RESEARCH AND EXPLORATION IN THE BRIDGE RIVER MINING CAMP (92J/15, 16)

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KEYWORDS: Regional geology, Bridge River, mineralization, geochemistry, conodonts, geophysics, ammonites, age dating.

INTRODUCTION

The Bridge River mining camp comprises approximately 1500 square kilometres of heavily staked terrain in the Bridge River drainage basin between the Shulaps ultramafic body on the northeast and the Coast Range batholith on the southwest. This area was mapped at 1:20 000 and 1:50 000-scale during the summers of 1986, 1987 and the early part of the 1988 season (Church and MacLean, 1987a; Church *et al.*, 1988). More detailed mapping and mineral studies were completed on the major mining exporation properties (Church, 1986, 1987a, b; Church and MacLean, 1987b; Gaba and Church, 1988; Hanna *et al.*, 1988).

The first contributions to the geology and mineral deposits of the area were by the Geological Survey of Canada, especially the publications of Cairnes (1937, 1943) and more recently Roddick and Hutchison (1973) and Woodsworth (1977). Papers by Joubin (1948), Bacon (1978) and Barr (1980) give an overview of mineralization from the vantage of the mineral exploration industry. The university-based studies of Harrop and Sinclair (1985); Maheux *et al.* (1987); and Leitch *et al.* (1988) provide research data and modern interpretations of the mineralization.

The object of this study is to re-evaluate the mineralization and geology of the Bridge River mining camp in the light of new mining activity in the area. The rationale for the regional mapping completed to date was to fit the numerous mining claims comprising the camp to the geological setting (Church, 1987a; Church *et al.*, 1988). The study updates lithological and structural interpretation of the region providing a framework for further mineral investigations. Control of the mapping is based on approximately 200 traverses and 3000 geological stations scattered across the area.

PHYSIOGRAPHY AND GLACIATION

The Bridge River mining camp covers much of the intervening area between the grey crags and serrated ridges of the Coast Mountains west of the towns of Bralorne and Gold Bridge and the less rugged Chilcotin Ranges north of Carpenter Lake. Elevations diminish from a maximum of 2880 metres at the summit of Mount Truax to the local base level of 650 metres at Carpenter Lake (Figure 1-13-1).

The episodic history of recent uplift and erosion in the region can be gauged in part from the evidence of concordant summits such as viewed locally in the Coast Mountains and the upland surfaces commonly seen in the Chilcotin Ranges. The evidence from buried erosion surfaces is more fragmented and difficult to interpret, nevertheless, the mesa-forming plateau basalts on Mount Noel (dated 18.7 ± 0.7 Ma, this study), at an elevation of about 2400 metres, seem to correlate with the basalts of the Chilcotin Group located 40 kilometres to the north, at roughly the same elevation on Cardtable Mountain and Castle Peak. These outliers are considerably higher in elevation than equivalent lavas exposed to the east on the Interior Plateau, suggesting relative uplift of more than 1500 metres in the Coast Mountains in post-Miocene times.

Near the end of the Pleistocene, the broad Cadwallader valley above the present location of the Pioneer mine was filled with melting ice which drained northwest, depositing much sand and gravel en route to its confluence with the Hurley River. These alluvial deposits were subsequently cut through to bedrock by Cadwallader Creek intercepting its antecedent channels which are now favourable targets for placer exploration.

RESEARCH

New mapping supported by laboratory analyses and research has facilitated interpretation of the structural history of the region.

A significant contribution of the project was to confirm the presence of major units of the Cadwallader Group east of the Eldorado–Taylor basin suture. This north-south lineament, lying roughly between the Eldorado and Taylor Creek basins, was interpreted to be a line of mid-Jurassic docking between the Cadwallader and the "Bridge River" terranes. We now know that significant parts of the Cadwallader lie well within the limits of the so-called Bridge River terrane, suggesting a former broad superposition of the former rocks on the latter. Examples of these outlying Cadwallader rocks are the thick accumulations of Pioneer pillow lavas and Hurley sedimentary beds in the area centred 4 kilometres southwest of Liza Lake, and an area underlain by Hurley conglomerates adjacent to the Shulaps complex 3 kilometres northeast of Liza Lake. Numerous other smaller slices and wedges interpreted to be Cadwallader and younger rocks, containing Late Triassic to Early Jurassic radiolaria (Cordey, 1986) or conodonts, are found throughout the map area, testifying to a complicated paleogeographic and tectonic history.

The sampling of carbonate beds for conodonts has generally confirmed that units assigned to the Cadwallader Group are of Late Triassic age (Table 1-13-1, Figure 1-13-2). Recov-

British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork, 1988, Paper 1989-1.

