holocaust roared quickly through half the town. Water from Barker's overhead flume was used to keep the fire at bay in the other half for several hours. Fortunately, fifty-two kegs of blasting powder standing on the surface were dropped down dry mine shafts in time to avoid an explosion that would likely have killed most of the residents. In any case, the whole town was destroyed except for a few outlying houses on the adjacent slopes (Dally 1868). The town was quickly rebuilt and parts have lasted to this day (Fig. 15c), but the excitement of the early days never returned.

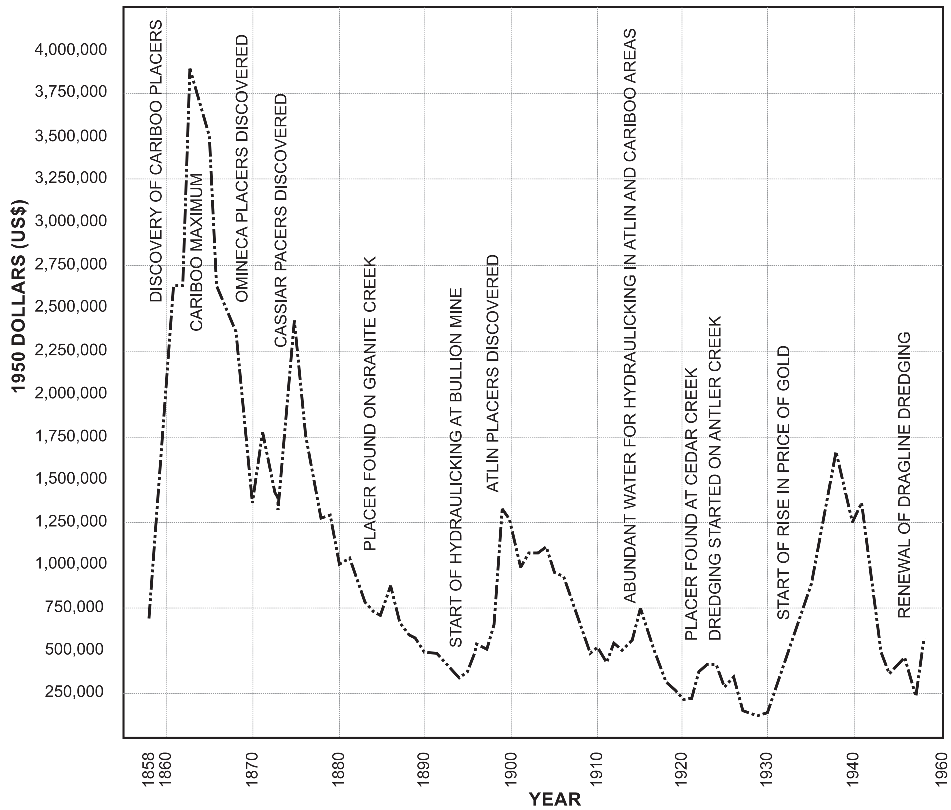

Figure 14. Annual production of placer gold in BC from 1863 to 1948 (after Holland 1950).

Placer Mining since the Rush

The value of placer mining in the Cariboo declined continuously from the 1880s until the 1930s in spite of the general introduction of hydraulic mining. Around 1905 many of the significant leases around Williams Creek were acquired by John Hopp. These included the Mucho Oro on Stouts Gulch, the Forest Rose on Conklin Gulch, and pits on Lowhee and Mosquito creeks. In effect, he was the only significant operator with hydraulic mines other than Thistle Mines on Eight Mile Creek. The success in lode mining in the 1930s and the rise in the price of gold encouraged a new wave of placer mining until WWII, when manpower shortage related to the 'call to the colours' limited mining again. The prewar wave of placer mining principally employed hydraulic mining, but included two dredges first introduced to the Cariboo Goldfield in 1924 (see below).

The first and only bucket-line dredge, the Kafue dredge (Fig. 13b), was constructed in place using local wood to build the pontoon and to fuel the two locomotive boilers for power. The buckets held 4 cubic yards, and could dig to a depth of 15 m. The boat was 32 m long and held a compact washing plant with a rotating trommel (Fig. 16). The whole plant cost $200 000.

The manager and engineer in charge, Charles A. Banks, later had a highly successful career as an engineer and entrepreneur. As a result of his experience in the Cariboo, he created, at considerable risk, Placer Development Company, which flew dredging equipment into the highlands of New Guinea in the 1920s by Ford Tri-motor aircraft to exploit gold-bearing gravels. This innovative project, which proceeded in spite of widespread scepticism, was a great success and set Placer on its course to become an important mining company. Banks kept a major interest in the company as president and director throughout his life. Before WWII he also became a colonel in the Canadian Militia and during the War was appointed Lieutenant Governor of British Columbia.

In 1924, the Kafue Copper Development Company, an English enterprise, re-drilled the meadows of Antler Creek and Cunningham Creek (Whiskey) Flats and established a resource of 1 146 832 m^3 (1 500 000 cubic yards) of paying ground at 50 cents a yard on Antler Creek, and supposedly twice that yardage on the Flats. They went ahead with construction and testing of a dredge that December. Starting in April the following year, the dredge dug 45 900 - 53 500 m^3 (60 000 to 70 000 cubic yards) a month to earn $95 000 while dredging gravel previously drift-mined in the early rush. In 1926, a series of accidents resulted in little gold being produced, and in 1927 the dredge dug its way to Cunningham (Whiskey) Flats, where the results were disappointing. Later, in 1928 it encountered more problems and the dredge was sold to an Oregon company (AR-BCMM).

The second dredge, a dragline, was owned by Kumhila Exploration Ltd. The plant consisted of a steel pontoon, a Bucyrus dragline shovel with a 2.7 m^3 (3.5 cubic yards) bucket and a trommel washing plant. It initially operated in 1945 and 1946 on Pine Creek, a minor creek flowing into Summit Lake adjacent to the Eight Mile hydraulic. The first year was very successful, with an estimated production of $125 000 at 1945 prices (Hong 1978, p. 176-180). It ceased operation until it was re-positioned in 1955 at Devlin Bench on Williams Creek north

