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BEMA INDUSTRIES LTD. | 19790-88 AVENUE, R.R.4 LANGLEY, BC. V3A4P7 (604)888-9300

A GEOLOGICAL COMPILATION

OF THE

PACIFIC EASTERN CROWN GRANTED CLAIMS
BRALORNE, B. C.
92 J 15/W

FOR

MONITOR RESOURCES LTD.
LANGLEY, B. C.

BY

R. J. BARCLAY
BEMA INDUSTRIES LTD.

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1.0 INTRODUCTION

1.1 TERMS OF REFERENCE

Mr. T. Martin of Monitor Resources Ltd. has engaged Bema Industries Ltd. to compile published information on the Pacific Eastern Claim Group and to assemble it into an exploration concept to further sample and evaluate the gold bearing zones if warranted.

The above requirements have been fulfilled and our terms of reference with Monitor Resources are concluded with the preparation of this report.

1.2 LOCATION AND ACCESS

The Pacific Eastern Claim Group is situated 160 Kilometers north of Vancouver and lies adjacent to the southeast of the former producing Bralorne-Pioneer Mine on Cadwallader Creek (Figure 1). The claims extend south-westerly up Cadwallader creek and cover the south slope of the creek for 8 kilometers to Aggie and Chism Creek.

Access is by a gravel road along the northeast side of Cadwallader Creek from Bralorne but is presently in disrepair.

1.3 TERRAIN

The elevation of the claim group is from 1,200 to 1,500 meters and topographically is an area of steep relief with tree covered slopes, various creeks drain into Cadwallader. The main area of interest lies in the valleybottom and is covered with up to 75 meters of glacial till which to date has made surface exploration difficult.

2.0 CLAIM STATUS

Monitor Resources Ltd. holds title to 59 crown granted mineral claims and 27 fractions covering 2,958 acres. The mineral land taxes amount to $747.50 per year and are of this date in good standing.

The following list gives the legal description of each claim and its folio number, figure 2 outlines the claim group and its relationship to the adjoining Bralorne-Pioneer ground.

Mining Division and Land District	Folio	Lot No.	Claim Description	Kamloops L.R.O. C. of T.
Lillooet	32395	5659	Besance	68605F
Lillooet	32395	5658	Mac Fraction	68606F
Lillooet	32328	6169	Diorite	68619F
Lillooet	32328	6174	Jackson Fraction	68593F
Lillooet	32328	6170	Augite	68596F
Lillooet	32328	6167	Last Fraction	68597F
Lillooet	32328	5652	Six Eight Fraction	68391F
Lillooet	32328	5651	Foursix Fraction	68855F
Lillooet	32131	5569	Twofour Fraction	68856F
Lillooet	32131	5565	Justrite	66354F
Lillooet	32131	5566	Docrite	66355F
Lillooet	32131	5567	Jackrite	66356F
Lillooet	32131	5663	Pioneer Extension No. 2	68615F
Lillooet	32131	5551	Hoover Fraction	67671F
Lillooet	32131	5590	Plutus No. 8	68390F
Lillooet	32069	5589	Plutus No. 7	68843F
Lillooet	32069	5584	Plutus No. 2	68839F
Lillooet	32069	5586	Plutus No. 4	68841F
Lillooet	32069	5587	Plutus No. 5	68607F
Lillooet	32069	5585	Plutus No. 3	68608F
Lillooet	32069	5583	Plutus No. 1	68609F
Lillooet	31992	5578	Undershot No. 3	68610F
Lillooet	31992	5577	Undershot No. 2	68611F
Lillooet	31992	5576	Undershot No. 1	68612F
Lillooet	31992	5575	Full Measure Fraction	68613F
Lillooet	31909	5554	Jefferson	67669F
Lillooet	31992	5572	Adams Fraction	67666F

Mining Division and Land District	Folio	Lot No.	Claim Description	Kamloops L.R.O. C. of T.
Lillooet	31992	5574	Overdraft Fraction	
Lillooet	31992	5552	Roosevelt	67672F
Lillooet	31950	5568	Pioneer Extension No. 1	68614F
Lillooet	31909	5560	Pioneer Extension	66353F
Lillooet	31909	5559	Bess	61693F
Lillooet	32131	5570	Pioneer Extension No. 3	61693F
Lillooet	31909	5557	Lincoln	68618F
Lillooet	31909	5558	Bryan	68617F
Lillooet	31909	5556	Cleveland	67667F
Lillooet	31909	5553	Garfield	67670F
Lillooet	31909	5555	Washington	67668F
Lillooet	31909	5561	Pioneer Extension Fraction	68616F
Lillooet	32328	6165	Mix No. 1	70946F
Lillooet	32069	5588	Plutus No. 4	68842F
Lillooet	32700	5807	Dan Tucker No. 7	68398F
Lillooet	32735	5845	East	68598F
Lillooet	33359	6172	Alta	68595F
Lillooet	33359	6173	Zenith	68594F
Lillooet	33359	6202	Chism A Fraction	68850F
Lillooet	33359	2162	Al Fraction	68857F
Lillooet	32735	5837	EPU No. 4	68849F
Lillooet	32700	5836	EPU No. 3 Fraction	68848F
Lillooet	32603	5801	Dan Tucker No. 3	68847F
Lillooet	33359	2164	Don Fraction	68840F
Lillooet	33359	2163	Hyatt Fraction	68838F
Lillooet	31909	5559	Bess	61693F
Lillooet	31909	5570	Pioneer Extension No. 3	61693F
Lillooet	33359	648	McKinley	60587F
Lillooet	32735	5835	EPU No. 2	68403F
Lillooet	32735	5838	EPU No. 5	68404F
Lillooet	32735	5840	Rex	68405F
Lillooet	32735	5839	EPU No. 6	68406F

Mining Division and Land District	Folio	Lot No.	Claim Description	Kamloops L.R.O. C. of T.
Lillooet	32735	5841	EPU No. 7	68407F
Lillooet	32700	5662	Undershot Fraction	68603F
Lillooet	32700	5663	Mix Fraction	68602F
Lillooet	32700	5664	Odd Fraction	68601F
Lillooet	32700	5833	EPU	68600F
Lillooet	32700	5834	EPU No. 1	68599F
LIllooet	32638	5806	Dan Tucker No. 6	68397F
Lillooet	32638	5808	Dan Tucker No. 8	68399F
Lillooet	32638	5809	Dan Tucker Fraction	68400F
Lillooet	32638	5811	Close Fraction	68401F
Lillooet	32638	5812	Close A Fraction	68402F
Lillooet	32638	5802	Dan Tucker No. 4	68395F
Lillooet	32638	5803	Dan Tucker No. 5	68396F
Lillooet	32603	5800	Chism Fraction	68846F
Lillooet	32603	7069	Extra Fraction	68851F
Lillooet	32603	7070	PEG No. 1 Fraction	68852F
Lillooet	32603	7071	PEG Fraction	68853F
Lillooet	32603	5661	Gold Field Deep No. 2A	68854F
Lillooet	32395	5654	Skull	68392F
Lillooet	32395	5655	Cross Bones	68393F
Lillooet	32395	5657	Dan Tucker No. 2	68394F
Lillooet	32395	5653	Plutus Fraction	68844F
Lillooet	32395	5656	Dan Tucker No. 1	68845F

(hereinafter referred to as "the said mineral claims")

3.0 HISTORY

In 1863 placer gold was discovered on the Bridge River, lode showings were discovered in 1897 and the Cadwallader Creek showings were staked but until 1928 very little development was done. In spite of favourable reports by Alan M. Batemau and other engineers, it wasn't until Mr. David Sloan instigated production of the Pioneer Mine that the potential of the mineralized zones was realized.

Production from the Bralorne-Pioneer Mines from 1900 to 1971 was 4,154,119 ounzes gold and 950,510 ounces silver from 7,950,931 tons. Reserves in 1973 were reported at over 600,000 tons averaging 0.25 to 0.30 ounces gold per ton. The Bralorne-Pioneer Mine is now closed and all underground workings have been allowed to flood.

4.0 GEOLOGY

4.1 FERGUSSON GROUP

The oldest rocks in the area are those of the Fergusson group*;a group that includes a succession of sedimentary rocks intercalated in places with volcanic rocks. These rocks were originally assigned to the Bridge River series, a loosely defined term first used by Drysdale (1915, p.79) and adapted by later writers (McCann, 1922, p.23), but subsequently discarded by Cairnes (1937, p.9) in favour of the term Fergusson series; Cairnes still later (1943, p.2) discarded the word "series" as this term is more generally used to describe the rocks of a geologic epoch and he substituted the word "group".

Rocks of the Fergusson group form two northwesterly to northerly trending belts that extend the full length of the area, on either side of Cadwallader Creek and the Hurley River.

The predominant sediments in the group include ribbons, a few centimeters to several centimeters wide, of dark grey to white sugary chert separated by partings of shaly black argillite 2 millimeters thick.

The Fergusson lava is dark green and weathered outcrops tend to be shaly; a feature that results from a well developed pillowed structure characteristic of much of the lava. Texturally and mineralogically, the lava is coarse grained, diabasic and has prominent hornblende phenocrysts set in a groundmass of plagioclase laths, some of the hornblende grains have residual kernels of pyroxene. Limestone pods, from 10 centimeters in length to 5 meters, occur in much of the lava.

Light greyish green, schistose lava occurs on the Pinebrayle property west of Bralorne in a northwesterly trending band about 152 meters wide between the Noel argillite and the Fergusson chert. Thinner flows of similar lava, 5 centimeters to 1 meter thick also occur interbedded with the adjacent Noel sediments. These narrower bands of lava die out within 100 meters along their strike. Most of the lava possess a definite schistose structure; the rock in the wider bands of lava may appear massive and blocky as seen in the outcrop, but on closer examination in a hand specimen is seen to be definitely schistose.

*Named after Mount Fergusson, where these rocks all were

TABLE OF FORMATIONS

ERA	PERIOD	FORMATION	LITHOLOGY
Cenozoic	Modern		Recent: stream deposits, volcanic ash, rock slides. Pleistocene: fluvioglacial, glacial and stream deposits.
Cenozoic and Mesozoic	Post Lower Cretaceous		Lamprophyre dykes
		Bender intrusives	Granodiorite and related dykes
Mesozoic	Jurassic?		Albitite dykes
		serpentine	Serpentine
		Bralorne intrusives	Soda granite Augite-diorite
	Triassic	Hurley group	Sediments: argillaceous, tuffaceous and limy
		Pioneer formation	Greenstone lavas
		Noel	Sediments: argillaceous and tuffaceous
Palaeo-zoic	Pennsyl-vanian to Permian	Fergusson group	Cherty sediments and some lavas

Under the microscope the lavas are seen to consist of well-shaped phenocrysts of oligoclase-andesine, An_3, in a fine grained groundmass of felted plagioclase laths. However, the groundmass of some of the lavas is schistose and altered to a fine-grained aggregate of chlorite, zoisite and carbonate. Amygdules, most of which are lined with chlorite and clinozoisite, are common. All the lavas possess varyingly developed cataclastic textures, the result of deformation of the lavas. Much of the lava contains streaks and centres of quartz-albite aggregates; this probably represents a hydrothermal alteration of the lava. Such features are well displayed by the lavas on the Alma claims.

The strikes of the chert ribbons parallel the northwesterly to northerly trend of the belt of Fergusson rocks. The dips of the chert beds are, with few exceptions, to the southwest, ranging from 80 degrees to vertical. Close folding is indicated.

The rocks of the Fergusson group have been severely deformed. Where particularly intense, deformation has produced small dragfords in the chert ribbons, that pass into overthrusts accompanied by tearing of the folds and the production of a chert breccia that consists of angular fragments of grey chert in a schistose, argillite matrix. Such a breccia is well seen in the diamond-drill holes on the Holland claims and underground at Pacific Eastern; in both places the holes were drilled in chert in and close to the hangingwall of the Fergusson overthrust.

The northeastern belt of Fergusson rocks is in fault contact along the Fergusson overthrust with the younger Huley formation, and the southwestern belt is conformably overlain by the Noel.

The Fergusson rocks have been intruded by rocks belonging to both the Bendor and Bralorne intrusions.

Close to the Bender batholith the argillaceous chert has been thermally metamorphosed to a rock consisting of ribbons of chert separated by layers of brown biotite schist.

The rocks of the Fergusson group are generally considered to be of late Palaezoic, probably Permian age (Cairnes, 1943, p.2). They may be correlated with rocks of the Cache Creek

group which in the Ashcroft area to the east have been determined (Duffell and McTaggart, 1952, p.24) as Middle and possibly Upper Permian. It is to be noted, however, that these determinations of age are based chiefly on collections of foraminifera from the Marble Canyon limestone formation, an upper member of the Cache Creek group not found in the Fergusson group, which therefore may be somewhtat older than much of the Cache Creek group. Duffell and McTaggart, (1952, p. 24) suggest this when they say "The lower limit of this group (Cache Creek - writer's insert) which is not well defined, may be at some horizon in the Pennsylvanian."