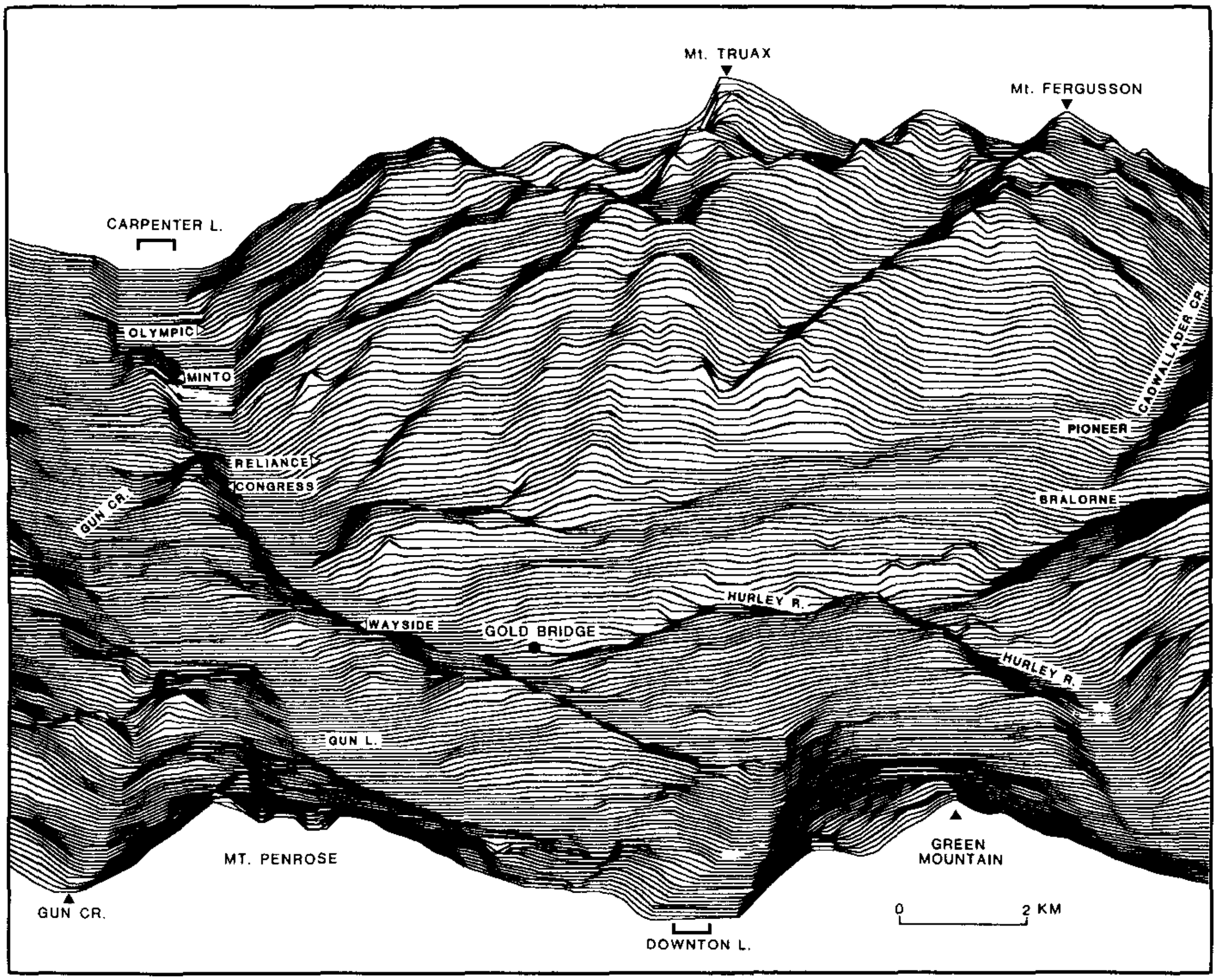

Figure 1-13-1. Panoramic view of the Bridge River mining camp (looking east).

ery of conodonts from rocks mapped as Fergusson Group (Bridge River complex) has been generally negative, these rocks commonly being markedly recrystallized and severely affected by dynamic metamorphism.

The few exceptions to the conodont results are the Late Triassic fauna found in the carbonate lenses intercalated with Fergusson-like ribbon cherts and phyllites near the mouth of Tyaughton Creek and southwest of Marshall Lake (Cameron and Monger, 1971; Table 1-13-1, No. 4, this study) and radiolaria interpreted to be Late Triassic to Early Jurassic in age from several localities along Carpenter Lake (Cordey, 1986). From this evidence it appears that some facies of the Fergusson are younger than similar rocks in the Gold Bridge area cut by the Bralorne intrusions (Permian). Consequently it is believed that part of the Cadwallader and Fergusson groups may have been formed penecontemporaneously – the Cadwallader rocks characterizing the clastics and volcanics of arc-type deposition and the Fergusson rocks a more distal ocean basin environment. The unifying elements in the two groups may be the associated volcanic rocks – the pillow

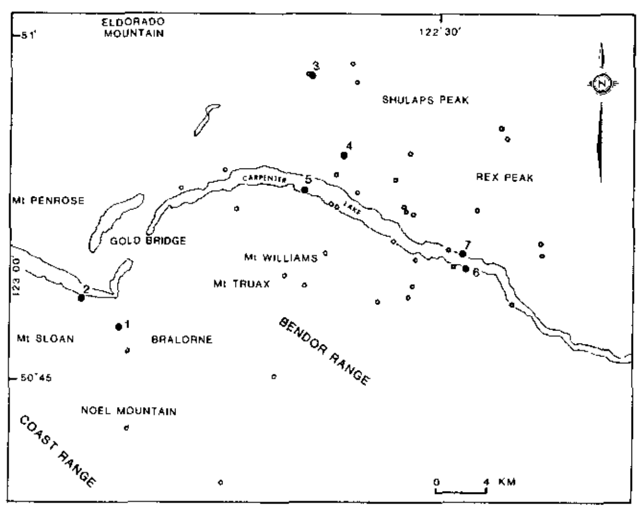

Figure 1-13-2. Conodont sampling stations.

TABLE 1-13-1
NEW CONODONT LOCALITIES

Sample No.	UTM Easting	UTM Northing	Location	Taxa	Age
1	5092	56266	Gwenyth L.	*Epigondolella abneptis* *Neogondolella sp.*	early Norian
2	5062	56289	Downton L.	*Neogondolella navicula*	early Norian
3	5206	56481	Liza L.	*Epigondolella sp.*	Norian
4	5273	56402	Marshall L.	*Epigondolella abneptis* *Neogondolella navicula*	early Norian
5	5374	56315	Carpenter L.	*Paragondolella polygnathiformis*	Late Carnian
6	5244	56374	Carpenter L.	*Neocavitella? sp.* *Paragondolella ex. gr. polygnathiformis*	Carnian
7	5374	56326	Carpenter L.	*Epigondolella? sp.*	Late Triassic

lavas and aquagene breccias of the Pioneer Formation, and the Noel Formation consisting mostly of thinly bedded turbidites. Both formations occur in the lower part of the Cadwallader Group and appear to be either intercalated, intruded or in-faulted into the Fergusson Group.