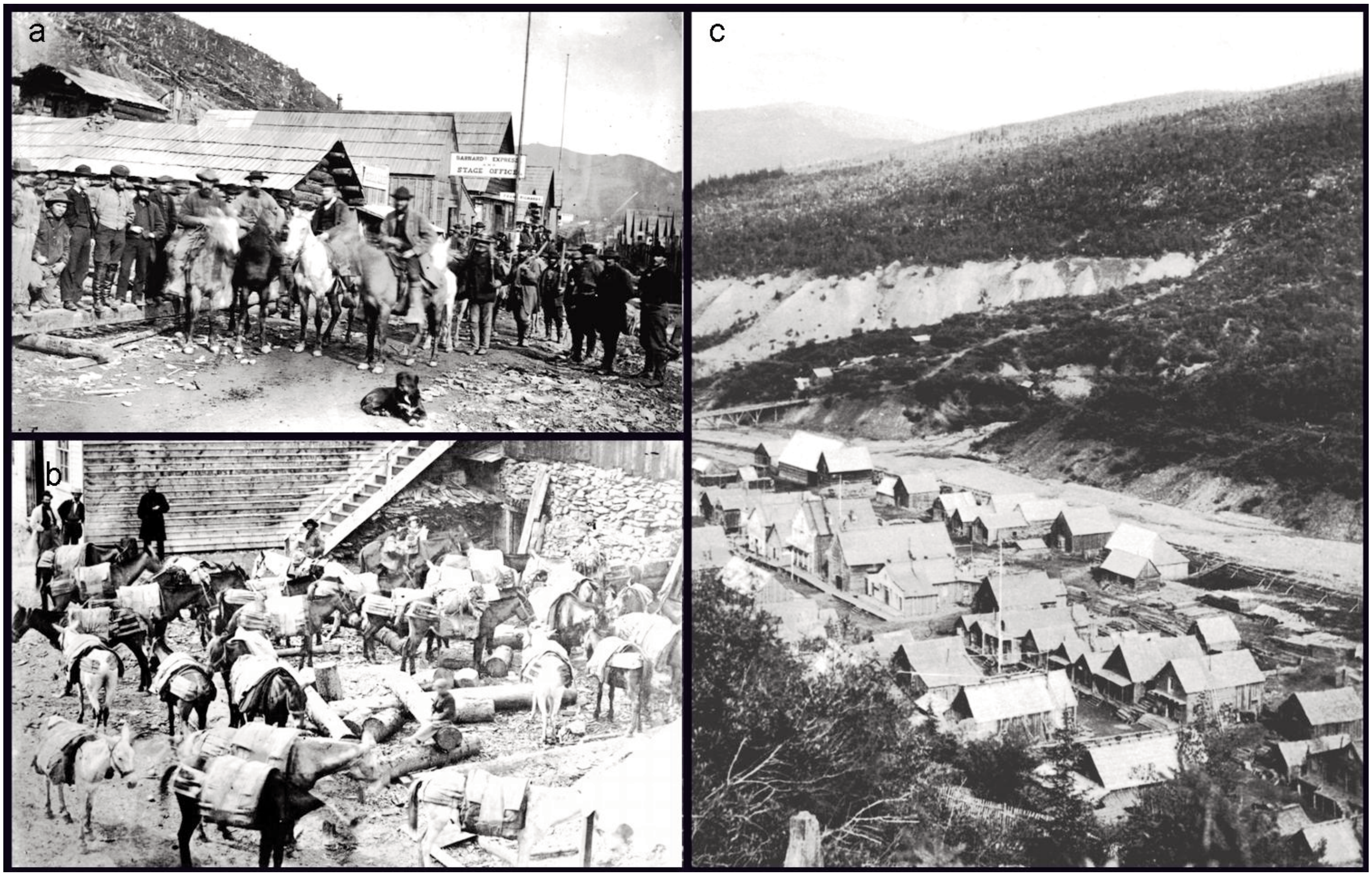

Figure 15. The town of Barkerville. a) The gold escort about to leave Barkerville circa 1863 in front of Barnard Express office (Carlos Gentile collection, BCARS photo A-03148). b) Pack train loaded and waiting in Barkerville to service a local mine (BCARS photo C-08171). c) View of Barkerville, looking east (circa 1907). Bridge on the road south to Cunningham Creek crosses Williams Creek in front of the two hydraulic pits (BC Department of Mines, BCARS photo I-55171).

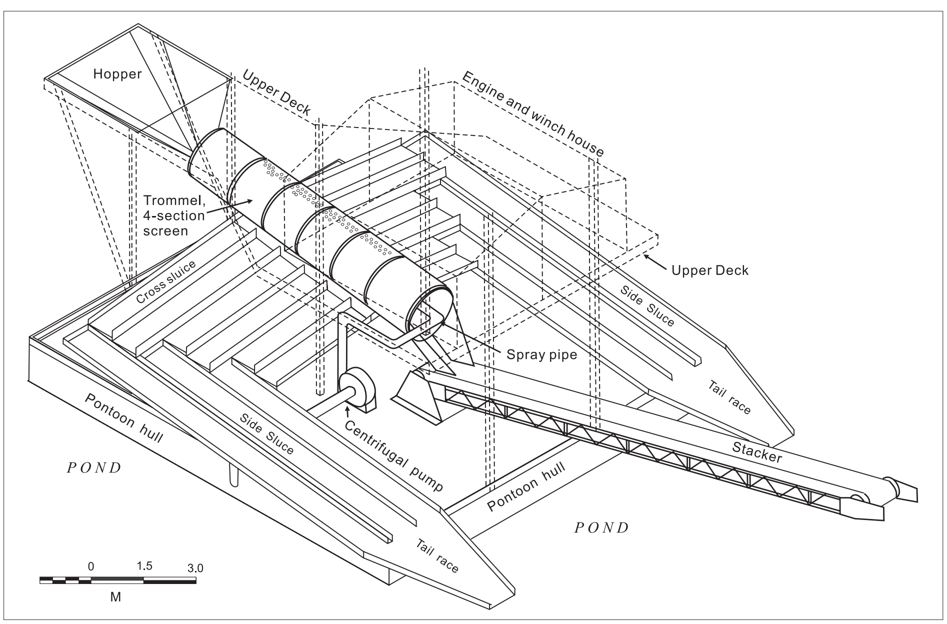

Figure 16. Scale drawing of a trommel, a floating washing plant, gold saver and tailing stacker for dredges (after US Bureau of Mines plans).

of Conklin Gulch. First it stripped along the bench to prepare for dredging. Then it dug a pond and assembled the equipment on the pontoon. In 1957 and 1958 it operated nearby on Williams Creek meadows and in the latter year dug 141 443 m^3 (185 000 cubic yards), producing 72.875 kg (2343 ounces) of gold. The enterprise ended when the pontoon sank in the winter of 1958-59 (AR-BCMM).

Placer mining has been re-invigorated any time the price of gold increases sharply, but current environmental regulations are so restrictive and fuel costs so high that it is not a viable business. Regardless, all the Creeks in the Cariboo are currently leased in anticipation of profit. Many of these ventures operate with modern diesel-powered equipment including backhoes and small, mobile tracked trommels (Fig. 12c).