4.2 NOEL, PIONEER AND HURLEY ROCKS

The rocks of the Noel formation, the Pioneer formation and the Hurley group represent subdivisions of a series of sedimentary and volcanic rocks in the Cadwallader Creek - Hurley River section of the area to which Drysdale (1915, p. 79) originally assigned the term Cadwallader series. Drysdale included part of the Bridge River (Fergusson group) series, and the serpentine (President Intrusions) in this Cadwallader series, but later McCann (1922, p. 28) excluded these from the Cadwallader series. Cairnes (1937, p. 15), for stratigraphic and palaeontologic reasons, divided the rocks that Drysdale and McCann mapped as Cadwallader series into the conformable Noel and Pioneer formations and Hurley groups.

(a) Noel Formation

This name was applied by Cairnes (1937, p.14) to a series of sediments conformably overlying the Fergusson group and typically exposed in the lower valley of Noel Creek and on the ridge to the southeast of this creek.

The Noel formation occurs in a long belt that extends northwesterly from the Pacific Eastern Gold property along the southwest side of Cadwallader Creek, swings northerly at Bralorne and crosses the creek and extends as far as the Grull property. A second, narrower belt occurs parallel to the first, about ½ kilometer southwest, on the Pinebrayle property.

This formation includes principally argillite, and flaggy sandstone. The Noel argillite is dominantly jet-black and platy as compared with the lustrous, black phyllitic argillite of the Fergusson. This difference may be seen along the highway north of Bralorne, in passing from Noel argillites on the Mother Lode claim into Fergusson argillites on the Tacoma claim.

Argillite that appears to be transitional into a dominantly sandy phase of the Noel consists of black shaly rock that contains nodules and 1 millimeter thick layers of grey sandstone - and still more sandy material that consists of finely laminated black argillite and grey sandy layers. This passes into a grey flaggy sandstone in other places, more massive grey sandstone. None of this material contains any calcite, either in stringers or lenses, and thin-sections show a complete absence of any intergranular calcite. The lack of calcite is evident megascopically as seen in the complete absence of effervescence when dilute hydrochloric or nitric acid is applied to specimens of the Noel.

The sandy layers consist of quartz and plagioclase grains in a matrix or cement that is largely sericite and fine-grained recrystallized quartz. The size of the grains is usually about 0.1 millimeter, their sphericity is very poor and their roundness moderate. Stringers of calcite cutting the beds are occasionally seen, but they are extremely rare. In the thicker more massive beds such as occur on the east and west banks of Carl Creek, near the south line of Peru No. 5 claim, the grains tend to be larger, from one-third to one-half a millimeter in diameter.

The feldspar in these is predominantly plagioclase, but perthite and granophyre grains have also been noted.

A conglomerate phase of the Noel occurs above the highway north of Bralorne - this phase contains well-rounded pebbles and cobbles up to 5 centimeters in diameter closely packed in a sandy matrix. The pebbles include dense felsitic rocks, coarse-grained granitic rocks and some pebbles of a cherty rock. The relations of this phase have not been studied in detail, but Cairnes (1937 p. 14) feels that it is intraformational rather than basal.

The beds of the Noel formation strike parallel with the trend of the formation. They have been severely deformed and

possess steep dips, but tend to be platy and parallel and lack the intense crumpling seen in much of the Fergusson. The dips are usually vertical, but in places are steeply northeastward and eastward. Because of its complex structures and absence of marker strata within the formation no reliable estimates of its thickness can be made. With this in mind a provisional estimate has been made by Cairnes (1937, p.15) "of at least 365 meters, and doubtfully over 760 meters thick."

The Noel formation appears to be in conformable contact with the Fergusson group. In places there is a transition from the dominantly cherty rocks of the Fergusson through cherty argillite into platy argillite of the Noel, a feature that may be seen on the Pinebrayle property. The Noel formation is overlain conformably by the younger Pioneer volcanic formation.

No fossils have been found in the Noel but Cairnes (1937, p. 16) suggests a possible correlation of this formation with sediments north of this area, in which McCann found Upper Triassic fossils.

(b) Pioneer Formation

This is the dominant greenstone volcanic formation in the area and because of the producing gold veins found in it, it is of considerable economic importance. The formation derives its name, first given by Cairnes (1937, p. 16), from its extensive development at Pioneer mine and in commonly referred to as the Pioneer greenstone.

The Pioneer greenstone occurs as a narrow belt on both sides of Cadwallader Creek where it extends from the Pacific Eastern Gold property to Pioneer, swings northerly across the creek at Pioneer and extends northwesterly and northerly across the Bridge River to the Wayside property. A second shorter belt extends from Pinebrayle property northerly across the Hurley River.

The Pioneer greenstone includes phases that are fine, even-grained and in places porphyritic, with occasional

amygdules, phases that are highly amygdaloidal, and phases that are well defined flow-breccias. The flow-breccias consist of irregular but smoothly curved masses of amygdaloidal lava, from 2 centimeters to 5 centimeters in diameter in a fragmented matrix. In some places as on the B.R.J. property and on the Why Not and California claims, the greenstone exhibits exfoliation and ellipsoidal structures that are suggestive of structures possessed by pillowed lavas. The repeated alternation of the amygdaloids and flow-breccias with the more massive, fine-grained phases indicates that the greenstone originated as a series of lava flows, which from widths of these phases available for study either in outcrops or in diamond-drill holes ranged from 1 meter to 5 meters thick.

The Pioneer greenstone or lava is predominantly dark green in colour, except where altered by vein solutions, and may be distinguished from the augite diorite, the rock in the area most similar lithologically to the greenstone, by fineness of grain of the greenstone, presence of amygdules, which though scarce, may usually be found on diligent search. Some of the greenstone lava may on megascopic examination look like sandy tuff, but on microscopic study, such rock is seen to be definitely crystalline and to possess a diabasic texture; features characteristic of lavas and not tuffs.

As seen in thin-sections, the Pioneer greenstone consists predominantly of plagioclase laths and interstitial chlorite; in most of the greenstones the plagioclase laths range from one-quarter to one-third millimeter long and are markedly slender with a ratio of breadth to length of about 1 to 5. This ratio is in marked contrast to the much smaller ratio of 1 to 3 or even 1 to 2 in plagioclase crystals that characterize the augite diorite of the area.

In some of the flows, laths of hornblende are present in addition to the plagioclase; many of these hornblende crystals contain kernels of pyroxene, suggesting that the lavas were originally pyroxene andesite. The occurrence of pyroxene in both the Pioneer greenstone and the Bralorne augite diorite may indicate a genetic relationship between the two rock types.

A porphyritic phase of the greenstone consists of large, well-shaped phenocrysts of plagioclase set in a fine-grained, felted mass of plagioclase laths that usually show a well defined fluxion texture.

Amygdaloidal phases consist of amygdules that are principally filled with quartz, calcite, epidote, and hornblende, either singly or in combination. All phases of the lava contain an abundance of secondary chlorite altering from the hornblende, much of which has in turn altered from pyroxene.

Irregular, in part, dyke-like bodies of quartz porphyry and dacite porphyry occur within the Pioneer greenstone on the B.R.X. and the B.R. Consolidated properties respectively. They are tentatively classified as rhyolite flow rocks, although no positive evidence of such an origin has been seen. However, in support of this concept the following flow-like characteristics may be mentioned: they are strikingly porphyritic, with conspicuous quartz phenocrysts set in a fine-grained matrix; some possess quartz feldspar spherulites; in general they trend northerly with the trend of the enclosing formations; and texturally and mineralogically similar rocks have not been seen cutting either the augite diorite or the soda granite.

Quartz porphyry outcrops on the Goldside property and in the central and eastern parts of the B.R.X property and has been intersected in the California workings on the property. The porphyry occurs as isolated bodies that are aligned in a northerly direction conforming to the general trend of the enclosing formations; individual bodies range from 2 meters to 20 meters in width and may be traced for only short distances, usually less than 30 meters.

The quartz porphyry is light grey in colour and does not show any of the greenish colour that characterizes the more basic lavas that generally characterize the Pioneer formation. The porphyry consists of watery-appearing quartz phenocrysts 1 millimeter to 2 millimeters in diameter and somewhat smaller regular-shaped crystals of white plagioclase feldspar set in a fine-grained groundmass. Where it has been cut in the drifts and drill-holes the porphyry is seen to be laced by a network of quartz veinlets and mineralized by widely disseminated, fine-grained arsenopyrite and pyrite; some visible gold has been reported from the silicified porphyry.

Spherulitic dacite porphyry in a dyke-like body from 1 meter to 10 meters wide has been found in andesite in the bluffs near the B.R. Consolidated adits and in drill-holes on this property. The rock is massive, light grey and has conspicuous quartz eyes and clusters of feldspar. Under the microscope the feldspar is seen to be andesine, accompanied by abundant spherulites of quartz and plagioclase and the groundmass is seen to be a finely felted mass of plagioclase laths.

The internal structure of the Pioneer greenstone is difficult to determine. However, studies of the surface and underground workings and of diamond-drill hole intersections in the California section of B.R.X. suggest that the flows, locally at B.R.X., strike north 38 degrees west and dip 30 degrees to 60 degrees southwestward.

Because it is a lava, the thickness of this formation varies considerably. Outcrop widths of the greenstone indicate a formational thickness, allowing for dips of about 50 degrees, of as much as 1,000 meters. However, folding and repetition of flows may account for much of this apparent thickness. Cairnes (1937, p.17) estimates the thickness to be at least 300 meters.

No exposures of the contact of the Pioneer greenstone and the underlying Noel formation have been seen within the area. In many places where the contact would be expected, the two formations are separated by serpentine. Concerning the contacts of the greenstone with the underlying formations Cairnes says (1937, p. 17) "In the few places where contacts could be seen they appeared to be quite sharp and locally, as underground at the Butte - I.X.L., the greenstone is coarse and dioritic."

The Pioneer formation underlies and is older than the Hurley group in which Cairnes (1943, p. 4) found fossils, in the area to the north that he feels point rather definitely to a Triassic age for the group. The age of the Pioneer formation is therefore not later than Triassic. These lavas may be of nearly the same age as lithologically similar lavas of the Nicola series in the nearby Ashcroft area for which recently found fossils indicate an Upper Triassic age (Duffell and McTaggart, 1952, p. 30).

c) Hurley Group

Rocks belonging to this group were assigned to the Hurley

formation by Cairns (1937, p. 18) from type exposures on the Hurley River just upstream from Cadwallader Creek; he subsequently (1943, P.3.) assigned them to the Hurley group because, whereas he formerly considered them part of, and therefore comprising a formation in, the Elderado group, the rocks were found to be sufficiently different stratigraphically and lithologically to warrant segregation as a group older than the Eldorado group, and should not be considered a formation within that group.

The longest and most continuous belt of these rocks extends from south of Cadwallader Creek at Pacific Eastern Gold property northwesterly across the creek, through the northeasterly parts of the Pioneer and Bralorne properties, thence northerly through the California section of the B.R.X. property to the Wayside property.

Another belt, the belt that includes the type section, extends from the Hurley River near the Pioneer Dam, northwesterly beyond the area.

The Hurley group consists essentially of sediments but includes some volcanics.

The sediments include argillite, sandy or tuffaceous beds, lenses of limestone and lenses of comglomerate. As compared with sediments of the Noel formation, the Hurley sediments are distinctly limy. Much of the argillite consists of zones, 1 to 2 meters thick of massive, black argillite, alternating with zones 1 to 3 meters thick of dark grey slatey argillite. This slatey argillite in turn consists of laminated or rhythmically banded, fine-grained black argillaceous layers and coarser-grained, grey sandy layers. Occasional layers as much as 5 centimeters thick occur in the more massive argillite. Both the massive and laminated argillite are limy and some zones are cut by closely spaced, hair-like veinlets of coarsely crystalline calcite. Megascopically, these veinlets are dark coloured and watery appearing.

The laminated argillite consists of alternating layers of closely packed, firm and coarsely angular quartz and some plagioclase grains. Microscopic lenticles of calcite may be seen between many of the layers. Some of the coarse-grained,

sandy layers contain small rock fragments that include fine-grained, diabasic lava.

Occasional lenses of limestone, as much as 7.5 meters thick, and lenses of conglomerate of comparable thickness occur with the argillite and more sandy beds. Lenses of limestone conglomerate have been found in the Hurley, underground at Pacific Eastern. Andesitic flows, 1 meter thick and irregular bodies of black argillaceous chert are common. Cherty tuffs, some green, and some brown in colour occur in the Hurley in north crosscut on the 800 level in the King section of the Bralorne mine, about 180 meters northwest of the King shaft.

The strata in the Hurley group strike northwesterly and northerly with the trend of the group. They dip steeply, dips ranging from steeply northeastward to vertical, and like the Noel sediments, lack the crumpling and drag-folding characteristic of much of the Fergusson.

Neither in this area, nor in the Tyaughton area to the north has any complete section of the Hurley group been observed, but Cairnes notes, in referring to the Tyaughton area (1943, p. 4) that "the group must comprise 1,000 meters of beds".

Except where in faulted contact, the Hurley group appears to overlie the Pioneer formation conformably. It has been observed in faulted contact with the Pioneer along the Cadwallader fault on the Pacific Eastern Gold property.

Surficial rocks younger than the Hurley have not been found in the area. However, it has been intruded by the various intrusive rocks of the area. Underground at the Pacific Eastern Gold property, Hurley sediments show, in the development in them considerable biotite, contact metamorphic effects due to the intrusion of nearby Bralorne intrusions. The brown biotites found in Hurley chert underground in the King section of the Bralorne mine are also the result of contact metamorphism probably of the nearby Bralorne intrusions.