From Chayes and Velde (1965) it is expected that volcanic rocks from different tectonic settings would show different chemical signatures, that is, that the arc phase of the Pioneer volcanics should be chemically different from the ocean-basin or back-arc phase. However, silicate analyses of fresh-looking pillow lavas and aquagene breccias from a variety of localities indicate simply basaltic composition showing no trends or significant differences in major oxides or titania (Table 1-13-2, Figure 1-13-3).

Leitch and Godwin (1988) have inferred that the Bralorne intrusions (Permian) feed some of the older volcanic rocks, although they could not distinguish these in the Bralorne area. It is possible that some of these missing volcanics are a metamorphic facies of the Fergusson Group such as the amphibolites found with the schists in the Piebiter area and within the phyllites on Mission Ridge in the headwaters of Jones and Bighorn creeks. Figure 1-13-4 shows a clear discrimination between the Bralorne gabbros and the Pioneer basalts on a titania versus felsic index (quartz and orthoclase and albite) plot, the major variable in the index being sodic feldspar (albite). Furthermore, the Bralorne intrusions display a strong anorthositic to mafic cumulate trend (Figure 1-13-5, Table 1-13-3), a feature not shown by the Pioneer volcanics of the Cadwallader Group. Clearly, the Bralorne plutonics (and possibly related Fergusson effusives) are distinctive and seem to fit the ophiolite association: ultramafics, gabbros with soda metasomatism, and cherts.

The Relay Mountain Group is superimposed (unconformable and faulted) on the Permo-Triassic geology adding to the tectonic complexity of the region. The main exposures are near Spruce Lake and in a large downfaulted block of shales and polymictic conglomerate that contains clasts of

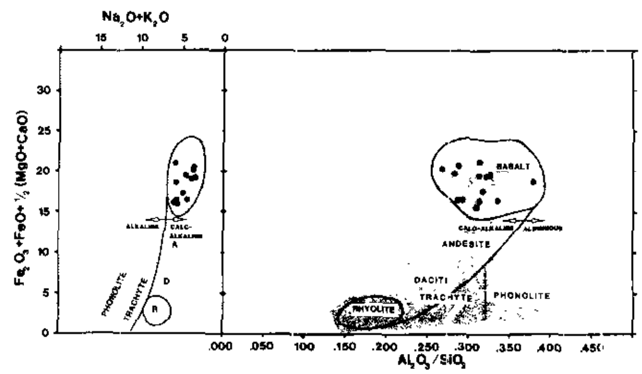

Figure 1-13-3. Variogram showing compositional clustering of pillow lavas and breccias.

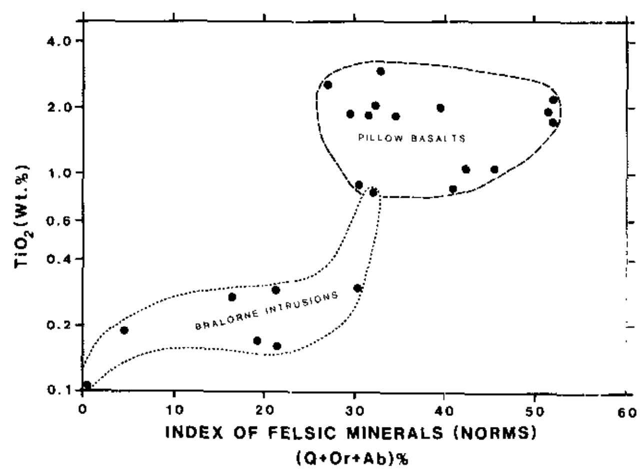

Figure 1-13-4. Compositional range showing discrimination of Pioneer volcanics and Bralorne intrusive rocks.

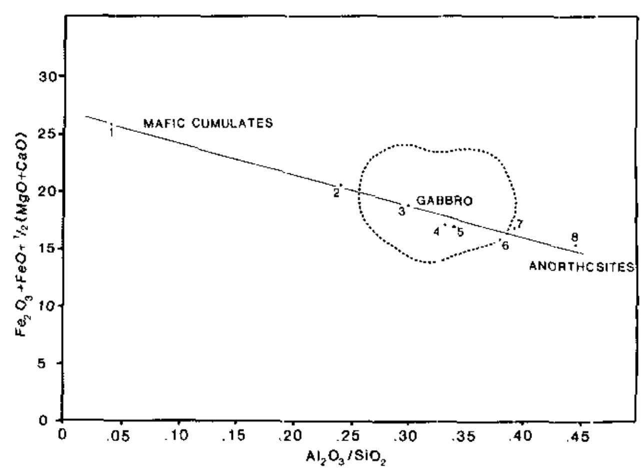

Figure 1-13-5. Cumulate mixing curve for Bralorne intrusions and related plutonic rocks.