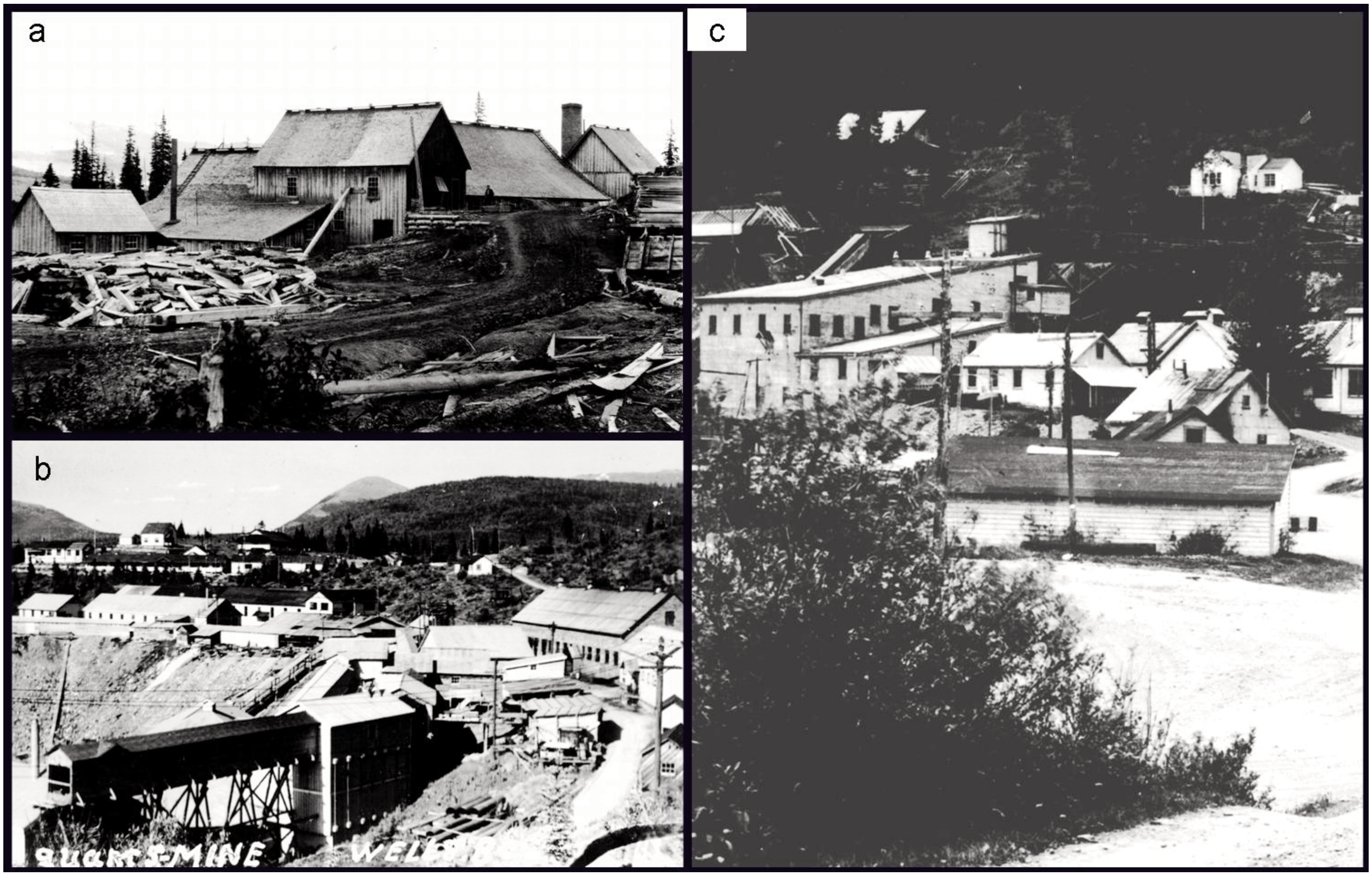

Figure 17. Lode mines and mills. a) BC Government's stamp mill and reduction works (roaster) above Barkerville in 1902 (BC Department of Mines, BCARS photo A-05057). b) Cariboo Gold Quartz mine buildings in 1937: crusher house, foreground; mill, lower left; waist dump, left; portal behind shops, right; offices beyond and senior staff residences on hill. Slide Mountain is in centre distance (BC Department of Mines, (BCARS photo C-09720). c) Island Mountain mine buildings (circa 1940): mill in foreground and mine portal above (BC Department of Mines, BCARS photo C-09721).

Lode Exploration and Mining History

The history of lode mining in the goldfield is one of repeated unsuccessful ventures from the early 1870s until 1933, and since then there have been pulses of activity followed by periods of quiescence. In the years immediately following the peak of placer production in 1863, interest was directed to exploring the large quartz veins in the camp. Many were examined and tested.

Initial approaches to mining the quartz veins of the Cariboo applied the same methods that was successfully used for decades in the Mother Lode (ML) belt of California. With the vein systems there, it was not really a matter of finding gold at any particular place on the surface but simply a matter of drifting downward and outward on the vein, and at some point the operators would obtain their reward. The initial naming of the largest vein, the 'Bonanza Vein' (later re-named the B.C. Vein), showed an expectation of some equivalence to the ML veins. In fact, Governor Douglas of British Columbia, in an 1858 letter, said there was reason to hope for wealth in BC equivalent to that discovered in California because of "*the geological formation being similar in character to that of the mountains of the Sierra Nevada*" (Begg 1894, p. 264). Furthermore, a 20-stamp mill that was transported to the B.C. Vein by the BC Mining and Milling Company in 1878, even before any significant lode discovery, showed a level of expectation for finding profitable lodes. However, it was never erected because very little ore was ever mined, even after 10 years of underground exploration on the largest quartz veins, i.e. B.C., Pinkerton, Enterprise and Aurum.

Some small veins, transverse to the foliation and to the large veins, yielded encouraging assays in samples collected from weathered outcrops. However, fresh material at depth on these veins proved of lesser value. Even worse, the technology of the day, involving stamp mills and roasting, was not capable of treating even relatively good pyritic ores successfully. Among the veins examined and named were the Bonanza, Steadman and Pinkerton veins (on what became the CGQ mine), the Black Jack on upper Williams Creek, Proserpine on Proserpine Mountain, and Aurum on Island Mountain.

Little additional work was done between 1878 and 1886, when activity was stimulated by two factors. The provincial government built a custom mill and roaster above Barkerville (Fig. 17a) that coincided with the

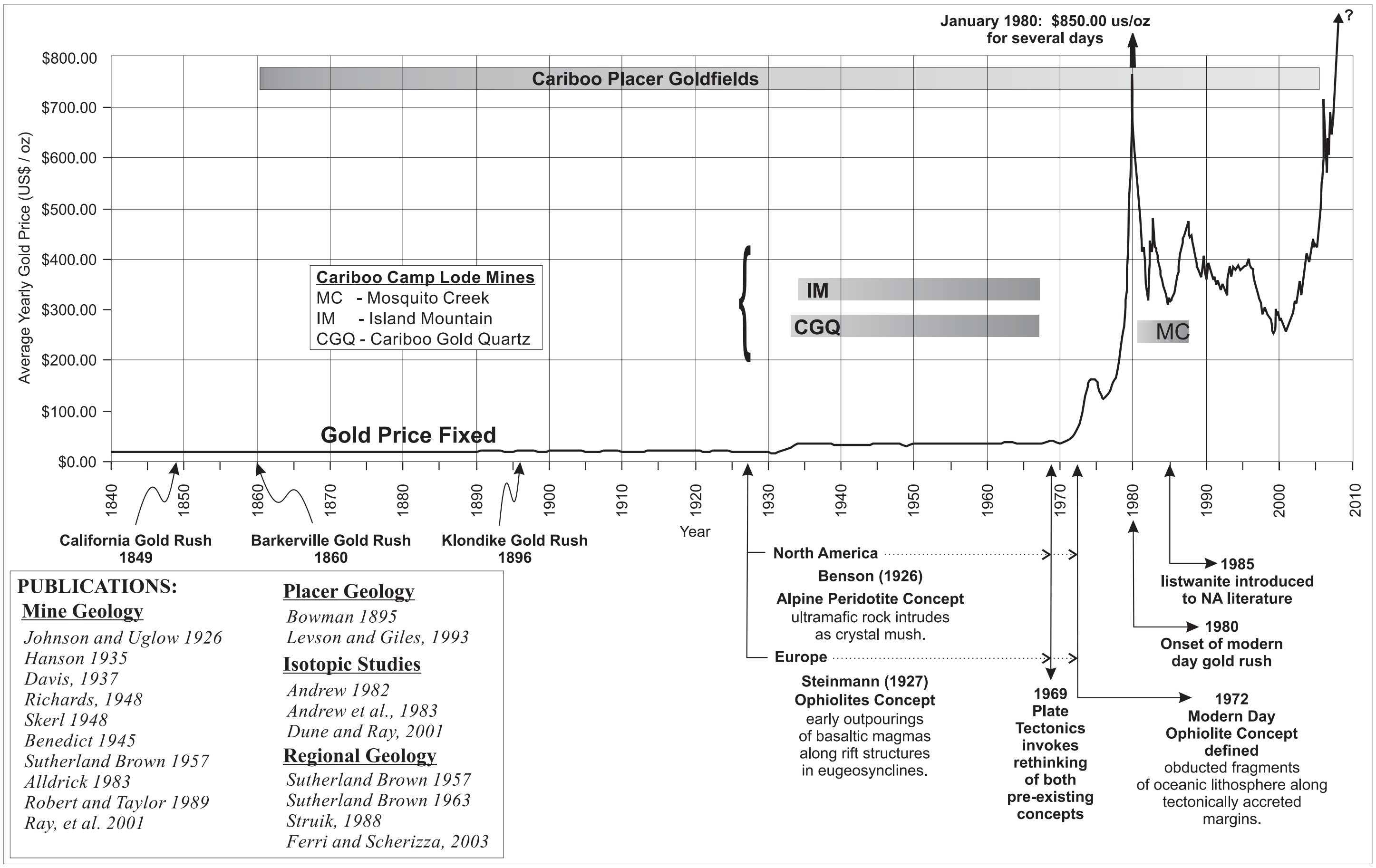

Figure 18. Chart showing gold price, productive life of Cariboo mining operations, related historical events and pertinent references on the Cariboo Goldfield (after Ash 2001).

release of Bowman's detailed maps of the main placer creeks (Bowman 1886, 1888). These maps revealed the gradients, distribution and stratigraphy of placer-bearing gravels, displayed the surrounding geography and general geology, and provided assays of vein samples. By 1891, activity declined because of the lack of success in finding the source of the placers. A few diligent prospectors such as C.J. Seymour Baker (after whom the Baker Member was named) continued the search.