Fossils have been found in the nearby Eldorado area in

limestone beds belonging to the Hurley, and of these fossils Cairnes, (1943, p. 4) says that they "point rather definitely to a Triassic age." The Hurley rocks are lithologically somewhat similar to the rocks of the Tyaughton group to the north but are not correlated with them because the fossils collected from the Tyaughton indicate that it, the Tyaughton, is a distinct assemblage of marine formations of Upper Triassic age (Cairnes, 1943, p. 5).

4.3 BRALORNE INTRUSIONS

The writer includes under this term the augite diorite and soda granite with which the gold veins of the district are closely associated. Cairnes, (1937, p. 21) first used the term Bralorne intrusions to include these two rock types because both are typically developed on the Bralorne property. However, the significance of the two rocks had been early recognized in the history of the camp. Bateman (1912, pp. 188-210) concluded that the principal mines were confined to and dependent on intrusions of augite diorite. Drysdale (1915, p. 79) uses the term Cadwallader diorite and describes the occurrences as "Intrusive sheets and stocks of augite diorite varying from quartz monzonite and augite porphyrite to gabbro and pyroxenite. Country rock of gold-quartz veins." The area he mapped as underlain by the Cadwallader diorite is essentially the same as that underlain by the Bralorne intrusions. McCann (1922, p. 30) referred to the country rock of the gold-quartz veins simply as the "augite-diorite stock." Cockfield (1931, Fig. 6) and Cockfield and Walker (1932, Fig. 5) outlined in considerable detail the area of augite diorite, and the latter noted the scarcity of pyroxene in the rocks and suggested the term hornblende diorite or greenstone might be more appropriate in some places.

James (1934, pp. 342-347) was perhaps the first to stress the possible significance of the granite included in the area of augite diorite, with particular reference to the "quartz-diorite" at Pioneer. Cairnes (1937, p. 21) introduced the term Bralorne intrusions to include both petrographic types, augite diorite and granite or soda granite; the term is appropriate because both types are well and about equally exposed in the Bralorne mine.

These rocks underlie a narrow discontinuous belt that

extends northwesterly and northerly from the Pacific Eastern Gold property northwesterly to Pioneer and Bralorne, thence northerly past B.R.X. to Wayside. Along this belt, the intrusions are exposed reasonably continuously in two principal areas; in an area that extends northwesterly from Pioneer to Bralorne, and in another area that extends from the B.R. Consolidated past the Arizona workings of the B.R.X. to the Wayside; a long narrow zone of the intrusions has been followed underground at Pacific Eastern. Elsewhere along the belt the intrusions occur as numerous tongues and small masses in the older rocks.

4.4 AUGITE DIORITE

The augite diorite is the more abundant of the two general rock types and occurs wherever areas of the intrusions are found.

The diorite is typically a greyish-green, medium-grained rock almost always cut by minute cream coloured veinlets 1 centimeter to 5 centimeters wide, of such secondary minerals as epidote, clinozoisite and/or prehnite carbonate and quartz.

Where massive and fresh, the diorite is seen to consist of glistening black crystals of hornblende, and large white crystals of albite plagioclase (An_3). In many of the thin-sections studied, the hornblende was seen to contain residual kernels of pyroxene. The plagioclase crystals tend to gather in knots and this gives the diorite a marked blotchy appearance and a texture unlike that of normal intrusive rocks. Specifically the rock perhaps should be called augite sodaclase diorite (Johannsen, III, p. 133), but in accordance with local usage the term augite diorite has been retained. Coarse-grained hornblende-rich masses of hornblendite with indefinite boundaries, occur at many places within the diorite. Hornblendite masses may be seen in the bluffs on the east side of the Hurley River, in the long entry crosscut of the Arizona adit and in the Paxton, No. O and No. 5 adits Wayside. The hornblendite is medium to coarse grained in texture and as its name implies consists principally of hornblende. The contact between hornblendite and diorite is not sharp and a gradation may be traced from hornblendite, through hornblende-rich diorite to the average diorite. This feature suggests that the hornblendite is an intermediate stage in the alteration of greenstone to diorite.

Another variation from the average diorite is a very coarse-grained diorite phase, one with about the same equal amounts of plagioclase and hornblende as occur in the more average medium-grained diorite. This phase occurs as irregular patches in the diorite from 5 centimeters to 1 meter across. Because of their extremely coarse grain as compared with the average diorite the term "gabbro" might be used to describe them. Mineralogically, however, they consist of albite plagioclase and not labradorite and of hornblende and not pyroxene, and therefore, strictly speaking, should not be called gabbro or gabbroic.

The diorite within vein-shears and shear zones is often badly sheared and schisted but still possesses a recognizable dioritic texture. In some shear zones, e.g. the Empire Fault, the slip surfaces of the diorite are coated with films of glossy brownish black chlorite that give the rock the appearance of serpentine. However, the large plagioclase and hornblende crystals characteristic of the more massive diorite are usually recognizable in thin sections when studied under the microscope. The more intensely sheared and altered phases consist of abundant sericite, carbonate and chlorite, lacking plagioclase, but these phases can be traced in to rock in which plagioclase is readily discernible.

Much of the diorite appears to have been formed by the replacement of greenstone. Many unreplaced patches of greenstone surrounded by diorite, and alternating bands of diorite and greenstone may be seen underground at Bralorne in the walls of the crosscut northwesterly from the "55" vein on the 800 level. The material still recognizable as greenstone in the fragments and bands has an even-grained, sugary or recrystallized texture, typical of replaced rocks. A mottling by clusters of hornblende and plagioclase in otherwise uniform diorite is also suggestive of a replacement origin for the diorite.

4.5 SODA GRANITE

Soda granite occurs in small masses in all areas of augite diorite; and in a single large, lens-like area of continuous granite that extends from Pioneer to Bralorne along the northeast side of a lens-like mass of augite diorite. The host rock of veins here, i.e. at Bralorne and Pioneer, is about equally divided between the granite, and diorite and greenstone.

Somewhat different modes of occurrence of the granite have been found in different places along the belt of Bralorne intrusions. The Pioneer-Bralorne mass is a large body of homogeneous granite. Underground, at Bralorne, a contact zone of mixed granite and diorite occurs. At B.R.X. a long narrow belt of granite occurs, and at Wayside the granite occurs in smaller lenticular bodies in the diorite. The Wayside bodies include surface exposures measuring 50 meters by 25 meters, underground lenses as much as 50 meters by 105 meters and "the amount of granite appears to increase with depth."

The massive, unsheared and unaltered granite is very light coloured and consists of abundant quartz and moderate amounts of white plagioclase and the rock is spotted with small crystals of hornblende; but in general, dark minerals are lacking, and there is no gradation in their amount from diorite to granite.

Although the granite contains abundant quartz and sodic plagioclase (An_3), it does not contain orthoclase. Although potash feldspar or orthoclase is absent, this rock has been referred to in literature on the Bridge River camp as soda granite. Because of this lack of orthoclase, the rock would more properly be called sodaclase tonalite (Johannsen, 1932, Vol. 11, P. 373) or albite quartz diorite, but not granite. The proprietry of the term soda granite may therefore be debated, but the usage of the term is so well established that it has been retained by the present writer.

In general, the Pioneer-Bralorne body of granite, trends northwesterly, is in contact on the southwest with diorite, and on the northeast with Pioneer greenstone.

The immediate contacts, between diorite and the granite, tend to be sharp and well defined, but between large bodies of homogeneous granite and of diorite, there is usually a contact zone, 1 meter to about 120 meters wide, in which both diorite and granite are found. Within this contact zone the diorite is cut by many granite dykes and tongues from 5 centimeters to 15 meters wide.

These features of the contact zone may be seen on the 2000 level of the Bralorne mine in the western part of 51 vein. In many places the rock of contact zone possesses a foliated structure given to it by alternating bands, 5 centimeters thick, of dark coloured diorite and lighter coloured

granite. Foliated structures in the contact zone may be seen underground at Bralorne on the 800 level, 60 to 120 meters west of the Empire shaft, on the 1400 level in the crosscut south from the Empire shaft.

In general the granite intrudes all phases of the diorite and related rocks; these include bodies of greenstone plus diorite, hornblendite, the average diorite and its coarse-grained phases. The granite intrudes and replaces these rocks as small amoeba-like masses of granite from 2 centimeters to 5 centimeters across, as dykes from 10 centimeters to 1½ meters wide and, in areas from 1/3 meter to 1 meter in diameter. The granite also occurs as a breccia-filling for 2 to 10 centimeter fragments of greenstone and diorite. The direct control of the intrusion of the granite by fracturing and general absence of textural and mineralogical gradation between the granite and any of these phases of the diorite suggest that the emplacement of the granite was more of the "forceful injection type" than was the emplacement of the diorite, whose formation seems to have been a more passive replacement of the earlier rock, the greenstone.

On the northeast, the Pioneer-Bralorne mass of granite is in contact with Pioneer greenstone and is best exposed underground at Pioneer. Here the strike of the contact is northwesterly and dip vertical or within 10 degrees on either side of vertical. The actual contact is usually marked by a narrow shear from a fraction of a centimeter to as much as 20 centimeters wide; this feature suggests recurrence of a movement along the contact that was initiated at the time of intrusion.

It is of interest to note that the contacts between granite and unreplaced areas of greenstone within the diorite, contacts in the diorite and the southwest side of the main granite mass differs from those with the main greenstone on the northeast. There is not the same straight-line type of contact, relatively uniform in strike and dip, as with the main greenstone on the northeast. Where the southwestern contacts have been studied, the granite is seen to brecciate the greenstone and in varying degrees replace the brecciated material. Breccia may be seen underground at Bralorne at the 1800 station of the Empire shaft, and on the 1000 level in a crosscut northeasterly from the "77" vein. It may be further noted that there is no contact zone

on the northeast between greenstone and granite as there is on the southwest between diorite and granite. These features suggest a closer genetic relationship between the diorite and the granite than between the greenstone and the granite.

4.6 SERPENTINE

Serpentine and partly serpentinized ultrabasic rocks occur at several places, in several geological horizons in the area. Ultrabasics relatively unserpentinized are not found in the area, but rocks that vary from dunite to pyroxenite occur southerly and southeasterly and northwesterly of the area. Cairnes (1937, pp. 9, 28) has used the term President Intrusives to describe both the serpentines and the ultrabasic rocks from which they were derived. This replaces the term "Shulaps volcanics" used by Drysdale (1915, p. 79) and McCann (1922, pp. 26, 27) to describe these rocks and similar rocks in Shulaps Range and Yalakom River areas.

The origin of these serpentine and associated ultrabasic rocks has been the subject of considerable discussion by those who have studied the occurrences of these rocks in the Bridge River and nearby areas. Drysdale and McCann regarded them as essentially of volcanic origin, Cockfield and Walker (1932, p. 60) suggested the possibility of some intrusive phases, and Cairnes (1937, p. 28; 1943, pp. 8-9) considers them intrusions. More recently Leech has suggested an intrusive origin for these rocks where he has studied them in the Shulaps Range, but for reasons of priority and correlation prefers to refer to them as the Shulaps ultrabasic rocks.

Cairnes (1937, p. 28) assigns the term President intrusions to these rocks as they are very well exposed in President Creek, a northerly flowing creek that joins Cadwallader Creek between Pacific Eastern Gold property and Pioneer. Because most of the material in the area has been very extensively serpentinized, the term serpentine for these rocks is used.

Within the Cadwallader Creek-Hurley River area, the serpentine occurs in narrow northwesterly to northerly trending belts in both the Palaeozoic and the Mesozoic sediments, from the Pacific Eastern Gold property at the southeast to

Wayside on the north. The serpentine occurs in these belts largely as a series of discontinuous lenses.

As seen in outcrops the serpentine is cut into cuboidal blocks by many joints and along these joints the rock is a glossy, greenish black in colour, but between the joint surface it is a massive dull or dead black rock. Some phases are fine and even grained in texture, but some phases are porphyritic with glistening, silver coloured phenocrysts of enstatite now completely altered to bastite .

In areas of massive and unsheared serpentine outcrops are deeply weathered and dark brown in colour. However, in areas where the serpentine has been intensively sheared, the shearing induces considerable sloughing, particularly on hillsides and canyon walls, and in such places the serpentine is relatively unweathered, because of the frequent sloughing, and is a glossy, blackish green in colour.

The dense, black serpentine consists principally of mesh antigorite and the porphyritic phase consists of this plus conspicuous phenocrysts of bastite, the name given to antigorite that is pseudomorphic after the orthorhombic pyroxene enstatite. Relicts of unserpentinized amphibole pseudomorphic after the monoclinic pyroxene, augite, are abundant in some places. All the serpentine possesses disseminated grains of magnetite and of chromite; no lenses of massive chromite were seen in any of the serpentine rocks in the area.

The serpentine is massive and unlayered. It possesses a characteristic three-way joint pattern, which is accentuated in outcrops by weathering and erosions along the fracture surfaces. Locally the serpentine is sheared over zones as much as 150 meters wide, and the material in such zones breaks into characteristic sharp lens-shaped fragments with highly polished slickensided surfaces.