TABLE 1-13-2
ANALYSES OF PIONEER VOLCANIC ROCKS

	1	2	3	4	5	6	7	8	9	10	11	12	13
Oxides recalculated to 100:													
SiO_2	44.21	45.10	47.21	47.40	47.47	48.22	48.70	48.92	49.19	49.96	50.32	51.31	52.59
TiO_2	1.88	2.58	2.00	1.82	0.88	1.09	2.20	1.86	2.05	2.99	1.73	1.09	1.96
Al_2O_3	14.02	14.25	13.54	12.74	15.63	15.38	16.41	14.19	15.47	16.13	15.84	14.79	16.42
Fe_2O_3	3.38	4.08	3.50	3.32	2.38	2.59	3.70	3.36	2.70	2.82	3.23	2.59	3.46
FeO	6.81	7.87	8.91	7.99	7.53	7.17	7.94	7.79	6.98	9.57	7.50	6.99	6.55
MnO	0.15	0.17	0.18	0.20	0.18	0.16	0.14	0.15	0.15	0.18	0.13	0.30	0.08
MgO	5.87	6.63	5.90	4.63	9.68	8.24	2.57	7.24	7.87	6.46	4.43	6.10	1.72
CaO	12.16	10.03	6.83	11.49	7.86	5.67	4.84	9.84	11.74	7.72	4.86	6.11	7.65
Na_2O	2.92	2.74	3.44	3.35	3.14	4.61	4.48	3.26	3.35	2.43	4.33	3.94	4.47
K_2O	0.05	0.09	0.85	0.27	0.23	0.29	1.06	0.27	0.50	1.74	1.60	0.36	0.48
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Molecular norms:													
Qz	—	—	—	—	—	—	1.4	—	—	0.6	—	2.7	6.2
Or	0.3	0.6	5.5	1.7	1.4	1.8	6.9	1.6	2.9	10.5	10.1	2.3	3.0
Ab	28.9	26.7	33.8	32.8	29.3	43.5	44.2	30.3	30.3	22.1	41.4	37.7	42.6
Ne	—	—	—	—	—	—	—	—	—	—	—	—	—
An	27.6	28.5	20.8	20.6	29.0	21.4	23.7	24.2	25.6	28.5	20.3	23.1	24.8
Wo	15.6	10.2	6.5	16.6	4.6	3.2	1.1	10.1	13.0	4.2	2.1	3.7	6.2
En	8.5	18.2	15.6	12.9	12.7	4.8	7.8	17.3	6.5	18.1	11.5	18.0	5.0
Fs	2.9	5.7	8.2	7.6	4.2	1.6	7.3	6.2	1.8	8.8	6.6	8.0	5.3
Fo	7.0	1.2	1.6	0.8	11.3	14.3	—	2.6	11.4	—	1.1	—	—
Fa	2.4	0.4	0.9	0.5	3.7	4.9	—	0.9	3.2	—	0.6	—	—
Il	2.9	3.9	3.0	2.8	1.3	1.6	3.4	2.7	2.8	4.2	2.6	1.6	2.9
Mt	3.9	4.6	4.0	3.8	2.6	2.8	4.2	3.6	2.8	3.0	3.6	2.9	3.8

Key to Analyses:

1 – Pillow basalt at beginning of Slim Creek logging road, UTM 5143 56374.
2 – Pillow basalt on south shore of Carpenter Lake, near delta of Jones Creek, UTM 5394 56309.
3 – Pillow basalt with wedges of limestone, north slope of Mt. Truax, UTM 5193 56350.
4 – Pillow basalt on Ranger property, UTM 5173 56334.
5 – Pillow basalt at headwaters of Steep Creek, UTM 5178 56319.
6 – Pillow basalt, north fork of Liza Creek, UTM 5265 56494.
7 – Pillow basalt, road cut on Reliance property, UTM 5155 56360.
8 – Massive greenish volcanics on Ranger property, UTM 5174 56322.
9 – Pillow basalt on summit 0.8 kilometre south of Mowson Pond, UTM 5170 56388.
10 – Aquagene basalt breccia in logging slash 1 kilometre northwest of Gwyneth Lake, UTM 5084 56277.
11 – Pillow basalt at cut on Noaxe logging road, UTM 5189 56480.
12 – Basalt breccia 0.8 kilometre north of Wayside mine, UTM 5119 56368.
13 – Pillow basalt at head of Girl Creek, UTM 5192 56336.

granite in the Truax Creek area – an area shown on previous maps to be underlain by the Bridge River Group. These widely separated outcrops suggest that the Relay Mountain beds were originally continuous across the structural quilt of older terranes. Intercalated shales containing *Buchia* fossils (Church and MacLean, 1987b) correlate generally with Upper Jurassic to Lower Cretaceous *Buchia* and ammonite-bearing beds near Spruce Lake in the northwest corner of the map area (Plates 1-13-1 and 1-13-2). A westerly source of the granitic clasts fits the paleogeographic setting and indicates early uplift and unroofing of the Coast Complex. This proves an earlier development of the southwest margin of the Tyaughton trough than the mid-Cretaceous age proposed by Kleinspehn (1984).

The Taylor Creek Group is a more or less unbroken sequence of sedimentary rocks extending upward from the Relay Mountain Group (Jeletzky and Tipper, 1968). The Taylor Creek Group consists of a broad wedge of mostly coarse polymictic conglomerate (about 1 kilometre thick) exposed in the north part of the map area. The headwall fault of this basin marks the southern limit of the group. The rocks are interpreted to have been deposited in a taphrobasin. Major gravity displacement here is balanced by major uplift in the source are to the southwest. New studies by the authors and Schiarizza *et al.*, and Garver *et al.* (1989, this volume) shed further light on this area, which is underlain by ribbon chert and chlorite-lawsonite-glaucophane blueschists and phyllites, together with sandstones and conglomerate containing clasts from younger formations (Evans and Brown, 1988). The blueschist metamorphism is apparently Permo-Triassic age (Garver *et al.*, 1988). Schiarizza *et al.* propose revision of the stratigraphy and describe overturning and thrusting that was not previously recognized.

STRUCTURAL EVALUATIONS

The results of double derivative filtering of regional magnetic fields for the Bridge River mining camp (Figure 1-13-6) manifest Late Cretaceous to Early Tertiary structures

Plate 1-13-1. *Homolsomites?* from the Relay Mountain Group near Spruce Lake collected by Margaret Hanna and identified by J.W. Haggart, G.S.C. (Early Cretaceous).