In 1922, Uglow (Johnston and Uglow 1926) examined and analyzed the vein systems, which attracted the interest of some serious prospectors, including Fred M. Wells (after whom the town was named) and F.J. Tregillus (successful prospector and long-time resident of Barkerville, after whom a lake north of the Goldfield was named). In 1927, the Cariboo Gold Quartz (CGQ) Company was incorporated with money invested principally from Seattle interests that were headed by Dr. W.B. Burnett, M.D. It has been said that Wells would have preferred working on Island Mountain in the warmth of the early morning sun rather than in the frosty shade of Cow Mountain; however, Baker continued to hold the Aurum claims so Wells drove adits west from Lowhee Creek to intersect the Pinkerton veins that he had worked on the surface. When these veins did not pan out, the company started to drive a long, low, level adit about 30 m above Jack of Clubs Lake toward the same target area. Fred Wells thought the veins should be richer at depth. A few hundred metres from the entry, this adit struck previously unknown veins that proved to be economic. As a result, a mill was built and production started in January 1933 (Fig. 17b).

Baker optioned the Aurum claims to various companies, and eventually to Newmont Mining Corporation, who formed Island Mountain (IM) Company Limited, built a mill and started operating in November 1934 (Fig. 17c). The mine's success depended on the discovery of a new type of ore, gold-bearing pyritic replacement deposits adjacent to pyritic quartz veins and faults. Thus, a two-mine camp began as a result of a favourable exchange rate and a re-valuation of gold in 1932 (Fig. 18).

While a successful mining operation developed near Wells, fairly intense prospecting for lodes went on throughout the goldfield. Many exploratory adits were driven or extended, but none successfully developed ore. Then WWII caused a manpower shortage that hindered mining.

After the war, mining and lode prospecting flourished for a few years, and several major companies examined prospects on Proserpine Mountain and elsewhere, but escalating costs and shrinking profits soon dampened this enthusiasm. The US Treasury controlled the price of gold, and the

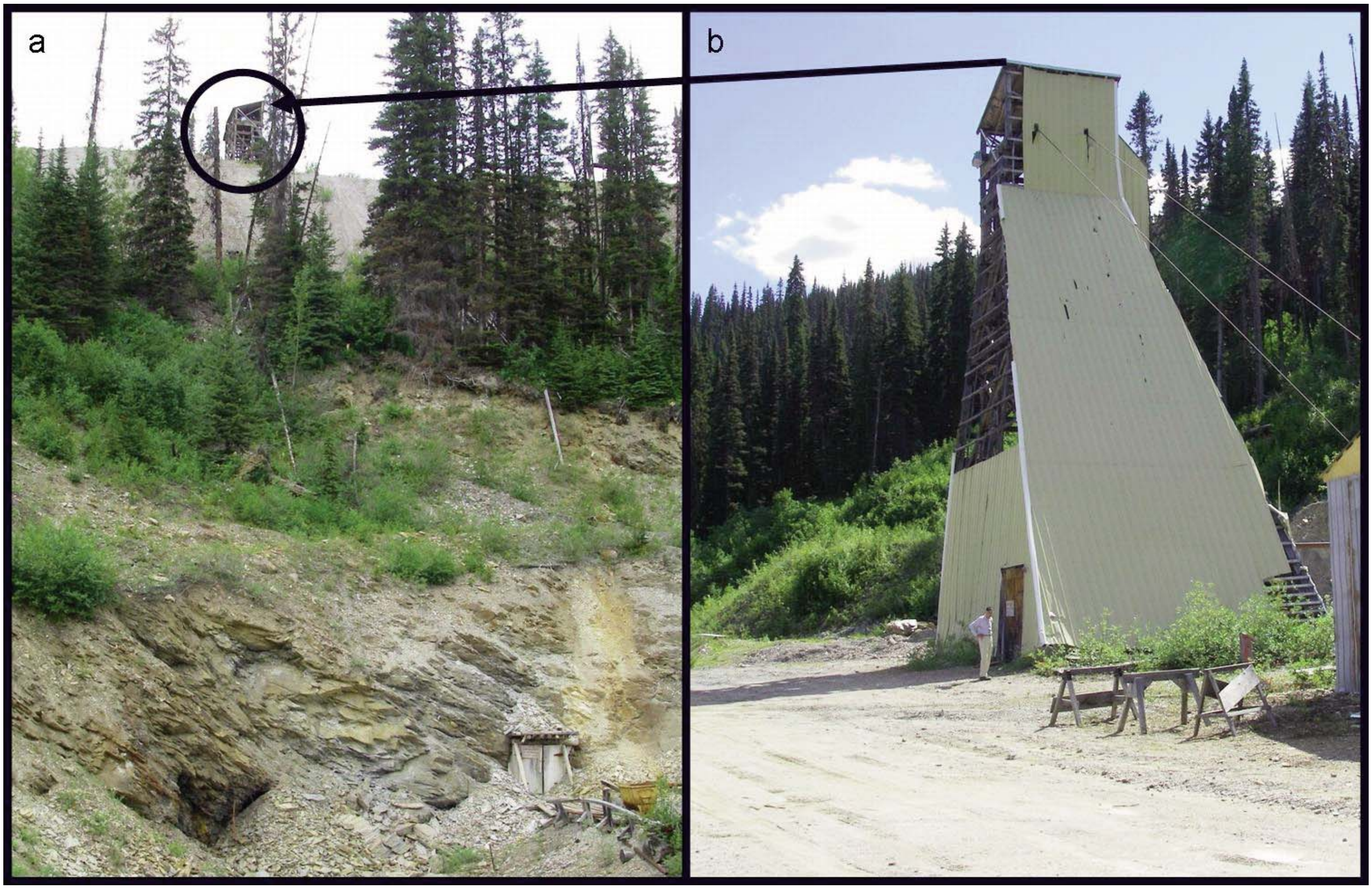

Figure 19. The Mosquito Creek mine. a) The 100 Level portal looking west with the headframe and waste dump above. b) the headframe looking southwest with Atholl Sutherland Brown beside it (both photos taken in 2008 by Chris Ash)

upturn in the Canadian economy led to higher costs and hence a decline in profits leading to losses. The first to react to the approaching decline was the house of ill repute locally called the 'Riding Academy'. The house madam, whose *nom de guerre* was 'Cold Arse Marie', led the girls to a more profitable location. The next to leave was the local bank branch. Then Newmont Mining could see no future for the IM Mine because expansion of its workings was constrained by CGQ's claims and the ore had run out at depth. CGQ purchased the IM mine, allowing the company deep access to its northwest zone without having to sink another costly shaft, and it also increased efficiency of scale by adding more feed to one mill. However, escalating costs and a lack of economic reserves forced CGQ to stop mining in 1966, and operations ceased the following year after completing the milling of broken, stockpiled ore.

In 1980, the Mosquito Creek (MC) Mine came into production on ground northwest of Island Mountain that had been held by CGQ (Fig. 19). The property had some good replacement ore, which was mined quickly when the price of gold was soaring. When the price dropped and new ore became hard to find, the mine closed in 1987.

The goldfield continues to be a target of exploration with the strengthening price of gold in the 21st century. Drilling for pyritic gold lodes in the historic mine areas has been the ongoing focus of International Wayside Gold Mines Ltd. since 1995 (International Wayside Mines 2006). Since that time, in excess of $40 million has been expended and more than 50 000 m of exploration drilling has been done. This work has successfully outlined a number of near-surface, relatively low-grade, bulk tonnage, gold zones that could be mined by open pits. Three of them are located on Cow Mountain and overlie workings of the historic CGQ Mine; the others are on the southern side of Barkerville Mountain.