The serpentine appears to be intrusive. The writer has observed contacts of the serpentine with a variety of rock types and they are all vertical, but usually badly sheared. However, occasional lenses of serpentine close to a main body serpentine, but separated from it by faulting along the contact of the main body with the adjacent rocks, seem to be intrusive offshoots from the main body of serpentine. Such features may be seen in outcrops north of the Pioneer mill and underground at Bralorne. A feature bearing on the relative ages of the serpentine and diorite was noted in surface outcrops north of the serpentine at Pioneer. Here it was seen that although there had been dioritization of the greenstone, there had been no dioritization of the serpentine, suggesting that the serpentine was later than the diorite. Intrusive relations

are further implied by the diversity in age of the rocks with which lithologically similar serpentine bodies are associated. They are found associated with both the Palaeozoic Fergusson rocks and Mesozoic Noel and Hurley rocks. The serpentine is younger than these sediments and volcanics and also younger than the Bralorne Intrusions. The relation of the serpentine to the Coast intrusions is not determinable but of the area to the north, Cairnes (1943, p. 9) says that the President intrusives are intruded by Coast range intrusions and says concerning the age of the President intrusives (1943, p. 9) "It seems likely, therefore, that they were intruded in Mesozoic time and that they are of late Jurassic or early Cretaceous age." Leech (1953) considers that ultrabasic rocks in the Shulaps Range are younger than the Triassic Hurley strata, but older than later Lower (?) Jurassic sediments. Working in the Ashcroft area, Duffell and McTaggart (1952, pp. 72-78) have not been able to contribute any further information from studies of similar bodies associated with Coast intrusions in that area.

4.7 ALBITITES

Cream-coloured or light green felsite dykes are common in all the surficial and intrusive rocks described so far. They include quartz-feldspar porphyry, feldspar-hornblende porphyry, and non-porphyritic plagioclase-rich dykes. Because of the almost universal presence of albite in these dykes they have been referred to in the literature as albitites and/or quartz albitites. Because the term albitite is so well established in the literature, and is widely used locally it has been retained. Albitite dykes are to be differentiated from ankeritic carbonate alteration of diorite or greenstone wallrock along vein shears that produces a dense cream coloured rock very similar in appearance to the rock of some albitite dykes.

The albitite dykes range in width from 5 centimeters to 1 meter, in colour from white to pale green and from even-grained to porphyritic in texture. Because of their fine-grained texture the dykes are usually closely jointed; this is a feature that is useful in distinguishing the dykes from light coloured phases of the granite or even diorite, and from ankeritic carbonate wallrock alteration.

Along many of the vein shears as seen underground, the albitite dykes are altered to platy quartz-sericite schists. Where the main country rock is diorite, as underground at Bralorne, along the western portion of the "77" vein on the 2000 level, the altered albitite is recognized in the drift by platiness and under the microscope by an abundance of quartz,

the diorite is not platy and only roughly sheared and, excepting that found in clinozoisite-quartz veinlets possesses no quartz. Where the main rock is granite, as along the eastern part of the "77" vein on the 2000 level at Bralorne the altered albitite possesses the above features whereas the altered granite is not platy and only roughly sheared and contains conspicuous large "eyes" of quartz. Platy quartz-sericite schist derived from albitite, is seen along other veins but the degree of schistosity and alteration is not always the same and appears to be most intense where a vein most closely follows along a dyke. Where a vein crosscuts a dyke the alteration has only been slight.

Albitite dykes that cut the talc-rock are themselves altered to a fine-grained talc for 5 centimeters to 30 centimeters from the contact.

As would be expected, the albitites are not all of the same age. Examples of this diversity in age may be seen underground at Bralorne on the 1751 north crosscut where a fine-grained albitite dyke cuts a coarse-grained albitite dyke, and both dykes cut Pioneer greenstone, and underground at Pioneer, where a quartz porphyry albitite dyke was seen cutting a non-porphyritic albitite.

4.8 BENDOR INTRUSIONS

The Bendor intrusions comprise the youngest of the major intrusions in the Bridge River mining camp.

The term Bendor batholith was first used by Drysdale (1916, p. 79), later by McCann (1922, p. 36), and subsequently modified to Bendor intrusion by Cairnes (1937, p. 37) and is followed by the present writer.

The principal occurrence of these intrusions is the area of the Bendor batholith, in the mountains of the same name that lie easterly from Cadwallader Creek and the Hurley River, and comprise the heighth of land between the Cadwallader drainage and the drainage northeasterly into the Bridge River downstream from Gold Bridge. In this general region rocks of the Bendor batholith underlie an area of about 80 square hectares measuring roughly 20 kilometers long in an easterly direction and 3 to 8 kilometers wide. This is one of several

such areas, mostly smaller, that trend northwesterly in front or northeast of the main belt of Coast Range intrusions. The Bralorne intrusions appear to be genetically related to these intrusions.

The Bendor intrusions are granitic as typical of batholithic areas. Although the rocks range in composition from granodiorite to diorite, the bulk of the material comprising the Bendor appears to be granodiorite.

The Bendor intrusions intrude all the formations in the area and tend to thermally metamorphose all the intruded rocks. The effects of this metamorphism are strong for 100 meters from the contacts and minor effects are noticeable for ½ a kilometer from contacts. Intense metamorphism by the Bendor intrusions may be seen on the Chalco and Gray Rock where, respectively, limy rocks have been altered to lime-silicate rocks and sandy and silty rocks to various types of biotite hornfels rocks. Less intense metamorphism at a considerable distance is seen in the development of biotite in the Hurley sediments on the Pacific Eastern Gold property on it's eastern boundary.

The Bendor intrusions cut all the formations in the Bridge River area and are therefore younger than the Triassic Hurly groups, but no other information as to their time of intrusion is available in the immediate area. However, intrusions north of Gun Lake that may be correlated with the Bendor intrusions have been found by Dolmage (1928, pp. 86-87) intruding formations as young as late Lower, or early Upper, Cretaceous Age suggesting that the Bendor intrusions are post-Lower Cretaceous. Further, by virture of their probable similarity in age to other Coast Range intrusions along the eastern flank of the Coast Range, the Bendor intrusions are probably not younger than pre-Eocene in age, a youngest limit assigned to Coast Range intrusions in the Ashcroft area by Duffell and McTaggart (1952, p. 83).

These authors (Idem. p. 83) limit the time of the Coast Range intrusions west of the Fraser River in the Ashcroft area to the early mid-Lower Cretaceous.

Lamprophyre dykes occur throughout the area. Because of extreme susceptibility of lamprophyre dykes to weathering, outcrops are rarely found and most of those noted have been found

underground. The dykes range from ½ to 1 meter in width and consist principally of biotite and horblende and plagioclase. Because of the presence of plagioclase rather than orthoclase, these dykes belong to the dioritic series of lamprophyres and because of the predominance of biotite over hornblende they could be called kersantites (Johannsen, 1937, Vol. III, pp. 187-191).

The lamprophyre dykes definitely cut the gold-quartz veins of the district, but have themselves been cut and displaced several centimeters by late slips along the vein shear. The composition and sugary texture is not unlike the composition and sugary texture of recrystallized older rocks in later granitic rocks but the remarkable continuity of some of the dykes as seen underground and their post-vein age indicate that they are post-granite dykes and not merely very much elongated inclusions of older volcanic rocks in the granite.

Narrow lamprophyre and basaltic dykes have also been noted within areas of the Bendor batholith. In ages, therefore, these dykes are post-Bendor, and are probably either late Cretaceous or early Tertiary.

5.0 STRUCTURAL GEOLOGY

5.1 FOLDING

In the southerly part of the area, from the Pacific Eastern Gold property to Bralorne the surficial rocks strike northwesterly, and in the northerly part of the area, from Bralorne to Wayside they strike northerly. Close folding with some overturning has resulted in dips that are predominantly vertical and are never more than a few degrees on either side of vertical.

The principal controlling structural feature is a northerly to northwesterly trending syncline within a major anticlinal arch with the same trend. The Bralorne intrusions and serpentine bodies follow the trends of these folds.

The folds in the mapped area (see Fig. 2) appear to be related to a broad northwesterly trending anticlinal arch, the axial part of which is about 16 kilometers to the northeast where it is followed by the Bridge River for 1 kilometer downstream from the Congress mine. Drysdale (1915, p. 80) describes this structure "as that of a broad anticlinal dome elongated in a northwest-southeast direction and pitching at a low angle to the northwest" and further "Unconformable overlapping the Palaeozoic core, and forming the limbs of the northwestward plunging anticline, are two great series of Mesozoic formations, first the Jura-Triassic, Cadwallader series, then farther out on the dome, the Lower Cretaceous Eldorado series. The western limb of the anticline, next the Coast Range batholith, is composed of closely oppressed formations belonging to the Cadwallader series which are intruded and deformed by large stocks of the Bendor granodiorite."

The Fergusson rocks in this anticlinal structure are closely folded and the dips are steep, so that, rather than the structure being a simple anticline, it is one that consists of many smaller anticlines, resulting in a structure normally called anticlinorium. Structurally, includes only the closely oppressed formations on the western limb of this anticline, referred to by Drysdale as the Cadwallader series, but formations that are referred to in this report as the Noel, Pioneer, and Hurley Rocks.

The local structures along the west side of Cadwallader Creek and the Hurley River, appear to be two northwesterly to northerly trending, closely folded synclines with Hurley group rocks in the exposed cores. One syncline extends from Pacific Eastern northwesterly across Cadwallader Creek to Pioneer and Bralorne, thence northerly past the California workings of the B.R.X. to the Wayside. The other syncline, southwesterly from the first trends northwesterly down the lower reaches of Carl Creek and across the Hurley River at the Pioneer claim.

5.2 FAULTING

Continuation of the same deforming forces responsible for the folding has resulted in considerable faulting in the area. For purposes of description the several faults may be grouped into two principal systems, each of two or more sets of faults. The one system consists of two sets of perpendicular fractures with strikes approximately at right angles to each other and at acute angles with the trend of the formations. The other system consists of two sets of fractures with opposed dips but with strikes parallel to each other and to the trend of the formations.

The fractures of the first system contain the principal veins in the area and appear to be earlier than the second as they are cut and offset by some faults belonging to this second system. The fractures of the second system are principally shear zones in less competent sedimentary members whereas the veins, which belong to the first fracture system, are in the more competent augite diorite, granite and Pioneer greenstone.

Three principal and reasonably continuous faults, the Fergusson overthrust, the Cadwallader shear and the Carl Creek shear appear to be most important in the second system of faults.

The Fergusson overthrust, strikes northwesterly to northerly and dip steeply northeastward, forms a fault contact between Mesozoic rocks on the southwest and overthrust Palaeozoic Fergusson group rocks on the northeast. This fault can be traced from the Pacific Eastern northwesterly past Pioneer to Bralorne. Northwesterly beyond Bralorne its continuation is indefinite. However, northerly from Bralorne, from the California workings of the B.R.X. to the Wayside north of Bridge River, shearing between the Fergusson rocks

on the east and Hurley rocks on the west suggests that a similar and possibly the same overthrust, shifted to the east by cross-faulting, marks the contact between the Palaeozoic and Mesozoic rocks. This Fergusson overthrust has been intersected at several places underground. "The 520-foot crosscut on Pacific Eastern intersects a broad shear zone, strike northwest and dip 70 degrees northeast, 320 meters southwest of the shaft, between serpentine and Fergusson chert, this shear is correlated with the Fergusson thrust." A vertical drill-hole in the southwestern corner of the Langdon claim on the Holland property intersected a strong fault at 275 meters from the collar; typical Fergusson sediments were found both above and below this fault and therefore, although suggesting the Fergusson fault, this fault probably represents a related hangingwall fault rather than the principal shear between the Hurley and overthrust Fergusson. On the Pioneer property, diamond drilling into the hangingwall of the Taylor or "40" vein has intersected zones of intense shearing, in mixed sediments and serpentine that may represent footwall shears related to the main Fergusson fault that should lie farther to the northeast. A similar condition appears to exist at the southeast faces of drifts on the "51" vein at Bralorne where sheared greenstone has been intersected but no Fergusson chert; this probably represents shearing in the footwall, rather than in the principal zone, of shearing of the Fergusson fault. In the Taylor (Bridge River) section of No. 8 level at Bralorne, a north crosscut intersects a strong shear zone, strike northwest and dip northeast, that marks the contact between Hurley rocks in the footwall of the shear and Fergusson rocks in the hangingwall and very probably represents the Fergusson overthrust.

The Cadwallader fault, roughly parallel to the Fergusson, but dipping southwestward rather than northeastward, for much of its length follows the northeast side of the prominent band of serpentine that extends from Pioneer to Bralorne and marks the western ends of the veins in these mines. The zone of strong shearing along the northeast contact of this serpentine with diorite, where entered by the west ends of drifts at these mines, marks the location of this fault. West of the presently active workings of the Bralorne, i. e. in the King section, the Cadwallader fault probably corresponds with the "No. 3" fault in that section.

Farther to the northwest beyond the King section, the more or less single, well defined structure that to the southeast has been the Cadwallader fault loses itself in several northerly trending shears, any one of which might be called the Cadwallader fault. Much farther to the north, from the California workings of the B.R.X. past the B.R.X. Consolidated workings to the B. C. Electric quarry north of Bridge River, a strong shear zone that could be correlated with the Cadwallader fault follows along a narrow serpentine band that can be traced down the Hurley River and north across the Bridge River. However, definite evidence that would indicate the correlation is lacking because of overburden and absence of underground workings in the crucial area between B.R.X. and the King section of Bralorne. This shear zone is marked along much of its length by a strong carbonate-silica alteration of the serpentine.