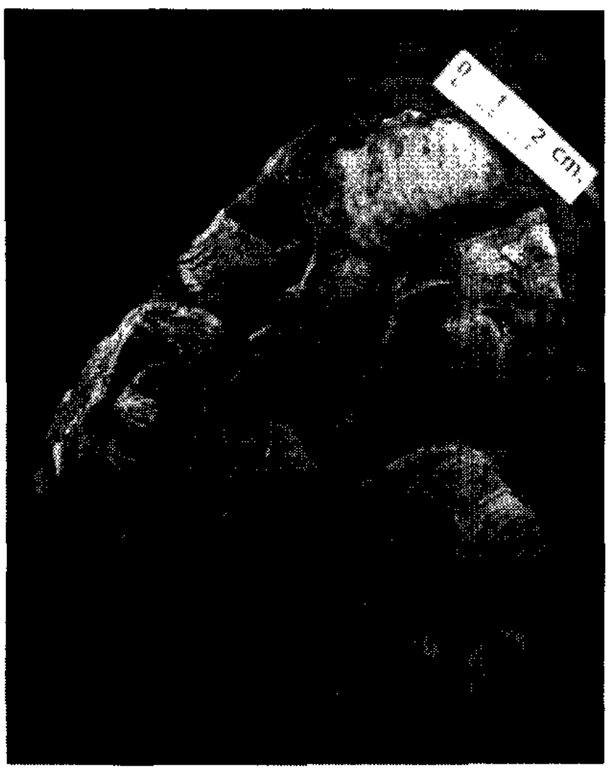

Plate 1-13-2. *Buchia pacifica* from the Relay Mountain Group near Spruce Lake collected by Margaret Hanna and identified by T.P. Poulton, G.S.C. (middle Valanginian).

TABLE 1-13-3
ANALYSES OF BRALORNE INTRUSIONS

	1	2	3	4	5	6	7	8
Oxides recalculated to 100:								
SiO_2	53.25	50.82	51.86	50.45	51.15	49.27	49.19	47.71
TiO_2	0.07	0.19	0.82	0.29	0.30	0.27	0.16	3.17
Al_2O_3	2.19	12.37	15.65	16.90	17.34	19.53	18.86	21.89
Fe_2O_3	1.28	1.68	2.30	1.78	1.79	0.92	1.64	1.66
FeO	6.12	3.78	7.13	3.19	5.63	3.92	3.82	2.78
MnO	0.16	0.13	0.19	0.11	0.15	0.10	0.10	0.07
MgO	19.80	10.10	7.64	9.36	10.30	9.67	10.74	8.60
CaO	17.09	20.20	9.76	14.89	9.27	14.26	11.64	13.16
Na_2O	0.04	0.07	3.51	2.32	3.21	1.62	2.11	1.46
K_2O	0.00	0.02	0.15	0.12	0.37	0.44	0.56	1.04
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Molecular norms:								
Qz	—	3.7	—	—	—	—	—	—
Or	—	0.1	0.9	0.7	2.2	2.5	3.3	6.1
Ab	0.4	0.7	31.5	20.6	28.2	14.3	18.6	12.9
An	5.7	33.7	26.6	34.9	31.7	43.8	39.6	49.4
Wo	31.0	27.0	8.8	15.2	5.3	10.2	6.8	6.0
En	51.9	28.1	18.0	16.3	13.2	14.6	13.2	13.6
Fs	8.1	4.6	7.2	2.2	3.4	2.8	2.3	1.7
Fo	1.3	—	2.4	6.9	11.0	8.8	12.0	7.4
Fa	0.2	—	1.0	0.9	2.8	1.7	2.1	0.9
Il	0.1	0.3	1.1	0.4	0.4	0.4	0.2	0.2
Mt	1.3	1.8	2.5	1.9	1.8	0.9	1.9	1.8

Key to Analyses:

1 – Websterite, on north slopes of Mt. Penrose, 0.4 kilometre west of Jewel Creek, UTM 5038 56389.
2 – Mafic gabbro, Wayside mine area, UTM 5122 56364.
3 – Gabbro, Ranger property, UTM 5170 56322.
4 – Gabbro, on side hill 3.2 kilometres west of Shulaps Peak, UTM 5298 56442.
5 – Gabbro, north spur of Mt. Truax, UTM 5170 56324.
6 – Anorthositic gabbro, B.C. Hydro quarry 1 kilometre north of Gold Bridge, UTM 5110 56340.
7 – Anorthositic gabbro, Wayside mine area, UTM 5170 56363.
8 – Anorthosite, Wayside mine area, UTM 5118 56363.

(Church and James, 1988). A northwest-trending "slice fabric" dominates the region. This consists of panels of Cadwallader and Fergusson rocks (and ramped? ultramafic bodies) bounded by *en echelon* transcurrent fractures subparallel to the Yalakom fault. Lithological correlation across these panels seems to preclude major transcurrent dislocation on known faults such as the Cadwallader break and the Marshall Creek lineament. Early Tertiary effusives such as the northwest-elongate Rex Peak–Mission Ridge pluton (45 Ma) were intruded advantageously along the pre-existing fracture system. Subsequent downward rotation along the same fractures has preserved slabs and wedges of Tertiary volcanic rocks from erosion in the Mission Ridge area and on Big Sheep Mountain.

EXPLORATION

Mineralization in the Bridge River mining camp is widely scattered and hosted in a variety of rock types of different ages; no single geological event or process can account for all of the numerous deposits (Figure 1-13-7).