Lode Distribution, Production and Resources

The three past-producing mines are aligned in a single northwest trend in the vicinity of Wells (Fig. 8), with CGQ in the southeast, IM in the centre and MC in the northwest. The geology of all three mines is similar except that the percentage of limestone beds within the Baker Member appears to increase from southeast to northwest, as does the ratio of replacement to vein ore (Guiguet, pers. comm. to ASB, 1952). Similarly, the ratio of silver to gold increases in the same direction, as shown by the production figures quoted below. The ore-bearing zones and replacement ore bodies all plunge 13° to 22° northwestward, parallel to regional fold axes. In the vertical dimension, the ore zone in the CGQ mine extends from the crest of Cow Mountain (where the zone "daylights") to a base about 370 m below. At Island Mountain, the vertical extent of the zone is about 550 m. Grade generally declines with depth (Skerl 1948) and may, in part, be limited by a major low-angle fault.

The CGQ started production in January 1933; mining continued until 1966 and milling until 1967. During this period 1 951 944 tonnes of ore were mined and 26 851 811 grams of gold and 2 850 371 grams of silver were recovered (MINFILE).

The IM mine started production in November 1934 and was bought by CGQ in 1959. Thereafter, a considerable proportion of the production of the CGQ came from original IM claims, which CGQ called the Aurum mine. Production from the IM mine, while under Newmont ownership, was 699 536 tonnes from which 10 379 382 grams of gold and 1 497 021 grams of silver were recovered (MINFILE). The mill also recovered 241 kg of zinc and 61 kg of lead. Each mine provided its shareholders with several million dollars in dividends.

The MC mine was brought into production during the gold price surge in the 1980s, and it produced from 1980 until 1987. During this time its yearly production varied greatly from 22 508 tonnes in 1982 to 2329 tonnes in 1984; various causes were responsible for these fluctuations, including a strike. The total production was 92 826 tonnes from which 1 090 316 grams of gold and 303 249 grams of silver were recovered (MINFILE).

International Wayside Gold Mines (2006) has reported the following resources for its Cariboo Gold Project (Cow Mountain), based upon an independent estimate by Giroux Consultants Ltd. of Vancouver: an indicated resource of 6.01 million tonnes averaging 2.23 g/t gold (6.6 million tons averaging 0.065 oz Au/ton) at 0.69 g/t cut-off (0.02 oz Au/ton) with an additional inferred resource of 1.53 million tonnes averaging 1.85 g/t gold (1.68 million tons averaging 0.054 oz /ton (Giroux 2006). The company is in the process of acquiring permits to renew mining at the CGQ mine, with proposed production of up to 500 000 tonnes per year at a grade of 2.23 g/t (0.065 oz. per ton) to be processed at a new local mill. Permitting for a 70 000 tonne per year open-pit mine at Bonanza Ledge, which has an average grade of approximately 8.57 g/t (0.25 oz. per ton), is also underway.

Details of Lode Mine Development

The CGQ and IM mines were initially established by driving exploration adits into the hillside at relatively shallow depths below significant showings; with success, adits were then driven at sequentially lower elevations until eventually a main haulage tunnel was established at the lowest level, allowing gravity feed of ore and tailings through the mill. Drift tunnels followed the veins laterally. Raises were driven upward close to the ore zones, where stopes were developed along with adjacent chutes to carry broken ore to a lower level. From there it was transported to the mill, where the unmineralized rock was separated from the ore and deposited in waste dumps. Mill tailings were discharged into Jack of Clubs Lake, which had previously received millions of cubic metres of silt, sand and gravel from sluice and hydraulic mining on Lowhee Creek.

The main haulage level at the CGQ mine was established at approximately 1230 m (4000 feet) above sea level and about 25 m (80 feet) above Jack of Clubs Lake (Fig. 7). This level, called the 1500, is the footage below the top of Cow Mountain. The main haulage was eventually driven southeast for 3 km (2 miles) to reach the BC shaft at the head of Lowhee Creek. Mine workings were extensive and totalled more than 40 km (25 miles). The vertical distance between levels was 33.8 m (110 feet). Three internal shafts were sunk in the Cow Mountain area to develop and recover ore from below the mine haulage level. The mined ore bodies extended from the top of Cow Mountain to a depth of 370 m (1200 feet).

The IM mine main haulage was also at an elevation of 1230 m (4000 feet) and was called the 4000 level. The vertical distance between levels was 38.5 m (125 feet), in contrast to the CGQ. One internal shaft was sunk and eventually extended down to the 2550 level. Mine workings totalled more than 32 km (20 miles). Ore bodies extended vertically for about 550 m (1750 feet), but little was mined above the Mid Lake (4250) level.

The CGQ mill was a basic cyanide plant, designed by Van H. Smith, consisting of a coarse crusher and ball mill that led to agitation and precipitation tanks. It was designed to treat 68 tonnes (75 tons) a day, with room for expansion, which took place in several stages and ultimately reached 318 tonnes (350 tons) a day by 1940. Ore, averaging 63.1 g/t (1.84 oz. per ton), was ground to -48 mesh and remained in the agitation tanks for 24 hours. The mill eventually reached a 97.1% gold recovery. In 1977, the CGQ mill burned to the ground; arson was suspected.

The IM mill was similar although it initially treated only 45 tonnes (50 tons) per day. It was expanded to treat 90 tonnes (100 tons) per day in its second year of operation. The mill also recovered lead and zinc from the ore.

The MC was developed differently than the earlier mines. An exploration adit (First level) at 1341 m elevation was established above most of the ore and provided access for drill-testing and delineating the ore zones. Then a shaft with a surface headframe was sunk to provide access to the ore, followed by development of internal (Second and Third) levels (Figs. 8, 9d, 18). Later, a large-diameter tunnel was driven southeast to truck ore and waste to a proposed new mill and dump at Jack of Clubs Lake, because the old IM main haulage tunnel was narrow and winding. The lower levels were also later connected to this tunnel by a ramp.

NOTABLE CHARACTERS

Placer Miners

Most who succeeded as placer miners lived high for a while, gambled, and showered others with generosity, but proved poor managers of their money. One of the leaders of the party that led the advance to the Goldfield by crossing the Snowshoe Plateau (Bald Mountain) in the late autumn of 1860 and found gold in Cunningham Creek was the American John Rose. Only three years later he starved to death in the woods while prospecting after he