The southeasterly extension of the fault southeasterly from Pioneer, can be correlated with a well defined shear zone, strike northwesterly and dip 70 to 80 degrees southwestward that has been intersected on the Pacific Eastern Gold mine by a 158 meter crosscut at a point 580 meters southwest of the shaft. "At Pacific Eastern the fault apparently follows a narrow zone of diorite and granite with Hurley argillite and Pioneer greenstone on both sides" of the zone and the fault. The southwestward dip of the fault and the succession of northeastward-dipping Hurley argillite and Pioneer greenstone on both sides of the fault suggest that the Hurley sediments and Pioneer greenstone in the hangingwall of the fault have dropped down relative to the same formations in the footwall of the fault; that is, from evidence at Pacific Eastern the Cadwallader appears to be a normal fault.

At Pioneer and Bralorne, the sheared contact zone between serpentine and greenstone and diorite, that marks the position of the Cadwallader break, has been entered by many of the drifts. Because the vein structure and vein matter disappeared as soon as the sheared contact zone was entered, no drifts have been extended beyond the fault into unsheared serpentine. However, evidence of displacement along the fault zone was found at the west end of 1653 drift at Bralorne. Here, in the presence of a large fragment of grey ribbon chert, typoial Fergusson, within the shear zone where one wall was diorite and the other was

serpentine, suggested that the chert within the fault was very much out of place and that there had been displacement of one wall with respect to the other wall. The direction of movement along the fault and of offset of the veins can only be assumed from the tendency of the veins to curve northerly aginst the fault, suggesting that the southwestern side of the fault has been offset to the northwest. From the evidence at Pacific Eastern and Bralorne it would therefore appear that the Cadwallader shear is a normal fault in which the hangingwall has moved down and northwesterly with respect to the footwall.

5.3 PINEBRAYLE FAULT

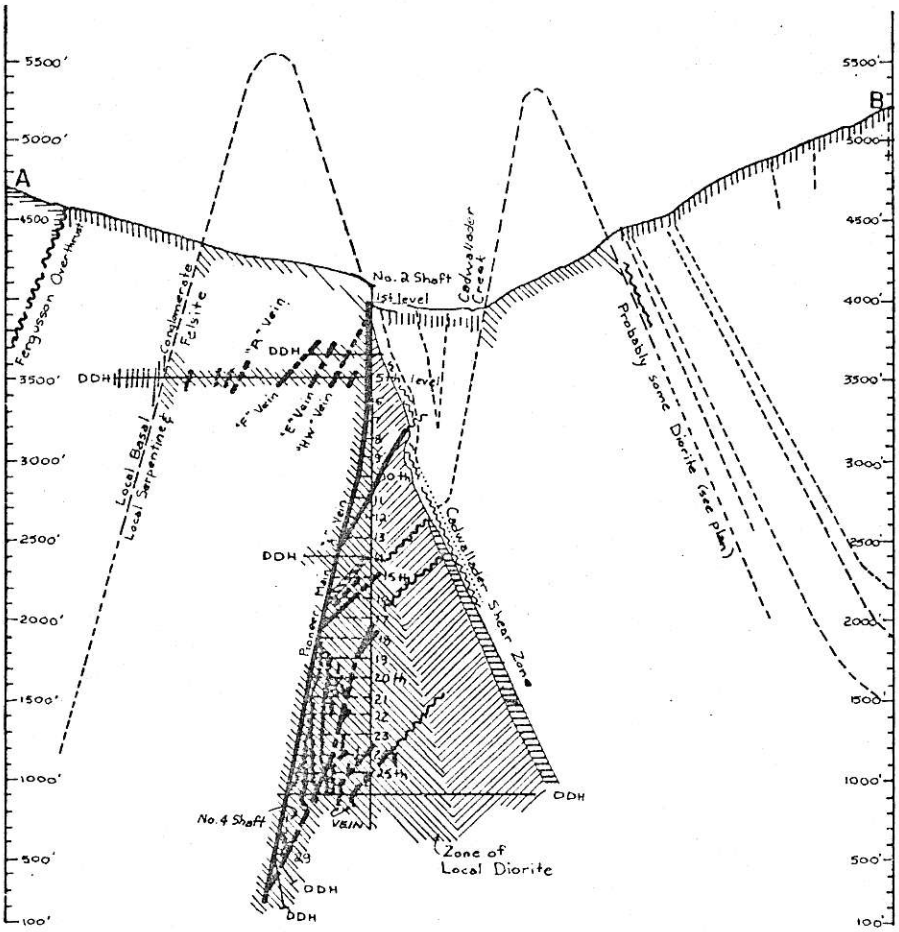
On the Pinebrayle property a strong, persistent shear zone follows a northwesterly trending carbonate-silica zone down Carl Creek and northwesterly across the Hurley River at a point near the northeast corner of the Vera claim. This has been termed the Carl Creek shear. Although the Carl Creek shear is a prominent shear structure, evidence of displacement along it is not too satisfactory. This evidence consists principally of the offset of a postulated east-west fault on the Pinebrayle property that has been invoked to explain the presence of extrusive Pioneer greenstone lying across the strike of Fergusson sediments.

Minor shear zones or faults related to the two principal systems are abundant.

Several minor northerly to northwesterly striking diagonal faults trend between the Fergusson and the Cadwallader break, and of them, the Empire fault at Bralorne is the most important. This fault is of considerable local economic interest at Bralorne as it offsets one set of veins against another. Because of the close association of this fault with producing veins considerable underground work has been done on it and more is known of it than of other faults in the area.

In general, the fault strikes north 20 degrees west and dips 55 degrees southwestward, but in places it may depart from the average both in strike and dip. At the surface and in the upper levels of the Bralorne mine the Empire fault consists of a single shear zone, 5 centimeters to as much as 3 meters wide,

but at the 1200 level it branches on the dip and a break, parallel in strike, branches downward with a flatter dip, from the hangingwall of the main fault. This branch encloses, with the main fault, a block of ground that contains faulted portion of the vein in the footwall of the main Empire break and in the hangingwall of the branch and is referred to as the "E" block. Extensive late faulting has occurred both in the planes of the veins and diagonal to the veins.



GEOLOGICAL CROSS SECTION OF PIONEER MINE

FIGURE: 5

6.0 MINERALIZATION

Gold-quartz veins characterize the mineral deposits of the area. Small amounts of placer gold are found on Cadwallader Creek and Hurley River.

The greater part of the mineral production has come from two adjacent mines, Bralorne and Pioneer. However, the widespread nature of the mineralization within the area and the encouraging development on the Pacific Eastern Claim Group of quartz veins in geological environments and with structural and mineralogical features similar to those of Bralorne and Pioneer, it would appear to justify further exploration.

6.1 GOLD-QUARTZ VEINS

The gold-quartz veins of the Cadwallader Creek-Hurley River area have been localized in the northwesterly to northerly trending zone of Bralorne intrusions. They occur principally in the augite diorite, soda granite, and Pioneer greenstone but some veins occur in the adjacent sediments. Locally within areas of diorite, granite or greenstone, the veins occur along the walls of or within albitite dykes.

6.2 VEIN STRUCTURE

The veins range in strike in general from north 75 degrees west to north 40 degrees west except for a few, but important, "cross-over" veins. This strike bears an approximate constant angular relation of about 30 degrees to the local trend of the diorite-granite body in or near which the veins occur. Where the zone of diorite-granite trends northwesterly as at Pioneer and Bralorne, the veins in general strike north 70 to 80 degrees west, where the zone trends more northerly as at B.R.X. the principal veins strike about north 30 degrees west. A set of veins, strike northeasterly, intersects the first set at a considerable angle and has been referred to as "cross-over" veins; these perforce also bear a corresponding constant relationship in strike to the trends of the diorite-

granite bodies.

Nearly all the veins dip in the same sense. The westerly striking veins dip northward, the northwesterly striking veins dip northeastward, and the northerly striking veins dip eastward. The cross-over veins, strike northwest, also dip northeastward.

Movement along the veins has been such that the northern or hangingwall side moved westerly, with horizontal components that range from 1 meter to 100 meters. The veins are cut by northerly trending faults, which dip eastward and westward; on these the western side has moved northerly for horizontal distances as much as 120 meters. In the Bralorne mine some investigators (Joubin, 1948, p. 47) feel that the faults are hinge faults, with centres of rotation near the present surface.

From the patterns shown by the vein fractures at Pioneer and Bralorne mines it has been possible to deduce directions of shear and tension applicable to each of these properties. The veins at each of these properties are principally within two rock types, wither granite and massive greenstone as at Pioneer, or granite and diorite, as at Bralorne. Although these rock types are similar physically there may be differences in response to stress as between granite and greenstone at Pioneer and granite and diorite at Bralorne, and therefore it was thought best to consider the pattern of fractures at the two mines as comprising two separate fracture patterns; directions of shear and of tension may therefore differ slightly for each pattern. At Pioneer, the directions of shear have been assumed to be those followed by the long, straight sections of the Main vein and the "27" vein; namely, north 60 degrees west, dip 80 degrees northeast and north 45 degrees east and dip 55 degrees northwest respectively. Along the Main vein, the hangingwall has been displaced westerly and up, with respect to the footwall, and on the 27 vein the hangingwall has been displaced northeasterly and up with respect to the footwall. The direction of tension for such shear directions strikes a few degrees north of east and dips 45 degrees northward.

At Bralorne, the principal direction of shear appears to be that followed by long sections of the 51 and 77 veins; namely, stride northwesterly and dip northeastward, with the

hangingwall moving up and to the west with respect to the footwall. The principal direction of tension appears to be from north 70 to 90 degrees east and dip northwestward to northward.

Structurally the veins tend to be well defined, fairly regular, and steep in the more massive rocks such as the augite diorite, soda granite, and Pioneer greenstone, but are tight and poorly defined in the sediments, particularly if the sediments are thinly bedded and lie at a small angle to the strike of the fissure. In schistose greenstone the fissures tend to split and to die out.

All the veins are somewhat lenticular and the pinching and swelling appears to be proportional to the variation in strike and dip.

The vein matter consists principally of milky-white quartz with only small amounts of metallic minerals, a maximum of 3 per cent sulphides has been estimated and usually the amount of sulphides is less than 1 per cent.

A conspicuous feature of the veins in not only the Bralorne and Pioneer mines but others as well is the ribboning parallel to the strike and dip of the vein. In such material the quartz ribbons, ranging in general from 1 centimeter to 5 centimeters thick, are separated by thin septa, 1 centimeter thick, of sericite schist. The material of this schist is principal sericite mica but includes considerable finely granular sulphides and gangue and occasionally, slickensided visible gold. The vein breaks readily along these films and often reveals striated walls of quartz or small areas of striated sulphides. Ribbon structure is due to movement that occurred within the vein in part during and, in part, after formation of the vein. It may be confused with a sheeted structure where both the vein and wallrock are equally sheared. The amount of ribboning within the same vein varies from entirely lacking with a resultant massive type of vein quartz, to intensely developed, with many narrow ribbons comprising the vein.

Parts of some of the veins possess a marked breccia texture. In places this consists of angular fragments or inclusions of wallrocks, usually highly altered, cemented by vein quartz, or in other places it consists of fragments of early vein quartz cemented by later vein quartz. The footwall of some of the veins is fractured and so laced by quartz stringers, that a breccia texture is formed. Although much of the good grade ore is ribboned, much of both the breccia type and the massive quartz have also constituted good grade ore.

The gangue minerals include mainly quartz, locally abundant calcite, and minor amounts of sericite, chlorite, mariposite, talc, scheelite, dolomitic and ankeritic carbonates. Ankeritic carbonate and mariposite are also found along the vein partings and in wallrock inclusions.

Mariposite (a chrome-potash mica) is conspicuous, not so much because of its abundance, but because of its brilliant green colour and flaky habit. It is common in parts of the veins near serpentine, decreases away from it, but has been seen as much as 150 meters away from the serpentine. At various times during the history of the Bridge River mining camp the presence of mariposite has been used as a criterion of a promising gold-quartz vein, but more complete information has shown that many of the veins have the requisite mariposite but very little gold. Statistics of association of mariposite with gold-bearing quartz show that the presence of the mineral cannot be used indiscriminately as indicative of a good gold vein.

Foliated masses of watery green talc up to 5 centimeters wide occasionally occur in wallrock shears adjacent to the veins where they cut talc rock. The talc in these veins is much more coarsely foliated than that which replaces the serpentine to form talc rock, or that which may be found in small amounts in adjacent diorite.

Scheelite, usually widely scattered, has been found in a great many of the gold-quartz veins. In the Bralorne mine, pale orange-coloured scheelite is widespread in small amounts and two small oreshoots of tungsten ore were found. These were mined during World War 11 and the ore, a few hundred

tons, concentrated in a small plant built for that purpose.

Sulphides are generally not abundant and in most veins constitute less than 1 per cent of the vein matter. Pyrite and arsenopyrite are the principal sulphies, pyrite the more abundant. Sphalerite, galena, chalcopyrite, and tetrahedrite (grey copper) occur in small amounts. In mill products from the Bralorne mine Warren reports (1942, p. 30) finding bornite, stibnite, chalcocite, covellite and magnetite, but says they are rare. He also reports (Idem) microscopic hair-like crystals of millerite, a sulphide of nickel, in a small cavity of quartz. Marcasite, and a telluride, thought to be either sylvanite or calaverite have been reported. Stibnite has been reported by McCann (1922, p. 56) from the Ida May and Coronation mines, where it occurs as grains and long crystals in vuggy quartz.