The Bridge River mining district is known mainly as a vein camp and gold producer. A complicated system of fractures is thought to have controlled the ore deposition. The oldest and

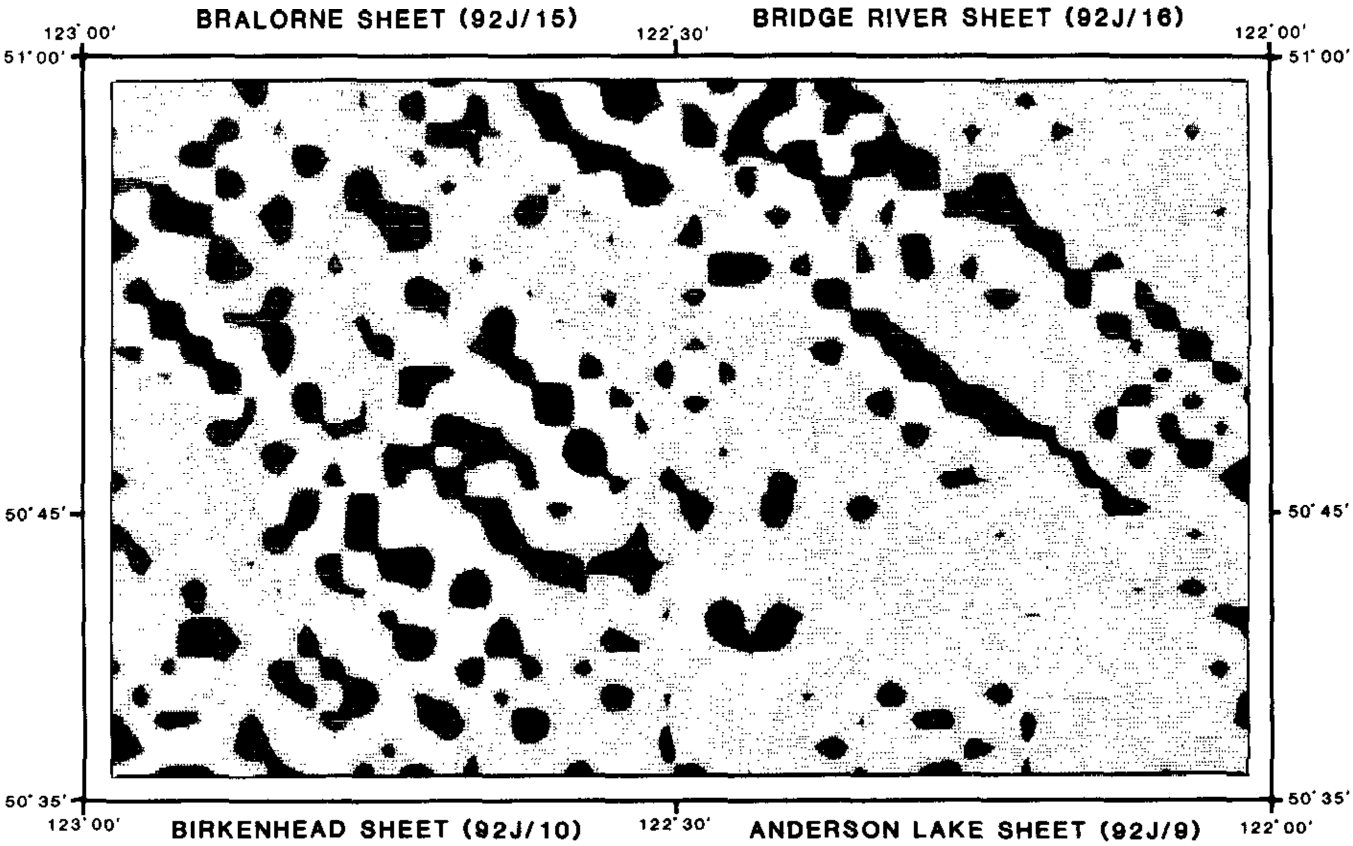

Figure 1-13-6. Double-derivative plot of the total magnetic field based on the G.S.C. regional magnetic Map 8548G – (blank area for values less than 500 /Mi^2 units, dark grey greater than 500 /Mi^2 units).

deepest fault zones appear to be the main solution channels and the site of repeated igneous intrusions. For example, the Cadwallader fault zone, along which the principal mines are located, hosts the Bralorne diorite and soda granite, Bendor-related intrusions and a belt of ultramafic rocks.

The source of mineralizing solutions was considered by Cairnes (1937) to be magmatic; a process of differentiation which also produced the soda granite. The Bralorne diorite (Permian) was thought to be the ultimate source and also the prime host rock of the ore fluids because of the location of these bodies on the major fractures and the brittle, fissure-sustaining character of the rocks. A different model was proposed by Gaba and Church (1988); according to this model the Bendor pluton and associated intrusions (63.4 and 64.3 ± 2.3 Ma, this study) are the source of hydrothermal fluids. The age of the Bendor intrusions is within the definite limits for mineralization (91.4 to 43.7 Ma) set by Leitch *et al.* (1988).

According to Woodsworth *et al.* (1977), mineral zoning in the entire camp is the result of a thermal gradient along the eastern margin of the Coast plutonic complex. They have also shown that the younger outlying Tertiary intrusions were involved in the mineralizing process on a more local scale.

The favourable exploration climate in the Bridge River camp reflects the geologic setting and is manifest by the continuing vigorous exploration activity. Evidence of good mineral potential is also indicated by geochemical sampling. The analyses of moss-mat sediments collected from streams in the camp generally yielded good results and anomalous gold values in several samples. The moss from rocks and logs on the banks and beds of streams provides a relatively uniform sampling of silt and minerals. From a total of 112 samples collected during the 1988 field season 15 yield values greater than 100 ppb gold. These are widely scattered across the camp and suggest some new exploration targets (Figure 1-13-8, Table 1-13-4). All samples were collected between June and August 1988 and were subsequently analysed by ACME Laboratories Ltd., Vancouver. The detection limit on all samples is 1 ppb gold. Replication error on samples collected from a location is usually less than x10.

PROPERTY ACTIVITY

The major exploration programs in the camp are by Corona Corporation at the Bralorne mine (MINFILE 092JNE001) and Levon Resources Ltd. on the adjoining Love Oil claims. Other important programs are by Chevron Canada Ltd. on the Wayside property (MINFILE 92JNE030) on the north shore of Carpenter Lake, and Levon Resources Ltd. on the Congress (MINFILE 92JNE029), Minto (MINFILE 92JNE075), and Olypmic (MINFILE 92JNE092) properties to the east. Westmin Resources Limited has initiated a program on the Bristol property (MINFILE 92JNE071) on Tommy Creek 20 kilometres east of Gold Bridge. There is also continuing activity and interest in the Summit property (MINFILE 92JNE035) southwest of Marshall Creek and the Elizabeth-Yalakom property (MINFILE 92OSE012) in the Shulaps area.