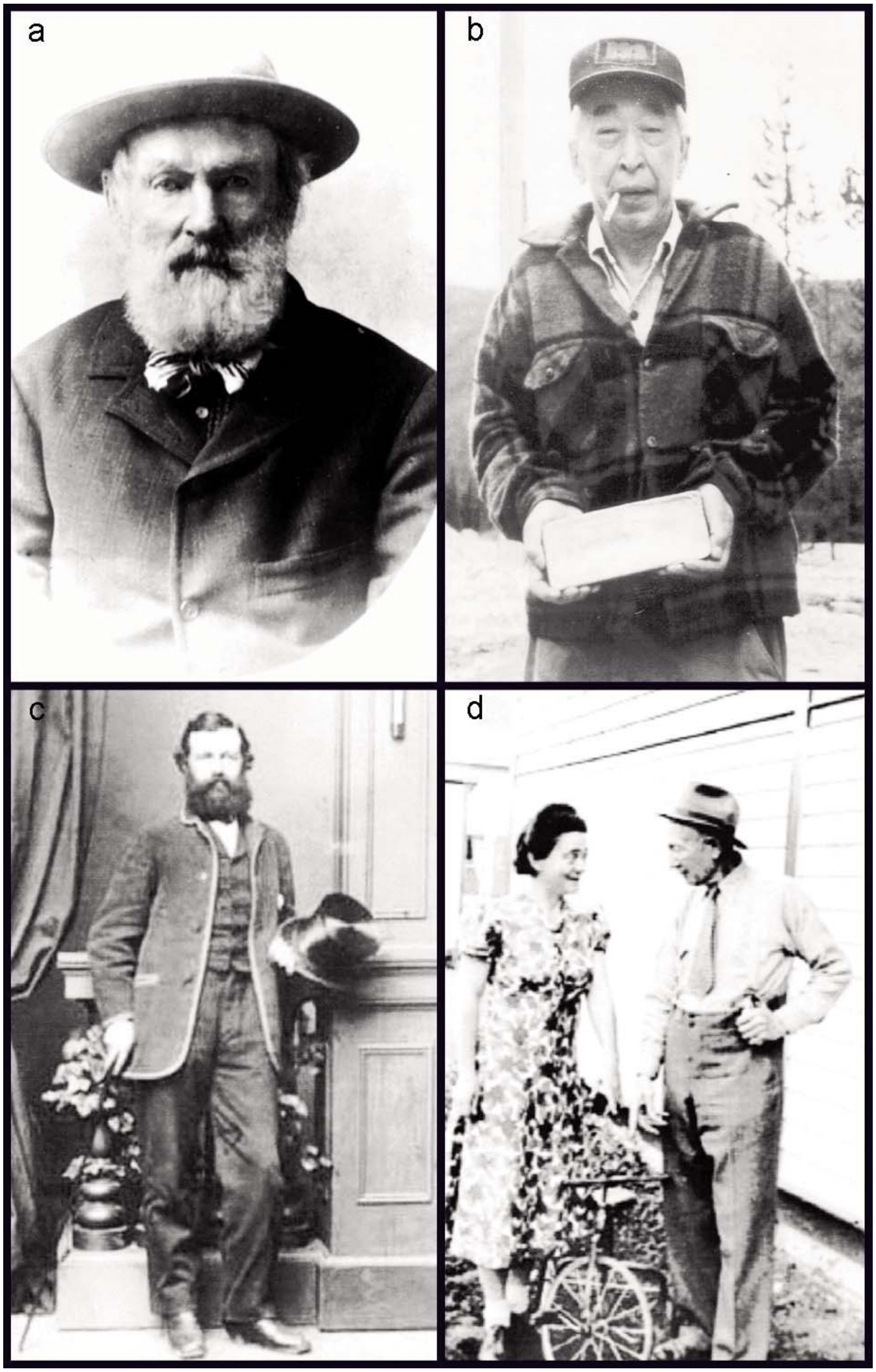

Figure 20. Notable characters of the Goldfield. a) Billie Barker in his prime (BCARS photo A-01144). b) Bill Hong with first gold bar from Mosquito Creek Gold mine, 1981 (Stuart Holland collection). c) Amos Bowman, probably in New York (from family records). d) Fred Wells in his heyday with the wife of his chauffeur.

had run through his money. The other leader, the Cape Breton Scot Ranald McDonald, was an exception, for he retired a wealthy man after only three years of mining. William 'Dutch Bill' Dietz, the discoverer of the rich diggings on the creek named after him, died in Victoria in 1877 as a pauper. Billy Barker, after whom the town of Barkerville was named, was typical of this group.

William Barker was born in Cambridgeshire, England, in 1817 (Moore 1968) and is possibly the best-known of all the Cariboo characters. He worked as a youth on the canals of England so was no stranger to long hours of cold wet work. He had a short heavy body and, although he had a handsome face, he was often the butt of jokes because of his stature (Fig. 12b, 20a). In 1845, Barker abandoned a wife and son in England and immigrated to New York. His wife died not long after, a pauper with syphilis.

That same year, Barker was lured to California by the gold excitement and travelled around the Horn by sailing ship. He had little success in the California goldfield but he learned mining methods and was among those who journeyed to the Cariboo for another try.

In 1861, Barker and his partners staked claims above and below Richfield Canyon on Williams Creek. Regulations forced them to sell one of the claims. They chose to sell the upstream one, which they soon regretted, because the gold was so deep on the lower claim that they initially had little success. His company was out of money and desperate. It is said that Barker managed to borrow $100 from Judge Matthew Bailie Begbie (surely a hard sell) and this loan enabled the partners to continue sinking their shaft (Fig. 12b). At 10 m they encountered good pay on blue clay, and later, at 15 m, they encountered rich pay on bedrock. Thereafter, the Barker Co. members were all rich and in 1863, they reportedly earned $300 000. The adjacent village, which until then had informally been called Mid-Town, was re-named Barkerville. Barker's company was the first to demonstrate that deep mining could be profitable. After his success, Billy spent his winters living extravagantly in Victoria, partying, acting the 'good chap' and getting married again.

In 1868, during the great fire that ripped through Barkerville, Billy Barker is credited with saving a Chinese woman and her two children from being burned to death by the blaze. After 1868, Barker realized he was beggaring himself, so he moved to Clinton to avoid the expenses of high life in

Victoria. In the summers, he continued to prospect in the Horsefly country without success. Later he became ill and was diagnosed in Victoria with cancer of the throat, presumed to have been caused by excessive chewing of tobacco. He moved into the Old Man's Home in Victoria and died in 1894. Crowds attended his funeral but he was buried in a pauper's grave at Ross Bay Cemetery. In 2008, his descendents and other interested persons placed a headstone with a bronze plaque on his gravesite in his memory; the headstone was made of micaceous quartzite cut by quartz veinlets (*Times Colonist* 2008-09-27).

Chinese Contribution

Placer miners were, initially, dominantly Caucasian, and most were British subjects, contrary to what might be expected, as they had come north from California. As production became less rewarding, Chinese miners progressively became more numerous. They had migrated mostly from rural communities in Guangdong Province in southern China, which was suffering great droughts and famine (Morton 1973, p. 5), to work as labourers in railway construction. As the railways were completed, they were laid off and many turned to placer mining. Bancroft (1887) estimated that in 1875 Caucasians constituted 55 percent of the miners but by 1880, Bowman (1886) reported that 80 percent of the miners were Chinese (Table 2). They were prepared to work for less pay and they were secretive and careful with the gold they found. The objective of most was to accumulate enough gold to return to their families and villages in China as relatively wealthy men. They worked hard to do so. Their radical difference in culture and their ability to live cheaply in groups in quite unhealthy conditions, led to their being ostracized to a degree and harshly treated by government (Morton 1973). Nevertheless, many stayed and became British subjects (i.e. Canadians).

One of the Chinese miners, Wong Gar Won, was born in Nam Lung village, Guangdong Province, in 1852 (Hong 1978). He and his two brothers left in 1862 to become hardrock miners in Nevada. In 1880, he decided to come to Canada to prospect for gold. He got to New Westminster and from there walked to Stanley in the Cariboo. He made enough money to start a grocery store in Stanley and later, in 1910, to take his family back to China for a two-year visit.

One of Wong's sons was born in Stanley in 1901 as Wong Mon Hong, with Wong being his surname in the Asian fashion. However, usage in Western society meant that he was listed as W.M. Hong, which was soon transliterated into Wm. Hong, i.e. William Hong. Eventually Hong changed his name legally to William Hong.

William (Bill) Hong worked hard all his life as a placer miner, and in winter he toiled at many other jobs, from cutting firewood to working on the railroads. His first jobs in mining were digging hydraulic ditches, helping to build dams for the thirsty hydraulic mines, and patrolling the facilities for leaks and other failures. Soon he was helping with hydraulic monitors and became a skilled operator in this demanding task. He called himself a 'hydraulic man'. Bill progressed to owning leases (mines) and, with profit and loans, buying and running general and grocery stores in Stanley, Barkerville and eventually in Wells.

Following his father, he took his family of five back to China in 1936. The return was to help establish relations with the Chinese family branch, but also so his children would learn to speak acceptable Cantonese. Bill himself spoke a rapid-fire English that little resembled that of the Queen. Bill returned to Canada in 1937 but some of the family remained longer in China and got caught in harrowing adventures avoiding Japanese invaders. During WWII, Bill worked in Vancouver for Boeing, building Catalina flying boats.