Visible or free gold is frequently seen in the veins and in places it has occurred in spectacular amounts. Although some gold is found in white quartz, most of the readily visible gold occurs along the thin layers of schist that separate the ribbons in the quartz veins. Arsenopyrite is commonly associated with the gold, but both sphalerite and galena also occur associated with it.

Factors that govern the localization of oreshoots within the veins in the producing mines are imperfectly understood but several that appear to exert some control have been noted.

On a regional scale, the fact that the principal veins in the area have been found in areas of Bralorne Intrusions indicates a first control, either structural or genetic, by these intrusions over the localization of potential ore-bearing veins. Related to this factor, is that of the physical competency of the rock types in sustaining fractures, that can become veins. Thinly bedded sediments of the Fergusson, Noel and Hurley are seldom host rocks for strong veings, whereas the more competent Bralorne Intrusions, the Pioneer greenstone or where the bodies are sufficiently large, greenstone belonging to the Fergusson, are more competent rock types than the sediments, will sustain vein fractures and are found as host rocks for strong veins. These features will acount for the formation of gold-quartz veins.

At Pioneer and Bralorne oreshoots may be shown to be related, in part, to the direction of tension-fracturing that is followed by some veins, or by parts of veins, where they possess a variable strike. At Pioneer this direction strikes a few degrees north of east and dips 45 degrees northward, and at Bralorne it strikes northeasterly and dips northward. Oreshoots will tend to form in those veins, or in those parts of veins, that approximately follow the direction of tension fracturing.

Veins that follow fractures that are remarkably straight for long distances are usually less productive than those that follow fractures that are markedly undulating on strike and dip. In curving fractures, movement of the walls past each other will form pinches and swells along the fissures, and the latter tend to be the location of oreshoots. A relation between oreshoots in zones of tension or low compression as contrasted to their absence in zones of compression or bearing surfaces, has been shown in strongly curving fractures such as the Main vein at Pioneer.

Another probable factor in the formation of oreshoots within the veins has been a local one responsible for the formation of rich oreshoots in veins near the serpentine and still more locally, adjacent to the grey talc-rock of the serpentine. Particularly at Bralorne, high-grade oreshoots are found in several of the veins where they are in talc-rock close to the serpentine.

The suggestion has been made by many writers that the serpentine acted as a dam to vein solutions and because of reduced velocity of flow of ore solutions at such places, indirectly promoted the deposition of vein matter behind the serpentine dam. However, as the veins are not noticeably wider or may be even narrower behind the serpentine, the amount of vein matter deposited has not been increased as would be expected behind a dam. The talc rock, and not any reduction in velocity of flow of ore solutions, acted as a chemical precipitant for gold in particular, but without any increased precipitation of quartz. Specks of native gold have been seen, away from vein-quartz, in the water-green talc of the seams, further suggesting a precipitating effect on the gold by the talc.

The several rock types cut by the vein have been varyingly altered near the vein by the vein solutions. The altered wallrock is usually lighter in colour and denser in texture than the unaltered rock; and may extend outwards from the veins for 5 centimeters to 1 meter.

The processes involved in wallrock alteration include carbonatization, sericitization, silicification and biotitization. Locally, as on the Alma claim, albitization involving the formation of patches of quartz and albite in carbonatized greenstone has occurred near the vein shears. The deposition of fine-grained, well crystallized pyrite and arsenopyrite has also occurred in much of the altered wallrock of the veinn. Mariposite occurs in altered wallrock where the veins are near serpentine; it has been observed in wallrock of veins as far as 150 meters from serpentine.

The greenstone of the Fergusson formation where forming the wallrock of vein shears as on the Golden Ledge and Congress properties has been altered to a dense cream coloured rock for distances from 5 centimeters to, at the Congress mine, 10 meters from the vein. These carbonate zones consist principally of ankeritic carbonate, but in many places the zones are cut by hair-like stringers of fine-grained sulphides that include pyrite, arsenopyrite and rarely sphalerite. The carbonate zones have been formed by alteration of greenstone outward from fissures. The gradational nature of the alteration is shown by intermediate stages in the alteration of the lavas.

The greenstone of the Pioneer formation, adjacent to many of the vein shears has also been altered to a dense, cream coloured rock. In many places as on Pacific Eastern, Pinebrayle, the Alma adit on Grull Wihksne, B.R. Consolidated, and Congress, the cream coloured altered phase consists of abundant ankeritic carbonate, with varying amounts of chlorite and clinozoisite. In some places on the Pinebrayle property, the altered lava contains streaks and circular areas of quartz-albite aggregates.

The greenstone at many places along the vein shear at B.R.X. has been altered to a similarly dense, cream coloured rock for distances from 25 centimeters to 1 meter from the vein. This altered rock is seen to consist of fine-grained quartz, kaolin and pyrite.

A further type of greenstone alteration near the veins is that of biotitization observed at Pioneer. Here inclusions of wallrock in the vein, and the wallrock for 5 centimeters from the vein, contain an abundance of small biotite flakes. In the inclusions these decrease in number as silicification increases to such a degree that the inclusion is entirely quartz barely distinguished from the bulk of the quartz in the vein.

Carbonatization and to a lesser extent sericitization characterizes the alteration of diorite wallrock. At Bralorne the diorite within the vein shears and for a distance of about 20 centimeters on either side has been intensively sheared and altered to a light green coloured rock that, however, still possesses a recognizable dioritic texture. The most intensively altered phases consist of abundant sericite, carbonate and chlorite.

At B.R.X. Consolidated and Wayside the diorite is mixed with much greenstone and here the rock adjacent to, and for as much as 6 meters from, the principal veins and also branch shears, has been conspicuously altered to a massive cream coloured rock, mottled with small patches of a light green chlorite. At both Wayside and Congress the alteration persists even where vein quartz is narrow and intermittent and in such places the vein will be marked by a well defined zone of carbonate rock. The altered rock consists of a fine-grained ankeritic carbonate, sericite mica, chlorite and pyrite; in some places the carbonate is more abundant than sericite, in other places the sericite is more abundant than the carbonate. The light-green patches are chlorite that has replaced hornblende of the unaltered diorite. In the hand specimen the chlorite looks very much like the chrome-mica, mariposite, but under the microscope it appears to be a chlorite, and a spectrochemical analysis showed only spectrochemical traces of chromium. At B.R. Consolidated gradations in the altered rock can ben traced from slightly altered diorite to rock in which the hornblende and feldspar are completely replaced by carbonate and sericite but may still be recognized by outlines of the original crystals. Nearer the vein, replacement may have proceeded to the point where all trace of the former texture of the rock has been destroyed. In some places the transition between unaltered and altered diorite is very sharp and so pronounced that the contact between unaltered and altered rocks is similar to a dyke contact.

Furthermore, because of its fine-grained almost dense texture, much of the carbonate rock possesses a massive igneous-like structure and breaks with a conchoidal fracture, and for these additional reasons the carbonate rock may sometimes be mistaken for a dyke. However, the spatial relation of the carbonate rock to vein fractures and the variable width of these masses of altered rock indicate that it has formed by alteration of the wallrock of these fractures.

The most intensive alteration yields a silicified rock that contains, in addition to ankerite and sericite, a moderate amount of vein quartz. Stringers or narrow zones of cream coloured altered diorite are not be be confused with similarly coloured veinlets that are widespread both in the diorite and greenstone. These veinlets consist mainly of clinozoisite and/or prehnite, and some quartz, and represent a phase of mineralization much earlier than that of the quartz veins.

The granite adjacent to many of the veins has been sheared and altered for short distances from the vein, from 5 centimeters to about 1½ meters. The altered rock consists of prominent grains of residual quartz in a cream coloured matrix that consists of sericite and carbonate. The albite plagioclase of the granite has been completely replaced by sericite and carbonate and only the quartz remains, and even it has been fractured and in part replaced by sericite.

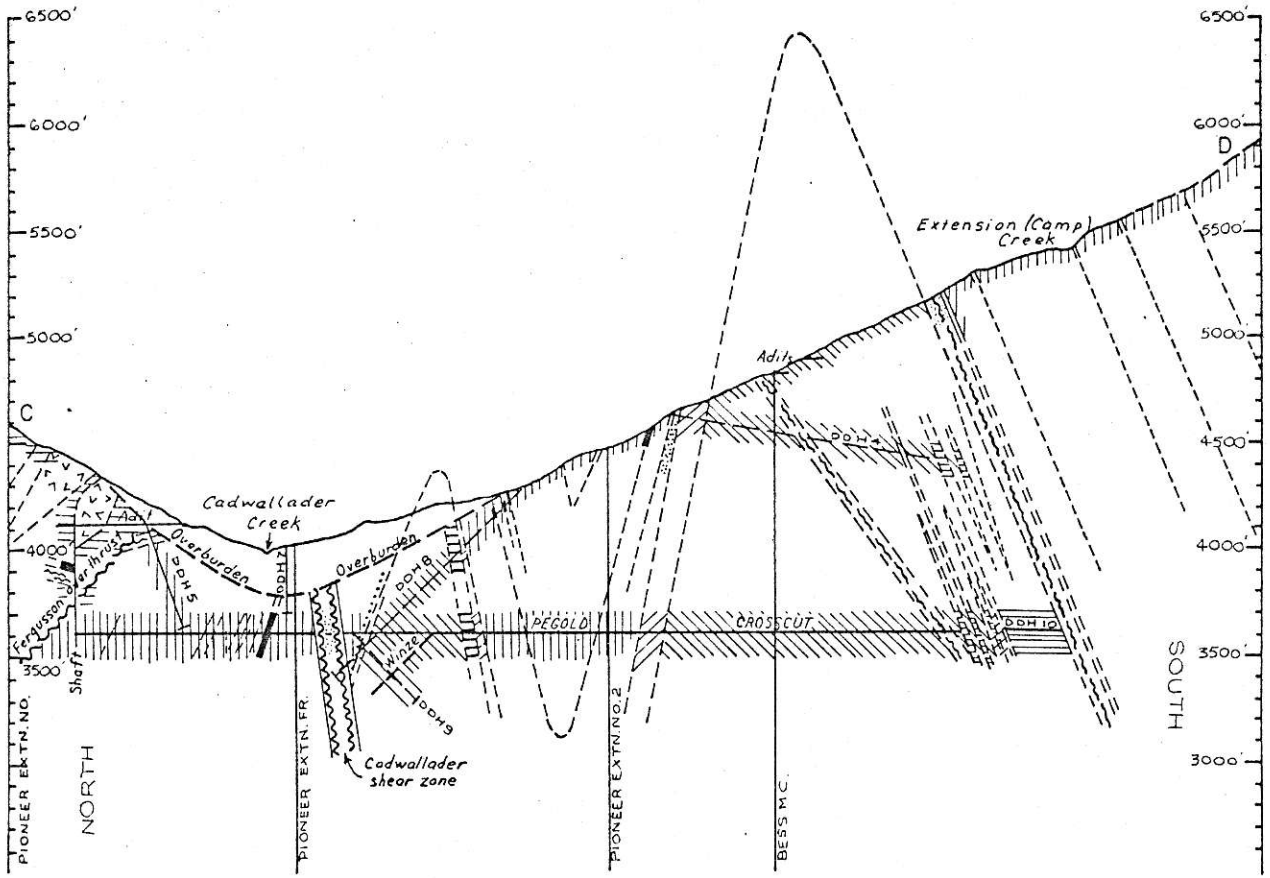
Silicification, involving replacement by hydrothermal quartz, is a further alteration of the granite. Where granite occurs as inclusions within a vein, it is completely silicified and, also where, as wallrock it has been fractured and intricately laced by a network of quartz stringers. Silicification of the granite has been extensive along parts of the 77 vein at Bralorne and in lower parts of the Main vein at Wayside.

Albitite dykes where cut by the veins are altered to platy quartz-sericite schists. Pyrite and arsenopyrite are also extensively developed in the altered albitites. In sections of the mines where the principal country rock is diorite, the altered albitite may be distinguished from the

diorite megascopically by a markedly platy structure in the albitite and microscopically by an abundance of quartz. A further alteration of the albitite includes biotitization of inclusions of albitite in the veins. In sections of the mines where the albitite dykes are in granite, the altered albitite may be distinguished from altered granite by the non-platy but coarsely sheared nature of the granite and by the conspicuously large "eyes" of quartz in the granite. The degree of alteration of the albitites varies from place to place and appears to be most intense where a vein most closely follows along a dyke. Where a vein crosscuts a dyke, the alteration has only been slight.

The carbonate-silica alteration responsible for development of the extensive carbonate zones in the serpentine are not directly related to the gold-quartz vein mineralization, because carbonate zones are found in areas remote from veins.

However, much of the serpentine near the western ends of many of the Bralorne and Pioneer veins has been altered to a grey talc rock. In addition to the fine-grained talc of the grey talc rock, watery-green talc has formed along slips in the sheared diorite near the vein shear, and in microscopic veinlets in more massive diorite away from the veins. Although it is a question whether or not hydrothermal solutions from the vein shears are responsible for the alteration of serpentine to the grey talc rock, it does seem reasonalbe to assume that these solutions were in part responsible for the lenses and blebs of watery-green talc in veinlets of the wallrock.