The main target of investigation by Corona at Bralorne is the 51B footwall vein. The geological setting of the Bralorne veins has been described by Joubin (1948) and Campbell

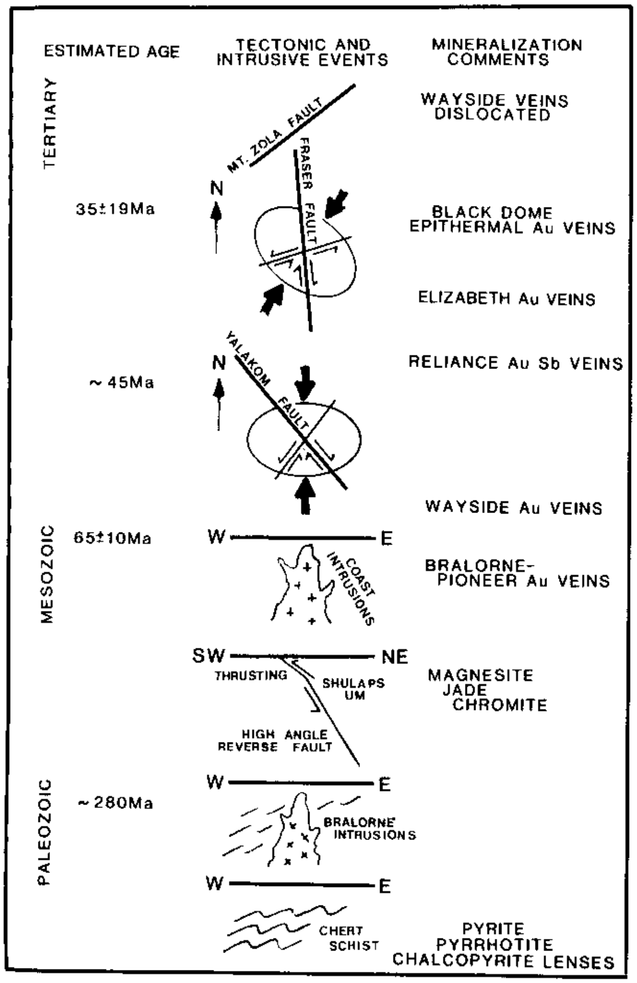

Figure 1-13-7. Some aspects of the structural evolution and mineralization in the Bridge River camp.

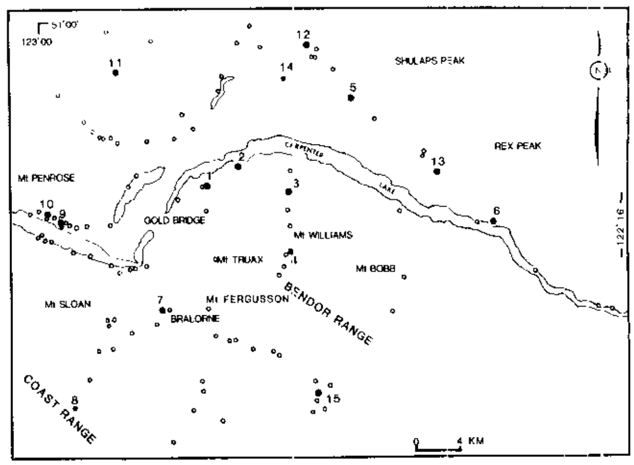

Figure 1-13-8. Moss sampling stations (see Table 1-13-4).

TABLE 1-13-4
GOLD IN MOSS GEOCHEMISTRY

Sample No.	UTM Northing	UTM Easting	Gold ppb	Location Stream
1	5147	56356	212	Steep Cr.
2	5173	56373	164	Girl Cr.
3	5220	56349	592	Unnamed
4	5219	56298	137	Unnamed
5	5274	56432	204	Liza Cr., east
6	5395	56323	592	Jones Cr.
7	5108	56251	913	Carl Cr.
8	5028	56167	245	Unnamed
9	5018	56324	1103	Unnamed
10	5006	56329	1347	Unnamed
11	5067	56455	133	Eldorado Cr.
12	5235	56475	225	Liza Cr., west
13	5350	56368	105	Marshall Cr.
14	5223	56424	165	Tyaughton Cr.
15	5242	56178	274	Cadwallader Cr.

(1975). Over the past several years the 51B vein has been tested by surface drilling (72 holes) and underground drifting on the 400 and 800 levels. This is one of several partially developed veins, the relics of previous mining that are cut off by the Empire fault. Matching the veins across the fault has been an ongoing endeavour. A comparison of fracture patterns across this fault shows a rotation of the principal vein fissures from 118°/45°NE east of the fault to an average attitude of 105°/66°NE west of the fault. This appears to be the result of a small rotation on the fault of about 10 degrees. More research is needed to determine the net slip on the fault.

The new Taylor Cabin discovery by Levon on the Love Oil property has added more interest to the area. The discovery (late 1987) is a quartz vein on the Cosmopolitan Crown-granted claim (latitude 122°47′20″ north, longitude 122°48′40″ west). This is adjacent to the old King workings at the Bralorne mine. The vein is about 1 metre wide and has an attitude of 130°/60°NE. A 3-metre sample across the vein and weathered microdiorite host rock reportedly assayed 60 grams per tonne gold. An arsenopyrite-rich grab sample from the same vein, assayed in the Ministry laboratory, returned gold 332.9 grams per tonne, silver 69 grams per tonne, copper 55 ppm, lead 0.75 per cent, zinc 0.45 per cent, arsenic 2.40 per cent, and antimony 0.11 per cent. Exploration is continuing in the area underlain by the pyritic microdiorite which is well mineralized with quartz veins and stringers. By October 1988 a crosscut was completed intersecting the vein below the regolith.