After the war he returned to the Cariboo, where he maintained his association with placer and lode mining. He is shown in Figure 20b holding the first gold brick from the Mosquito Creek mine in 1980. His public involvement included service as a volunteer fireman, which ultimately led to several years as Fire Chief. He climaxed his career by writing his memoirs, focusing on his own and the Chinese contribution to the Commonwealth (Hong 1978).

Geologists

Many geologists, mining engineers and surveyors have worked to unravel the complexities of the geology of the goldfield. Most of their names are in the reference list at the end of this article. However, Amos Bowman was the first and, in many ways, the most interesting. He is scarcely known today in Canada other than by those familiar with the geology and placer deposits of the Cariboo, but his importance is comparable with many of the titans of early Canadian geology (Fig. 20c).

Amos Bowman led an extremely varied and adventuresome life. His father (born Benjamin B. Baumann) was a Mennonite who emigrated, with others, from Pennsylvania to Waterloo County, Ontario. Amos was born there in 1838 and died prematurely in 1894 near Anacortes, Washington, after exposure during fieldwork in the Cariboo (Eby 1895).

While he was a youth, his family returned to Ohio, where he attended Oberlin University. He became a newspaperman under Horace Greeley of the *New York Tribune,* and moved to California to work for the *Sacramento Union*, then a leading paper in the state. Bowman then resumed his education and obtained engineering and mining degrees from Munich and Freiburg. He worked as editor and special correspondent with the Mining and Scientific Press of San Francisco, which later led him to become a party chief with California Geological Survey before its temporary disbandment in 1874. He turned briefly to engineering with the CPR in western Canada, but returned to geology and surveying with the Geological Survey of Canada (GSC). Finally, he became a developer and promoter of the Skagit area of Washington. He named the town of Anacortes on Fidalgo Island after his wife Anna Curtis, latinizing it to match other nearby island names (Eby 1895).

Amos Bowman was hired by A.R.C. Selwyn, Director of the GSC, to assist G.M. Dawson with surveys along the CPR right-of-way in the eastern Cordillera, and with other potential railway routes in the Cariboo. His success in map making and geological surveying and his knowledge of placer and lode mining led to his being sent to the Cariboo Goldfield in 1885 to apply these skills. His project was financed equally by the province and the GSC. Bowman's work in two field seasons, 1885 and 1886, was a *tour de force*. His maps of the placer creeks of the goldfield are still sought after by placer miners for their accuracy, inclusion of detail and insight, and are treasured by collectors for their beauty. His main report was never published and his placer maps were not issued until just after he died. They were probably withheld because the report was sceptical about the potential for lode mining using the technology then available; his preliminary report (1886, p. 382) stated this distinctly. Gold Commissioner Bowron, an influential man at the time, was probably responsible for this delay in publication.

Amos Bowman was the principal source of information on the Cariboo gold rush for H.H. Bancroft's (1887), 'History of British Columbia'. His regional geological mapping, carried out without topographic or geographic reference, is recognized by insiders as showing remarkable insight, and his placer maps have remained the standard reference. His life demonstrates great talents and energy as well as strong personal networking with diverse individuals in the developing west of the USA and Canada. It was said of Amos, "he often impoverished himself to enrich others." Nevertheless, Bowman's work was little noted in the major study of the history of the GSC, *Reading the Rocks,* by Zaslow (1975). The BCGS celebrated Bowman's prowess by naming a prominent massif in the Cariboo Mountains east of Isaac Lake, Mount Amos Bowman (Sutherland Brown 1963).

Lode Prospectors and Developers

Hardrock prospectors and developers had many characteristics in common with placer miners. They were optimistic (often beyond all logic), hard working, diligent, and many were perceptive. Prominent amongst this group in the Cariboo were C.J.S. Baker, A.W. Sanders, F.J. Tregillis and F.M. Wells. Wells typifies the breed.

Fredrick M. Wells was born in 1860 in Island Pond, Vermont (BCARS *ca*. 1965). He came to BC in 1883 to work for the CPR, probably as a surveyor or engineer. He then turned to prospecting and hand-steel mining in many of the camps of southern BC, including the Giant Mascot mine, Rossland camp and elsewhere in the province, such as Surf Point on Princess Royal Island. Fred was a tough, wiry man, as shown by his accomplishments in competitive snowshoe racing: he was champion of southeastern BC from 1898 to 1900.

Fred Wells (Fig. 20d) is most noted for his tenacious prospecting, promoting and bringing the Cariboo Gold Quartz (CGQ) mine into production. He and Fred Tregillus optioned key claims on Cow Mountain from Al Sanders, and those claims became the CGQ mine. After some success with surface showings, he drove adits, which proved unsuccessful, from above Lowhee Creek. However, his persistence led to more prospecting, the creation of the CGQ company, and the raising of significant funds, mostly in Seattle. He knew he needed both money and corporate direction, and consequently recruited two Seattle men, Dr. W.B. Burnett, MD as President and O.H. Solibakke as fiscal agent. Together, and with a little luck, they successfully brought the mine into production.

Fred Wells was a strong-minded man. He initially thought that Douglas Lay, Mineral Engineer with the BC Department of Mines, was denigrating the CGQ, so he refused Department engineers and geologists entry to the mine (Sutherland Brown 1998, p. 45). The rumour was not true and a court case proved Department personnel could not be refused entry. Fred later became enthusiastic about the Department's work and used their reports as advertising.

The town of Wells was named after Fred; late in his life he was recipient of numerous awards as the "Grand Old Man of BC Mining" from the Canadian Institute of Mining and Metallurgy (including life membership in 1953), and from the BC and Yukon Chamber of Mines.

THE IMPORTANCE OF THE CARIBOO GOLDFIELD

Development of Infrastructure

Initial transport to the goldfield was by a combination of foot, canoe or dog sled and the route taken was to Keithley Creek and over the Snowshoe Plateau. The cost of freight in Barkerville in 1861-2 was 30 cents a pound. Flour cost $72 a barrel and bacon 68 cents a pound. The apparent richness of the terrain and the expected continuance of high yields led Governor Douglas of the colonial administration to request help from the Imperial government to construct a wagon road through the Fraser Canyon. Surprisingly, a company of Royal Engineers was soon in British Columbia, planning and building the tough part of the road to the goldfield. Even before its completion in 1864, coach and freight lines reduced travel time to a week's hard, dusty slog from Yale (Fig. 1).

Road access slowly improved but the north was not served by an excellent system of asphaltic highways until the 1950s under the W.A.C. Bennett government. These highways reduced the time of the journey from Vancouver to just one long day. Occasional seaplane service to Jack of Clubs Lake started on demand in 1926 with the famous bush pilot, Ginger Coote. Access is unchanged today. Principal use of the roads is now by loggers extracting the beetle-damaged forests or by tourists bound for the Barkerville Heritage Park and/or a canoe trip around the chain of lakes within Bowron Lake Park to the east. Daily scheduled flights from Vancouver to Quesnel, followed by road transport to Wells, have cut current travel time to several hours.

Other elements of infrastructure were installed during mining booms and many went out of service during economic downturns. Telegraph service started about 1863, enabling the *Cariboo Sentinel* newspaper to publish from then until 1875. Two or three other newspapers were published in the area for shorter times. Telephone service started in the early 1930s. Radio reception was unreliable even in the 1950s.

Electricity was supplied by a number of small plants until the CGQ mine installed its Ruston diesel-powered generator *ca*. 1930. Barkerville had its own power company around the same time. The BC Power Commission took over power supply for the area in the 1950s, when BC Hydro was established.

Water for Barkerville came from Williams Creek, or from wells for a short time in the earliest days, but turbidity and water-borne disease led to a system based on springs at the base of Barkerville Mountain. Water for the mine plants in Wells was pumped from Jack of Clubs Lake, but most residents drilled their own wells until the townsite provided water from Red Gulch. Later, water again came from a municipal well.

Both Barkerville and Wells had post offices, almost from their inception, as well as libraries. The first hospital was established at Marysville in 1863; this was succeeded by the Royal Cariboo Hospital (RCH) in 1866 until it burnt down in 1936. A private hospital had been opened in Wells two years before, so the RCH was not rebuilt. The Wells hospital closed in 1964.