LEGEND

- Hurley - Noel sediments
- Hurley - Noel conglomerate
- Pioneer greenstones
- Pioneer rhyolite
- Fergusson cherty argillite
- Fergusson volcanics
- Serpentine
- Bralorne diorite
- Soda granite
- Aplitic and porphyritic dyke

Fault ..... Bedding .....
Shear ..... Contacts .....

300 150 0 150 300 metres
Approx.

GEOLOGICAL CROSS - SECTION OF PACIFIC EASTERN WORKINGS

FIGURE: 4

7.0 PACIFIC EASTERN GEOLOGY

The old camp buildings and principal workings are on the northeast side of Cadwallader Creek about 1/2 kilometer upstream from Pioneer Mine. With the exception of the entry adit and a shaft on the northeast side of the creek, the principal workings are beneath the creek where they explore the southeasterly extension of formations found in the Pioneer mine.

The Pacific Eastern workings compromise an entry crosscut adit 198 meters long driven northerly from a point on the northeast side of Cadwallader creek about 30 meters above the valley-bottom and 1/2 kilometer upstream from the Pioneer mine; from this adit a vertical shaft 168 meters deep, sunk at 159 meters from the portal of the adit and from a point 159 meters down the shaft, 2,134 meters of workings have been driven; these include a long crosscut, drifts, and a winze. Approximately a thousand meters of diamond drilling have also been done. Surface work and diamond drilling has been done on showings elsewhere on the extensive property.

The original company, Pacific Eastern Gold Mines Ltd., was incorporated in 1929 to acquire and develop the Pioneer Extension group of claims adjoining Pioneer Gold Mines on the southeast. Subsequently this company and its successors, the Pioneer Extension Gold Mines Ltd. and the Pacific Eastern Gold Ltd., acquired the President, Plutus and Dan Tucker groups of claims which lie between the Pioneer Extension group and Chisin Creek.

Surface work and diamond drilling was done at widely scattered locations on the claims, but the underground work has been concentrated on the Pioneer Extension group and most of that work done at two periods in the history of the property. The first period was between 1935 and 1937, when the present shaft was sunk and much of the crosscutting and drifting was done. An indication of the amount of work done during that period is given by the British Columbia Minister of Mines Report for 1936 which states that the main crosscut was 945 meters from the shaft, 775 meters of exploratory drifting had been done, a winze had been sunk 70 meters to the 210 meter level, and drifting done on this level.

A company plan dated December 3, 1937 indicates that by the end of 1937 the 520 crosscut had been driven to its present face and the short drifts near the face had been driven. Also by that time, the 1595 East drift had been extended to the South Crosscut and from this crosscut, the East and West Drifts, No. 2 East and No. 3 East drifts had been driven. From the 1595 Drift, the West Drift had been driven and from the bottom of the winze, the 690 level had been driven to its present east and west faces. The same plans referred to above indicate that thirteen short drill-holes had been drilled by that time.

No work was done on the property from 1937 to 1944. In 1944 it was acquired by Pacific Eastern Gold Mines Ltd. and a preliminary study of the geology made.

In 1945, a detailed geological survey was made of the property, diamond-drill holes S-11, S-12 and S-13 were drilled from the surface and a start made on cleaning out the old workings. Diamond drill hole S-13 cut a section of soda granite and Bralorne diorite 762 meters to the south-east from the Pacific Eastern adit and workings. The hole intersected 2 veins at 370 meters, one with a core width of 1 meter assayed 0.1 ounces gold per ton and the other 1.5 meters wide contained free gold, no assays are available for this section.

In 1946, the old workings were cleaned out proparatory to extending the 1595 Drift in an easterly direction to explore ground in the vicinity of an intersection in drill-hole S-13 of free gold in quartz. About 610 meters of surface and underground diamond drilling were also done during the year.

In 1947 this drifting was continued, several crosscuts were driven from the main drift to prospect short quartz veins; and twenty-two diamond-drill holes were drilled. The mine was closed that summer because "On August 18, 1947 an explosion of methane gas on the 520 level resulted in the death of three men. Shortly after this the mine was abandoned, the equipment removed, and the mine allowed to flood." B. C. Minister of Mines Report, 1947, p. 134. No further work has been done on the property to date.

7.1 GEOLOGY

The principal showings on this property consist of quartz veins in Pioneer greenstone and adjacent augite diorite and soda granite that extend southerly from the Pioneer mine. These veins have been explored principally by workings beneath the valley of Cadwallader Creek.

The underground workings are reported to have intersected rocks of the Fergusson group, the Pioneer formation and Hurley group, serpentine, both augite diorite and soda granite, and the two principal faults of the region, the Fergusson and the Cadwallader. Because several quartz veins occur in them, the Pioneer formation and the belt of augite diorite and granite have been explored underground by drifts, orosscuts and diamond-drill holes.

A band of Fergusson group rocks has been intersected by the shaft, the first 320 meters of the 520 crosscut and by diamond-drill holes drilled northerly from the 1595 Drift. Both sediments and lavas have been found. The sediments consist of contorted laminae of argillaceous chert, and chert-fragment breccia in a black argillite matrix. The lava is coarse grained, diabasic and has prominent, hornblende phenocrysts, some of which have residual kernels of pyroxene. As is characteristic of the Fergusson group, the sediments are more abundant than the lava, lava having only been found in the vicinity of the shaft and in drill-hole No. S-13.

Two bands of Hurley sediments have been intersected by the underground workings, one band 15 meters - 30 meters wide, just northeast of the 1595 Drift, and the other band, 213 meters wide, 91 meters southwest of that drift. Much of the Hurley underground contains newly formed biotite flakes that are abundant enough to impart a definite brownish cast to the rock. It consists of alternating argillaceous and sandy layers some of which contain lenticles of calcite and are cut by zones of calcite stringers. Some layers contain small rock fragments that include fine grained diabasic lava, finely granular chert.

Occasional lenses of limestone, some up to 7½ meters thick are interbedded with the argillite of the Hurley and have been intersected by the 520 level crosscut and several of the diamond-drill holes. Both sandy layers, and some conglomerate lenses have also been found in the Hurley underground.

Two bands of the Pioneer greenstone have been cut by the workings, one band, from 30 meters to 137 meters wide, contains several quartz veins and has been followed by the 1595 Drift for 853 meters and the other band, to the southwest about 396 meters wide has been intersected by the 520 crosscut. The Pioneer formation is a series of superimposed flows characterized by flow breccia, amygdaloid and porphyry. The different types of flows and their sequence are well shown in cores of diamond-drill holes that cut across the formation. The groundmass in all the flow types consists of slender plagioclase laths arranged in closely packed, felted masses, typical of lavas. In the porphyritic phases the phenocrysts are principally large, well shaped crystals of plagioclase. In the amygdaloids, the amygdules are principally quartz, but epidote, hornblende and calcite amygdules occur. The flow breccias consist of irregular but smoothly curved masses of amygdaloidal lava, from 2 centimeters to 5 centimeters in diameter in a fragmented matrix. All phases of the lava contain an abundance of secondary chlorite.

Augite diorite and soda granite occur together as long, narrow, lenticular bands within a northwesterly trending zone that ranges from 30 to 76 meters wide and extends the full length of the 1595 Drift, a distance of 869 meters. This diorite-granite mass appears to be a steeply dipping axial planes of the closely folded formations that it intrudes.

The augite diorite is similar to that found elsewhere in the Bralorne-Pioneer area. It is coarse to medium grained and is characterized by abundant amphibole and plagioclase. In some of the amphibole, kernels of pyroxene are still present.

The soda granite is coarse grained and consists principally of large grains of plagioclase and quartz, usually in a ratio of 3-1; dark minerals are lacking; the large hornblende crystals of the augite diorite are conspicuously absent; and there is no gradation in the amount of hornblende from the diorite to the granite. Where sheared the granite has been intensely sericitized and carbonatized to a siliceous, cream coloured rock. In this rock the plagioclase has been completely replaced by sericite and carbonate and only the quartz remains; and it has been fractured and in part replaced by sericite.

Two northwesterly trending bands of serpentine occur underground, one band occurs north of the 1595 Drift, and where intersected by the 520 crosscut is 67 meters wide but narrows southeast towards the end of the 1595 Drift; the other band, southwest of the 1595 Drift, is 55 meters wide where cut by drill-hole 35, but pinches out northwest and is absent from drill-hole 24.

Both unaltered and altered serpentine are found in these bands. The bulk of the material is glossy greenish-black serpentine consisting principally of antigorite. However, occasional bodies of grey, altered serpentine occur at the shaft and in several drill-holes. The grey serpentine consists principally of antigorite, talc and carbonate and because of the light grey color and general softness of the rock could be referred to as talc.

The serpentine is itself an altered rock that has been derived from peridotite and relicts of this original rock may be seen in the southwestern band of serpentine. This serpentine contains large masses of unserpentinized peridotite that consists principally of amphibole, pseudomorphic after pyroxene.

Dykes of feldspar porphyry up to 2/3 of a meter wide cut the Fergusson rocks. The rock in these dykes consists of well shaped phenocrysts of plagioclase in a matrix of closely packed laths of plagioclase.

A 10 meter section of a hornblende porphyry dyke was cut in drill-hole 32 where in serpentine. The hornblende phenocrysts in this dyke have been completely altered to aggregates of biotite flakes.

The principal structural features are the northwesterly trending, closely folded sediments and volcanics, the long, narrow intrusive body of diorite and granite, and the two northwesterly trending faults, the Fergusson overthrust and the Cadwallader fault.

The isoclinally folded Fergusson rocks have been overthrust against the similarily isoclinally folded younger formations along the Fergusson overthrust. This fault strikes northwesterly and dips about 70 degrees northeastward and is characterized by a zone of intensely crushed rock 1 - 2 meters in width.

The pioneer greenstone and the younger Hurley sediments have been repeated, as seen underground in diamond-drill core, by close folding and possibly by faulting. The Cadwallader fault, strike northwesterly and dip 70-80 degrees southwestward, apparently follows the zone of diorite and granite; movement along it may account for some anomalous dips in the Hurley rocks in the footwall of the fault; the anomalous dips and the succession of strata as seen southwest of the fault, suggests that the Hurley and greenstone in the hangingwall of the fault have dropped down with respect to the same formations in the footwall of the fault, i.e. between the Cadwallader fault and the Fergusson overthrust.

7.2 MINERALIZATION

The work underground has been directed towards the prospecting of several quartz veins that occur in the narrower band of greenstone and in the adjacent diorite-granite band. The majority of these quartz lenses trend northwest with the general strike of the formations, and dip from 60 degrees southwest to 35 degrees northeastward. They range in width from several centimeters to 1 meter and in length from 1 meter to 61 meters. The major vein appears to be the vein found in the West Drift and followed by a winze to the 690 level where it was drifted on for 61 meters. Spectacular assay values in gold and some free gold have been found in some of the veins.

One section of a vein in the West Drift assayed for 28 meters with an average width of 33 centimeters ran an average of .58 ounces gold per ton. A winze has followed this vein down 70 meters. The vein has shown erratic widths and values, but has demonstrated two sections where the quartz has the following widths and values:

(a) Collar to 10½ meters, 48 centimeters wide 0.153 oz-ton.

(b) 20 meters to 49 meters, 44 centimeters wide 0.199 oz/ton.

Free gold was visible in a number of places 52 meters below the collar.

In the area of Chism Creek a number of northwesterly shear zones were observed across widths of as much as 15 meters or more. One shear zone is mineralized and has been extensively prospected on the Dan Tucker. Work has included trenching, two short adits and a 18 meter shaft. The quartz veins in this area occur in the Bralorne greenstone in or near albitic dykes. Occasional free gold has been found in the shear zones in lenses of crushed vein quartz up to 1 meter wide. South of this zone in Chism Creek diorite outcrops that contains a quartz vein stockwork with some albite.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

The Pacific Eastern crosscut as seen in figure 4 intersects the eastern extension of the Bralorne-Pioneer geological structure. A Comparison of figure 4 and figure 5, a cross section of the Pioneer Mine, after Franc R. Joubin, shows the similarity of the geological structure on the second level of the Pioneer Mine and the 520 level of the Pacific Eastern workings. Significant intersections of gold bearing quartz veins have been made in the northern section at greenstone on the 520 level and have been driven on by a winze and intersected in diamond drill hole number nine drilled from the crosscut. This greenstone belt has been drifted on for 750 meters to the east on the 520 level. These workings, 1595 east drift, intersected numerous quartz veins which are parallel to the northern contact of Bralorne diorite and soda granite. To date, assays in this area have not been located.

As can be seen in figure 5, the soda granite, Bralorne diorite, and Pioneer greenstone widen dramatically with depth. The Bralorne-Pioneer ore zones have been mined to a depth of 2,000 meters, W. R. Bacon states in Lode Gold Deposits in Western Canada,"on the bottom level 1900 meters below the collar of the Empire Shaft, there has just been sufficient work to indicate a 160 meter length of vein, 2.0 meters wide and averaging better than 1 ounze Au per ton."

Initial work in the Pioneer Mine on the upper five levels was sporadic as gold values were low and intermittent. Consistent gold values of ore grade were found after deeper exploration was carried on the widening Pioneer greenstone and soda granite structure.

It is postulated that because the geology is similar in cross section to the Pioneer structure and the intersections of gold bearing quartz veins in the Pioneer greenstone, the Pacific Eastern structure will widen with depth and as with both the Pioneer and Bralorne operations, significant gold values will be encountered within the Pioneer greenstone over mineable widths.