On the Wayside property, Chevron has completed a two-year program of exploration (21 drill holes) to locate the faulted extension of the Wayside vein and other mineralization. The Wayside mine is near the north end of the "Cadwallader Break" which is an old northerly trending fault system that hosts many igneous intrusions and the principal ore deposits in the camp (Gaba and Church, 1988). The peculiar left-hand movement on the Cadwallader fault appears to be the result of emplacement of the Bendor pluton. It is speculated that lateral forces developed from the rising Bendor intrusion may be responsible for the easterly directed vein sets in the Bralorne-Pioneer area and the northerly oriented veins at Wayside. In the Wayside area, a northeasterly trending fault – known locally as the Mount Zola fault – has displaced a segment of the Bralorne diorite and the Wayside vein. Preliminary results of a fracture study in the diorite north and south of the fault provide an estimate on the attitude and amount of rotation on the Mount Zola fault of 052°/35°SE, and 35 degrees respectively. Strike slip on the fault is dextral with total offset of about 1 kilometre.

Studies have also been completed on the Summit, Minto, and Congress properties on the north side of Carpenter Lake (Church, 1986). Each of these mining areas has a characteristic fracture pattern which controls the mineralization. Northerly trending gash fractures at the Congress and Minto mines coincide with the principal ore zones (Figure 1-13-9). Mineralization in the Summit area is mainly galena, sphalerite, arsenopyrite and pyrite on small north and northeasterly trending fissures (077°/64°SE). The absence of stibnite distinguishes this property from Congress and Minto. A basic similarity in fracture frequencies on all three properties, particularly the northerly trending fracture set, may be related to the stress field associated with the Yalakom fault system.

On the south side of Carpenter Lake the Bristol, Reliance and Olympic properties are the focus of significant exploration programs. These are vein properties where an understanding of the local fracture pattern is important. Each property is geologically unique and in a distinct fracture domain. On the Bristol property mineralization appears to be related to small gash fractures (020°/80°SE) feathering from shears trending 045°/81°SE. The main cross-fracture direction is 107°/78°SW. On the Reliance property there are two principal shear directions, 150°/82°SE and 036°/54°NW; mineralization is mostly related to the latter. Ancillary cross-fractures are 168°/59°NE and 022°/88°NW (Hanna, *et al.*, 1988). On the Olympic property the southeasterly trending fractures (107°/66°NE, 126°/80°SW and 133°/48°SW) are related to dykes, mineralization and shear zones. The principal cross-fracture trend is 022°/60°NW.

The Elizabeth-Yalakom property, in the heart of Shulaps range, has been intermittently developed since 1934 (Gaba *et al.*, 1988). The targets of previous work and current exploration are gold-bearing quartz veins in two adjacent

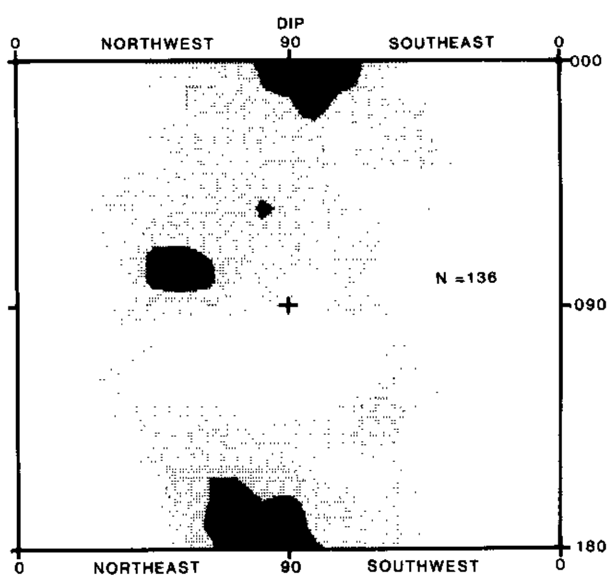

Figure 1-13-9. Fracture-frequency plot for the Congress and Minto properties.

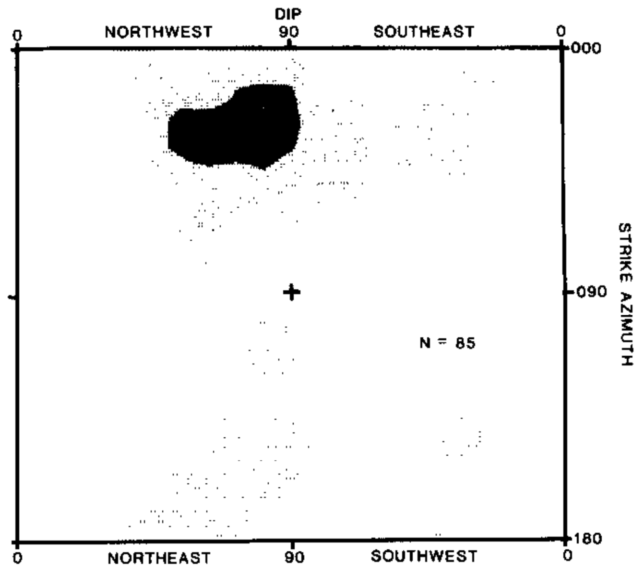

Figure 1-13-10. Fracture-frequency plot for the Elizabeth-Yalakom property.

biotite feldspar porphyry bodies (58.4 ± 2.0 Ma, this study) intruded into ultramafic rocks. A detailed study of the fracture pattern in these bodies shows a general correlation with the stress field of the Fraser River fault system (Church, 1987c), that is the principal veins and joints strike northeast averaging 034°/67°NW (Figures 1-13-7 and 1-13-10).

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