Locals developed ski facilities on Cow Mountain in the 1930s, including a rope tow and a ski jump that was used for a national championship late in the decade. Likewise, hotels were built in the earliest days. Kelly's in Barkerville remained in operation until 1955, when the longtime owner died. Two hotels were built in Wells during the lode mining heydays, the Wells and the Jack of Clubs. They both had pubs and dining rooms. The latter hotel burnt down in 1994 but the Wells still provides good service.

Geological and Mining Innovations

Study of the geology of the Cariboo Goldfield for 120 years has generated a host of ideas on how to explain the complicated geology, structure and origin of mineralization. Skerl (1948) identified a boundary defining the downward extension of the ore zone that he suspected marked a structural break of regional extent; however, he was unable to conclusively demonstrate this at his detailed scale of mapping. Benedict (1945) recognized major isoclinal overturned folds where previous interpretations had indicated a single, very thick, inclined sequence. Sutherland Brown (1957) recognized the anomaly of eugeosynclinal (ophiolitic) sequences inboard of miogeosynclinal (platformal) sequences but proposed no explanation. Struik (1988) provided a structural explanation, elaborated on the concept of terranes, and explained the significance of terrane accretion. In addition, he refined the age limits of the host rocks and provided tighter constraints on related structural events. Ash (2001) attempted to demonstrate the presence and inherent significance of ophiolitic rocks on lode gold mineralization at the camp scale. He suggested that low-sulfide gold-quartz vein mineralization, distinct from that mined from the lodes but characteristic of that recovered from the placers, was originally hosted by hanging-wall ophiolitic rocks that have since been eroded.

Bowman's (1886) initial study may be the earliest example of formal co-operation between federal and provincial mining agencies. Since that time, the Geological Surveys of both governments have alternately studied the area, and cooperation between the two agencies has been the norm.

Social Impact

Towns that arose in the Cariboo were the first truly multiracial communities in the province and the first not dominated by a British elite element. The population was derived from five main groups. The largest group came by ship from California; it was multiracial but contained a surprising proportion of British subjects, such as Billy Barker and Cariboo Cameron (Begg 1894). The group that came by land from the south mostly consisted of American horsemen and stockmen. The group that came from Montreal and southern Ontario, commonly referred to as Overlanders, were the true Canadians; most of these were British but some were of Québecois descent (McNaughton 1896). A small number of Victorian British came but they were mostly officials, not miners. These groups were later joined by the Chinese, whose numbers increased substantially after they were laid off from railway construction. There were no aboriginal communities in the Barkerville area but they maintained summer hunting and fishing camps near Quesnel Lake to the south.

The communities developed with a large measure of racial harmony within a regime of law and order created by Governor Douglas, and enforced by Judge Begbie and a small police force; the latter was created in 1858 and eventually became the BC Provincial Police when the province entered Confederation. Surprisingly, there was little need for enforcement. Violent events were rare, and life in the wilderness was conducive to getting along together. Firearms were only used for hunting, in contrast to US frontier towns. Drinking, gambling and prostitution were common, but not a major problem. There were few married women in the Goldfield until after 1865. Most of the growing Chinese community lived separately, but it was well integrated. A library opened in Barkerville in 1865 and was well-used. Hard work was the driving force of the community except in deep winter, when many of the fortunate escaped to Victoria.

Well-known Canadian artist, W.G.R. Hind, who actually prospected in the Cariboo, painted the picture shown on the front cover of this issue of *Geoscience Canada*. The image depicted in the painting, the miner panning gold, is realistic: conifer forests, rocky creeks, no firearms and no donkey. In the earliest days, leather-bagged gold was transported to Victoria banks under an armed escort (Fig. 15a), but this soon proved unnecessary as the BX Express guaranteed delivery for a shilling an ounce. This safety from robbery continued into the era when gold bars were produced by the lode mines and sent by express to banks in Vancouver.

Environmental Considerations

Placer mining in the 19th century involved little consideration of the environment. The area was complete wilderness and there was lots of it. Also, knowledge of the detrimental effects of pollutants, chemical or otherwise, was slight, so little effort was expended to contain them.

A large artificial delta was created at the east end of Jack of Clubs Lake by millions of cubic metres of tailings flushed out of the hydraulic mine on Lowhee Creek. Entire valley bottoms were re-sculpted by placer operations, as typified by Williams Creek. The forest adjacent to Barkerville was clear-cut to provide housing and structural timber for the mines (Fig. 15c). Many miners suffered from silicosis until aluminum dust treatment was introduced in the late 1940s.

In the 1970s and later, environmental sensitivities greatly increased. Environmental mining laws were upgraded and enforced by the BC Ministry of Energy, Mines and Petroleum Resources. No hydraulic mining is now permitted and no placer mining is allowed within 10 m of a creek. Discharge of mud and silt must be contained in adequate settling ponds and deleterious materials are monitored and severely restricted.

Economic and Political Impact of the Cariboo Goldfield

British Columbians for generations have been taught that the province was created by the fur trade and developed and sustained by forestry. In fact, it was mining that led to the political development: first to a Crown Colony, then progressing to a Canadian province. The gold rush initiated the evolution; coal mining on Vancouver Island confirmed it. Likewise, the development of four gold mines in the 1930s saved the province from bankruptcy when forestry and other industries had collapsed. The placer gold rush was the trigger to political development; the new lode gold mines the saviour from a financial and economic debacle (Sutherland Brown 1998).

Although the Cariboo Goldfield was considerably less rich than its Californian equivalent, the Cariboo discovery had a geopolitical importance significantly beyond its absolute size. The existence of major gold placer deposits in the northern Cordillera triggered the development of the territory now known as British Columbia. This terrain had existed as a relatively thinly populated region of aboriginal tribal associations living in only the most salubrious sites rich in bulbs, berries, game and fish. The land was then subject to incursion by British (mainly Scottish), French-Canadian and Metis fur traders under the suzerainty of the Hudson Bay Company (HBC). The discovery of the goldfield propelled the territory towards organized colonies under the British Crown. Had it not been for the gold rush in the northern Cordillera and the spread of miners north from California, it is unclear what form of government or political alignment might have been established in what is now British Columbia. As it happened, the HBC and the Foreign Office of the United Kingdom were alert to the danger of losing more territory to American adventurers and settlers who may have supported the United States philosophy of 'Manifest Destiny' (Bancroft 1887; Rickard 1947; Ormsby 1959). However, Governor Douglas was a man of foresight and initiative. He quickly established, on rather tenuous legal grounds, law and order and an administrative system with fees for access to the Fraser River, land, and mining claims. This led to the rapid establishment of two Crown Colonies (first Vancouver Island and then British Columbia). The colonies were soon combined as British Columbia to save administrative costs, and not long after, they united with the Dominion of Canada to form the Province of British Columbia. Hence, the gold rush and its consequences were very influential in establishing the Dominion of Canada from 'Sea to Shining Sea'.

The production of gold from the new lode mines in the 1930s was vital in the sustenance and recovery of British Columbia, and hence Canada, from the ravages of the Great Depression. Against the trend, gold buoyed the economy of the province, which was virtually bankrupt: industry had collapsed; forestry, manufacturing, agriculture, the fishery and even lead–zinc–silver mining in the Kootenays all had contracted severely. Unemployment was rampant. But during the worst of the depression, four gold mines sprang into production in the Cariboo and Bridge River. The mines led to the creation of the new town of Wells, sustained the economy of central BC, and in many ways saved the province, as there was not a great deal of consistent help from Ottawa (Ormsby 1959; Struthers 1983).

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Sutherland Brown worked in the area fifty-five years ago. During his field studies the co-operation of mine managements and staffs was generous and vital, particularly that of Marcel Guiguet, mine manager of CGQ, James A. Pike, mine manager of IM and George Gilbert, CGQ geologist. Sutherland Brown's association with Stuart Holland started his research in the Cariboo and was pivotal in his career.

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