The potential for similar tonnage and grade as found in the adjoining Pioneer Mine and with the increased value of gold to $300.00 in Canadian funds, the Pacific Eastern property is an attractive exploration target.

8.2 RECOMMENDATIONS

In the years 1935 to 1947, numerous geological surveys, underground drifting and diamond drilling were carried out. The writer has acquired some of the data generated by these surveys, appendix I, through the B.C.D.M. files. It is recommended that a further search of the files of the B.C.D.M. be carried out including a literature search of the Bralorne Resources Ltd. records. Further discussions with Noranda Mines Ltd. staff should be continued to insure that in the corporate records of Pacific Eastern Gold Mines Ltd. there is not further geological information. Diamond drill logs have been used as recently as 1957 by B.C.D.M. staff in geological compilations of the area. The core from all the diamond drilling was stored on the property, an effort should be made to locate the storage area and carry out a detailed examination of the core, including geochemical analysis of the soda granite, Pioneer greenstone and Bralorne diorite to test the potential for low grade gold within these rock types.

A geological compilation of the surface and underground geology in cross section and plan should be made at a scale of 1:50 and 1:500. In conjunction with this compilation a transit survey of the surface mine workings is required to facilitate further surface geological mapping and sampling of the ground between the Pacific Eastern workings and Chism Creek where quartz veining and a quartz vein stock work in diorite are reported. An east-west panel of 3-750 meter diamond drill holes is recommended to test the depth extension of the Pacific Eastern structure 250 meters below the 520 level. The first hole should be directed below the winze area and diamond drill hole number nine, the deepest hole drilled on the Pacific Eastern ground, figure 4. The following two holes should be drilled to intersect the Pioneer greenstone belt 250 meters below the 1595 East Drift at 500 meter intervals south easterly from the first hole. The location, direction and angle of these holes would be dependent on the detailed geologic compilation.

It is anticipated that the cost of this program would be approximately $150,000 and would serve as a base for further exploration as justified.

APPENDIX I

REFERENCES

Maps:

Claim Survey Map: Pacific Eastern Gold Ltd./by Underhill & Wilkie, B. C. Land Surveyors. Scale 1'/600'

Sections:

1. Hypothetical Section Gold Mines Ltd. N35 E Pacific Eastern
2. Geological Section 1"/150' P. E. Gold Ltd.
3. Section 1"/150' crosscut and shaft.

Plan:

1. Assay plan winze & drift 690 level 1"/10'
2. Geological (surface) P.E. & Pioneer properties scale 1"/300'
3. Outcrop Map P.E. Gold Ltd., 1"/100'
4. Contour Map President sheet 1"/100' C.I. 10' (serpentine belt)
5. Claims & Geology P.E. claims 1"/100 (no legend) C.I. 100' (shows adjacent Pioneer workings)
6. Claims & Geology (shows D.D.H.'s & underground workings)
7. Rolled Maps
   a. Geological map - surface Bralorne to Dan Tucker
   b. Underground workings & geology
8. P.E. Plan & Section (1937) 1"/150' geology/drill holes (for inspection branch)
9. Pioneer section & plan 1"/400'
10. Claim Map Bralorne property 1974
11. Miscellaneous sections (Noranda)
12. Magnetometer Map & Geological Maps mem. 213:

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APPENDIX II

Excerpt from GSC Memoir 213 C. E. Cairnes 1934-1935
Pages 108-111.

PACIFIC EASTERN GOLD

References: Geol. Surv., Canada: Sum. Rept. 1931, pt. A, p. 57; Sum. Rept. 1932, pt. A II, p. 70. Ann Repts. Minister of Mines, B. C.: 1929, p. 235; 1932, pp. 224-225: 1933, p. 264.

Pacific Eastern Gold, Limited, of Vancouver, own eighty-two claims and fractions, in the valley of Cadwallader creek, adjoining and lying south and east of those of Pioneer Gold Mines. The claims form a continuous ground along mainly the southern slope of Cadwallader valley and extending for over 5 miles to about midway between Chism and Aggie creeks.

In 1929, P. E. Gold Mines, Limited, was incorporated to prospect and develop the Pioneer Extension group of claims adjoining those of Pioneer Gold Mines. Prospecting on the south slope of Cadwallader creek resulted in discovering some vein quartz carrying low values in gold. The property was increased in 1932 by the addition of the President group of claims, lying south of Cadwallader creek and west of the Pioneer Extension group, and was taken over by Pioneer Extension Gold Mines, Limited. At that time the property comprised about thirty claims. Exploratory work was concentrated, chiefly, at the surface and an effective system of ground-sluicing employed in exposing the bedrock formations. Late in 1933 the adjoining holdings of Plutus Gold Mines, and Dan Tucker Mining Company were added to those of Pioneer Extension Gold Mines and, together with several other, scattered, adjoining claims, were acquired by the present company. Considerable work had been done on the Dan Tucker group prior to this transfer and was continued into 1934. Except, however, for some diamond drilling very little work has been done on the intervening, Plutus group. Recent work has been concentrated on the Pioneer Extension claims near the eastern boundary of Pioneer Gold Mines property. The main camp of Pacific Eastern Gold is here and to this point the company has extended the main, Bridge River highway, from below Pioneer Mines. Operating power is

supplied by the Bridge River Power Company at this, the present terminus of their line.

The geology of Pacific Eastern Gold property embraces an extensive representation of all the principal, geological formations of the area, except the Bendor batholith. The latter, however, flanks the eastern half of the property, within 2,000 feet to a mile to the north, and thermal metamorphism by it has extended well into formations within the property limits. The geological problems are mostly those of the entire area and are referred to at some length elsewhere in this report. Work now in progress at the Pioneer Extension camp, investigating the formations beneath Cadwallader creek, has been particularly interesting, geologically and structurally, and the writer is greatly indebted to the president of the company, Major Jas. R. Lowery, for complete information and representative material from the workings, up to the time of writing.

The property occupies a long, belt-like area alined with the general, northwesterly trend of the underlying, rock formations. The principal structures are synclinal, in which large bodies of the Noel, Pioneer Greenstone, and Hurley formations overlie, successively, the basal, Fergusson series. This structure is however, complicated by strong faulting, and has been partly obscured by abundant dioritic and ultrabasic intrusions. The former are chiefly albitic, Bralorne types and the latter, serpentinized periodotites of the President group. The intrusive bodies are alined, roughly , with the trend of the enclosing formations and have been involved to a varying degree in the deformation and fault structures affecting these formations. In detail, however, they are definitely crosscutting. Towards the northwest end of the property, in the vicinity of the Pioneer Extension workings, the members of the Fergusson series are in contact with, and have been overturned against, later formations. The zone of thrusting, along which the principal displacement has occurred, extends far to the northwest and southeast of these workings. Where seen, it dips north-easterly at about 45 degrees. To the southwest of this main fault structure and apparently, complementary to it, are other nearly parallel faults dipping southwesterly, along which under-thrusting has probably occurred. Elsewhere on the property, in the better exposed areas, as on either side of and in the valley of Chism creek, a number of northwesterly shear zones were observed, across

widths of as much as 50 feet or more, within which it appeared much movement in the aggregate may have occurred, although owing to the fact that they followed the formational trends and were not continuously exposed little definite information on relative displacements was obtained. One such shear zone is mineralized and has been extensively prospected on the Dan Tucker group of claims; another, not far below, also shows some mineralization and is probably continuous with strong shearing observed to the northwest in the lower canyon of Chism creek. Still others were noted farther up Chism Creek valley and are associated in part with heavy, iron-sulphide impregnations.

The workings on this property are mainly on the Pioneer Extension and Dan Tucker groups of claims, near the western and eastern ends of the property, respectively. On the former they have until recently consisted largely of surface trenching and ground-sluicing to expose bedrock and investigate, more carefully, localities where vein quartz had been uncovered. Supplementing this work are a few short adits and a couple of long diamond drill holes. Since 1935 explorations have been concentrated on work beneath the valley of Cadwallader creek and have been designed to investigate the southeasterly extension of the productive formations at Pioneer mine. These workings are about 4,000 feet southeast of Pioneer mine workings. They comprise a crosscut-adit, 650 feet long, driven northerly into rocks of the Fergusson series from 100 feet above the valley bottom; a vertical shaft, 500 feet deep sunk at 520 feet from the portal of the adit; a crosscut, driven southwesterly for 2,400 feet (October, 1936) from the bottom of the shaft; and from this crosscut level about 2,400 feet of drift and crosscut, a winze 230 feet deep, and an aggregate of 1,412 feet of diamond drilling.

Work on the Dan Tucker group has included a great deal of trenching across particularly one mineralized shear zone; a couple of short adits, one along, and one a crosscut to, this shear zone; and a vertical shaft from the surface, 60 feet deep, connecting with a drift from the crosscut adit.

Little work has yet been done on the intervening Plutus group and bordering claims to the south, mainly because much of this area is heavily drift covered and the southerly, exposed parts, extremely rugged and relatively inaccessible. Some exploratory work has, however, been done by diamond drilling.

Developments on this property are yet in a prospect stage. Explorations at and near the surface have revealed numerous, widely distributed, showings of mineralized quartz veins, but these have not contained material gold values. Occasional specks of free gold are reported to have been seen in them and this feature, combined with the geological occurrence of the deposits in either diorite or greenstone (in some cases in or near albitic dykes) has lent encouragement to the view that elsewhere in this assemblage of igneous rocks, either at or within unexposed or unexplored parts, more significant discoveries would be revealed.

The recent explorations beneath the valley of Cadwallader creek have been successful in discovering not only an apparent continuation of the greenstone body at Pioneer mine, but, also, intrusions of Bralorne diorite and Bralorne soda granite, the latter, at least, apparently identical in type with that at Pioneer mine. Investigations have further revealed vein-bearing fissures striking mainly about east, but, also, in part nearly north. These have been driven on for distances of a few feet to over 100 feet and one in greenstone 250 feet east of the main crosscut is being explored by the winze mentioned above. This quartz vein dips northerly at 45 degrees. For a length of 96 feet on the level it averages a foot wide and assays on the average of 0.58 ounces gold to the ton; free gold occurs in visible amounts. The sulphide content is low, but includes arsenopyrite. In all these respects the vein matter is analogous to the rich, gold-bearing veins of this camp. The other veins, though in part wider, have as yet provided no assays of consequence and owing to the faulted and shattered character of the containing rocks are discontinuous. The results of this work to date have, however, lent considerable encouragement to further exploration in this vicinity, for though the work is not in line with that of the neighbouring Pioneer mine vein system, it is at no great distance off it and the best hopes lie in discovering some parallel set of vein fissures into which mineralizing solutions such as those supplying the vein deposits at Pioneer mine might be expected to extend.

The mineral deposits on the Dan Tucker group occur, principally, along a shear or shear zone striking southeasterly, dipping steeply southwest, and traceable across

most of the width of the group into adjoining Red Hawk ground. It is exposed by surface cuts and followed underground by a short adit at a point about 1,500 feet southeast of, and 650 feet above, Chism creek. Here it occurs in greenstone, is several feet wide, and across this width is heavily charged with pyrite. It is stated that fair gold values have been obtained from parts of the zone and that free gold of spongy appearance has been panned from crushed samples. Between 1,000 and 1,500 feet southeast of this adit, what appears to be a continuation of the same shear zone is followed by a succession of trenches and is explored by the shaft and connecting adit previously referred to. In these workings the shear is partly in greenstone and partly in banded, dark grey sediments, much resembling those of the Noel formation. Disseminated pyrite is not pronounced and the deposits are chiefly sparsely mineralized, lens-like masses of crushed vein quartz up to several feet wide. Values in gold are reported to be mostly low.

South of the main shear is an irregular mass of dioritic and gabboic intrusive of heterogeneous texture which in places along the Chism creek slope contains a conspicuous network of minute veinlets, some at least of which are composed largely of quartz and albite. Their occurrence is of some interest as suggesting differentiated products of the dioritic magma and, in turn, the possibility of gold-bearing veins in this vicinity. Whether the gold in the main shear, referred to above, may be attributed to this geological condition is, however, not certain and, particularly in these upper parts of Cadwallader Creek valley, the possibility of mineralization connected with the adjacent and underlying masses of the Bendor batholith must be kept in mind.

APPENDIX III

W. R. Bacon 1975, Lode Gold Deposits in Western Canada Page 5 - 7

BRIDGE RIVER AREA

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

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

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

The early production, indeed a great deal of the production, came from quartz veins 3 - 5 feet wide. Of the 30 odd veins in the two properties and the ore environment, 6 produced the bulk of the gold. Bralorne's '77' vein produced 2,100,000 tons of ore over a vertical range of 4650 feet and on the bottom 'level' (actually a decline) 6150 feet below the collar of the Empire Shaft, there has just been sufficient work to indicate a 530 foot length of vein,

6.8 feet wide and averaging better than 1 oz Au per ton. It is also worth noting that at this depth the temperature (unrelieved) was 135°F (57°C).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Over a vertical range of more than 6000 feet, there is no change in mineralogy. The sulphides constitute 1% to 3% of the vein material at most. Where the vein quartz is ribboned or banded (due to the smearing and shearing of sulphides along fractures) parallel to the walls of a vein, economic grade can be anticipated.

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

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

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